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Operating Instructions

FOR

FIVE INCH, 38 CALIBER, GUN CREWS

February 1943



UNITED STATES FLEET
HEADQUARTERS OF THE COMMANDER IN CHIEF

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This pamphlet contains basic information relative to the training of gun crews for all type 5"/38 caliber guns.

W. R. PURNELL,
Assistant Chief of Staff.

A LETTER TO THE GUN CREW

This pamphlet was written for your benefit. It contains a good deal of information that will help you to understand your job a little better. It contains, also, information that will puzzle you—make you ask questions. If you *do* ask questions, and keep on asking them until you find the *right answers*, then this pamphlet has served its purpose.

Some of the material presented here borders on being confidential. Don't discuss it off your ship.

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Chapter 1. STANDARD BATTERY ORDERS

1. **All stations report when manned and ready.**
Initial command from control and group control stations.
2. **Ready.**
Report made when station is ready to function (at reduced speed).
3. **Manned and ready.**
Fully ready to perform all functions. Guns in "Local—Indicating."
4. **Test circuits.**
Test of all telephone, salvo, and cease-firing signals, firing circuits. Stations report "Circuits Satisfactory."
5. **Test transmission.**
Test of director outputs to other stations (normally done at daily F. C. test).
6. **Master key fire.**
 - (a) Pointer throws transfer switch to motor generator, locks pointer key closed.
 - (b) In case of misfire, shifts to battery then to percussion if misfire occurs.
7. **Pointer key fire.**
 - (a) Pointer throws transfer switch to motor generator.
 - (b) When "Commence firing" is given, and pointer is on target, he closes key.
 - (c) In case of misfire, shifts to battery, then to percussion if battery causes misfire.
8. **Continuous fire.**
(Normal method). Each gun fired individually as soon as loaded without regard to other guns. (Loading of gun completes firing circuit.)
9. **Salvo fire, interval (—) seconds.**
Directs firing of guns of battery simultaneously at designated interval.
10. **Rapid fire.**
Directs firing that type of fire in which no check fire for purpose of applying corrections to fire control is used.
11. **Action starboard (port), (bow), (beam), (quarter).**
Preliminary command from sky control to position director. (See command No. 17.) (Group control brings battery to bear, designates type of fire and target, and commences tracking.)
12. **Air (surface) (land) target.**
Preliminary type target designation.
13. **Target is bearing (———).**
Target must be accurately designated. (Relative bearings must be used.)
14. **Common (illuminating).**
Directs preparations to fire indicated type projectile.
15. **Stations.**
All personnel take assigned stations, ~~match zero readers~~ and stand by.

- * 16. Action.** - *To BE GIVEN WHEN ACTION IS CERTAIN. DO NOT WAIT FOR MOTORS TO GET UP TO SPEED. GET OUT IMMEDIATELY.*
 Preparatory command from group control to battery. All personnel take assigned stations, fill fuze setters and ammunition train, match zero readers, shift to automatic, start all motors, carry out procedure for "Master-key Fire", and stand by for order or signal to open fire.
- 17. Start tracking.**
 Group control tracks designated target. Battery is in readiness to open fire; primary method of control.
- 18. Fill ammunition train.**
 Fill fuze setters and ammunition train.
- 19. Shift to automatic.** - *THIS COMMAND IS NOT USED. ACTION OR DRILL ACTION INCLUDES SHIFTING TO AUTO MATIC.*
 Shift elevation, train and fuze setting to automatic; start motor.
- 20. Shift to indicating.**
 (a) Shift elevation and train to either LOCAL ^{HAND} or MANUAL.
 (b) Match gun order indicators.
 (c) Shift fuze setters to MANUAL.
 (d) Match fuze order indicators.
- 21. Shift to telescope.**
 (a) Shift elevation and train to either LOCAL ^{HAND} or MANUAL.
 (b) Using telescopes, point at target.
 (c) Set fuze order by telephone.
 (d) Set sights by telephone.
- 22. Battery officer (gun captain) control.**
 (a) Battery Officer (gun capt.) designated local or manual gun control.
 (b) Battery officer (gun capt.) designate target, transmit range, deflection and fuze order. Lay guns by telescope.
 (c) Pointer carry out procedure for "Pointer key fire."
 (d) Battery officer (gun capt.), controls rate of fire.
- 23. Bearing.**
 Report from director or guns, meaning: On designated bearing—no target.
- 24. Target.**
 Report from director or guns. Meaning: On designated target.
- 25. Load.** - *To BE USED ONLY WHEN TEST FIRING AND SHORE BOMBARDMENT.*
 Command to load guns may be used against surface or land objective but is normally omitted.
- 26. Commence firing.**
 Command to load and open fire on previously designated target.
- 27. Check fire.**
 Command to open firing key only; indicates temporary cessation of fire in order to shift target or spot. (In "Master key fire" only the director firing key is opened. Order to battery is for information alone.)
- 28. Resume fire.**
 Close firing key (Given after "check fire")—(battery stands by to pick up the fire.)
- 29. Silence.**
 Emergency command given to check fire—all personnel stand by for orders to correct casualty.

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30. Cease firing.

A command to stop loading and firing, prolonged blast on cease firing howler is used. Gun captains report—

1. Whether gun is loaded.
2. Ammunition expended.
3. Casualties.

31. Cease tracking.

Disregard present target, stand by for another target designation.

32. At ease.

Command to relax, on stations.

33. Secure from general quarters. Set condition (—), watch (—).

Secure, or set condition of readiness indicated.

** IN ALL CASES WHERE IMMEDIATE ACTION IS NOT CERTAIN THE COMMAND IS "DRILL ACTION." THE SAME PROCEEDURE IS FOLLOWED AS FOR ACTION EXCEPT THAT TIME IS TAKEN FOR MOTORS TO GET UP TO SPEED BEFORE MATCHING POINTERS. THE COMMAND "ACTION" CARRIES THE FOLLOWING MEANING; "GET READY TO COMMENCE FIRING IMMEDIATELY. THIS COMMAND WILL DEFINITELY BE FOLLOWED BY COMMENCE FIRING. THE ENEMY IS SIGHTED."*

DRILL ACTION MEANS; "I MAY FOLLOW WITH COMMENCE FIRING. SO BE READY. I AM NOT SURE THAT THE TARGET IS ENEMY."

Chapter 2. MOUNT CAPTAIN

A. DUTIES OF THE GUN CAPTAIN STATIONED ON A SINGLE MOUNT

As the gun captain you are in complete charge of the gun and crew. You are responsible for keeping the gun and all its parts in good working condition and you are charged with the training, discipline, and efficiency of your crew. You will enforce the United States Navy safety precautions and all other precautions and regulations set forth by the ship's captain and the gunnery officer.

It is your duty during gunnery exercises, and in action, to keep the gun firing at the maximum rate of effective fire. You must make every effort to keep the gun in operation regardless of casualties to the gun or to your crew.

Preparation.

It is assumed that you are the most experienced member of the gun crew. In an emergency, or for purposes of training, you should be able to take over any other position on the gun.

On some ships where space or personnel are limited, the gun captain serves also as rammer-man (pneumatic or Vickers rammer) or spademan (Northern Pump Co. rammer). In addition, the gun captain usually operates the breech mechanism operating lever by hand when there is a failure of the automatic breech operating mechanism.

Be prepared to answer the questions brought up by your crew when they are studying this pamphlet. Read it yourself and you'll know what to expect. Direct all questions concerning the various gun mechanisms to the gunner's mate.

Now—to outline and review your personal duties:

Prior to firing.—See that the following gear is supplied at the gun:

1. Flashlight (night).
2. Gloves for loaders and hot caseman.
3. Fuze-setting wrench.
4. Hide-faced maul.
5. Know where case extractor is stowed and how to use it.
6. Flameproof clothing—a complete suit for each man on the gun.
7. Fire-fighting gear.

Report "Ready" to control as soon as the gun is manned sufficiently to fire at a reduced rate by local methods. A report of "Ready" means that:

1. All canvas is off, and gun is clear for training and elevating.
2. Centering pin is out.
3. Telescope covers are removed.
4. Tompion is out for firing.
5. Breech is open and the bore is clear.
6. Cam plate retractor lever is on "A" (automatic), and the breech mechanism operating lever is latched forward.
7. Rammer has been tested without load.
8. Safety link is out for firing.
9. Cartridge case stop is housed—for surface target fire; out—for firing at angles of elevation above 40°.
10. At least one phone to control is manned.

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Report "Manned and ready" when in condition to carry out the primary method of firing (director control). A report of "Manned and ready" means that—

- (1) Hoists have been tested.
- (2) Training and elevating gears have been started and tested in power control.
- (3) Gun is fully manned, and all telephones have been tested.

Loading.

1. Load when ordered, or at "Commence firing."
2. See that ammunition is supplied and gun is loaded according to orders received, and with proper type of projectiles.
3. Prevent loaders from placing another round in the tray under the following conditions:
 - (a) Gun not fired.
 - (b) Case not fully ejected.
 - (c) Gun fails to return to battery.
4. After the gun has been loaded do not trip the salvo latch except by order of the gunnery officer.

Firing.

1. See that fire is commenced, checked, resumed, or ceased according to orders received. Be ready to control gun locally when ordered or situation demands it.
2. See that the methods of gun control and fire ordered by the controlling station are employed at the gun.
3. Watch the gun to see that it returns to battery.
4. Watch opening and closing of breech mechanism. In case breechblock fails to close fully, tap bottom of breech with hide-faced maul, if considered safe to do so. If plug does not close readily, attempt to correct fault before proceeding.
5. You are responsible for the administering of first-aid to injured personnel, and the remedying of casualties, but above all, keep the gun in action!

Cease firing.

