4-20

WAR DEPARTMENT FIELD MANUAL

COAST ARTILLERY

FIRING PREPARATIONS, SAFETY PRECAUTIONS, CARE AND SERVICE OF MATÉRIEL

WAR DEPARTMENT : 22 MARCH 1944

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BY ORDER OF THE SECRETARY OF WAR:

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The Adjutant General.

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

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(The matter contained herein supersedes FM 4–20, 10 April 1940, and C 1, 15 January 1942.)

CHAPTER 1

FORMATIONS AND INSPECTIONS

SECTION I
FORMATIONS

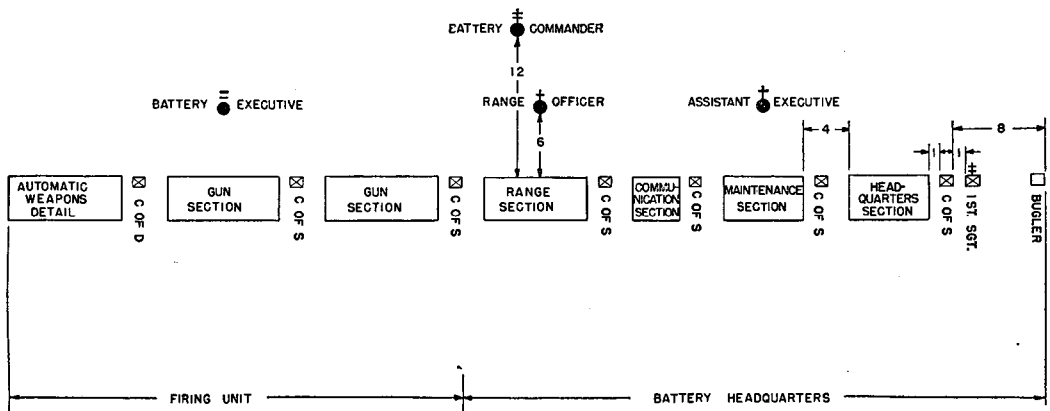
1. INFANTRY FORMATIONS. For infantry formations, drills, ceremonies, and inspections, all seacoast artillery units conform to the provisions of FM 22–5. Batteries are organized into squads and platoons for this purpose and may be marched to the parade ground for various battalion and regimental formations.

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 9 paces in front of where the center of the battery is to rest and, facing that point, commands: FALL IN. Each chief of section or separate detail takes post 3 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 at close interval with normal distance 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). At the command of the first sergeant, CHIEFS OF SECTIONS, POSTS, each chief of section takes post in front rank 1 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." At the direction of the battery commander, the first sergeant takes his post in the front rank 1 pace to the right of the headquarters section. 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 command of execution, 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 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.



ALL DISTANCES AND INTERVALS IN PACES

Figure 1. Harbor defense gun battery artillery formation.

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 command of execution 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 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. a. Artillery inspections are made with all individuals at their battle stations to —

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

(2) Determine the efficiency of the personnel in the performance of their duties, individually and as a team.
(3) Detect faults or deficiencies for the purpose of correcting them.
(4) Ascertain whether deficiencies noted in previous inspections have been corrected.

b. Artillery inspections give all commanders concerned an opportunity to check the adequacy of the preparations for firing prescribed for the battery in chapter 3. For a true check of the readiness of the battery to carry out its service assignment, some of these inspections should be made at unexpected hours and without prior warning. Some unannounced artillery inspections should be made at night.

8. INSPECTING OFFICERS. Artillery inspections are made by battery and higher 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 battery commanders, twice a month by commander of the next higher echelons, and monthly by harbor defense commanders. In addition, the battery commander will require a report twice daily from the battery executive as to the readiness of the gun sections for action. 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 the appropriate Field Manual. The inspector inspects the emplacements, maga-

zines, 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 B2," or "Sir, Sergeant Jones, Battery A, No. 1 gun commander." Chiefs of sections or details give necessary commands to display the mechanical functioning of various equipment.

b. The inspecting officer checks the following points in a battery artillery inspection:

(1) Guns, carriages, and accessories, carefully noting the proficiency of the gun sections in the performance of their duties. He inspects gun books in mobile batteries for proper entries.

(2) Emplacements and immediate surrounding areas, paying special attention to the camouflage of emplacements. He examines each emplacement book for completeness of entries.

(3) Magazines, ammunition, ammunition records, and accessory equipment, carefully noting the thoroughness with which safety regulations are observed.

(4) Power plant equipment, including log books and records pertaining to lubrication and maintenance.

(5) Fire control stations and apparatus, noticing especially the condition and adjustment of all instruments and appliances, tables and charts, and the knowledge observers and operators have of adjustments and operation of instruments, charts, tables, and special fire control apparatus.

(6) Communication system, including data transmission and firing signal apparatus. He checks provisions for alternate communication methods.

(7) Searchlights, including control and power equipment, noting particularly the thoroughness of preparations for operating at night.

(8) Transportation equipment issued to mobile units, including operating logs and lubrication and maintenance records.
(9) Local defense installations, noting the alertness of guards and the thoroughness with which camouflage and gas discipline are maintained.

c. Commanders of mine batteries and mine planter batteries include examination of mine casemates, storerooms, loading rooms, wharves, boathouses, cable tanks, and mine planting vessels in their inspections.

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 the 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 gives the battery REST after opening ranks and then faces toward the front. As the inspecting officer approaches, the battery commander faces toward the battery and commands: BATTERY, ATTENTION, faces to the front, salutes, and reports, "Sir, Battery ——— ready for inspection." 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 battery officers, 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 of those services. 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 an examination of the current training program, and observation of the scheduled drills, exercises, assemblies, and conferences. Tactical inspections may be formal or informal. Training inspections are essentially informal and of such nature as to avoid interruption of routine or scheduled duties. Detailed information is included in AR 265–10.

CHAPTER 2

SERVICE OF THE EMPLACEMENTS

SECTION I

GENERAL DUTIES OF BATTERY OFFICERS

13. BATTERY COMMANDER. **a.** The battery commander is responsible for—

(1) The preservation and proper use of matériel, including ammunition, issued to his organization.

(2) The instruction, tactical and technical efficiency, and preparedness for action of his command.

(3) Compliance with all orders and commands issued to his battery by higher authority.

(4) Observance of all safety regulations pertaining to the operation of the battery.

b. He assures himself that—

(1) Firing data are received at the guns in such a way and at such times that the gun sections will not be confused as to the instant at which such data are good for firing.

(2) All commands received at the guns from the battery command post are correctly interpreted.

c. He orders all fire, specifying the ammunition to be used, and coordinates the action of the various sections.

d. Before firing and at least once a week at other times, he makes a careful inspection of matériel and ammunition, personally tests all safety devices, and assures himself that all safety precautions are understood by the battery personnel.

e. Twice daily, morning and evening, he receives the report rendered by the battery executive upon completion of the inspection of the matériel and ammunition.

14. BATTERY EXECUTIVE. **a.** He 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) Technical handling of the guns.

(3) Condition of the matériel and ammunition under his charge, including its camouflage.

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

(5) Enforcement of camouflage discipline.

(6) Police of all emplacements.

(7) Selection of positions for and supervision of the emplacement and employment of the automatic weapons.

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

c. Twice daily he inspects all matériel and ammunition under his charge and personally verifies the adjustment of all pointing devices. He tests the operation of all traversing,

elevating, and breech mechanisms. He tests all circuits and firing devices, paying special attention to the safety features.

d. At least once daily 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 gun commanders or the assistant battery executive 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 commands: CEASE FIRING, and 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. He exercises general supervision over the loading and pointing. If, for any reason, he desires to hold fire for one firing interval, he commands: RE-LAY, and reports his action to the battery commander.

h. In cases where the battery executive acts as the officer in charge of one of the gun emplacements during drill and firing, he performs the additional duties for that emplacement as prescribed for an assistant battery executive.

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

15. ASSISTANT BATTERY EXECUTIVE. Assistant battery executives, in addition to the duties described below, will perform the duties of the battery executive so far as they apply to the emplacement or emplacements to which they are assigned.

a. The assistant battery executive receives the reports of the gun commander and reports to the battery executive, "Sir, No. ——— in order," or reports any defects he is unable to remedy without delay.

b. When firing on time interval signal, if it becomes apparent that a piece will not be set in time, he commands: RE-LAY, and reports his action to the battery executive. When the piece is set and the personnel is clear, he reports or signals to the battery executive, "No. ——— ready."

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

d. When the piece is firing with Case III pointing, he is responsible that it is fired immediately upon receipt of the proper firing signal, safety precautions permitting. (Not applicable when data computer and data transmission system are used.)

e. After a firing, he supervises cleaning of guns and preparation for the next action.

f. At the conclusion of 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 GUN SECTION

16. COMPOSITION. The strength and composition of gun sections are covered by pertinent T/O & E and by Field Manuals pertaining to the service of the piece for each weapon. Each gun section consists of a gun squad and an ammunition squad.

17. FORMATION. To form the gun section at the emplacement, the gun commander takes post 3 paces in front

of and facing the point where the center of the gun section is to form and commands: GUN SECTION, FALL IN. At this command, the gun section assembles in two ranks at close interval with 40 inches between ranks. The gun squad forms on the right and the ammunition squad on the left with no interval between squads. The chief of ammunition is in the front rank on the right of the ammunition squad. The positions for the various members of the gun section in the formation are prescribed in manuals covering the service of the piece. After forming the section, the gun commander may command: CALL OFF, at which the members call off their titles or numbers in order. The post of the gun commander in ranks is 1 pace to the right of the section and in the front rank. To post the section, the gun commander commands: DETAILS, POSTS.

SECTION III

DUTIES OF CERTAIN ENLISTED MEN

18. CHIEF OF SECTION. **a.** A chief of section (noncommissioned officer) is authorized for major caliber harbor defense batteries by pertinent T/O & E. He is the chief of the gun commanders and is charged with the duty of coordinating the activities of the gun sections. At the emplacements, his duties are such that he is kept free to go to any point where needed in an emergency.

b. His presence in a battery in no way relieves the gun commanders of their responsibilities; however, as a means of expediting firing and insuring safety, he may take charge of certain supervisory duties not directly a part of the service of the piece. For example, when gun commanders are required to remain at their posts during firing, the chief of section makes such checks of matériel, auxiliaries, and per-

sonnel as may be necessary to insure proper functioning and safety. He is particularly responsible for checking the methods being used to handle ammunition in the magazines.

19. GUN COMMANDER. **a.** The gun commander (noncommissioned officer) commands the gun section and is also chief of the gun squad. He directs and supervises the—

(1) Training of the personnel of the gun section.
(2) Maintenance of matériel.
(3) Preparation of the piece for firing.
(4) Firing the piece.
(5) Cleaning the piece.
(6) Police of emplacement.

b. He is responsible for the observance of all safety precautions.

c. He is responsible for the observance of camouflage and gas discipline.

d. Twice daily, morning and night, he forms his section and posts them at the piece. After all details have reached their posts, he commands: EXAMINE GUN. He then 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 which are most likely to cause trouble and to which special attention is directed by pertinent Field Manuals and Technical Manuals. He then commands: REPORT, receives the reports of the chief of ammunition and the various details of the gun squad, and reports to the battery executive or assistant battery executive, "Sir, No. ——— in order," or reports any defects he is unable to remedy without delay.

e. In a permanent or semipermanent position where the gun has been emplaced and prepared for firing previously,

it is not necessary when going into action to go through the commands of DETAILS, POSTS or EXAMINE GUN. The sounding of the alert signal is sufficient to post the details. The gun commander verifies his details, especially at night, by the command, CALL OFF, at which the cannoneers call off their titles and numbers in succession. He checks their readiness for action by the command, REPORT. The command EXAMINE GUN is unnecessary since guns and servicing equipment are maintained constantly in a state of readiness for use, insured by the two daily inspections.

f. At the command TARGET, he repeats the command and target (aiming point) designation. He then assists the gun pointer in locating the target (in Case II) or aiming point (in Case III), if one is used, and directs the traversing of the piece. As soon as the gun is properly set, the gun commander reports or signals to the battery executive or assistant battery executive, "Sir, No. ——— on target."

g. He informs the chief of ammunition as to the projectile, fuze or fuze setting, and propelling charge to be used. At the command LOAD, he signals to the chief of breech to supervise the loading.

h. At the command COMMENCE FIRING, he gives the commands and directs the firing as prescribed in manuals covering the service of the piece.

i. At the command CEASE FIRING, the gun commander repeats the command. If the number of rounds has been specified, he gives this command on the firing of the last round and reports to the executive or assistant executive, "Sir, No. ———, (so many) rounds fired." When firing with separate loading ammunition, should the gun be loaded at the command CEASE FIRING, he reports the gun loaded to the executive or assistant executive and causes such action to be taken to insure safety as may be prescribed in manuals covering the service of the piece. When fixed or dummy

ammunition is used, he gives the command, UNLOAD, and supervises the unloading of the gun.

j. At the command SUSPEND FIRING, the gun commander repeats the command and if the piece is unloaded, he has it loaded, instructs the gun section to stand by for action, and withholds fire until he receives the command RESUME FIRING.

k. In Case III firing when using time interval signals, he may command: RE-LAY in case his gun is not loaded or pointed in time to fire. He repeats this command when it is given by the executive or assistant executive.

l. At the command STAND FAST, he halts action at the emplacement and takes such other precautions as may be directed.

m. During firing he will station himself in such a position as best to observe the functioning of the gun section and the gun. He will pay particular attention to the action of the gun in recoil and counterrecoil.