1. When cease firing is ordered, report to control the number of rounds your gun has fired, any casualties, and whether or not the gun is loaded.
2. In case the gun is loaded at "Cease firing," remain at your station until the gun is unloaded. Keep it pointed in a safe direction. Order firing key opened and firing switch turned off. Keep crew clear of gun.

Casualties.

1. Report all casualties or unusual conditions of the gun to control.
2. See that every effort is made to remedy casualties and keep the gun in action. Be familiar with all possible casualties and their remedies.
3. Order "Silence" upon detecting present or threatened danger. Instruct every member of the crew to do the same. Order "Carry on" when safe to do so.
4. In case of misfire, by electricity, report to pointer "misfire."
5. In case of misfire by percussion, recock firing mechanism—keeping clear of path of empty case should gun fire during recocking.
6. If director is put out of action, or power and indicators go out on gun, shift to telescope control and continue firing on target.

Securing.

1. See that fuzed projectiles are set on safety, safety wires in place, before striking below.
2. See that primer protecting caps are placed on powder cartridges, and cartridges returned to ranks.
3. At "Secure" see that gun is properly secured before you leave.

B. DUTIES OF THE MOUNT CAPTAIN STATIONED ON A TWIN MOUNT

As the mount captain you are in complete charge of the mount and crew. You are responsible for keeping the mount and all its parts in good working condition, and you are charged with the training, discipline, and efficiency of your crew. You will enforce the United States Navy safety precautions, and all other precautions and regulations as set forth by the ship's captain and the gunnery officer.

It is your duty during gunnery exercises, and in action, to keep the mount firing at the maximum rate of effective fire. You must make every effort to keep the gun in operation regardless of casualties to the mount or to your crew.

Preparation.

It is assumed that you are the most experienced member of the mount crew. Your two immediate assistants are the right and left gun captains. In an emergency, or for purposes of training, you should be able to take over any other position on the mount.

Be prepared to answer the questions brought up by your crew when they are studying this pamphlet. Read it yourself and you'll know what to expect. Direct all questions concerning the various mount and gun mechanisms to the gunner's mate. Have the gun captains hold regularly scheduled training and instruction periods for their crews.

Now—to outline and review your personal duties:

Prior to firing.—See that the following gear is supplied at each gun:

1. Flashlight (night).
2. Gloves for loaders and hot caseman.
3. Fuze-setting wrench.
4. Hide-faced maul.
5. Know where case extractor is stowed, and how to use it.
6. Flameproof clothing—a complete suit for each man on the mount.
7. Fire-fighting gear.

Report "Ready" to control as soon as the mount is manned sufficiently to fire at a reduced rate by local methods. A report of "Ready" means that:

1. All canvas is off, and the mount is clear for training and elevating.
2. Centering pin is out.
3. Telescope covers are removed.
4. Tompions are out for firing.
5. Breeches are open and bores are clear.
6. Cam plate retractor levers are on "A" (automatic), and the breech mechanism operating levers are latched forward.
7. Rammers have been tested without load.
8. Safety links are out for firing.
9. Cartridge case stops are housed—for surface target; out—for firing at angles of elevation above 40°.
10. Ejector trays are hooked on, and ejector flaps open (at night open ejector flaps at "Commence firing").
11. At least one phone to control is manned.

Report "Manned and ready" when in condition to carry out the primary method of firing (director control). A report of "Manned and ready" means that:

1. Hoists have been tested.
2. Training and elevating gears have been started and tested in power control.
3. Mount is fully manned, and all telephones have been tested.

Loading.

1. Load when ordered, or at "Commence firing."
2. See that ammunition is supplied and guns are loaded according to orders received, and with proper type of projectiles.
3. Supervise loading of the guns.
4. After a gun has been loaded do not trip the salvo latch except by order of the gunnery officer.

Firing.

1. See that fire is commenced, checked, resumed, or ceased according to orders received. Be ready to control mount locally when ordered or situation demands it.
2. See that the methods of gun control and fire ordered by the controlling station are employed at the mount.
3. You are responsible for the administering of first aid to injured personnel, and the remedying of casualties, but—above all—keep the guns in action!

Cease firing.

1. When "Cease firing" is ordered, report to control the number of rounds your mount has fired, any casualties, and whether or not either or both guns are loaded.
2. In case a gun is loaded at "Cease firing," remain at your station until the gun is unloaded. Keep it pointed in a safe direction. Order firing key opened and firing switch turned off. Keep crew clear of gun.

Casualties.

1. Report all casualties or unusual conditions of the mount to control.
2. See that every effort is made to remedy casualties and keep the mount in action. Be familiar with all possible casualties and their remedies.
3. Order "Silence" upon detecting present or threatened danger. Instruct every member of the crew to do the same. Order "Carry on" when safe to do so.
4. If director is put out of action, or power and indicators go out on mount, shift to telescope control and continue firing on target.

Securing.

1. See that fuzed projectiles are set on safety, safety wires in place, before striking below.
2. See that primer protecting caps are placed on powder cartridges and cartridges returned to tanks.
3. At "Secure" see that mount is properly secured before you leave.

C. DUTIES OF THE LEFT AND RIGHT GUN CAPTAINS STATIONED ON A TWIN MOUNT

As the right or left gun captain you are in complete charge of the gun and crew, and take orders directly from the mount captain. You are responsible for keeping the gun and all its parts in good working condition, and you are charged with the training, discipline, and efficiency of your crew. You will enforce the United States Navy safety precautions, and all other precautions and regulations set forth by the ship's captain and the gunnery officer.

It is your duty during gunnery exercises, and in action, to keep the gun firing at the maximum rate of effective fire. You must make every effort to keep the gun in operation regardless of casualties to the gun or to your crew.

Preparation.

It is assumed that you are the most experienced member of your gun crew. In an emergency, or for purposes of training, you should be able to take over any other position on the gun.

On some ships where personnel is limited you will act as the Spademan, in addition to your duties as Gun Captain. Study chapter 8, Spademan; learn this job thoroughly.

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Be prepared to answer the questions brought up by your crew when they are studying this pamphlet. Read it yourself and you'll know what to expect. Direct all questions concerning the various gun mechanisms to the gunner's mate.

Now—to outline and review your personal duties:

Prior to firing.—See that the following gear is supplied at your gun:

1. Flashlight (night).
2. Gloves for loaders and hot caseman.
3. Fuze-setting wrench.
4. Hide-faced maul.
5. Know where case extractor is stowed, and how to use it.
6. Flameproof clothing—a complete suit for each man on the gun.
7. Fire-fighting gear.

Report "Ready" to the mount captain as soon as the gun is manned sufficiently to fire at a reduced rate by local methods. A report of "Ready" means that:

1. All canvas is off, and the gun is clear for training and elevating.
2. Telescope covers are removed.
3. Tompion is out for firing.
4. Breech is open and the bore is clear.
5. Cam plate retractor lever is on "A" (automatic), and the breech mechanism operating lever is latched forward.
6. Rammer has been tested without load.
7. Safety link is out for firing.
8. Cartridge case stop is housed—for surface target; out—for firing at angles of elevation above 40°.
9. Ejector trays are hooked on, and ejector flaps open (at night open ejector flaps at "Commence firing").

Report "Manned and ready" to the mount captain when in condition to carry out the primary method of firing (director control). A report of "Manned and ready" means that:

1. Hoists have been tested.
2. Training and elevating gears have been started and tested in power control.
3. Gun is fully manned, and all telephones have been tested.

Loading.

1. Load when ordered, or at "Commence firing."
2. See that ammunition is supplied and gun is loaded according to orders received, and with proper type of projectiles.
3. Prevent loaders from placing another round in the tray under the following conditions:
 - (a) Gun not fired.
 - (b) Case not fully ejected.
 - (c) Gun fails to return to battery.
4. *After the gun has been loaded do not trip the salvo latch.*

Firing.

1. Watch the gun to see that it returns to battery.
2. Watch opening and closing of breech mechanism. In case breech block fails to close fully, tap bottom of breech with hide-faced maul, if considered safe to do so. If plug does not close readily, attempt to correct fault before proceeding.

Cease firing.

1. When cease firing is ordered, report to the mount captain the number of rounds your gun has fired, any casualties, and whether or not the gun is loaded.

2. In case the gun is loaded at "Cease firing," remain at your station until the gun is unloaded. Keep it pointed in a safe direction. Order firing key opened and firing switch turned off. Keep crew clear of gun.

Casualties.

1. Report all casualties or unusual conditions of the gun to the mount captain.
2. See that every effort is made to remedy casualties and keep the gun in action. Be familiar with all possible casualties and their remedies.
3. Order "Silence" upon detecting present or threatened danger. Instruct every member of the crew to do the same.
4. In case of misfire, by electricity, report to pointer "Misfire."
5. In case of misfire by percussion, recock firing mechanism—keeping clear of path of empty case should gun fire during recocking.

Securing.

1. See that fuzed projectiles are set on safety, safety wires in place, before striking below.
2. See that primer protecting caps are placed on powder cartridges, and cartridges returned to tanks.
3. At "Secure" see that gun is properly secured before you report "Right (left) gun secured" to the mount captain.

Chapter 3. POINTER

NOTE.—The principal duties of pointers on all types of 5-inch .38-caliber guns are the same. There are minor differences in the performance of these duties—and they are dealt within the following paragraphs. All pointers should study thoroughly part A of this chapter, and any other parts of the pamphlet to which they are referred.

A. POINTER STATIONED ON SINGLE MOUNT—OPEN MOUNT

As pointer you are responsible for the proper pointing (elevating and depressing) and firing of the gun. Under certain conditions, where it would endanger the ship or crew to continue firing, it is your job to see to it that the gun does *not* fire.

This chapter will tell you what to study and how to drill in order to become a good pointer. Remember, in a fight between two equal warships, it's the best trained crew behind the best aimed guns that wins. There is no medal for "second place" in a fight.

Preparation.

Now that you have been selected as the pointer of your gun crew it is up to you to see that the job is well done.

Eyes and optics.—Your eyes are important. Check with the ship's doctor to see whether or not they are good enough for this job. Take good care of them. Learn how to use the "optics"—or telescope sights—so that you will not damage your eyesight. Read chapter 12, "Battle Lookout," for instructions on adjusting and focusing eyepieces.

Elevating and training gears. Study the section in chapter 16, "Training and Elevating Gears," that deals with the type of elevation gear installed on your gun. Discuss this chapter with the gunner's mate. Learn operation of gear for all types of normal and emergency control.

Methods of control and fire. Study chapter 15, "Methods of Control and Fire." Discuss this chapter with your gun captain and with men on the director.

Open sights—Leading the target. During a dive-bombing attack or a coordinated dive-bombing and torpedo-plane attack, you would ordinarily shift to local control and use your open sights to get on the fast-moving targets. Learn how to use these sights.

Sight setter. Read chapter 5, "Sight Setter," and you will learn a little more about your own job.

Pointer's station. Familiarize yourself with all the equipment on the pointer's station. Learn where the following are, and how to use them:

1. Handwheels, levers, and switches—for operation of the elevating gear.
2. Sight (focus ring, cross wires, ray filter, sight covers, sight cover brackets) for magnifying and observing the target.
3. Gun elevation indicator regulator—with elevation, zero reader, and follow-the-pointer ring dials.
4. Sword arm—indicating degrees of gun elevation above the deck plane.
5. Foot firing pedal—for percussion fire.
6. Transfer switch—for putting firing circuit on director motor generator or local battery (stand-by circuit).
7. Adjustable pointer's seat.
8. Firing key and locking wedge on the right handwheel.
9. Firing stop mechanism—learn location and operation of firing stop cam that automatically prevents gun from being fired when gun is pointed at ship's *permanent* superstructure.

Drill.—The primary method of firing the gun is in director control. Drill constantly, with the director, in the proper procedure for *quickly* and *safely* placing the gun in local power and automatic power. Practice doing this in the dark—with no illumination except that on the dials and in your sight.

In telescope control and in local control you will have to use your telescope sight or open sight to get on and to stay on the target. With the trainer, practice "getting on" a target. You will notice that most of the time the trainer's vertical wire and your vertical wire will not be on the center of the target at the same time. Here's why:

A gun is bore sighted to aline the pointer's and trainer's lines of sight with the axis of the bore at a given range. What does that mean? Look at the sketches at the end of this chapter entitled "Point of Aim."

You will notice that the pointer's and trainer's lines of sight in (a) are not alined, and that they are looking at two different points on the target. Looking through the pointer's sight the gun seems to be "on"; in the trainer's sight it appears off.

Now, in (b) the gun has been bore-sighted at a range of 10,000 yards. The pointer's and trainer's vertical wires have been converged (in) by the gunner's mate. At this *one range*, then, of 10,000 yards the pointer's and trainer's vertical wires will be on the target together. *But exact coincidence of the two vertical wires occurs only at the bore-sight range!* (Sketch (c)).

Now, to reduce the error in sighting to an even smaller distance, one line of sight is taken as the reference line; that is the pointer's line of sight. By means of the deflection scale (ch. 5, "Sight Setter") the gun is corrected to the pointer's line of sight at all ranges—sketch (d).

But it's the trainer who moves the vertical wires; the pointer controls only the horizontal wires. How does the trainer—whose vertical wire is almost always off the target—know when the pointer's vertical wire is on the target? Simple—the pointer says "Mark!" whenever his (left) vertical wire is exactly on the target. At the instant the pointer says "Mark" the trainer notes the exact spot on the target in line with his (right) vertical wire, and he keeps his wire on that spot until it is moved again by another "Mark!"

But—as the range increases or decreases—the point of aim for the trainer will vary slightly to right or left. The pointer must constantly keep the trainer on by coaching him. Use the following terms:

"Right (left)-a-lot"—Train right (left) rapidly.

"Right (left)"—Train right (left) slowly.

"Hair-to-right (left)"—Ease right (left) very slowly—a hair (width of the vertical wire) at a time.

"Mark"—Steady. I'm on.

Now that you understand the rudiments of director and telescope control, let's try to point and fire the gun in action.

Pointing and firing the 5-inch .38-caliber gun.

General quarters.—Upon manning your station use the following check-off list:

1. Remove pointer and check-sight eyepiece and lens covers; secure them in stowed position. Clean with dry, clean lens paper as necessary.
2. Adjust telescope ray filter for best visibility, or as directed. Adjust cross-wire illumination, using the minimum consistent with clear definition of the cross wire. Focus telescope on horizon.
3. Test firing circuits and percussion mechanism as directed. Put transfer switch on motor generator.
4. See that gun is clear for elevating and depressing.
5. Place gun in local power and remain in the ready position unless otherwise directed. Report "Ready in elevation" to gun captain.
6. When directed to "Shift to automatic (power)" match pointers approximately and put elevation gear in automatic power. Report to gun captain "Gun follows in elevation" if gun

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follows, and pointers stay matched. If pointers are *not* matched by more than 5 minutes, shift to local power and keep matched by handwheels. Report to gun captain.

Tallyho!—When you hear this cry the enemy has been sighted. Be prepared to go instantly to any one of the various types of gun control and methods and types of fire as outlined in chapter 15, "Methods of Control and Fire."

In connection with this, you must also know the various orders that apply to you in chapter 1, "Standard Battery Orders."

Target!—This is the report you make when your cross wires are on the designated target.

Action Starboard (Port).

"Action!" is the command to get on the designated target as quickly as possible; to match pointers and shift to automatic power if the director is on the target; to be ready to open fire on the target instantly.

Director control (normal method).—1. Start up system in manual and test out. Be sure gun is clear for elevating and depressing.

2. Place transfer switch on director motor generator.

3. Match zero readers in local power. Shift to automatic power. (Synchro circuits must be energized before shifting to automatic power.)

4. At "Commence firing" lock firing key closed.

5. Observe pointers to detect errors in synchronism. If error exceeds 5 minutes, shift to local power and keep matched.

6. Observe through telescope to see that gun is on correct target.

Pointer Fire.—

1. Operate gun in local power or manual.

2. Keep horizontal wire on target by moving handwheels.

3. Coach trainer on if necessary.

4. Fire on the salvo signal when cross wires are on the target.

Open firing key.—

1. When gun captain orders "Cease firing" or "Check fire." When cease-firing gong sounds.

2. When a dangerous condition exists. When directed by the trainer or a safety observer.

3. If you hear the command "Silence!" Resume method of fire previously employed when the gun captain orders "Carry on!"

4. When pointers are not matched in director control.

Misfire.—

In case of misfire by electricity, fire the round by percussion on the next regular opportunity to fire. Then resume method of firing previously employed.

In case of repeated misfires by motor generator, shift the transfer switch to battery and fire pointer key—following the salvo plan in effect at the time. Make certain firing key is open before shifting to battery.

In case of repeated misfires by battery, fire by percussion following the salvo plan in effect at the time.

Casualties.

1. Report all casualties and misfires to the gun captain.

2. In case of casualty to elevating motor, or loss of power, shift to manual and lay gun in elevation manually in accordance with method of control ordered.

3. If indicators go out, shift to telescope control and keep cross wires on target by handwheels in local power or manual.

Securing.

Upon securing the gun—

1. Unlock firing key.

2. Elevate gun to ready position designated by gun captain.

3. Secure elevating gear in condition prescribed for your type of gear, chapter 16, "Training and Elevating Gears."
4. Insert wad of clean lens paper in eye buffer of pointer and check-sight telescopes.
5. Screw on pointer and check-sight eyepiece covers.
6. Turn sight lighting rheostat off (if switch is installed on your station).

B. POINTER STATIONED ON SINGLE MOUNT—ENCLOSED MOUNT

Your duties—as pointer on an enclosed mount—are the same as outlined in part A of this chapter. In addition to the above you are responsible for the care and operation of the windshield wiper and sight port covers.

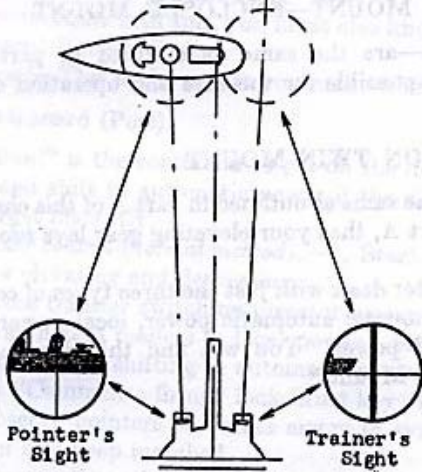
C. POINTER STATIONED ON TWIN MOUNT

Your duties—as pointer on a twin mount—are the same as outlined in part A of this chapter. However, you must bear in mind, while studying part A, that your elevating gear lays *two* guns simultaneously rather than just one.

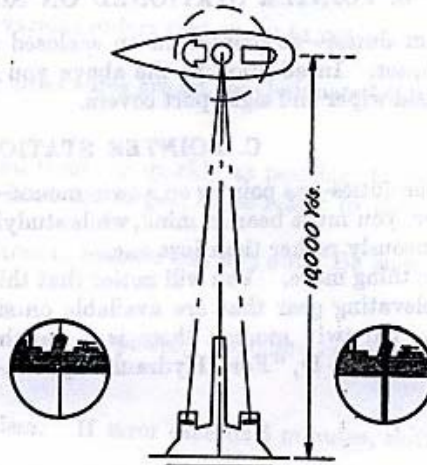
One thing more. You will notice that this chapter deals with just the three types of control of the elevating gear that are available on single mounts: automatic power, local power, and manual. On twin mounts there is a fourth—hand power. You will find this described in chapter 16, part D, "Ford Hydraulic System—Twin Mount."