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

o. In case of a misfire, he reports to the executive or assistant executive, "No. ———, misfire," and the cause of the misfire if known. He is responsible for the observance of the safety precautions to be taken in such a case. (See pars. 80 and 87.)

p. At the command REPLACE EQUIPMENT, the gun commander repeats the command and supervises the cleaning, lubricating, covering of the piece, and the replacing of equipment. If the piece has been fired, he supervises the washing, drying, and lubrication of the bore, powder chamber, breech recess, breech mechanism, and firing mechanisms. He directs the cleaning of the carriage, especially the bearing surfaces, and checks that all bright parts and bearing surfaces are properly lubricated. The piece being covered,

equipment replaced, and the emplacement policed, he forms his section.

q. He keeps a record of the number of rounds fired by his gun during a practice or action, showing the date and approximate time, and keeps the gun book posted accurately and up to date.

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

(1) Efficiency of the personnel of his squad.

(2) Care of the ammunition.

(3) Enforcement of 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 gun commander for the ammunition cars and 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. He keeps a record of all ammunition received and ammunition used by the battery, exercising particular care that projectiles and fuzes are listed under proper name and type.

f. He keeps the gun commander informed regarding am-

munition on hand, checks the weights of projectiles, and reports defects found in ammunition.

g. He is prepared to furnish information as to powder temperature when so directed by the battery officers.

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

i. 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 gun commander, "Ammunition service in order," or reports defects that he is unable to remedy without delay.

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

k. 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 gun commander.

21. ARTILLERY MECHANIC. The artillery mechanic, assisted by members of the gun sections, makes such minor repairs and adjustments as can be made with the means available. For detailed duties, see manuals covering the service of the piece. The 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. He 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

NOTES 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 when properly authorized.

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. Whenever a piece is fired with HE shell equipped with a fuze not considered safe, each member of the gun section will be required to take shelter. (See par. 72.)

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.** Batteries should be thoroughly trained in the use of signals, both as an alternate method of communication for fire control and as a normal means of communication at the guns. During continuous firing, it is de-

sirable to limit verbal commands to the minimum and none should be necessary except in case of accident or unforeseen occurrences. The means of giving signals may include use of bells, buzzers, whistles, lights, and hand motions. Decision as to the kind of signals to be used is left to organization commanders; however, suggestions are offered by various manuals covering the service of the piece. Care should be taken to make certain that all signals are understood and that strict discipline is maintained in the use of signals.

b. When hand motions are used, the signals ELEVATE, DEPRESS, RIGHT, or LEFT, given in pointing, refer to the direction of the motion of the muzzle. The following hand signals are in common use:

(1) ELEVATE. Raise either hand to the height of the shoulder, 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 shoulder, 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 toward and fingers pointing toward the right (left) when it is desired to move the muzzle to the right (left).

(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. LOADING AND FIRING. a. General. The commands used by the battery commander in directing the battery to fire on a target are discussed in FM 4–5. The commands to initiate action are divided into three elements:

(1) Target designation—TRACK.

(2) Ammunition designation—LOAD.

(3) Method of firing—COMMENCE FIRING.

b. Target. The command TARGET is the command used to notify the battery that a target is being assigned. It is followed by designation of the location and description of the target. Guns pointed in direction by sighting on the target are reported "On target" as soon as the gun pointer has traversed to the target and is following its course. Gun pointers on guns pointed in direction by azimuth traverse pieces to the center of the normal field of fire and await data. As soon as observers report "On target," the battery commander gives the command TRACK. At the command, the gun pointer and the elevation setter set data as it comes from the plotting room. They continue to set data until the command CEASE TRACKING is given.

c. Ammunition. Ammunition is designated whenever there is a choice or a change from the normal and where it is necessary for the range section and magazine detail to know what projectile, fuze, fuze setting, and powder charge are desired. As a means of expediting firing, ammunition may be designated and the command LOAD given immediately after the target is designated; however, in case the target is still out of range and there is no certainty that the battery will be able to fire on it, the command LOAD may be withheld. The command LOAD may also be delayed when changing from one target to another if its use would result in a propelling charge remaining for some time in a hot gun chamber.

d. Method of firing. As an aid in identifying the splashes of rounds fired by the different guns of the battery, the battery commander may use the command BATTERY RIGHT (LEFT), ONE SALVO, COMMENCE FIRING. This command indicates that the right (or left) hand gun of the battery fires first and that the remaining guns (or gun) fire in order at regular intervals. Unless prescribed otherwise in battery SOP, the time interval between guns is that occasioned by waiting to hear the report of the preceding gun before taking necessary firing action. The battery com-

mander may specify any desired number of salvos. Other commands that may be used to order firing are—

(1) NUMBER ONE, FOUR ROUNDS, COMMENCE FIRING, when it is desired to fire a definite number of rounds with a single gun.

(2) HALF RATE, COMMENCE FIRING when it is desired to fire at a reduced rate.

(3) COMMENCE FIRING. All guns fire at full rate. Firing continues until CEASE FIRING or SUSPEND FIRING is given.

e. The supplementary commands to be given and actions to be taken by the battery executive, assistant executives, gun commanders, and gun sections are described in detail in manuals covering the service of the piece for various guns.

25. CEASE FIRING. When the number of rounds to be fired is specified, the gun commander will give the command CEASE FIRING at the end of the series and report the completion of firing. If the number of rounds is not specified, firing continues until the command CEASE FIRING is received. When fixed ammunition or dummy ammunition is being used, the piece is unloaded at the command CEASE FIRING unless otherwise directed. When separate loading ammunition is being used and the piece is loaded when the command CEASE FIRING is given, the gun commander will direct that the piece be kept pointed at a safe part of the field of fire and will report the piece loaded. Disposal of the round by firing or removal will be effected only under the direct supervision of an officer. After the command CEASE FIRING has been given, firing will be resumed only after the command COMMENCE FIRING is given.

26. SUSPEND FIRING. At this command, firing is halted and members of the gun section stand by ready for action. If the piece is not loaded when the command SUSPEND FIRING is given, the gun commander will direct that it be loaded. The command to fire is: RESUME FIRING.

27. SERVICE OF AMMUNITION. The method of serving ammunition will often depend on the lay-out and matériel of the individual battery and is not covered in the procedure prescribed for the service of the piece. A complete plan must be worked out for each battery to be followed in drill and firing. 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 other than standard shelters in the vicinity of the emplacement.

28. ARTILLERY GUN BOOK. Keeping the gun book (O. O. Form No. 5825) posted promptly and accurately is an important function in mobile batteries. It must always remain with the matériel regardless of where the latter may be sent. The book is divided into the following parts: record of assignments, battery commander's daily gun record, and inspector's record of examination, as well as forms to be filled out in the case of premature explosion. Lubrication records are also kept in this book. The completeness of its records and its whereabouts are the responsibility of the battery commander. It must also contain the date of issue of the matériel, by whom issued, and the place where issued. If a new gun is installed on the mount, all data previously recorded in the old book with reference to sights, mount, and other items must be copied into the new book before the old book is relinquished.

29. EMPLACEMENT BOOK. Records pertaining to each fixed gun and mobile gun assigned to a seacoast fortification are kept in the battery emplacement book. For complete information on the entries to be made, see TM 4–245.

CHAPTER 3

PREPARATIONS FOR FIRING

SECTION I
GENERAL

30. GENERAL. **a.** The effectiveness of the fire of a battery, measured in hits per gun per minute, is determined by several factors:

(1) Time required to open fire.

(2) Time required to place the center of impact on the target after fire is commenced.

(3) Skill of the battery in keeping the center of impact on the target during firing.

(4) Size of the dispersion zone.

(5) Volume of fire maintained.

b. Since these are factors that are directly affected by the preparations made by the battery, it may be said that effectiveness of fire depends on careful and continuous preparation for firing.

31. ORGANIZATION OF WORK. Preparations for firing include all the steps taken to insure the proper functioning of the battery in action. Preparations may be divided into three parts:

a. Initial preparations.

b. Regular checks.

c. Immediate preparations.

SECTION II
INITIAL PREPARATIONS

32. SCOPE. Initial preparations include such steps as may be taken by the battery commander to familiarize himself with the local situation, insure the proficiency of personnel, check the accuracy and completeness of orientation data, verify the adequacy of matériel, and reach decisions as to the methods and procedure to be followed by the battery. This section is intended to serve as a guide only and will not exclude other preparations recommended by pertinent manuals or deemed advisable by the battery commander.

33. LOCAL SITUATION. **a.** Consider the missions most likely to be assigned to the battery.

b. Ascertain the field of fire for the battery and endeavor to discover any limitations in ability to cover this field of fire.

c. Study the hydrography of the water area to determine most probable lines of approach.

d. Estimate the limits of the ranges at which the battery may be called upon to fire.

e. Consider the possible effects of enemy action and study the possibilities for countering such action.

NOTE.—For a detailed discussion of how these factors may affect the effectiveness of the fire of a battery, see FM 4–5.

34. TRAINING OF PERSONNEL. a. Train personnel under conditions approximating service conditions as nearly as possible. Introduce out of the ordinary situations to prepare the battery for emergencies. (For a complete discussion of drill, drill analysis, and target practice procedure, see TM 4–235.)

b. Make a careful check of the accuracy of the work of the personnel in key positions.

c. Avoid detailing any man to a position in the duties of which he has not been instructed.

d. Train personnel to ram the projectile properly and uniformly and to place powder charges so that the final motion of the breechblock will push the charge forward.

e. In order to insure the most uniform results from observation, plotting, and pointing instruments and other similar equipment, train operators to operate them so that the backlash of the gears or play in the brackets and supports affect the readings or settings in the same manner each time. This causes any existing play to have a uniform effect on the pointing of the gun.

f. Train elevation setters to set 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 is 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.

g. Where displacement corrections are necessary, train personnel in their application.

h. Train personnel in the methods used for the adjustment of fire, both for range and direction. Install the fire adjustment board or bracketing adjustment chart and conduct drills to teach their use in the adjustment of fire. This may be accomplished independently of regular drill by the use of dispersion tape and scale.

i. Train personnel in observation stations and at the guns in the recognition of targets, methods of locating targets, and selection of the part of the target to be sighted upon in tracking.

j. Instruct all personnel in the meaning of all commands used in firing, particularly such commands as may be given infrequently in firing for training.

k. Within sections, rotate personnel to provide capable understudies in case of emergency.

35. ORIENTATION DATA. **a.** Compute or, if already computed, check all orientation data including—

(1) Length and azimuth of base lines.

(2) Distance and azimuth of directing point from observation and spotting stations.

(3) Azimuths of aiming points, reference points, and datum points.

b. Post pertinent data permanently and conspicuously at all stations, plotting room, and guns.

36. BATTERY POSITIONS. **a.** Determine the exact location of the directing point.

b. Determine the displacement corrections that must be made both in range and azimuth. Decide how they will be applied. (See FM 4–15.)

c. In mobile batteries, inspect the existing battery commander's station and plotting room. Take steps to have them moved to a more suitable position, if necessary.

d. Study the existing communication system. Make the communication plan fit the location of the battery elements. Provide and organize auxiliary emergency communication systems. (See FM 4–5.)

e. In mobile batteries, inspect the ammunition magazines and relocate them if necessary. In addition to the main magazines, there must be suitable ammunition storage space at the guns. (See FM 4–5.)

37. POSITION FINDING AND FIRE CONTROL SYSTEM. **a.** Decide upon the type of standard and alternate position finding systems to be used.

b. Decide upon the method of fire control to be used.

c. Initiate a systematic course of training for battery personnel in the operation of the position finding and fire-control systems.

d. Decide upon standard and alternate methods of spotting and fire adjustment, both in range and direction. Obtain the necessary fire adjustment charts, range rakes, field glasses, and other equipment required for each system. (See FM 4–10 and FM 4–15.)

38. MATÉRIEL. **a.** Procure and store in the prescribed places, easily accessible to using personnel, all necessary tools, accessories, spare parts, and equipment needed by the battery. Improvise if the necessary equipment is not available.

b. Check the condition of all equipment, including communication, necessary in the determination of firing data. If any is missing or damaged, procure replacements or improvise substitutes with the materials at hand.

c. Procure and make available to all using sections firing tables for all combinations of ammunition used.

d. Replace unserviceable charts. In procuring additional or new charts for fire control equipment, endeavor to obtain them from the next higher organization supply officer, artillery engineer, or local ordnance officer in the order named. If none of these sources can supply charts, write to the Coast Artillery Board, Fort Monroe, Virginia, requesting the desired charts and furnishing the data called for in FM 4–15.

39. MUZZLE VELOCITY. a. In initial preparations, make every effort to determine the most probable value for the muzzle velocity that may be expected with the various powder lots, projectiles, and guns.

b. If possible, use muzzle velocity determined by chronograph firing. If such data are difficult to obtain, endeavor to use a value determined by field methods.

c. In determining expected muzzle velocity in the field, consider the order of preference usually given the various sources:

(1) Calibration firings.
(2) Records of previous firings.
(3) Results obtained locally in firing similar guns.
(4) The standard muzzle velocity as listed on the powder tag.

d. When records of previous firings are used, endeavor to use the records of at least four practices. The value shown in one or two practices will not necessarily be developed in subsequent firing.

e. In cases where no data on the muzzle velocity for a particular powder lot are available, other than those listed on the powder tag, take the following action:

(1) Apply to the local ordnance officer for information which he may have on the performance of the powder.
(2) If the powder is old and no weight adjustment in the charge has been made in recent years, or where, for any other reason, the accuracy of the available information is

doubted, apply through channels to the Chief of Ordnance for information as to what muzzle velocity may be expected. (3) Apply directly to the Coast Artillery School for any information the school may have on the performance of the powder in target practice firings.