POINT OF AIM

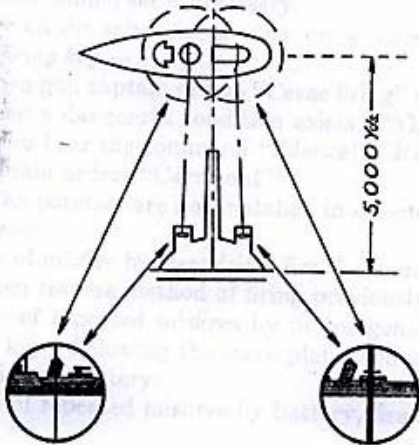
(a) Sights not aligned.



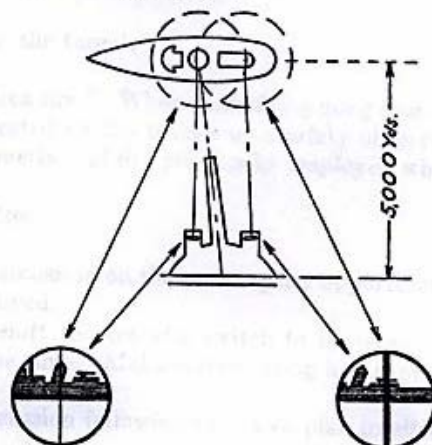
(b) Gun boresighted at 10,000 yards.



(c) Gun boresighted. Target inside of boresight range.



(d) Gun corrected to Pointer's line of sight by Deflection scale setting.



Chapter 4. TRAINER

NOTE.—The principal duties of trainers on all types of 5-inch 38 caliber guns are the same. There are minor differences in the performance of these duties—and they are dealt with in the following paragraphs. All trainers should study thoroughly part A of this chapter, and any other parts of the pamphlet to which they are referred.

A. TRAINER STATIONED ON SINGLE MOUNT—OPEN MOUNT

As the trainer your main duty is to train the gun on the target. You work in close harmony with the pointer, and should understand his duties well enough to take his place in an emergency—or when ordered.

Preparation.

Now that you have been selected as the trainer of your gun crew it is up to you to see that the job is well done.

Eyes and optics.—Your eyes are important. Check with the ship's doctor to see whether or not they are good enough for this job. Take good care of them. Learn how to use the "Optics"—or telescope sights—so that you will not damage your eyesight. Read chapter 13, "Battle Lookout," for instructions on adjusting and focusing eyepieces.

Elevating and training gears.—Study the section in chapter 16, "Training and Elevating Gears," that deals with the type of training gear installed on your gun. Discuss this chapter with the gunner's mate. Learn operation of gear for all types of normal and emergency control.

Methods of control and fire.—Study chapter 15, "Methods of Control and Fire." Discuss this chapter with your gun captain and with men on the director.

Open sights—Leading the target.—During a dive-bombing attack or a coordinated dive-bombing and torpedo-plane attack, you would ordinarily shift to local control and use your open sights to get on the fast-moving targets. Learn how to use these sights.

Sight setter.—Read chapter 5, "Sight Setter," and you will learn a little more about your own job.

Trainer's station.—Familiarize yourself with all the equipment on the trainer's station. Learn where the following are, and how to use them:

1. Handwheels, levers, and switches—for operation of the training gear.
2. Sight (focus ring, cross wires, ray filter, sight covers, sight cover brackets) for magnifying and observing the target.
3. Gun train indicator regulator—with train angle, parallax zero reader, and follow-the-pointer ring dials.
4. Adjustable trainer's seat.

Drill.—Read chapter 3, "Pointer," section entitled "Drill."

Training the 5-inch 38 Caliber Gun.

General quarters.—Upon manning your station use the following check-off list:

1. Remove sight covers; secure in stowed position. Clean sight with dry, clean lens paper as necessary.
2. Adjust telescope ray filter for best visibility, or as directed. Adjust cross-wire illumination using the minimum consistent with clear definition of the cross wires. Focus telescope on horizon.
3. See that gun is clear for training to right and to left.

4. Place gun in local power and remain in the ready position unless otherwise directed. Report "Ready in train" to gun captain.

5. When directed to "Shift to automatic (power)" match pointers approximately and put training gear in automatic power. Report to gun captain "Gun follows in train" if gun follows, and pointers stay matched. If pointers are *not* matched by more than 5 minutes, shift to local power and keep matched by handwheels. Report to gun captain.

Tallyho!—When you hear this cry the enemy has been sighted. Be prepared to go instantly to any one of the various types of gun control and methods and types of fire as outlined in chapter 15, "Methods of Control and Fire."

In connection with this, you must also know the various orders that apply to you in chapter 1, "Standard Battery Orders."

Target!—This is the report you make when your cross wires are on the designated target.

Action Starboard (Port).

"Action" is the command to get on the designated target as quickly as possible; to match pointers and shift to automatic power if the director is on the target.

Director control (normal method).—1. Start up system in manual and test out. Be sure gun is clear for training right and left.

2. Match zero readers in local power. Shift to automatic power. (Synchro circuits must be energized before shifting to automatic power.)

3. See that the parallax setting knob is locked in Out position (auto on G. E. system), and observe parallax dials from time to time to see that follow-up is functioning properly. If not push knob In (hand on G. E. system) and keep parallax matched manually.

4. Observe pointers to detect errors in synchronism. If error exceeds 5 minutes, shift to local power and keep matched.

5. Observe through telescope to see that gun is on correct target. If gun is not on target, notify pointer and gun captain. Shift to local power and get on target, reporting when on.

6. In case of power failure, shift to manual and match pointers. If gun is not on target, shift to telescope control.

Securing.

Upon securing the gun—

1. Train gun to ready position designated by gun captain.

2. Secure training gear in condition prescribed for your type of gear, chapter 16, "Training and Elevating Gears."

3. Insert wad of clean lens paper in eye-buffer of trainer's telescope.

4. Screw on trainer eyepiece cover.

5. Turn sight lighting rheostat OFF (if switch is installed on your station).

6. Secure centering pin in locked position if directed by gun captain.

B. TRAINER STATIONED ON SINGLE MOUNT—ENCLOSED MOUNT

Your duties—as Trainer on an enclosed mount—are the same as outlined in part A of this chapter. In addition to the above, you are responsible for the care and operation of the wind-shield wiper and sight port covers.

C. TRAINER STATIONED ON TWIN MOUNT

Your duties—as Trainer on a twin mount—are the same as outlined in part A of this chapter. However, you must bear in mind while studying part A, that your training gear trains *two* guns simultaneously rather than just one.

One more thing. You will notice that this chapter deals with only the three types of control of the training gear that are available on single mounts: automatic power, local power, and manual. On twin mounts there is a fourth—hand power. You will find this described in chapter 16, part D "Ford Hydraulic System—Twin Mount."

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Chapter 5. SIGHT SETTER

As sight setter you operate the deflection, sight angle, and range dials on the trainer's side of the gun. Your mechanism is geared to the prisms in the pointer's and trainer's optical sights, so that each time you change the sight angle or deflection, the pointer's and trainer's cross wires are moved simultaneously. Let this be a reminder to you not to move those settings any more than necessary to keep them matched with control!

Preparation.

Were you confused to learn that the pointer's and trainer's cross wires are moved every time you touched the deflection and sight angle hand cranks? The explanation is as follows:

Sight angle dial.—The sight angle hand crank rotates the sight angle dial and the range dial—which are geared together. It also moves the pointer's and trainer's horizontal wires up or down, depending on the amount and direction of hand crank rotation.

Let us imagine that we have lined up the gun and the pointer's and trainer's horizontal wires together on the horizon. In this position the sight angle dial will read 2000 (minutes) and the range dial will read 0 (yards). 2000 (minutes) is the zero setting of the sight angle dial. The pointer's horizontal wire will be flush with the horizon, and looking down to the bore of the gun you can see the horizon cutting across the center of the muzzle. Then we fire the gun. What happens?

Will the projectile hit the horizon at which the gun barrel is aimed? *No.* Can you pass a football from goal line to goal line? *No.* Why? Because the weight of the football, the weight of the projectile, make them *fall towards the earth.* Thus—although you can *see* in a straight line, the path of a projectile or football thrown through the air will be *curved down* rather than straight. *And the projectile that you aimed at the horizon will splash into the water a few hundreds yards from your ship.*

So—to hit the horizon we keep the pointer's horizontal wire *ON* it, but we elevate the gun *above* the horizon.

Do we actually elevate the gun by means of the sight angle hand crank? *No*—the gun is too heavy for you to move easily. It is simpler to *depress* the pointer's optical sight—an amount *equal but opposite* to the sight angle we want on the gun. Then the pointer must elevate the whole gun to bring his wire back up to the horizon. When the pointer's horizontal wire is back on the horizon the gun will be elevated above the line of sight through the pointer's telescope, an amount equal to the sight angle setting on your dial.

Now look at the sketch at the end of this chapter titled "Sight angle—range." Here you are trying to hit an observation balloon 3,000 yards distant. To make the problem easy, let's assume that your ship and the target are standing still, and that there is no wind pushing the projectile as it flies through the air. The pointer's (and trainer's) sight is on the target.

Crank the range dial up to the range to the target—3,000 yards. Notice that the sight angle dial now reads 2090 (minutes); this is 90 minutes—or one degree and 30 minutes—above the zero position of the sight angle dial. As you crank in this new setting, the pointer's (and trainer's) horizontal wire is *depressed* $1^{\circ}30'$. In order to get the horizontal wire on the center of the target again the pointer must *elevate* the whole gun and the sights (which are connected to the gun by a sight yoke) $1^{\circ}30'$. Now—if everything else is O.K.—the gun is in position to hit the target.

Range dial.—The range dial indicates the approximate range to the target along the line of sight. It is geared directly to the sight angle dial. For any given setting of range there is

always the same corresponding sight angle setting. (These values can be found listed in the 5-inch range table, Ordnance Pamphlet No. 551.) If your gun captain could memorize the sight angle settings corresponding to each 100 yards of range, you would not need a range dial. You could set the sight angle directly. However, this is too difficult. When the director is out of commission it is simpler to estimate the range to a target and set it directly on the range dial. Thus—the range dial is used in *local control*.

Deflection scale.—The deflection hand crank rotates the deflection scale and moves the trainer's (and pointer's) vertical wire to left or right, depending on the amount and direction of rotation of the hand crank. When the gun is lined up with the trainer's (and pointer's) vertical wire, the deflection scale will read 500 (mils). This is the zero position of the scale. To bring the gun left in train, the scale must be decreased; to bring the gun right, the scale setting must be increased.

Mil.—Just as a *yard* is the unit for measuring *range* to a target *in the line of sight* to the target, a *mil* is the unit for measuring *deflection to right and left* of the line of sight. A yard is a constant linear measure; it is always equal to 3 feet. A mil is a constant angular measure; it is always equal to 3.44 minutes of arc.

If you take two straight lines and separate them by an angle of 3.44 minutes you would find that at a distance of 1,000 yards from the point of intersection the ends of the two lines would be only 1 yard apart; at 2,000 yards they would be 2 yards apart; and so on. Thus, a mil is a yard of deflection at a thousand yards of range. At a range of 10,000 yards 1 mil equals 10 yards of deflection; 10 mils equals 100 yards of deflection.

$$\text{Formula: Mils} = \frac{\text{Deflection (in yards)}}{\text{Range (in yards)/1,000}}$$

Study the sketch entitled "Deflection." Here you see an airplane target 3,000 yards distant from the firing ship. It is headed in the same direction but going faster than the ship. If you fire the gun with a deflection scale setting of 500 (mils)—zero position of the deflection scale—the gun will be lined up with the trainer's (and pointer's) vertical wire, and the projectile will burst approximately where the target was at the instant the gun fired. But, the target is moving—*fast*. The burst is a *miss*.

During the few seconds it has taken the projectile to travel 3,000 yards and burst, the target has moved 30 yards *left* of the line of sight. In order to hit, the gun must be brought 30 yards left. According to the formula for mils, 30 yards of deflection at 3,000 yards of range equals 10 mils. The deflection is *left*—so remember to *decrease* the scale setting. This will give you a deflection scale setting of 500 minus 10, or 490 (mils).

Notice in the sketch, "Deflection," that the projectile does not move in a straight line in the vertical plane; it curves just a little to the *right* of the line of sight to the target. This is known as the *drift* of the projectile. It is *always* to the *right*. It is caused by the right hand rifling inside the bore which rotates the projectile in a clockwise direction about its fore and aft axis. This is exactly the same thing as the "spin" that a pitcher gives to the baseball in order to pitch an "in curve" to a right-handed batter.

Illumination.—Your dials are illuminated for firing the gun at night. If there is a lighting switch on your mount learn exactly where it is so that you can find it in the dark.

Telephones.—Read chapter 14, "Telephone Talker." Use the correct telephone procedure.

Setting Sights.

You have learned the importance of sight angle (range) and deflection in the aiming of the gun. Remember this—an error of 1 mil in setting deflection, or an error of 5 minutes in setting sight angle, can make the gun miss a target entirely. It is important to keep the deflection and sight angle dials matched *exactly* with the settings sent by the controlling station.

General quarters.—1. Man the sight setter's phones on your gun. Test them out with the controlling station. Observe instructions for telephone talkers.

2. When you see that the synchros are energized, match zero readers by rotating hand cranks. Always be sure that you are not one complete turn out.

3. In case sight angle and deflection settings received by phone do not agree with those on the dials, set the proper settings as received by phone.

Stations.—As soon as sight angle and deflection settings start coming in from the controlling station, match them up *exactly* on your dials. Continue setting sight angle and deflection constantly and accurately while your gun remains in operation.

Fire.—The shock of gunfire may jar your dials out of correct position—and thus give the gun a wrong point of aim for the next round. *Keep your eyes on the dials constantly, and this won't happen to you.*

Secure.—At *secure* stow your phones in the assigned box. Set the sight angle and deflection dials on the *ready* position or as otherwise directed.

Ready Position.

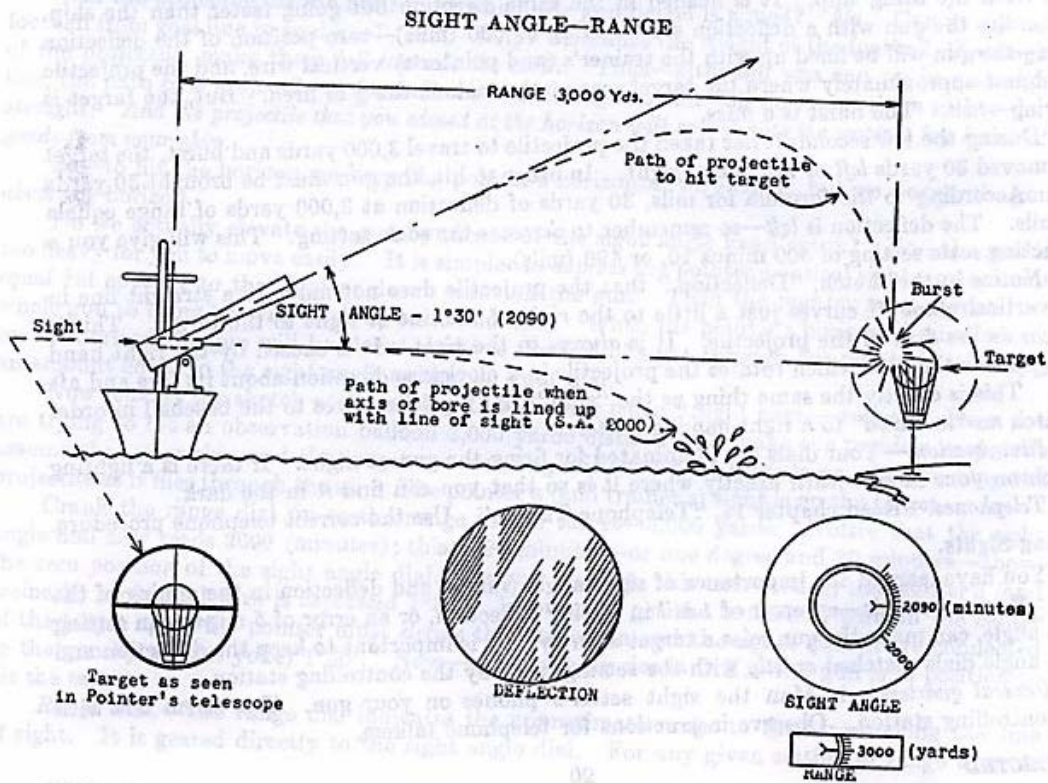
Before you leave the gun, set the sight angle and deflection dials on the settings designated by your gun captain. This will be: Deflection, 500; sight angle, 2000—or some other settings used to put the gun in instantaneous position for an *average* type of surprise attack by dive bombers.

Local Control.

In local control set sight angle (or range) and deflection dials as ordered by the gun captain.

Warning.

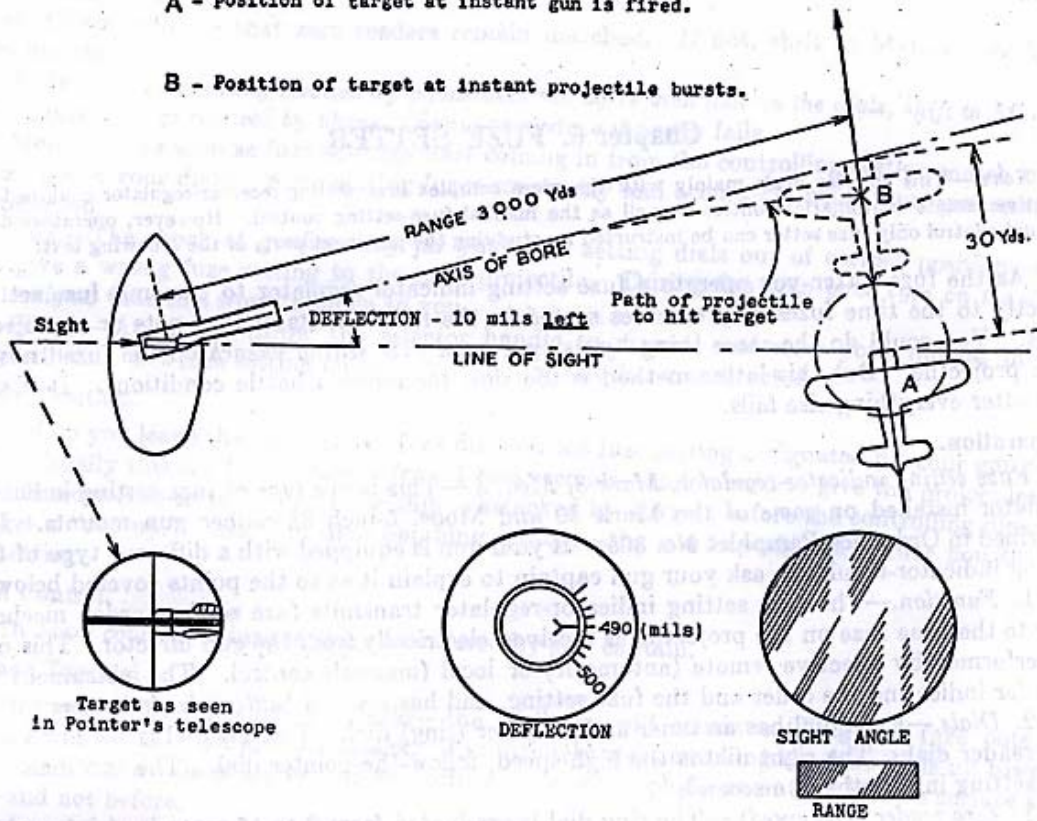
There is some *lost motion* in the sight angle and deflection dials. To compensate for this, *always* set these dials from *high to low*. This will cause the lost motion to be applied always in the same direction, and it can be more easily corrected by control.