(4) In the absence of any additional information from the above sources, study records of firings with other powder lots. If it is shown that the guns of the battery are consistently developing a muzzle velocity higher or lower than the standard listed velocity, a proportional correction may be applied to the value shown on the powder tag.

40. CALIBRATION CORRECTIONS. **a.** In his initial preparations, the battery commander should reach a decision as to the calibration corrections to be applied to the battery. For a discussion of the considerations that apply and the procedure to be followed, see FM 4–10 and TM 4–235.

b. If no records of calibration firing are available, some indication of the corrections needed may be obtained from records of target practice firings. While the values for muzzle velocity determined in a single practice are not necessarily true values, the differences developed between guns may approximate the true differences. This is because the errors common to all guns are included in the determination for each gun and are therefore stripped by obtaining a difference.

41. EMPLACEMENT BOOK. In addition to furnishing battery orientation data and records of previous firings, the emplacement book kept by fixed batteries may be the source of other useful information as follows:

a. Warming-up effect. 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.

b. 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 increases in dispersion. The most dependable information is to be had from the history of previous firings.

c. Malfunctions. Special attention should be given to the malfunctions which have occurred in the past in order that suitable precautions and preventive measures may be taken. A chart showing common malfunctions and methods for prevention appears in appendix I.

42. METEOROLOGICAL MESSAGE. Since accurate information on tide and meteorological conditions is desired for the preparation of firing data, the battery commander should check the source of supply for this information and make certain that it will be delivered promptly at regular intervals.

SECTION III
REGULAR CHECKS

43. GENERAL. a. The checks to be performed at regular intervals by the battery commander and battery officers will vary depending on the matériel and local conditions. Each battery commander should study his own particular situation and prepare a list of all pertinent points which should be under constant surveillance. Suggestions for items to be included in this check list appear in this section.

b. All boards, instruments, guns, and equipment pertinent to firing should be checked before and after each drill and left in a state of readiness. The habit of checking should be instilled in all personnel. After each firing, a thorough check should be made of all matériel for malfunctions and adjustments.

44. GUNS. a. Emplacement. (1) Check all existing electrical equipment, including power supply, lights, motors, and emergency systems.

(2) Inspect the power transmission systems, such as the Waterbury speed gears of fixed batteries.

(3) In fixed guns, periodically check the level of the base ring every 10° throughout the field of fire. Make provisions for the application of any necessary corrections. Record corrections in emplacement book. This must be done at least once a year.

(4) Make certain that means are provided for preventing excessive dust during firing.

(5) In mobile batteries, check suitability of regular and alternate aiming points, taking into consideration the possibility of adverse weather conditions.

(6) In mobile batteries, see that spades and outriggers are firmly imbedded, that the recoil pit (if needed) is adequate, and that the gun platform (if used) is readily removable.

(7) Make certain that means are provided for extinguishing any fire that might be started in camouflage or grass at the emplacement.

(8) See that cotton, waste, or other form of ear protection is provided for personnel.

b. Maintenance. (1) Inspect the breechblock frequently. Dismantle, clean, check, assemble, and adjust the thrust bearing at least monthly, paying particular attention to the condition of the venthole and gas check pad. (Refer to pertinent Technical Manuals.)

(2) Inspect the condition of the bore and powder chamber and clean them when necessary.
(3) Check the firing mechanism. Test all safety features on the firing mechanism and the breechblock at least every week; test electrical circuits for continuity and safety.
(4) Keep continuous records of lubrication of the gun and carriage. Make certain that proper lubricants are available and are used as specified in the appropriate Training Manuals and Lubrication Charts.
(5) Continually check the elevating and traversing mechanisms for proper lubrication. They should work smoothly and easily at all times. Take immediate action when necessary.
(6) Maintain proper adjustment of antifriction devices installed on the gun.
(7) Make frequent checks of overload slip devices (slip friction devices). Test and adjust at least every month.
(8) Inspect the recoil system and check the supply of oil daily. Cylinders should be emptied and refilled twice a year.
(9) Inspect the counterrecoil system. Check the gas and liquid pressure if there are provisions for doing so. Consult pertinent Technical Manuals for specific information.

c. Pointing equipment. (1) Check the application of any calibration corrections made before and after each drill and firing.
(2) Check installation of night lighting equipment and its operating condition. Be sure that all electrical connections are secure. Provide extra bulbs and flashlights. Due to improper installation or maintenance, night lighting devices have failed in action after a few rounds were fired.
(3) Check reading of range disk or elevation quadrant with a clinometer or gunner's quadrant for at least three elevations. Verify any adjustments and record them in the emplacement book.

(4) Check the synchronization and operation of the data transmission system, if the battery employs such a system.
(5) In fixed batteries, check the orientation of the guns and pointing equipment before and after each drill and firing. Check, where applicable, the azimuth index, the vernier, and the sight. Verify any adjustments made.
(6) In mobile batteries, check the orientation of each gun and its sight before and after each drill and firing. Check—
(*a*) Boresighting of each gun.
(*b*) Level of level bubbles.
(*c*) Clear line of sight to aiming point.
(*d*) Adjustment of sight for Case II pointing.
(7) Check training of gun pointers in shifting rapidly from one aiming point to another and from one case of pointing to another.
(8) Check the compensating sight as outlined in FM 4–10. Make certain that the sight shank is tight in the sight mount.

45. AMMUNITION. a. Projectiles. (1) Check precautions taken to provide protection for rotating bands of all projectiles in the magazines and at the guns.
(2) Weigh projectiles not already marked with weight; segregate all by weight, type, and lot number. Remove grease and oil from projectiles before they are fired.
(3) Caliper bourellets of all projectiles. Scrape paint from those measuring over the diameter of the bore.
(4) Ascertain that there are sufficient projectiles, ready for action, at the guns. (Consult local SOP.)

b. Powder. (1) Separate powder in central magazine into lots. If possible, use powder only from a particular lot during a firing.
(2) Ascertain that there is a maximum-minimum thermometer at the powder magazine.
(3) Check measurements and conditions of powder charges, including sewing of igniter pads, for conformance with safety provisions of AR 750–10.

(4) Provide an adequate supply of powder, ready for action, at the guns. (See local SOP.)
(5) Insure that there is a thermometer to determine the temperature of the powder stored at the guns and that the powder temperature is furnished the plotting room at regular intervals.
(6) Make a record of the muzzle velocities listed on the powder tags for various lots for use in computation of ballistic data.

c. Fuzes. (1) Check all point detonating fuzes for type and fit.
(2) See that there is an adequate supply of fuzes at the guns ready for action.
(3) Check availability and serviceability of the equipment used for assembling point detonating fuzes.
(4) Check all projectiles designed for base detonating fuzes. See that fuzes are assembled.

d. Primers. (1) Test all primers for fit in the firing mechanism and, except for 155-mm guns, test all primers in the primer seat.
(2) Check length of button wire on friction and electric primers.
(3) Test electric primers for resistance and continuity of circuit. See ordnance personnel for details.
(4) See that all fired primers are properly disposed of. Fired primers should never be returned to the primer pouch.
(5) Check disposal of defective primers.
(6) Make certain that primers are stored in a suitable and accessible location known to all gun section personnel (see par. 126).

46. FIXED AMMUNITION. The same checks as prescribed for separate loading ammunition will be followed for fixed ammunition wherever applicable. In addition the following precautions should be taken:

a. Wipe off the exterior of the cartridge cases and try the loaded rounds in the chamber of the gun in two positions about 90° apart. Replace any rounds that do not fit.

b. Examine all rounds for evidence of any damage to case or fuze or indication of any separation between case and projectile.

47. PLOTTING ROOM. a. Data computer. (1) Check availability of static check problem.

(2) Make certain that charts are included for each type of ammunition.

(3) Have situation charts posted in prominent location.

(4) Check mechanical condition of computer. Make certain that maintenance report is available and up to date.

b. All plotting boards. (1) Orient and check by check points before and after each drill or firing. Orientation of the boards must check to the nearest 10 yards and 0.01° (see FM 4–10.)

(2) Make certain that all battery orientation data are posted in a conspicuous place near the board. Data must include azimuth and length of base lines, azimuth and distance from DP to base-end stations, check point data, azimuth and range to datum points, and azimuth and distance from DP to displaced gun or platoon.

(3) Check all prediction devices. Make sure they are appropriate for the ammunition and timing system being used. (See FM 4–15.)

(4) Check maintenance of boards. (See TM 9–1570.)

(5) Check all couplers for proper length and correct assembly.

(6) Check supply of plotting paper.

(7) See that boards, when not in use, are protected by canvas covers.

(8) See that numbers on the azimuth circle and gun arm can be easily and accurately read.

(9) See that station arms can be quickly locked when azimuths have been set.

c. M1923 (Cloke) and M1 plotting boards. (1) Check platen arm for excessive play.

(2) On the M1923 (Cloke) board, check the azimuth strips and make sure they are located so that the degrees divisible by 9 are opposite the full lines on the brass strip and that they are in their proper positions with respect to adjacent strips.

(3) After orientation of the M1 board, make sure that the azimuth number chain is locked in position.

(4) Check the accessory chest to see that a full supply of parts is maintained.

d. M3 and M4 plotting boards. (1) Check and adjust orientation of all optical arms.

(2) Check accessories frequently and replace those missing.

e. 110° plotting board. (1) Check couplers for each base-end station on the board.

(2) Ascertain that operators are reading the azimuth scale correctly. This depends upon the base line being used. Refer to orientation data.

f. Range correction board. (1) See that charts are mounted on the board for every combination of ammunition used by the battery. Check the chart in use to determine whether it is appropriate for the combination of gun and ammunition being used. Be certain that titles of charts can be read easily.

(2) Compute a check problem using firing table data. Check the board using the same data. Ranges at which check problems should be computed and the board checked are indicated on pertinent charts. If corrections do not agree, determine the cause and correct the trouble. Check the boards in this manner frequently, as the charts may become distorted. (See FM 4–15.)

(3) Check the orientation of the board.

(4) Check the mechanical condition of the board. Be sure replacement springs for the slides on the M1A1 board are at hand.
(5) Provide a chart to determine the muzzle velocity developed at various temperatures for the powder stored at the guns.
(6) Post expected muzzle velocities for each lot of powder.

g. Wind component indicator (standard instrument). A common error made on the wind component indicator is adjusting it 180° out of true orientation. Check its orientation and operation frequently. (See FM 4–15.)

h. Percentage corrector. (1) See that the percentage corrector is equipped with tapes for all combinations of ammunition supplied to the battery. Make certain that the tape being used is for the ammunition being fired, and that it is assembled with increasing range in the proper direction. Be sure that the titles of the tapes can be read easily.
(2) Check the position of the setting index on the xylonite face. The setting should be opposite 300 on the ballistic correction scale.
(3) Check the tape for accuracy, using firing table data.
(4) See that the interpolator is ready in batteries requiring its use.
(5) Check the application of the calibration correction if it is being applied on the percentage corrector. (See par. 40.)

i. All deflection boards. (1) Check orientation.
(2) Check the zero deflection line on the wind and drift chart. It should read zero at all positions of the pointer on the vertical axis.
(3) Check the wind, drift, and rotation chart to make certain that it is the appropriate chart for the combination of ammunition used.
(4) Check accuracy of board against firing tables.

(5) Be prepared to use either Case II or Case III pointing. Check method of informing battery personnel of case of pointing to be used at each drill or firing.
(6) Check the normal on the deflection scale for conformance with the normal on the deflection adjustment board. If any possibility for confusion exists, make certain that the using personnel understand the differences.

j. Deflection board M1. (1) Make sure that ballistic charts for all combinations of ammunition used by the battery are on the board. See that the scale of the chart in angular units conforms to the angular units (mils or degrees) of the board.
(2) Check the mechanical condition and operation of the board. See that the appropriate gears are installed for the angular units used.
(3) If the displacement corrector is used, check for orientation and operation.
(4) Check lubrication of board.
(5) If rotation effects are not used, be certain that the rotation pointer is firmly fixed.

k. Universal deflection board. (1) Make sure that the proper chart for use with the ammunition being fired is on the board.
(2) Check the reference number system used on the angular travel computer. It should agree with the deflection board.
(3) Check wind and drift chart angular scale and adjustment scale to be sure that both are constructed to the same scale.
(4) Check assembly of all charts, scales, and tapes to ascertain that they increase in the proper direction with respect to one another.

l. Meteorological message board. Check to make certain that proper meteorological messages are being received regularly and are being posted promptly in a prominent place.

m. Spotting boards M2, M3, and M7. (1) Check the orientation of the station arm plate (orienting disk).
(2) Regraduate the grid on the M2 board to read in corrections. (See FM 4–15.)
(3) Run a check problem through the board. Make certain that it agrees with the mathematical solution. (See FM 4–15.)
(4) Check position of the grid.
(5) Check accessory chest to see that all spare parts are in order. For the M3 and M7 boards, have on hand an extra station arm plate oriented for a secondary spotting base line.
(6) Check general maintenance of the board.

n. Fire adjustment boards. (1) RANGE ADJUSTMENT. (*a*) Have at hand previously prepared bracketing adjustment charts.

(*b*) Check availability of supply of magnitude method graph paper and rulers graduated to agree with the spotting board in use.

(2) LATERAL ADJUSTMENT. (*a*) Ascertain that the angular units and reference number normal on the chart agree with the correction scale on the deflection board or can be readily converted to corresponding reading.

(*b*) Have the plotting rule graduated in the same manner as the instrument delivering spotting data.

(*c*) Make certain that the adjustments sent to the guns are in figures conforming with the index on the gun sight.