DEFLECTION

A - Position of target at instant gun is fired.

B - Position of target at instant projectile bursts.



Telephone Orders.

In addition to receiving verbal checks on sight angle and deflection settings you may receive gun orders over your phones. Notify the gun captain immediately. If his phones are out of commission, he may order you to repeat all orders to the entire gun crew. If so ordered, make sure you are heard. Use your lungs!

RESTRICTED

Chapter 6. FUZE SETTER

NOTE.—This chapter deals mainly with the more complex fuze setting receiver-regulator equipped with selective remote (automatic) control as well as the manual fuze-setting control. However, operators of the manual control only fuze setter can be instructed by studying the pertinent parts of the following text:

As the fuze setter you operate a fuze setting indicator-regulator to transmit fuze settings directly to the time fuzes of projectiles seated in the fuze sockets of fuze pots or a projectile hoist. You could do the same thing by using a *hand fuze setting wrench* on the fuze nose of each projectile. But this latter method is too slow for modern battle conditions. It is used only after everything else fails.

Preparation.

Fuze setting indicator-regulator, Mark 8, Mod. 4.—This is one type of fuze setting indicator-regulator installed on some of the Mark 30 and Mods. 5-inch 38-caliber gun mounts. It is described in Ordnance Pamphlet No. 805. If your gun is equipped with a different type of fuze setting indicator-regulator, ask your gun captain to explain it as to the points covered below:

1. *Function.*—The fuze setting indicator-regulator transmits fuze setting order mechanically to the time fuze on the projectile as received electrically from the gun director. This may be performed by selective remote (automatic) or local (manual) control. The instrument has dials for indicating the order and the fuze setting, and has a set of *battle order indicators*.

2. *Dials.*—Each dial has an inner and an outer (ring) dial. The left dial is the low-speed, zero-reader dial. The right dial is the high-speed, follow-the-pointer dial. The two dials give fuze setting in fiftieths of a second.

3. *Zero-reader (low speed).*—The ring dial is graduated from 0 to 45 seconds at intervals of 1 second, with each 5 seconds numbered. A graduation line and "S" at 48 $\frac{3}{4}$ seconds are provided for safe fuze setting.

4. *Follow-the-pointer (high speed).*—The ring dial is graduated from 0 to 1.0 second twice around the dial. Each graduation represents 0.02 second, and every 0.10 second is numbered.

5. *Mechanical stop.*—In order to limit the fuze setting indicator-regulator to a safe minimum setting, a mechanical stop is installed. The stop has a capacity of from 0 to 48 $\frac{3}{4}$ seconds fuze setting with the minimum fuze set adjustable from 0 to 5 seconds.

6. *Selector.*—The selector handle on the front of the instrument positions a shift mechanism inside the case for automatic or manual control.

7. *Illumination.*—Illumination for the dials and battle order indicators is provided by a watertight lightwell having two 6- to 8-volt lamps.

Fuzed projectiles.—Read the data on fuzed projectiles in chapter 12, "Ammunition Train." Learn how to use a hand fuze setting wrench.

Fuze setter's telephones.—Read chapter 14, "Telephone Talker." Use the correct telephone procedure.

Setting Fuzes.

Whatever the fuze setting is indicates how long the projectile will travel before bursting. For example, if the reading is 23.3 ("Two three point three"), then the projectile will travel 23 $\frac{3}{10}$ seconds after it leaves the gun before bursting in air. Remember to keep your "bugs" matched exactly. An error of just one-tenth of 1 second can burst the projectile as much as 300 yards away from the target!

General quarters.—1. Man the fuze setter's phones on your gun. Test them out with the controlling station. Observe instructions for telephone talkers.

2. Throw selector handle to manual and test out operation of the fuze setter.
3. When you see that the synchros are energized, match zero readers manually and throw selector handle to automatic.
4. Observe to see that zero readers remain matched. If not, shift to Manual and keep them matched.
5. In case fuze setting received by phone does not agree with that on the dials, shift to Manual and set fuze settings received by phone. Same procedure if power fails.

Stations.—As soon as fuze settings start coming in from the controlling station match them up *exactly* on your dials. Keep setting fuzes constantly and accurately while your gun remains in operation.

Fire.—The shock of gunfire may jar your fuze setting dials out of correct position—and thus give a wrong fuze setting to the next projectile. During fire *keep your eyes on the dials constantly* so that this won't happen to you.

Secure.—At secure throw the selector handle to manual and stow your phones in the assigned box. Set fuze setting on *ready* position or as otherwise directed.

Ready Position.

Before you leave the gun, set the fuze dials on the fuze setting designated by your gun captain. Usually this is a low number—from 1 to 3 seconds—and is used to give the projectiles an instantaneous fuze setting in case the ship is attacked by aircraft before the controlling director can get a "set up." Also—in dive bombing attacks—the gun captain may order you to use this setting.

Local Control.

In *Local control* set fuze settings as ordered by gun captain.

Surface Targets.

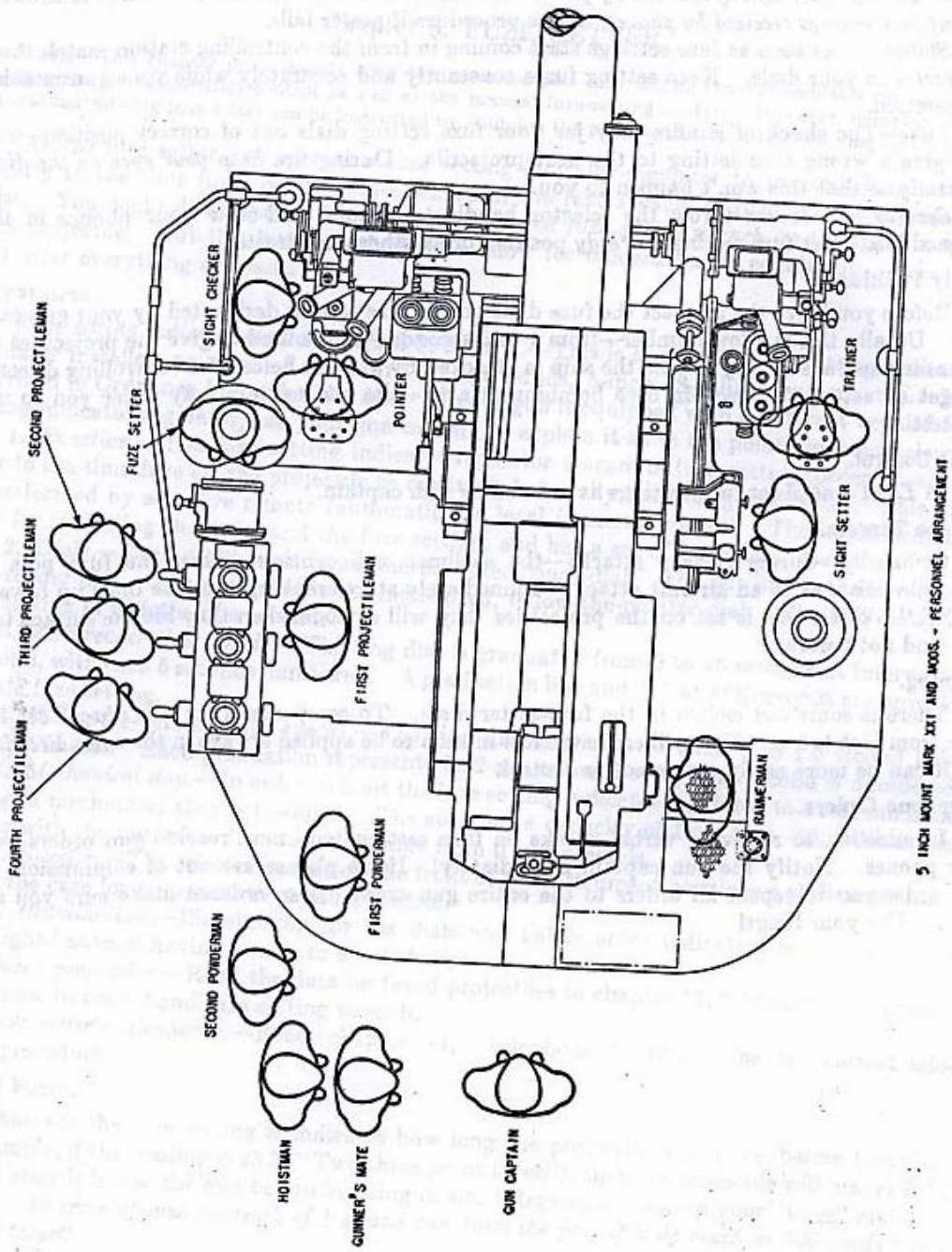
Ordinarily—during surface attacks—the shellmen will continue filling the fuze pots or projectile hoists as in an aircraft attack. Immediately start cranking the fuze dials up toward "SAFE." When this is set on the projectiles they will explode when they hit the surface target—and not before.

Warning.

There is some *lost motion* in the fuze-setter dials. To compensate for this *always* set the fuzes from *high to low*. This will cause the lost motion to be applied always in the *same direction*, and it can be more easily corrected by control.

Telephone Orders.

In addition to receiving verbal checks on fuze settings you may receive gun orders over your phones. Notify the gun captain immediately! If his phones are out of commission, he may order you to repeat all orders to the entire gun crew. If so ordered make sure you are heard. Use your lungs!



Chapter 7. RAMMERMAN

NOTE.—This chapter pertains to guns equipped with the Vickers electric-hydraulic rammer—with rammer control handle mounted on the extreme after end of the slide. The pneumatic rammer installed on mounts, Marks 21, and Mark 21 Mods. 1, 2, and 9, is basically similar in operation, and this chapter may be used to instruct pneumatic rammermen as well as operators of the Vickers rammer.

For operation of the Northern Pump Co. rammer—with rammer handle installed forward on the slide—see chapter 9 on duties of shell loader, paragraph B.

As the rammerman you are second in command at your gun and take orders directly from the gun captain. During action the gun captain's duties keep him moving about the station. It is then your job to take charge of the loading crew. It is up to you and your loading crew to keep that gun loaded and ready to fire.

Preparation.

Before you try to handle the rammer ask the Gunner's Mate to explain these points:

1. *Vickers electric-hydraulic rammer.* (There are good sketches of the Vickers rammer in Ordnance Pamphlets Nos. 735 and 553.) The gunner's mate can explain its parts and operation to you by talks, sketches, and demonstration.

2. *Breech mechanism operation.*—The opening and closing of the breech block directly affects the operation of the rammer system. Connected to the breech mechanism are the *salvo latch* (a safety device), the *cam plate retractor lever*, and the *manual operating mechanism*. Study these mechanisms! Learn their relationship to your job.

3. *Recoil and counterrecoil systems.*—Movement of the gun in recoil takes up the shock of firing; it also causes the rammer to retract. Counterrecoil is the forward movement of the gun back to battery. Two red marks (one on breech housing, one on slide) match up when counterrecoil is properly completed and the gun has returned to battery position. *If gun is as much as ¼ inch out of battery, it is unsafe to fire; call "Silence!" and notify gun captain.*

4. *Drill.*—Practice ramming on the loading machine until you can do it without having to think out each separate step. As you acquire skill through practice it will become easier—but don't get overconfident. Keep anticipating trouble. Stay alert! On a 5-inch gun *anything* can happen!

RAMMING THE 5-INCH .38-CALIBER GUN (SURFACE TARGETS AND TORPEDO PLANES)

Check-off.—Now you are ready to take over as rammerman on a 5-inch gun. You have practiced on the loading machine for 10 hours and more. Today you will act as rammerman, and we will actually load and fire the gun.

Inspect your station to see if the rammer is ready to operate. Use this check-off list:

1. Cam plate retractor lever in "A" (automatic). This is the rearward position that causes the breech mechanism to operate *automatically*.
2. Rammer starting motor switch lever (on bulkhead) in Main—for main power drive.
3. Rammer handle all the way back—in *retract* position.
4. Start rammer motor with ON push button (on trainer's side). When you are satisfied that rammer motor is operating satisfactorily, stop it with OFF push button. *Caution:* Never start rammer motor until you have first checked position of rammer handle—step 3.
5. House cartridge case stop (permitting ejected hot shells to ride clear of breech housing).

RESTRICTED

Stations.—When gun captain gives order "Stations" or "Man the gun," start rammer motor. Warning: *Never start the rammer motor when the breech is closed.* Stand on the rammerman's platform abaft the slide. Keep well to right of the breech housing with your body clear of the ejected hot cases. Rest right hand on gun over and to the right of the rammer handle. *Do not touch the handle yet.* Wait until the shell loader is clear of the breech. Watch the area of the breech housing constantly for these things: Cartridge loading; projectile loading; shell loader's hand signal; action of breech mechanism; alinement of red marks (indicating gun's return to battery position); ejection of empty cartridge case; and movements of the rammer shell guard. You can observe all this by centering your attention on the forward end of the tray and seeing the rest out of the corners of your eyes.

Stand-by.—Place left hand on the rammer shell guard release lever. At gun captain's command "Stand-by" hit release lever *sharply*—dropping the rammer shell guard (or spade) down into breech housing to hold the powder cartridge.

Load.—At the command "Load" the powder loader will place a powder cartridge in the tray. When the load is ready to be rammed the shell loader will make a hand signal. Now you ram if—

1. the hand signal has been properly made;
2. the load is *properly positioned* in the breech housing, i. e.—with the *base* of the cartridge against the *face* of the spade; the base of the projectile against the nose of the cartridge; both pieces squarely lined up with one another and the center of the bore, and the projectile resting *steady* in the tray. As soon as you have checked these points, drive the rammer handle smartly forward with the *heel* of your right hand. Remove your hand *immediately* as the breech plug rises and locks. *Do not grip the rammer handle with your fingers.* When the gun fires, the rammer handle snaps back *fast* and can put your hand or wrist out of commission if you are "riding" it.

Fire.—When the gun fires, the breech opens, ejecting an empty cartridge case and sending the rammer back to its retract position. The rammer crosshead and the spade will return to you first—lagged slightly by the ejected hot case. As the *open end* of the hot case passes under and aft of the crosshead, drop the spade down as you did for the gun captain's "Stand-by." Check alignment of the two red marks—indicating that the gun is back to battery. You are ready for another load.

Aircraft Targets.

Conduct frequent AA loading drills with the muzzle end of the loading machine *elevated* or *elevating* through 45°. As the breech is depressed you will note three important changes in the loading and ramming procedure:

1. The *rammer handle* will be depressed too low for quick ramming by the heel of your right hand. Shift to operation by fingers and palm of your right hand, but—as before—*do not close your hand about the rammer handle.*

2. The *cartridge case stop* must be unlatched and moved into the breech housing as the gun *elevates above 40°.* This prevents the ejected hot cases from jamming between the slide and the gun platform.

3. As the *powder cartridge* and *projectile* approach a near-vertical position in the breech housing they will tend to slip out of alignment with one another. Make doubly sure this doesn't happen while you are ramming an elevated gun.

Casualties.

Rammer fails to ram.—Call "Rammer out." Shell loader assisted by powder loader, will ram load by hand while you and the gunner's mate take steps to get the rammer back in operation.

Rammer fails to return automatically.—Retract rammer by hand, using rammer handle if possible. Notify gun captain. If you cannot move spade back into position for the next ram call "Rammer out" as in preceding casualty.

"Bale of hay".—You can prevent this by not ramming until powder and projectile are properly positioned in the tray.

Study carefully the chapter on casualties, particularly those that have happened to the shell loader, powder loader, and rammerman. Learn what to look out for; what you must guard against. The most frequent ones likely to happen to you are ramming before the projectile has steadied down—so that the nose of the projectile does not enter the breech, and the shell loader or powder loader dropping another round into the tray before you have lowered the spade.

Tests.

When directed by gun captain test rammer as follows: With hand tool house locking latch in breech housing so that the crosshead will not be locked in the forward position. Move rammer handle back and forth, dropping spade at the end of each stroke, and watching the operation of the rammer. Remove hand tool when test is completed. Test operation of rammer with rammer motor on both main and auxiliary power (if installed on your ship).

Chapter 8. SPADEMAN

NOTE.—There is no spademan on guns equipped with the pneumatic or Vickers electric-hydraulic rammer. His duties are incorporated into those of the rammerman. On guns equipped with the Northern Pump Co. electric-hydraulic rammer the following action takes place in loading a round into the gun: The rammer is rammed by the shell loader operating the rammer handle; automatically retracted by the recoil of the gun, and, at the end of the retract stroke, the shell guard (or spade) is dropped by the spademan.

As spademan your physical duties are light—when the gun is operating normally. You drop the spade as soon as the ejected empty cartridge case rides clear of the tray. You house the cartridge case stop for surface firing, and push it out into the tray for AA fire—when the gun elevates beyond 40°. However, you are in an excellent position to watch for trouble on the gun.

Preparation.

Study carefully the chapter on casualties. Discuss them with the gun captain or gunner's mate. When you have learned how to handle any casualties that might occur on or near your gun station you are ready to act as spademan.

Loading and Ramming the 5-inch 38-Caliber Gun.

Stations.—At the command "Stations" take position on spademan's platform abaft the slide. Keep well to right of the breech housing with your body clear of the ejected hot cases. Watch the area of the breech housing constantly for these things: cartridge loading; projectile loading; action of breech mechanism; alignment of red marks (indicating gun's return to battery position); ejection of empty cartridge cases; and movements of the spade. You can observe all this by centering your attention on the forward end of the tray, and seeing the rest out of the corners of your eyes.

Before a load is placed in the tray *make sure that the breech mechanism is all the way down and the breech open*. If it is not open notify the gun captain immediately. When directed by the gun captain open the breech by means of the breech mechanism operating lever. Remember—notify the gun captain *first*, and *then* open the breech *when ordered by the gun captain*.

Stand-by.—Hit the shell guard release lever sharply—dropping the spade down into the tray.

Load.—See that the powder loader places a powder cartridge in the tray properly so that the base of the cartridge lies flush with the face of the spade.

Fire.—Watch closely the loading of the projectile and the ramming of the full charge by the shell loader. Be on the alert for casualties. See that the breech closes and opens fully; that the gun goes back to battery; that the rammer operates smoothly; that the empty cartridge case ejects correctly. If anything goes wrong call "Silence" and notify the gun captain.

Casualties.

Rammer failure—Raise spade clear of tray—allowing shell loader and powder loader to ram by hand.

Breech mechanism fails to open fully after firing.—When ordered by gun captain operate breech mechanism operating lever to open breech, exercising care to prevent it from falling open suddenly.

Relief.

When directed by the gun captain you will relieve the shell loader. Study the duties of the shell loader, chapter 9, paragraph B. Know his job thoroughly so that you can relieve him properly when ordered.