48. OBSERVATION SYSTEMS. a. All systems. (1) In each station, post orientation data conspicuously for all reference points used by that station.
(2) Provide firm foundations for all observation and spotting instruments, particularly those located in the vicinity of the guns.
(3) Check lighting equipment.

b. Horizontal base system. (1) Check orientation of observation instruments located in the base-end stations.
(2) Check the mechanical condition of the instruments and adjust periodically.
(3) Check for removal of parallax.

c. Vertical base system. (1) Check the accuracy index of the observer frequently. (See FM 4–10.)
(2) Check orientation and adjustment of the depression position finder as outlined in FM 4–15 and pertinent technical manuals.

d. Self-contained base system. (1) Check adjustment of range and height finders before and after each drill or at least once each hour. (See FM 4–15.)
(2) Check the accuracy index of the observer frequently. (See FM 4–10.)

e. Spotting systems. (1) Have range rakes or field glasses, or both, in spotting stations to augment the normal spotting instruments.
(2) See that spotters are properly trained.

49. COMMUNICATION. Perform such communication checks as are prescribed in standing operating procedure. During drill, require personnel to check the communication system as a part of the drill. In addition—

a. Check the time interval system in the plotting room, at the guns, and at observation stations. Check timing with stop watch and make adjustment if necessary.

b. Provide an alternate time interval system and check frequently.

c. Provide and check alternate communication systems and damage control provisions.

d. Check operation of data transmission system.

e. Have line route maps and traffic diagrams posted at switchboards.

f. Have a supply of new batteries available for all telephones in a local battery system.

g. Provide firm supports for communication equipment, particularly when located at or near the guns.

SECTION IV
IMMEDIATE PREPARATIONS

50. CHECKS BY PERSONNEL. a. Since the success of the battery in firing depends on the smooth functioning of all sections and details, much benefit can be secured from checks performed individually and simultaneously by personnel immediately upon the sounding of an alert. A definite routine should be followed in performing these checks, and they should be made without waiting for direction or supervision by an officer. Duties should be memorized and performed quickly and instinctively by the individuals concerned, and careful training with direct supervision should be given in advance.

b. The checks to be performed are prescribed by the battery commander and are based on local conditions. Suggestions for some of the points to be covered are given in the paragraphs below.

51. BATTERY COMMANDER'S AND BASE-END DETAILS. a. Check orientation and adjustment of all visual and radio azimuth and range finding apparatus.

b. Determine the type of projectile, fuze, and powder charge to be used and notify all elements of the battery of same.

c. According to the situation, ascertain the pointing system to be used (Case I, Case II, or Case III) and notify all elements of the battery accordingly.

d. Check lighting equipment if alerted at night.

e. Check communication with all elements of battery and higher headquarters. Establish a definite routine for checking.

52. PLOTTING SECTION. **a.** Check plotting and spotting boards by means of check points which should be left "set up" on the boards after each drill or firing.

b. Check setting and operation of data computer (if one is used).

c. Based on the type of projectile, fuze, and powder charge ordered to be used, make sure proper charts and scales are in place on all plotting room devices.

d. Check setting of most recent meteorological data. This should be set on the boards immediately upon receipt of message. Ascertain powder temperature.

e. Check all fire adjustment equipment.

f. Check communication with all elements of the battery, including time interval system and the data transmission system (if one is used).

53. GUN SECTION. **a.** Prepare gun for firing.

b. Prepare for the immediate serving of projectiles, fuzes, powder charges, and primers as ordered.

c. Check accessories necessary for the service of the piece.

d. Set up sights for the type of pointing system ordered (Case I, Case II, or Case III) and check sight orientation.

e. Check recoil system.

f. Check lighting equipment for night firing.

CHAPTER 4

SAFETY PRECAUTIONS

SECTION I
GENERAL

54. GENERAL. **a.** General safety measures for firing, including methods for establishing safety limits, are prescribed in AR 750–10.

b. The safety precautions described herein cover general principles for firing at towed targets. They indicate as well the princples to be followed under combat 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 make the prescribed signal therefor.

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55. 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.

56. COMMANDING OFFICERS. It is the responsibility of the harbor defense commander or next subordinate commander that safety requirements (including precautions listed in sec. II) are strictly enforced. He will—

a. Decide whether or not the target may be towed from left to right (see AR 750–10) for seacoast artillery gun batteries.

b. Detail a safety officer and such assistants (see sec. III) as may be required and will make certain that individuals detailed as safety pointing observers have such knowledge of the ballistic and other conditions connected with the firing as to render them fully capable of judging when the field of fire is safe.

c. Designate an officer (normally the immediate superior of the battery commander) to be in charge of firing at each firing point.

SECTION II

SAFEGUARDING PROPERTY

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

58. WARNING ORDER. In all cases where firing for training 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 responsible for the firing.

59. PUBLIC NOTICES. **a.** Prior to firing over water areas or planting or firing submarine mines in water areas which are used by shipping of any kind, the harbor defense, post, or similar responsible commander will warn local naval officials and, subject to current instructions regarding secrecy, inform the public of the contemplated firing or submarine mine planting through one or more of the following agencies: public press, public radio, Coast Guard, or 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 precautions may be taken by those responsible for such property. Also general notice will be given by publication in local newspapers.

SECTION III
SAFETY OFFICER

60. GENERAL. Safety in firing is the responsibility of the officer in charge of the firing at a particular point or locality. In firing for training, the officer in charge will be assisted by a safety officer who verifies that the guns are set safely before firing. There will be a safety officer for each unit firing and he will have no other duty than that of safety officer.

61. DUTIES OF SAFETY OFFICER. 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.

62. 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 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 of 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. In some cases, other observers in the water area may be needed.

63. 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.

64. DANGER FLAGS AND LIGHTS. **a.** The safety officer will not permit firing at a towed seacoast artillery 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.

65. 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 notify all concerned when firing is to commence and to notify the firing point when the field of fire is unsafe.

SECTION IV
SAFETY POINTING OBSERVERS

66. GENERAL. **a.** Safety pointing observers will be used during all firing for training.

b. Officers will be utilized as safety pointing observers for all firing except subcaliber and machine gun practices. For the excepted firing, 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.

67. 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 set for firing. He will be connected directly by telephone 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 observer. 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

68. TUG OFFICER. For seacoast artillery 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.

69. TOWING VESSEL. **a.** During 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°. In firing at towed targets with automatic weapons, firing is prohibited when the target-gun-towing vessel angle is less than 9° (160 mils).

c. When the direction in which the target is to be towed has been prescribed (see par. 56), firing will be limited to conform with prescribed conditions. Officers in charge of firing will be alert to halt firing when water conditions are such that ricochet may endanger the towing vessel. For a discussion of the factors that affect direction of ricochet, see AR 750–10.

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. When using visual observation methods, firing on the target will be permitted only when the target is effectively illuminated and when both the target and the towing vessel, or light thereon, are visible from the battery. When using radar, the towing vessel must be visible.

h. For night firing, 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

70. GENERAL. **a.** Matches and unauthorized lights will not be taken into a 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 pointing and safety in firing, cannoneers who have duties in connection with pointing will be required invariably to verify the setting after the breech has been closed.

e. At the command CEASE FIRING, lanyards will be dropped. Safety devices on the firing mechanism will be placed in the nonfiring position. For detailed information on action to be taken, see manuals covering the service of the piece.

71. 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. 77.)

72. AMMUNITION. **a.** Technical Manuals describing the ammunition for various types of armament should be studied carefully before any high explosive ammunition is fired.

b. When shrapnel or high explosive ammunition is fired, no person will be allowed between the line of guns firing and and a line 200 yards forward of that line. Safety regulations also require that cover be provided for personnel when firing HE shell not equipped with fuzes classed as boresafe or otherwise specified as safe. Battery commanders should check all ammunition against lists published in AR 750–10 and enforce the prescribed safety regulations.

c. If the condition of ammunition is such that it may cause an accident, the particular lot involved will be withdrawn from service until the War Department authorizes its reissue.

d. All ammunition at the firing point must be placed so as to minimize the possibility of ignition, explosion, or detonation 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. Bases of fixed rounds should be placed so as to minimize the possibility of accidentally detonating primers.

73. 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 or are needed to meet the ammunition requirements of batteries on alert. If the fuze is equipped with a felt or rubber washer, make certain that the washer is in place before screwing the fuze home.

c. Mk. III and Mk. IIIA fuzes must be handled with greatest care. These fuzes are now in reserve and will not nor-

mally be used in target practice. If such a fuze is used, it 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, the fuze must be removed and destroyed to eliminate the possibility of a premature explosion in the gun. The brass spiral is frequently referred to as the tape, resulting in confusion as to the proper part to be removed. Enlisted men will be carefully instructed to remove only the waterproof cover with the friction tape and not the brass spiral.

74. PRESSURE GAUGES. **a.** When loose pressure gauges are used during practice firing, extreme care will be taken after each round to insure that no gauge remains in the bore.

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

75. SHELL STUCK IN BORE. No attempt will be made to remove a loaded shell stuck in the bore without complete familiarity with instructions contained in TM 9–1900. If the field of fire is safe, the most practical method for removing larger caliber shells is by firing. Removal with the aid of a rammer which bears only on the projectile and provides clearance around the fuze may be practical for smaller caliber shells but will be undertaken only under the direct supervision of an officer. If removal cannot be readily accomplished, the piece should be kept pointed at a safe part of the field of fire until ordnance personnel can effect removal.

SECTION VII

SAFETY PRECAUTIONS APPLICABLE TO ARMAMENT USING SEPARATE LOADING AMMUNITION

76. GENERAL. After each shot the powder chamber will be sponged with the liquid provided, unless the gun is equipped with gas ejectors (compressed air scavenging). Following the sponging, the inner face of the breechblock will be wiped with oily waste.

77. PRIMERS. Primers will not be inserted until after the breechblock is closed, rotated, and locked. (Exception: *electric* primers may be inserted while the breechblock is open on 6-inch guns M1903, M1905, and T2.) 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.

78. 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 guns mounted on disappearing carriages, the primer should not fire until the gun is in battery.

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

79. LANYARDS. When the lanyard is used, it will not be attached (except in the case of disappearing guns) until the

piece has been given sufficient elevation to clear any mask in front of it. Lanyards will be pulled with a quick, strong pull (not a jerk) from a position as near the rear of the piece as is convenient. Greatest care will be exercised in handling the lanyard on disappearing guns.

80. MISFIRES. **a.** A misfire is said to occur when the piece fails to fire when desired.

b. A misfire has a strong tendency to produce confusion and excitement in the gun squad. Great care, therefore, will be taken to prepare for this contingency by drill in the action to be taken and by explanation of the reasons for these precautions. Personnel will be trained to keep clear of the line of fire and the path of recoil when a misfire occurs.

c. With guns using separate loading ammunition the following procedure will be observed in case of a misfire. Two attempts will be made to fire the primer before it may be removed. If upon examination it is found that *the primer has not fired,* a new primer will be inserted and fire continued. If *the primer has fired,* a minimum of 30 seconds will be allowed before the breech may be opened and the faulty charge removed. The faulty charge will be stored separately from other charges.

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

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

81. FLAREBACKS. Flarebacks are caused by hot gases coming in contact with the air, thus affording sufficient oxygen to permit combustion. When the breechblock is withdrawn, the gases remaining in the bore sometimes pass

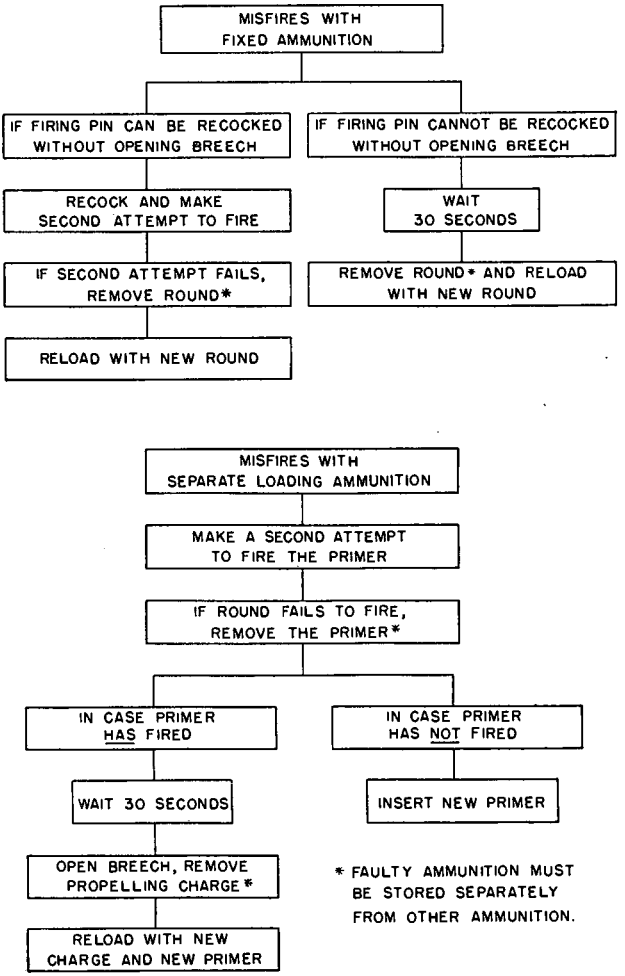

Figure 2. Action to be taken in case of a misfire.

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.

82. 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 guns 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 guns 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, not pinned, to the base section. The charge will be so handled that the igniter is habitually placed adjacent to the breech.

83. EXCESSIVE PRESSURES. a. In firing seacoast artillery guns, 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 to seriously 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 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 artillery guns 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 gauges 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, therefore, need not be gauged. All other precautions as listed above must 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. (1) Following is a list of the possible causes of erratic pressures in firing seacoast artillery guns:

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

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

(*c*) Damp igniter.

(*d*) Hangfire due to wet igniter or charge.

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

(*f*) Omission of igniter where required.

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

(*h*) Projectiles slipping back on powder charge due to faulty ramming.

(*i*) Increased density of loading resulting from use of wrong type of projectile.

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

(*k*) Charge overweight.

(2) Every effort will be made to insure that none of these causes exists. Should excessive 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

84. 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.

85. FIRING MECHANISMS. Firing mechanisms should be inspected and tested frequently to insure proper functioning 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.

86. LANYARDS. Lanyards or firing handles will be pulled with a quick, strong pull (not a jerk).

87. MISFIRES. In case of a misfire with guns firing fixed service or target practice ammunition, two attempts will be made to fire the piece before the breech is opened and the round removed. For guns which cannot be recocked without opening the breech, wait 30 seconds from the time of the occurrence of the misfire. Then remove the round. The faulty round must be stored separately from other rounds. (See fig. 2.)

SECTION IX

SAFETY PRECAUTIONS APPLICABLE TO FIRING OF SUBMARINE MINES

88. GENERAL. **a.** Methods employed in handling, loading, unloading, and testing submarine mines will be in accordance with procedure described in manuals covering these operations. See section X for safety precautions applicable to loading.

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b. All vessels used in submarine mine work must be maintained and operated in accordance with current regulations (see FM 4–6 and 4–7 (when published)).

c. In firing of mines for practice, the harbor defense commander will see that all pertinent safety requirements are strictly enforced and will detail a safety officer and such assistants as may be required to insure safety.

89. SAFETY OFFICERS. **a.** The safety officer detailed for the firing will have complete authority over all matters pertaining to safety. He will be assisted in the performance of his duties by the casemate and planting officials.

b. The casemate official will be connected to the safety officer by telephone and will have the duty of seeing that no firing power is applied until after word is received from the safety officer that the field of fire is clear.

c. The planting official will act as the tug officer during firing and will be responsible for compliance with signals received from the safety officer.

90. TOWING VESSEL. The vessel used in towing the target will approach the line of mines so that the acute angle between the line of mines and the course of the towing vessel extended will not be less than 50°.

91. LENGTH OF TOWLINE. The length of towline between the towing vessel and target will not be less than 500 yards for buoyant mines, and not less than 1,000 yards for ground mines.

92. SAFETY SIGNALS. The safety officer will cause a red streamer or red signal light to be displayed on shore when the towing vessel has cleared the line of mines by 200 yards, provided that the mine will be fired on that course. The towing vessel will acknowledge receipt of the message by raising a red streamer or red signal light.

Radio communication between the towing vessel and safety officer may be used to supplement the signals.

93. APPLYING FIRING POWER. a. During target practice firing power will be applied only to a mine in the line of mines in which the practice is being conducted, thus, if the practice is being held in the seaward line of mines firing power will be applied in that line only.

b. After firing a mine in target practice, a short period will be allowed for the purpose of checking the mine circuit, after which the power will be turned off.

SECTION X

SAFETY PRECAUTIONS APPLICABLE TO LOADING OF SUBMARINE MINES

94. GENERAL. a. Safety precautions applicable to explosives and ammunition in general appear in TM 9–1900. All personnel engaged in handling TNT in loading mines must be familiar with these regulations. General procedure for loading mines is covered in FM 4–6 and 4–7 (when published).

b. Safety shoes must be worn in loading rooms or buildings, or wherever loose TNT is handled. It is desirable but not required that personnel wear safety shoes when handling, storing, and shipping TNT in boxes.

c. Important safety rules. Use shovels or scoops made of copper or aluminum when handling granulated TNT. Use nonsparking tools in opening boxes. Never open containers in a magazine in which explosives or ammunition are stored; contents of a container may be transferred only

at a distance of 100 feet from a magazine. Limit the amount of TNT in the loading room to that needed to load four mines.

95. LOADING PROCEDURE. When filling the mine case, all cover holding and cap holding screws must be inserted into their holes to prevent TNT from getting into threaded recesses. Before replacing covers, brush all particles of TNT from finished surfaces and from screw threads.

96. HEATING OF LOADING ROOMS. Loading rooms will not be heated by any heating system employing an open flame or which produces a temperature in excess of 100° F. A free circulation of fresh air will be maintained in the building. No electrical machinery of any type capable of producing a spark will be installed in loading rooms.

97. TESTING RESTRICTIONS. Compound plugs or mines which have been loaded with TNT and detonators will not, under any circumstances, be tested electrically before they are planted in the mine field and the line of mines is clear and safe.

98. FIRE FIGHTING. If fire occurs where TNT is stored in wooden boxes, the explosive will usually burn quietly, but may possibly detonate. If the fire has gained headway before it is discovered, no attempt should be made to fight it.

99. PROTECTION AGAINST PHYSIOLOGICAL EFFECTS. It is important that personnel engaged in handling granulated TNT are informed of the potential toxic effects of this material.

a. Protection against absorption into the circulatory system is obtained by bathing at close of work and by chang-

ing and laundering work clothing before it becomes heavily impregnated with TNT, at least daily.

b. Protection of the respiratory tract is provided by dust-type respirators. Should lengthly periods of exposure be required, personnel should be rotated to provide 2 weeks of nonexposure duties to 1 week of exposure.

c. Protection of the digestive system is obtained by thoroughly washing hands and face before eating, drinking, or smoking. The use of a soap especially prepared for this exposure is recommended.

d. Exposed personnel should be subjected to regular and frequent medical examination, including blood count and urinalysis.

CHAPTER 5

SALUTES

100. GENERAL. **a.** Salutes with guns are fired to render 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 to commemorate certain holidays. Harbor defense and fort commanders should familiarize themselves with the provisions of AR 600–25 and 600–30, which list the occasions on which salutes are rendered, 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 guns is always fired under the personal supervision of a commissioned officer, who directs the firing. One gun may be used; however, use of at least two guns is desirable due to the possibility of misfires. 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, use of other guns may be authorized, particularly 3-inch guns in harbor defenses.

101. SALUTING AMMUNITION. **a.** Blank ammunition is provided for guns of caliber up to and including 105-mm for saluting purposes. A complete round of saluting or blank ammunition consists of a black powder charge placed in a primed cartridge case, a felt wad, and a 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 appear on the case. Each round is issued in a fiber container.

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

102. PROCEDURE. **a.** Firing of 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 before firing the salute, wipe off the exterior of the cartridge cases and try the loaded rounds in the chamber of the gun. Replace any rounds that do not fit.

(2) See that one or more extra rounds are provided for emergency use in case of misfires. Safety precautions must be observed in case of misfires.

(3) 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, use as many guns as are available (not to exceed four), so as to increase the time between rounds for a given gun and to 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 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 loaded until its proper turn comes again when a second attempt may be made to fire. The safety precautions to be observed in removing the round after a misfire are as listed in chapter 4.

103. PRECAUTIONS. Use greatest care to avoid accidents. Keep 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, observe the following precautions:

a. Do not tamper with rounds of blank ammunition under any circumstances. Report 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. Send reports to the local ordnance officer who is responsible for destruction and replacement.

b. Avoid removing blank ammunition from the fiber containers sooner than is necessary before firing. While firing, keep the remaining rounds well away from the gun, preferably in a box with a lid that closes automatically under its own weight.

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, turn the gun over to the local ordnance officer for removal of the round.

d. Handle ammunition with care at all times. Rough or careless handling frequently results in—

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

(2) A blow on the primer sufficiently severe to explode the round.

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

e. Avoid exposing blank ammunition to high storage temperatures, as this tends to cause the closing cup to shrink and break the seal.

f. Make certain that the bore of the gun is unobstructed and that no foreign material is placed therein.

g. Permit no smoking in the vicinity of guns or ammunition.

CHAPTER 6

CARE OF MATÉRIEL

SECTION I
GENERAL

104. GENERAL INSTRUCTIONS. **a.** The information and instructions contained in this chapter are brief and are intended as a general guide only. They apply primarily to matériel designated as class A in TM 4–245. (For care and preservation of other classes of matériel, see TM 4–245.)

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 agency concerned.

c. The methods prescribed for the operation, care, and preservation of matériel are those described in pertinent Field and Technical Manuals, a thorough understanding of which is required on the part of all officers and others having matériel in their 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 condition. Major repairs are made by the services concerned, only adjustments and minor repairs being made by the troops.

e. The immediate superiors of the battery commanders are directly responsible to higher 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. Detailed information describing the care and maintenance of matériel appears in the following publications:

(1) Preservation and care of seacoast defense matériel, TM 4–245.
(2) Cleaning and preserving materials, TM 9–850.
(3) Field Manuals covering the service of the piece.
(4) Technical Manuals covering the functioning, care, repair, adjustment, and maintenance of various types of matériel.

105. SUPPLY SERVICES. a. General. (1) The technical services of the Army Service Forces are responsible for the supply of all equipment, spare parts, and supplies used by the battery. In harbor defense batteries, most of the required matériel is included as a part of the fixed fortifications and structures constructed under approved harbor defense projects, equipment listed in Tables of Organization and Equipment being limited mainly to organizational equipment. In mobile batteries, all principal items of matériel are included as a part of the organizational equipment authorized by Tables of Organization and Equipment. In

both harbor defense and mobile batteries, such additional items of equipment, accessories, spare parts, and supplies as may be required are listed and authorized by various Tables of Allowances, supply catalogs, and circulars of the technical services.

(2) In general, the using arm is responsible for routine maintenance and repair of matériel, special maintenance and major repairs being the responsibility of the technical services supplying such equipment.

(3) Following is a brief summary of some of the items supplied by the various technical services; general instructions on the care and maintenance of property and installations are covered in sections II, III, IV, and V.

b. Corps of Engineers. The supplies and equipment furnished by the Corps of Engineers include drafting room equipment, surveying equipment, sand bags, camouflage material, apparatus for taking tide measurements, searchlights, and portable fire control towers, including spare parts, accessories, and expendable supplies. The Corps of Engineers is also responsible for the construction of fortifications and structures and it supplies most of the material and equipment required. Additional responsibilities include alterations, repairs, and maintenance, other than routine, required for the items it supplies.

c. Ordnance Department. The Ordnance Department supplies guns and carriages, automatic weapons, gun directors, small arms, ammunition, motor transportation equipment, railway ammunition and fire control cars, railway gun mounts, observation station and plotting room instruments and apparatus firing tables, data computers, and data transmission systems, including spare parts, accessories, and expendable supplies. It also supplies paints, oils, cleaning and preserving materials, and tools required in routine maintenance of ordinance property. The Ordnance Department

is responsible for maintenance, other than routine, of the items it supplies.

d. Signal Corps. Among the responsibilities of the Signal Corps are those of procuring and supplying communication, meteorological, photographic, and radio direction- and range finding equipment, including spare parts, accessories, and expendable supplies. As one of the technical services of the Army Service Forces, the Signal Corps supplies and installs the permanent communication lines and equipment required for harbor defense projects. It is also responsible for alterations, repairs, and maintenance, other than routine, required for the items it supplies.

e. Quartermaster Corps. The Quartermaster Corps supplies such items as buckets, axes, shovels, emplacement books, flags, tents, lanterns, field ranges, carpenter's tools, field desks, typewriters for administrative offices, oil, grease, and fuel for motor vehicles, soap, brushes, and brooms.

f. Transportation Corps. The Transportation Corps supplies kitchen, tank, gondola, box, and flat cars and locomotives for railway artillery units, and boats for harbor defense units. It also furnishes grease, oil, and fuel for the equipment it supplies and is responsible for other than routine maintenance.

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

SECTION II

ENGINEER PROPERTY AND INSTALLATIONS

106. 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 cold weather, care should be taken to prevent water from freezing in pipes and fixtures.

107. EARTH SLOPES AND PARAPETS. **a.** After rains, earth slopes and parapets should be inspected and any tendency to gully and wash corrected 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 so far as camouflage requirements will permit.

108. MACHINERY. All machinery, such as generators, motors, disappearing searchlight towers, and pumps must be kept in good working order at all times. Electric light and power equipment should be put in operation under normal load at least once each week. Operating periods will be long enough to bring equipment up to normal tempera-

ture to drive off condensation. In exceptionally damp climates, power plants and electric motors may require more frequent periods of operation to prevent deterioration due to moisture.

109. AMMUNITION SERVICE APPARATUS. **a.** The ammunition service apparatus (trolleys, motors, and hoists) should be operated under normal load each week 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 properly and in preventing the jamming of any part of the hoist.

c. Accident hazards may be created by operating ammunition hoists by hand to lower projectiles. Unless such procedure is specifically authorized, cranes provided at emplacements will be used for lowering projectiles.

110. SEARCHLIGHTS. **a.** Responsibility for maintenance of searchlights is defined in AR 100–21. Battery personnel will perform routine servicing, lubricating, cleaning, adjusting, and minor repair work.

b. An inspection of all parts of searchlights will be made as prescribed in the instruction manual accompanying the piece. The lamp will be cleaned and carbon particles removed after each period of operation. The motors and bearing surfaces require lubrication but care should be taken to avoid overlubrication. Infrequently, commutators may require smoothing with sandpaper (not emery cloth). The mirror will be dusted with a soft camel's-hair brush and then polished with the special solution provided for the purpose, using a cotton pad. Allow the solution to dry and wipe off with a dry cotton pad. In cleaning and polishing, use straight strokes from the center to the outer edge; never use circular strokes. The light will be kept as dry as possible at all times and will be covered when not in use.

c. During the test running of the power plant, the searchlight and control station will be operated for such a period as is required to insure satisfactory operation of all components and orientation between light and control station.

d. All searchlight power plants will be operated under load at least ½ hour per week. Generating sets will be kept clean, properly painted, and in such condition as to permit operation without delay. For detailed instructions on the preservation and care of local power plants, see books of instruction which accompany the sets. These manuals must be kept with the sets and readily accessible to operators of the sets at all times.

e. In exceptionally damp or cold climates, searchlights, power plants, and associated equipment will require more frequent inspections and periods of operation to prevent deterioration due to moisture and to insure readiness for immediate operation of all components. Where low temperatures are encountered, special care should be given to the problem of furnishing all moving parts with the correct lubricant.

SECTION III

ORDNANCE PROPERTY AND INSTALLATIONS

111. GENERAL MAINTENANCE. **a.** For prevention of corrosion, the methods of examination of metal surfaces will be such as to detect damage in the initial stages. The twice daily inspections required for matériel being held ready for immediate action will include examination of all surfaces. Blistering and scaling of paint are often an indication that corrosion is taking place under the paint; every opportunity will be taken to impress personnel with the necessity for close scrutiny and immediate action.

b. Rust-preventive compounds are intended for use on unfinished metal surfaces. In general, they will not be applied to matériel being held ready for immediate action. The covering of surfaces with rust preventive does not necessarily guarantee freedom from corrosion. In the preparation of a surface for examination, the rust-preventive material will be dissolved with dry-cleaning solvent. Abrasive or polishing material may remove evidence of corrosion and therefore will not be used prior to examination.

c. The approved material for polishing or removing rust and stains from finished metal surfaces is crocus cloth. Emery cloth will never be used for this purpose as it quickly produces appreciable wear.

d. Polishing will not be permitted 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.

e. 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 will not be given 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.

f. Detailed information on removal of paint, priming, and painting of matériel appears in TM 9–850. Synthetic, olive-drab, lusterless enamel, will be used for the final coat. Matériel must be kept properly painted; however, care will be used to avoid too frequent applications, as paint quickly builds up to an undesirable thickness. Ordinarily one painting per year will suffice.

g. All means of lubrication, including grease cups, handy oilers, oil cups, oil holes, and passages will be cleaned thoroughly and kept properly filled with prescribed lubricant, which will be forced into all bearings. Avoid over-lubrication. To secure the 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.

h. Oil cups, grease cups, and oilhole plugs will be painted red. Handy oilers and oilholes not provided with oil plugs will have a red ring painted around them.

i. In the event of a chemical attack, it may be expected that decontamination of ordnance matériel will have highest priority. Whenever chemical attacks are anticipated, all bright parts will be covered with oil. After a gas attack, the oil will be wiped off and fresh oil applied. If mustard or other persistent gas is used, absorbent objects may be deeply contaminated, and even hard surfaces may be dangerous for 6 to 8 days if the chemical is not neutralized. Surfaces will be sprinkled with chloride of lime or painted with a whitewash made from this material. After 2 to 6 hours the lime is washed off and the matériel rinsed thoroughly with water. When large quantities of water are available, warm (but not boiling) water will be used instead of whitewash. In all cleaning operations, the gas mask and special gasproof gloves will be worn. All cleaning rags and sticks will be burned. For detailed information, see FM 21–40.

112. GUNS. a. Painting. (1) Guns will be painted as frequently as required for their proper preservation and appearance.

(2) When the coats of old paint begin to scale off, all paint will be removed and a priming coat of synthetic ground primer applied to the cleaned metallic surface.

(3) Paint will be kept from all bearing surfaces, oilholes, electrical contacts, breech mechanism, and cross lines on

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

b. Care. (1) Breech mechanisms will be kept accurately adjusted and well polished. Lubricating oil of proper body will be used on all parts during use. Canvas covers are issued for the protection of these parts when not in use. Breechblocks will be dismantled for cleaning and lubrication at least monthly and both before and after firing. Care will be taken to 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 will be 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 will be exercised to prevent corrosion from getting a start in the bore. The following procedure will be followed in cleaning the bore after firing or at any other time cleaning is indicated:

(*a*) The bore will be washed with a solution of ½ pound of soda ash or 1 pound of sal soda in 1 gallon of water or, if this is not available, swabbed with hot, soapy water. In either case use of the cleaning solution will be followed by a thorough rinse with clean water. The bore will be swabbed, using dry swabbing material, until it is perfectly dry and then oiled with SAE 30 engine oil (for temperatures below 32° F., use SAE 10).

(*b*) This procedure will be repeated daily until "sweating" stops. This is to remove the effects of the chemical reactions of the burned powder which cannot be removed in the initial cleaning.

(*c*) Care will be exercised to prevent the staves of the sponge and the slush and cleaning brush from rubbing against the lower portion of the bore, as excessive wear of the lands will result.

(*d*) The bore will 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.

(*e*) When the piece is not to be used for a considerable time, the bore, breech mechanism, and bright, unpainted surfaces will be cleaned with dry-cleaning solvent, and the surfaces coated with rust-preventive compound.

113. CARRIAGES. a. Painting. (1) The painting requirements for carriages will be the same as for guns.

(2) The painting of bearing surfaces, oilholes, 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.

(4) Rubber mats or rubber air hoses will not be painted. Paint destroys rubber and renders it unserviceable.

b. Care and exercise. The following subparagraphs cover the minimum requirements concerning the exercise of carriages. Battery commanders may shorten the prescribed intervals whenever such action is desired in their preparations for firing. The purpose of retracting the gun into recoil position is to exercise the recoil mechanism. Any actual firing of the gun will be considered as a retraction of the gun for that period.

(1) DISAPPEARING CARRIAGES. (*a*) Disappearing carriages will be tripped and retracted, elevated, depressed, and traversed once every 2 weeks.

(*b*) Guns mounted on disappearing carriages have retracting mechanisms attached for the purpose of retracting the gun into recoil position without firing. These guns will be retracted to full recoil position twice each month. While these guns are retracted, all sliding portions, rollers, roller

tracks, and the interior of the cradle will be cleaned thoroughly and lubricated with the prescribed lubricant.

(2) BARBETTE CARRIAGES AND RAILWAY MOUNTS. (*a*) Guns mounted on barbette carriages will be elevated, depressed, and traversed once every 2 weeks and when not in use will be set at an elevation of 5°.

(*b*) Three-inch and 6-inch guns mounted on barbette carriages can be retracted without firing. Retraction to full recoil position will be performed at least once 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.

(*c*) Guns larger than 6-inch, mounted on carriages with spring recuperators will not be retracted without firing. The packing in the stuffing boxes of the recoil cylinders of these guns will be removed once every 6 months and all corrosion on the piston rods removed. New packing will then be installed around the piston rods. This work will be performed under the supervision of Ordnance Department personnel.

(*d*) The 14-inch gun on railway mount M1920, the 16-inch gun on barbette carriages M1919 or M1919M1, and 16-inch howitzer on barbette carriage M1920 have a means of slowly releasing the air pressure in the recoil system to allow the gun to slide back into recoil position. These guns will be retracted at least once every 6 months. While the gun is retracted, all sliding portions and the interior of the cradle will be cleaned thoroughly and lubricated with the prescribed lubricant. The personnel to retract the gun into recoil position will be men trained in the performance of this duty and endorsed as qualified personnel by the local ordnance officer.

(3) 155-MM GUN. The 155-mm gun will be traversed, elevated, and depressed at least once every 2 weeks. The

gun will be retracted to full recoil position once every 6 months.

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

(5) Railway cars will be given a run of several hundred yards once each 2 weeks to insure distribution of oil on journal bearings and axle shafts. At the same time, the air brake system will be operated several times to free the moving parts of any accumulated rust or corrosion and to test operation of air brakes. If railway cars are immobilized due to emplacement of the guns, journal boxes will be inspected and air brake equipment will be connected to air supply once each 2 weeks and the air brakes operated several times while the cars are stationary. Journal box packing will be inspected for oil content and for presence of grit and will be kept pushed down below the center line of the journal. If any grit is present in the journal box packing, the packing will be removed and replaced with new packing immediately.

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

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

(8) (*a*) Refer to TM 9–850 for information concerning the fluid to be used in recoil cylinders, tests to be applied to it, and instructions governing its storage.

(*b*) Care will be taken to insure that no unauthorized liquid is allowed to enter the recoil cylinders at any time. Water will cause corrosion and, if present in sufficient quantity, may freeze 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 filled as full as possible with the prescribed liquid at all times. Hydropneumatic mechanisms will be filled according to respective instructions. At least once every 2 years all recoil and recuperator systems permitted to be disassembled in the field will be dissambled 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 Technical Manual or Ordnance Department publication.

114. 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 SAE 10 engine oil, sparingly applied, and carefully worked in with a lightly oiled rag or with the fingers. Do not soak the pad in oil because the ingredients in the pad are soluble in oil.

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 guns 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. 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.

115. FIRE CONTROL APPARATUS. Considerable care must be exercised in lubricating precision instruments to protect all parts and at the same time to avoid leaving excessive amounts of lubricant on the instruments. This work is normally done at the time of a general overhaul rather than in the field. To prevent rusting, exposed steel parts may be covered with a thin film of light 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 lens tissue paper, issued for the purpose. A camel's-hair brush may be used for removing heavy dust.

(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. 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 tc 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. Instrument cases. Leather instrument cases will be kept in repair and the leather will be kept properly dressed.

e. Data computers and data transmission systems. See manuals pertaining to this equipment for detailed information about care and adjustment.

116. MOTOR TRANSPORTATION EQUIPMENT.

Normally, first and second echelon maintenance operations on trucks and tractors are performed by the personnel of

the organizations to which they are assigned; however, this work is sometimes pooled by several organizations as a means of obtaining better facilities. Lubrication, inspection, repair, and adjustment should be in accordance with instruction manuals accompanying the vehicles. Unit commanders should make frequent inspections to insure proper maintenance of equipment. Third and fourth echelon maintenance is performed by Ordnance Department establishments.

SECTION IV

SIGNAL CORPS PROPERTY AND INSTALLATIONS

117. 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.

118. 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 cleaned, defective telephone mouthpieces replaced, and weak circuits repaired before trouble actually occurs. All external connections to appara-

tus should be examined for possible corrosion. A strip of paper may be drawn between platinum contacts for the purpose of cleaning them. Only hard-surfaced paper should be used; otherwise paper lint may collect and cause poor or open contact.

119. 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 regular inspections 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.

120. 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 transmittters should be kept on hand.

121. RADIO EQUIPMENT. The care of radio equipment, including range and direction finding sets, should be entrusted only to trained specialists assigned to the organization for this purpose. Instruction manuals accompanying the equipment should be consulted for servicing information

122. 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, as the blowing of such a fuse might damage the face of the switchboard beyond repair.

123. MOBILE ARTILLERY WIRE SYSTEMS. 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. With a temporary system, maintenance may be more difficult; therefore, wire chiefs and trouble shooters must be constantly on the alert to diagnose, locate, and repair troubles.

124. BATTERIES. a. Storage batteries. 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 substances 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. Dry batteries will be removed from all equipment which is to be stored for a longer period than 24 hours. An adequate supply of *fresh* spare dry cells should be kept at all places where dry batteries are used. The number and freshness of batteries should be checked during inspections.

SECTION V

CARE AND HANDLING OF AMMUNITION

125. GENERAL. a. 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 unau-

thorized persons. At times one danger is greater than another, and the instructions are drawn up accordingly.

b. TM 9–1900 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. This section is intended to serve as a guide to the reading of that manual.

126. STORAGE. **a.** Storage spaces should be clean, dry, and well ventilated; free from fire hazards; locked and secure against intruders; and in buildings used for no other purposes. If the temperature of a magazine in which smokeless powder is stored exceeds 100° F. for 24 hours or 85° F. for 72 hours, the magazine should be cooled by wetting down the exterior with water or by opening the doors and ventilators at night. Consideration may also be given to removing the contents of the magazine.

b. (1) The general rules for the storage of ammunition call for separate storage space for the following classes of ammunition:

(*a*) Bulk black powder, TNT blocks, dynamite.

(*b*) Smokeless powder, bulk or charges.

(*c*) Fixed or blank ammunition, grenades. (Can also include small arms ammunition.)

(*d*) Fuzes, primers, detonators, and boosters. (Can also include small arms ammunition.)

(2) In case the total quantity to be stored is no more than 1,000 pounds, (*a*) items may be stored with (*b*) items, and (*c*) items with (*d*) items.

(3) Prescribed quantity-distance tables are to be followed.

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.

127. 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.

128. FIRE PREVENTION. Avoid fire hazards; permit no accumulation of trash; have fire extinguishers handy; have supply of gunny sacks and tools for use against grass and brush fires; within limits of camouflage requirements, keep grass and brush cut back.

129. 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.

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

131. POWDER CHARGES. Powder charges are fired as issued. Their dimensions must conform to certain rules. Containers must be kept airtight. This necessitates care in inspection and handling. Remove protective cap and tag before using. If black powder leaks from charge, it is col-

lected and destroyed in water. Smokeless powder becomes dangerous if exposed to high temperatures.

132. 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. Repairs to damaged containers will be made at least 100 feet from magazine. Containers that will be exposed to the sun for some time will be covered with paulins.

133. TRANSPORTATION BY MOTORTRUCK. Following are brief suggestions for safety precautions to be observed in transporting ammunition by motortruck:

a. Fire precautions. Inspect 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. Make certain that at least one serviceable fire extinguisher is available. Instruct personnel in methods of fighting gasoline fire and impress upon them that in nearly all cases there is time to extinguish fire.

b. Driving precautions. If trucks are in convoy, keep safe distances between trucks. Inspect trucks once each hour. Do not stop in towns. Avoid congested traffic; if the route is through cities, obtain recommendations from local traffic authorities. 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.

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c. Loading precautions. 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 it from weather and possible sparks. Do not unload or pile ammunition back of exhaust.

134. AMMUNITION IN THE FIELD. Observance of all storage and handling precautions may often be difficult when ammunition is stored in the field; nevertheless, the same safety precautions should be taken. Effort should be made to locate ammunition parks and dumps in woods and otherwise conceal them in order to prevent observation. The interval between piles of ammunition should be ample to prevent mass detonation in case one pile should be exploded. For protection, the reverse slope of hills and cuts with steep banks should be selected for 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.

CHAPTER 7

DESTRUCTION MATÉRIEL

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135. GENERAL PRINCIPLES. **a.** Tactical situations may arise when, owing to limitations of time or transportation, it will become impossible to evacuate all equipment. In such situations, it is imperative that all matériel which cannot be evacuated be destroyed as completely as the available time and personnel will permit to prevent its—

(1) Capture intact by the enemy.

(2) Use by the enemy, if captured, against our own or allied troops.

(3) Assembly by the enemy into complete units from salvaged parts.

b. The working principles to be followed are:

(1) Methods for the destruction of matériel subject to capture or abandonment in the combat zone must be adequate, uniform, and easily followed in the field.

(2) If thorough destruction of all parts cannot be completed, those parts essential to the operation of the matériel, particularly those which cannot be easily duplicated, should be destroyed or removed. *The same essential parts must be destroyed on all like units to prevent the enemy from constructing one complete unit from several damaged ones.*

(3) The destruction of matériel, subject to capture or abandonment in the combat zone, *will be undertaken only when ordered by the harbor defense or higher commander.*

c. To accomplish adequate and uniform destruction of matériel, it is essential that—

(1) All echelons prepare plans (see FM 4–5) for the destruction of matériel in the event of imminent capture. Such plans must be flexible enough to make allowances for variations in available time, equipment, and personnel.

(2) All echelons be trained to effect the desired destruction of matériel issued to them.

d. Certain of the methods outlined require special tools and materials, such as TNT and incendiary grenades, which normally may not be items of issue. The issue of such special tools and material and the conditions under which destruction will be effected *are command decisions in each case,* according to the tactical situation.

136. PRIORITY OF DESTRUCTION. **a.** Our own and captured enemy matériel should be destroyed in the following sequence:

(1) Tube, breech, and recoil mechanism.
(2) Carriages.
(3) Vehicles.
(4) Pneumatic tires.
(5) Ammunition and magazines.
(6) Fire-control equipment.
(7) Power equipment.
(8) Fire control and observation stations; permanent structures.

b. In the event of imminent capture, everything that could be of possible use to the enemy should be destroyed. If a withdrawal is ordered, all sights, optical instruments, and other valuable small items should be evacuated.

137. TUBE. The selection of a method of destruction will depend on the tactical situation, the materials available, and the matériel involved, but regardless of the method selected, all tubes must be rendered useless. Several methods for use in rendering tubes unserviceable are described below.

a. Destruction by unfuzed HE shell. Shell detonated by either M9A1 antitank grenade or M6 antitank rocket.

(1) Drain recoil cylinders by method prescribed in maintenance manual for each piece. It is not necessary to wait for all of the recoil fluid to drain before firing the piece.

(2) Place an armed (safety pin removed) M9A1 antitank grenade or M6 antitank rocket in the tube about 6 inches in front of the place where the nose of the projectile referred to in (3) below, will rest. The grenade or rocket must be centered in the tube, using either a wooden adapter or a wad of waste, with ogive end pointed toward the shell.

(3) Insert an *unfuzed*, point-detonating HE shell and propelling charge and close the breech.

(4) Fire the gun electrically if possible, if not, use a lanyard at least 100 feet long. The person firing the piece should be under cover in the rear of the piece and about 20° off the line of fire.

(5) When using this method, the danger zone may be 500 to 1,000 yards in radius, depending on the caliber of the piece.

b. Destruction with unfuzed HE shell and TNT.

(1) Drain the recoil fluid as in a(1) above.

(2) Ram an unfuzed HE shell into the forcing cone. Fill the chamber behind the shell with ½-pound TNT blocks and close the breechblock. Detonate the TNT charge with safety fuze or electrical wiring routed through the primer vent. Personnel should be under cover. If a safety fuze is used, allow sufficient length to permit the firer to reach cover. The danger space may be 500 to 1,000 yards in radius.

(3) For instructions on the wiring and firing of TNT, see FM 5–25.

c. Destruction by TNT blocks. (1) Drain the recoil fluid as in a(1) above.

(2) Insert TNT blocks through muzzle to fill a space 6 to 8 calibers long and plug the muzzle tightly with a similar amount of earth. Place about the same amount of TNT in the chamber and close the breechblock. Detonate as in b(2) above.

d. Destruction by incendiary grenades. If evacuation is imminent and it is desired to accomplish destruction without telltale explosions, this method should be used.

(1) Stack one layer of unfuzed M14 incendiary grenades in the powder chamber. The grenades should be placed on their sides and stacked one on top of another. Close the breech.

(2) Equip another incendiary grenade with a 15-second Bickford fuze, ignite it, and throw it into the muzzle. Elevate the gun quickly to its maximum elevation. The metal from the grenades will fuse the breechblock with the chamber, making it impossible to open the breech.

e. Destruction by firing gun at other guns. (1) Fire gun at other guns at point-blank range, using HE or AP shells. Two or more hits on a vital spot such as the breech mechanism, recoil mechanism, or tube should render the gun useless. Fire from cover. The danger space may be from 500 to 1,000 yards in radius.

(2) Destroy the last gun and carriage by the best means available.

(3) It is difficult to effect destruction of the same parts on all guns by this method.

138. BREECH. Any of the above methods for destroying the tube should also destroy the breech; but if the

method selected does not destroy it, a heavy sledge may be used to render the breech useless.

139. RECOIL MECHANISM. If the methods given in paragraph 137a, b, or c are used for destroying the tube, the resulting damage to recoil mechanism should be effective in rendering it useless.

140. CARRIAGES. Whenever possible, the carriage destruction should be accomplished in conjunction with the destruction of the tube, breech, and recoil mechanism under paragraph 137a, b, c, or e. *When this cannot be done, destruction of the tube, breech, and recoil mechanism will have priority.* One of the following methods may be used for destruction of carriages:

a. Place two, unfuzed, point-detonating HE shells of same caliber as piece on either side of carriage. Set shells upright and place a ½-pound TNT block over nose of each shell. Detonate TNT blocks simultaneously, using detonating cord, tetryl nonelectric caps, and at least 5 feet of safety fuze. Electric detonation by means of blasting caps and firing magneto or blasting magneto may be used if available. Fire from cover. The danger space may be from 500 to 1,000 yards in radius.

b. Place thirty to fifty ½-pound TNT blocks on or adjacent to carriage. Detonate TNT charges simultaneously, using detonating cord, tetryl nonelectric caps, and at least 5 feet of safety fuze. Electric detonating methods may be used if available. This method of destruction may be combined with destruction of the tube, breech, and recoil mechanism, under paragraph 137c, by simultaneous detonation. The danger zone may be 300 to 500 yards.

c. Fire gun at other guns at point-blank range, using HE or AP shells. One or more direct hits from a weapon of

the same caliber on a vital spot should adequately destroy the carriage. Fire from cover. Danger space is 500 to 1,000 yards. Destroy the last gun and carriage by the best means available.

141. VEHICLES. a. Vehicles should be destroyed by one of the following methods:

(1) (*a*) Puncture the fuel tanks if readily accessible. Place TNT charges as indicated in the following table. Insert tetryl nonelectric caps and detonate TNT charges simultaneously, using detonating cord, with at least 5 feet of safety fuze. Fire from cover.

CHARGES FOR DESTRUCTION OF VEHICLES

Vehicle	TNT charge (lbs.)	Location
Heavy tractor Ml	3	Over the transmission housing.
	2	Over the starting engine against the left cylinder block wall.
Trucks	2	On top of the clutch housing. It is necessary to open the hood to place the charge properly.
	2	On left side of engine as low as possible. (*Use only if time is available.*)
Trailers	2	Over axle inside each wheel.

(*b.*) If sufficient time and materials are available, additional destruction of track-laying vehicles may be accomplished by placing a 2-pound TNT charge at about the center of each track assembly. Detonate these charges simultaneously in the same manner as the others. If charges are prepared beforehand and carried in the vehicle,

keep the caps and fuzes separated from the charges until used.

(2) Puncture the fuel tanks, if readily accessible. Fire on the vehicle, using adjacent artillery. Aim at the engine and suspension, in the order named. If a good fire is started, the vehicle may be considered destroyed.

(3) Puncture the fuel tanks, if readily accessible. Smash all vital elements (such as distributor, carburetor, radiator, engine block, air and oil cleaners, generator, control levers, crankcase, and transmission) with a heavy ax, pick, or sledge. Pour spare gasoline, oil, or distillate over entire unit and ignite.

b. Whenever time and materials are available, combine the vehicle destruction with the armament destruction. Portable fire extinguishers should be removed and emptied. If possible, detach and evacuate all machine guns mounted in vehicles prior to destroying the vehicles. If machine guns or small arms cannot be saved, destroy or damage them by bending barrels or by breaking or damaging firing pins.

142. PNEUMATIC TIRES. Whenever matériel is subject to capture or abandonment, an attempt to destroy pneumatic tires must always be made, *even if time will not permit destruction of the remainder of the vehicle.* This action is important because rubber is a critical item. With adequate planning and training, the destruction of tires may be accomplished in conjunction with destruction of the vehicle without increasing the time necessary. One of the following methods may be used:

a. Ignite an M14 incendiary grenade under each tire. When this method is combined with destruction by TNT, be certain that the incendiary fires are well started before detonating the TNT.

b. Deflate the tires and damage them with an axe, pick, or heavy machine-gun fire. Pour spare gasoline on tires, dousing each one, and ignite. When used in conjunction with wheeled vehicle destruction, the fire will adequately destroy the vehicle.

143. AMMUNITION IN MOBILE UNITS. a. Time will not usually permit the destruction of all ammunition in forward combat zones. When sufficient time and materials are available, ammunition may be destroyed as indicated below. At least 30 to 60 minutes will be required to adequately destroy the ammunition carried by combat units. In general, follow the safety precautions outlined in TM 9–1900. These include the usual precautions to be taken in fuzing or removing fuzes from shells and in preventing premature explosion of fuzes, primers, grenades, and any spilled explosives.

b. Projectiles should be stacked horizontally with ogive ends pointing in the same direction. To destroy shells with point-detonating fuzes, remove the fuze plug in the center shell of the top row of each pile. Pack a detonating cap, with fuze, next to the booster or TNT filler in each such center shell and detonate. Base-fuzed shells can be destroyed by detonating three or more blocks of TNT at the base of the corresponding shell in each pile. The danger zone may be as much as 500 yards. Shells standing on their bases are difficult to destroy by sympathetic detonation.

c. Propelling charges and bulk explosives can best be destroyed by burning. This is most effectively accomplished when the bags are pulled part way out of their containers or when the containers are split. A few of the bags can be split open to form a powder train 5 to 10 feet long. Ignite and take cover.

d. Fuzes, boosters, detonators, pyrotechnics, and similar materials should be destroyed by burning in a very hot fire.

Place on a pile of inflammable material. Cover them with a piece of sheet metal to reduce danger of flying fragments and embers. Ignite and take cover.

144. AMMUNITION IN MAGAZINES. Destruction of ammunition in magazines is a dangerous operation; however, it is desirable because it may accomplish the destruction of a large part of the installation. Due to the danger of prolonged explosions, it should be accomplished either simultaneously with other demolitions or delayed until other work is completed. Destruction of stacks of projectiles may be accomplished as described in paragraph 143b. An alternate method is to place all available powder charges with projectiles and ignite with safety fuze or electrical firing. The danger area may be 1,000 to 2,000 yards in radius.

145. FIRE CONTROL EQUIPMENT. a. All fire-control instruments, including optical sights and binoculars, are difficult to replace. If evacuation of personnel is made, all possible items of fire-control equipment should be carried with them. If evacuation of personnel is not possible, firing tables, trajectory charts, slide rules, and similar items should be burned and all optical equipment thoroughly smashed. Most plotting room equipment, including charts, firing tables, and slide rules can be satisfactorily destroyed by burning. All metal and electrical parts of such equipment should be thoroughly smashed, using an ax or sledge.

b. The principles that govern and methods of accomplishing destruction of radar matériel, gun data computers, and directors are described in manuals covering these pieces of equipment.

146. POWER EQUIPMENT. All auxiliary power equipment should be rendered useless. Electric motors and generators can be put out of operation by injuring the field or

armature windings. If time is available, the motor shell may be broken with a sledge and the coils ruined with a crowbar. If time is short, a small-arms bullet fired into each coil will effectively destroy it. A .45- or .30-caliber bullet may be directed into the coils through the air vents in either end but care should be taken to see that no one is in the path of ricochet. Large internal combusion engines are difficult to destroy, but heavy TNT charges detonated next to the cylinder block will usually accomplish desired results. Smaller parts can be smashed with a sledge hammer.

147. FIRE CONTROL AND OBSERVATION STATIONS; PERMANENT STRUCTURES. **a.** These installations can best be destroyed by demolition with TNT.

b. See FM 5–25 for details of demolition planning and execution.

148. DESTRUCTION OF CAPTURED ENEMY MATÉRIEL. Captured enemy matériel may be destroyed by methods similar to those used for equivalent United States equipment. In general, it should be destroyed before our own equipment.

APPENDIX I

COMMON MALFUNCTIONS OF MATÉRIEL DURING FIRING

Malfunction	Causes	Method of prevention	Remarks
Primer fails to fire.....	ELECTRIC PRIMERS: 1. Broken circuit in primer. 2. Too much resistance. 3. Poor contact.....	1, 2. Test with M1 tester. Test primers as soon as issued. 3. Examine primer, primer seat, and contact points. Remove corrosion, oil, or dirt. Check size of primer and primer seat for snug fit. Arrange for replacement of oversize seats by ordnance personnel.	1, 2. Detailed instructions accompany M1 tester. 3. Avoid use of abrasives or file on primers.

Malfunction	Causes	Method of prevention	Remarks
Primer fails to fire.....	4. Defective circuit....	4. Inspect and test circuit from power source for continuity of circuit and short circuits. Clean safety switches. Keep oil and water off wiring and contact points.	4. The circuit may be tested with a primer test lamp.
	5. Defective magneto or battery.	5. Tighten all connections. Keep dry and in good electrical condition. Train gun section in proper operation of magneto.	5. Magneto armature should be accelerated very rapidly.
	PERCUSSION PRIMERS:		
	6. Sluggish action of firing mechanism.	6. Test firing mechanism action before firing. Avoid use of improper or excessive amount of lubricants. Remove dirt, gum, and corrosion.	6. Very light lubricants may be authorized for low temperature use.
	7. Broken or worn firing pin or firing pin spring.	7. Inspect parts; check length of firing pin.	

	8. Defective initiator (fulminate).	8, 9, 10, 11. Keep primer lots segregated; reject lots causing repeated failures.	
	9. Defective case construction.		
	FRICTION PRIMERS:		
	10. Defective friction material.		
	11. Loose button wires.	11. Inspect for loose wires.	11, 12. Handle friction primers cautiously. Seat by pressing on base of primer. Do *not* push in on button wire.
	12. Short button wires.	12. Inspect for short wires. Test for proper fit in firing leaf.	
	ALL TYPES:		
	13. Physical deficiencies.	13. Check for underweight primers.	
Propelling charge fails to fire after primer fires.	1. Plugged primer vent.	1. Clean vent with vent cleaning tool before initial round and after every round fired.	1. With rapid-fire guns clean before firing and when possible during firing.
	2. Charge inserted with igniter missing, on wrong end, folded over, or with primer protector cap still covering igniter.	2. Adequate training for gun section.	

Malfunction	Causes	Method of preveution	Remarks
Propelling charge fails to fire after primer fires.	3. Damp or wet powder.	3. Proper handling and protection for propelling charges.	
	4. Charge too far forward in chamber.	4. Train gun section to place charge so that final forward movement is performed by closing of the breech.	
Primer fails to seat properly.	1. Oversize primer.....	1. Check primer measurements. Test fit of primers before firing.	1. Avoid testing fit of unused primers in primer seat of 155-mm gun; prefitting deforms the case due to the tapered recess.
	2. Corrosion, dirt, powder fouling, or gum on primer or in seat.	2. Inspect and clean primers and seat. Ream seat when necessary.	2. Avoid excessive reaming.
Primer sticks in seat preventing ejection.	1. Undersize primer...	1. Check primer measurements.	1. See 1 above.
	2. Corrosion, dirt, powder fouling, or gum on primer or in seat.	2. Inspect and clean primers and seat. Ream seat when necessary.	2. Avoid excessive reaming.
	3. Improper expansion of primer case in seat, including rupture or splitting.	3. Examine primer seat for pitting and irregular wear. Watch for ruptured primer cases.	3. Pitted or worn primer seats should be reported for replacement to Ordnance

			Department.
Firing mechanism fails to eject primer.	1. Undersize primer base.	1. Test primer fit in firing mechanism before firing.	1. Primers may be fitted in firing mechanism 155-mm gun but do not insert in primer seat. (See above.)
	2. Defective firing mechanism.	2. Check firing mechanism.	
Lanyard failure.....	1. Breaking of lanyard.	1. Replace worn or frayed ropes.	1, 2. Procure extra lanyards with hooks before firing.
	2. Straightening out or breakage of lanyard hook.	1, 2. Train gun section to avoid excessive pull on lanyard.	2. Bend hooks to proper shape before firing. Replace worn hooks.
Failure of breechblock to close, open, or rotate.	1. Burs or corrosion on threads of breech or breechblock.	1. Dress down minor roughness with crocus cloth. Call Ordnance personnel to perform major operations.	1. Avoid careless loading.
	2. Seizure of metal parts.	2, 3. Use recommended lubricants and lubrication methods.	
	3. Lubricant blown off by gases.	3. Test fit of gas check pad and examine split rings. Install new parts if necessary.	
	4. Locking of block on tray.	4. Examine for excessive clearance between block and tray guide rails. Use recommended lubricants and lubrication methods.	

Malfunction	Causes	Method of prevention	Remarks
Failure of breechblock to close, open or rotate.	5. Abnormal expansion of gas check pad.	5. Handle gas check pad carefully. Use recommended lubricants and lubrication methods. Replace damaged or malformed pads.	
	6. Freezing of sponging solution in breech or on breechblock during cold weather.	6. Use antifreeze in the sponging solution.	6. Alcohol available for radiator antifreeze may be used. Other antifreeze solutions may hinder removal of powder residue.
Maladjustment of recoil and counter-recoil.	1. Excessive amount of fluid in system.	1, 2. Proper adjustment before firing. Keep close check on action during firing.	1, 2. Study of gun and emplacement books may reveal gun peculiarities that can be anticipated, thereby permitting proper precautions to be taken.
	2. Insufficient fluid in system.		
	3. Cold weather.....	3. If lighter recoil fluid is prescribed for low temperatures, make certain change is made.	
Nuisance type delays..	1. Bent vent cleaning	1, 2. Inspect all tools and	1. Trouble caused by

bit.	accessories before firing. Instruct gun section in proper handling of equipment.	cleaning bit being too long may be stopped by using tape on bit to make a stop at proper length.
2. Sponge or rammer head loose on staff.		
3. Fired primers mixed in with unused primers.	3. Be alert to stop all careless practices.	
4. Dust raised in plotting room by concussion.	4. Use thorough cleaning methods.	
5. Fire in camouflage..	5. Avoid use of inflammable camouflage materials. Chemicals for rendering materials fire-resistant may be employed when available. Keep fire extinguisher handy.	
6. Dust raised by blast obscuring vision.	6. Wet down area in front of gun.	6. If no violation of concealment is involved, areas in front of guns may be oiled.
7. Sleet obscuring sights, bubbles, or indexes.	7. Train gun section to function efficiently under adverse conditions.	7. Waste soaked in antifreeze solution may be used to remove ice.
8. Breakage of illuminating lights.	8. Keep extra bulbs on hand. Provide flashlights for emergencies.	

Malfunction	Causes	Method of prevention	Remarks
Slipping, displacement, or breakage of parts of matériel.	Concussion acting on slack, play, or looseness in matériel.	Inspect and adjust parts before firing.	During any lull in firing, rest for the gun section should come only after inspection, adjustment, and any necessary cleaning or lubrication of matériel.

APPENDIX II

LIST OF REFERENCES

Ammunition, General	TM	9–1900
Camouflage, Cover, Concealment	FM	4–5
		5–20
	TM	5–265
Care and Preservation of Matériel	TM	4–245
Care of Railway Equipment	FM	4–51
Chemical Attack, Protection Against	FM	21–40
	TM	3–220
Cleaning and Preserving Materials	TM	9–850
Commands	FM	4–5
Examination for Gunners	FM	4–19 (now published in FM 4–150)
Explosives and Demolitions	FM	5–25
	TM	9–2900
Fire Control and Position Finding	FM	4–15
Gunnery	FM	4–10
Infantry Drill Regulations	FM	22–5
Maintenance of Plotting Boards	TM	9–1570
Orientation	TM	4–225
Safety Precautions	AR	750–10
Submarine Mine Tactics and Technique	FM	4–6
	FM	4–7 (when published)
Target Practice	TM	4–235

INDEX

FM 4–20
C 2

FIELD MANUAL

COAST ARTILLERY

FIRING PREPARATIONS, SAFETY PRECAUTIONS, CARE AND SERVICE OF MATÉRIEL

CHANGES No. 2

WAR DEPARTMENT
WASHINGTON 25, D. C., 13 May 1946

FM 4–20, 22 March 1944 is changed as follows:

19. GUN COMMANDER. a.

* * * * *

(2) Maintenance of matériel **(first echelon).**

* * * * *

28. ARTILLERY GUN BOOK (as changed by C 1). Gun books are kept in all **seacoast artillery gun** batteries, **both fixed and mobile. (See TM 4–245.)** Keeping the gun * * * book is relinquished.

38. MATÉRIEL.

* * * * *

d. Replace unserviceable charts * * * the order named. If none of these sources can supply charts, write to the **Seacoast Service Test Section, Army Ground Forces Board No. 1, Fort Winfield Scott, California,** requesting the desired charts and furnishing the data called for in FM 4–15.

47. PLOTTING ROOM.

* * * * *

e. 110° plotting board. Rescinded.

* * * * *

AGO 8662D—May 692740°—46

g. Wind component indicator (standard instrument). Rescinded.

* * * * *

j. Deflection board M1.

* * * * *

(6) (Added). Check the orientation and operation of the wind resolving mechanism. A common error made is the adjustment of the mechanism 180° out of orientation.

* * * * *

48. POSITION FINDING SYSTEMS.

* * * * *

77. PRIMERS. Primers will not * * * rotated, and locked. (Exception: *electric* primers may be inserted while the breechblock is open on 6-inch guns **M1903A2, M1905A2,** and **M1.**) In no case * * * firing mechanism M1903.

111. GENERAL MAINTENANCE.

* * * * *

f. Detailed information on removal of paint, priming, and painting of matériel **will appear** in **TM 9–2851 (when published).** Synthetic, olive-drab * * * year will suffice.

* * * * *

h. (Superseded.) All oil cups, grease fittings, oil holes, and similar lubricating fittings (except recoil oil filling and drain points) will be marked with a circle about ¾ inch in diameter, painted with red enamel, in order that they may be readily located. Fittings themselves should not be painted. On recoil mechanisms filled with recoil oil (special), the locations of the oil

filling and drain plugs and reserve oil filling covers will be encircled with a ring of green enamel.

* * * * *

j. (Added). The lubricants and lubricating instructions prescribed in pertinent War Department Lubrication Orders will be used.

112. GUNS.

* * * * *

b. Care.

* * * * *

(3) Utmost care will * * * cleaning is indicated:

(*a*) (Superseded.) As soon as possible after firing, and on 3 consecutive days thereafter, thoroughly clean the bore with rifle bore cleaner, making sure that all surfaces including the rifling are well coated. Do not wipe dry. After the third day's cleaning, do not wipe the bore dry if the piece is to be fired within the next 24 hours. If the piece is not to be fired within the next 24 hours, wipe dry and coat with preservative lubricating oil ("medium" if above 0° F. and "special" if below 0° F.). After the third day following firing, renew the oil film weekly.

(*b*) (Superseded.) In the event that rifle bore cleaner is not available, a solution of ½ pound of soda ash to 1 gallon of warm water (or, if soda ash is not available, hot soapy water) will be used. The same procedure as with rifle bore cleaner will be followed except that after the bore has been cleaned with the solution, it will be rinsed with clean water, swabbed dry, and coated with a film of the prescribed oil.

* * * * *

113. CARRIAGES.

* * * * *

b. Care and exercise.

* * * * *

(2) *Barbette carriages and railway mounts.*

* * * * *

(*b*) **Six**-inch guns mounted on barbette carriages can be retracted without firing. Retraction to full * * * the prescribed lubricant.

* * * * *

(*d*) The **8-inch gun on railway mount M1A1, the 8-inch gun on barbette carriage M1, the** 14-inch gun on railway mount M1920, the 16-inch gun on barbette carriages **(all models),** and **the** 16-inch howitzer on barbette carriage M1920 have a means of slowly releasing the air pressure in the recoil system to allow the gun to slide back into recoil position. These guns will be retracted at least once every **2** months. While the gun * * * local ordnance officer.

(3) *155-mm gun.* The 155-mm gun * * * every 2 weeks. The gun will be retracted to full recoil position once every 3 months.

* * * * *

CHAPTER 7
DESTRUCTION OF MATÉRIEL

* * * * *

141. VEHICLES. a.

* * * * *

(1) (*a*) Puncture the fuel * * * Fire from cover.

CHARGES FOR DESTRUCTION OF VEHICLES

Vehicle	TNT charge (lb.)	Location
Heavy tractor M1 and high-speed tractor M4.	3	Over the transmission housing.
	2	Over the starting * * * cylinder block wall.
Trucks	2	On top of * * * the charge properly.
	2	On left side * * * *time is available.*
Trailers	2	Over axle inside each wheel.

* * * * *

[AG 300.7 (2 May 46)]

BY ORDER OF THE SECRETARY OF WAR:

DWIGHT D. EISENHOWER
Chief of Staff

OFFICIAL:
EDWARD F. WITSELL
Major General
The Adjutant General

DISTRIBUTION:

AGF (40); ASF. (2); Arm & Sv Bd (1); Def Comd (5); Tech Sv (2); HD (15); Gen & Sp Sv Sch (2) except 4 (200); USMA (1); ROTC 4 (1); A (ZI) (5); Special distribution.

Refer to FM 21–6 for explanation of distribution formula.

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