Chapter 8. SPADEMAN

NOTE.—There is no spademan on guns equipped with the pneumatic or Vickers electric-hydraulic rammer. His duties are incorporated into those of the rammerman. On guns equipped with the Northern Pump Co. electric-hydraulic rammer the following action takes place in loading a round into the gun: The rammer is rammed by the shell loader operating the rammer handle; automatically retracted by the recoil of the gun, and, at the end of the retract stroke, the shell guard (or spade) is dropped by the spademan.

As spademan your physical duties are light—when the gun is operating normally. You drop the spade as soon as the ejected empty cartridge case rides clear of the tray. You house the cartridge case stop for surface firing, and push it out into the tray for AA fire—when the gun elevates beyond 40°. However, you are in an excellent position to watch for trouble on the gun.

Preparation.

Study carefully the chapter on casualties. Discuss them with the gun captain or gunner's mate. When you have learned how to handle any casualties that might occur on or near your gun station you are ready to act as spademan.

Loading and Ramming the 5-inch 38-Caliber Gun.

Stations.—At the command "Stations" take position on spademan's platform abaft the slide. Keep well to right of the breech housing with your body clear of the ejected hot cases. Watch the area of the breech housing constantly for these things: cartridge loading; projectile loading; action of breech mechanism; alignment of red marks (indicating gun's return to battery position); ejection of empty cartridge cases; and movements of the spade. You can observe all this by centering your attention on the forward end of the tray, and seeing the rest out of the corners of your eyes.

Before a load is placed in the tray make sure that the breech mechanism is all the way down and the breech open. If it is not open notify the gun captain immediately. When directed by the gun captain open the breech by means of the breech mechanism operating lever. Remember—notify the gun captain first, and then open the breech when ordered by the gun captain.

Stand-by.—Hit the shell guard release lever sharply—dropping the spade down into the tray.

Load.—See that the powder loader places a powder cartridge in the tray properly so that the base of the cartridge lies flush with the face of the spade.

Fire.—Watch closely the loading of the projectile and the ramming of the full charge by the shell loader. Be on the alert for casualties. See that the breech closes and opens fully; that the gun goes back to battery; that the rammer operates smoothly; that the empty cartridge case ejects correctly. If anything goes wrong call "Silence" and notify the gun captain.

Casualties.

Rammer failure.—Raise spade clear of tray—allowing shell loader and powder loader to ram by hand.

Breech mechanism fails to open fully after firing.—When ordered by gun captain operate breech mechanism operating lever to open breech, exercising care to prevent it from falling open suddenly.

Relief.

When directed by the gun captain you will relieve the shell loader. Study the duties of the shell loader, chapter 9, paragraph B. Know his job thoroughly so that you can relieve him properly when ordered.

Chapter 9. SHELL LOADER

A. DUTIES OF THE SHELL LOADER STATIONED ON A SINGLE MOUNT GUN WITH TRIPLE FUZE POTS AND MANUAL FUZE SETTERS INSTALLED ON GUN PLATFORM

As the shell loader, you are in a position where maximum strength and coordination are required. Your primary duty is to load projectiles into the gun smoothly, quickly, and—above all—safely.

Preparation—Drill.

Preparation? You have been preparing for this job even before you entered the Navy. In baseball, basketball, boxing—in various American sports—your muscles have developed, and you have learned how to use them both consciously and subconsciously.

Practice loading projectiles into the loading machine just as you would practice for any other big game. Only—put more effort into it. The stakes in the game are the highest—your life and the lives of your shipmates.

Position.—Take position on the left side of the loading machine, facing toward the muzzle end, with your feet about 12 inches apart. Your right foot is used as a pivot, so place it so that when you turn towards the gun your body will be about even with the center of the gun tray. Your back will touch the powder loader's back. Don't let it worry you. You will have to learn to work closely together in order to load smoothly. Practice pivoting—on the ball of the right foot—from fuze pot to gun and back again, without a shell, until you find the best spot for your right foot.

Removing a projectile from the fuze pot.—Grip the upturned base of a projectile with your right hand, and place your left hand on the same projectile about 6 inches up from its nose. Press down sharply on the fuze pot release pedal with your left foot; this will unseat the projectile from the fuze pot. Now you swing the base of the projectile towards you and clear of the fuze pot. Remove left foot from pedal, bring right hand and base of projectile close to your chest, and go into a crouch so that when you straighten up you can push the 54-pound weight of the projectile up with your leg muscles; they are much stronger and will last longer than your arm muscles.

Placing the projectile in the tray.—Roll the projectile across the breech housing, and, as it drops into the tray, close both hands into fists. Hold projectile down with both fists until it is steady in the tray and resting firmly against the powder cartridge.

Hand signal.—As soon as both the powder cartridge and the projectile are properly seated in the tray and fully ready to be rammed, remove both fists from the projectile and clear of the breech housing; raise right hand up and over head, opening fingers, indicating to the rammer-man that it is safe to ram.

Precautions: 1. *Never drop a projectile.*—Besides the damage done by a 54-pound weight crashing down on machinery, hands, and toes, all projectiles are equipped with either nose or base fuzes—or both. These fuzes are quite delicate and, when struck, may fail to operate entirely—or may even explode prematurely.

2. Take special care to prevent the nose fuze from striking the gun between fuze pot and gun tray.

3. If you do drop a projectile from a height of 5 feet or more, heave it over the side immediately. No exceptions.

4. Don't load a projectile into the tray before the powder cartridge is properly seated.
5. Don't step on the foot release pedal until you are ready to load the projectile into the gun.
6. In selecting projectiles from the fuze pots, take first the one in the pot nearest the pointer, then the middle one, then the third, and repeat this procedure. Never take a projectile from its fuze pot while the shellman has his right hand on the base of the projectile.
7. Do not try for great speed so much as for smoothness and rhythm; you will then find that the speed takes care of itself.
8. Take care not to let the base of your projectile injure the cork on the cartridge nose in loading. A broken piece of cork may jam the breech mechanism.
9. Don't give the rammerman your right-hand signal until you are sure that:
 - (a) The load is properly seated and fully ready to be rammed.
 - (b) You and the powder loader have your hands clear of the breech housing.

Loading the 5-inch 38-Caliber Gun.

You've inspected your platform to make sure that your feet will not slip. You are wearing gloves that won't get greasy and let a projectile drop through.

Stations.—Take position on the gun platform facing the muzzle end of the gun—just as you have practiced it. Check your position by pivoting back and forth on the ball of your right foot to each of the three fuze pots. Make sure that *safety link* is removed.

Stand-by.—Place hands on projectile in fuze pot. Rest left foot in bracket just above foot release pedal. *Don't hit the release pedal yet!*

Load.—The powder loader loads a powder cartridge into the gun tray.

Fire.—Step sharply on the forward foot release pedal, swing the shell out of the forward fuze pot and roll it into the tray. Stop it from bouncing with your closed fists. Remove your hands from the breech housing and give the right-hand signal.

Pivot back to the middle fuze pot and remove another projectile as the gun fires. Load as before.

Casualties.

Rammer failure.—Ram by hand—assisted by the powder loader. Study carefully chapter 17, "Casualties."

B. DUTIES OF THE SHELL LOADER STATIONED ON SINGLE OR TWIN MOUNT GUN WITH COMBINATION PROJECTILE HOIST AND FUZE SETTER INSTALLED ON THE MOUNT. RIGHT-HAND GUN

As the shell loader on this newer type of 5-inch .38-caliber gun you will take over all the duties of the shell loader of earlier types (read par. A of this chapter). In addition you will operate a Northern Pump Co. electric-hydraulic rammer to ram the load into the gun. As shell loader-rammerman you are second in command at your gun, and take orders directly from the gun captain. During action the gun captain's duties keep him moving about the station. It is then your job to take charge of the loading crew. It is up to you and your crew to keep that gun loaded and ready to fire.

Preparation.

Before you try to operate the rammer or projectile hoist ask the gunner's mate to explain these points:

1. *Northern Pump Co. electric-hydraulic rammer.*—(There are good sketches of the Northern Pump Co. rammer in Ordnance Pamphlets Nos. 735 and 805.) The gunner's mate can explain its parts and operation to you by talks, sketches, and demonstration.

2. *Projectile hoist.*—The projectile hoist has a dual purpose; to hoist projectiles from below the deck and, during the hoisting, to set the time fuze on the nose of the projectile. It will not return projectiles below deck. *Don't replace a projectile in the hoist after having once removed it from the hoist.*

3. *Breech mechanism operation.*—The opening and closing of the breech block directly affects the operation of the rammer system. Connected to the breech mechanism are the *salvo latch* (a safety device), the *cam plate retractor lever*, and the *manual operating mechanism*. Study these mechanisms! Learn their relationship to your job.

4. *Recoil and counterrecoil systems.*—Movement of the gun in recoil takes up the shock of firing; it also causes the rammer to retract. Counterrecoil is the forward movement of the gun back to battery. Two red marks (one on the breech housing, one on the slide) match up when counterrecoil is properly completed and the gun has returned to battery position. *If the gun is as much as one-fourth inch out of battery it is unsafe to fire; call "Silence" and notify the gun captain.*

5. Practice loading and ramming on the loading machine until you can do it without having to think out each separate step. As you acquire skill through practice it will become easier—but don't get overconfident. Keep anticipating trouble. Stay alert! On a 5-inch gun *anything* can happen!

Loading and Ramming the 5-inch .38-Caliber Gun.

Check-off.—Follow this check-off list before manning your station:

1. Test projectile hoist as directed by the gun captain.

2. See that cam plate retractor lever is on "A."

3. Test rammer as directed by the gun captain. *Warning:*

(a) *Before starting rammer motor, if rammer is forward, place operating lever (rammer handle) in ram; if rammer is retracted, place lever in retract.*

(b) *Never start rammer motor when breech is closed.*

Stations.—Take position on the gun platform facing the muzzle end of the gun. Check your position by pivoting back and forth between shell hoist and gun tray. Set hoist control lever on HOIST. Make sure that the *safety link* is removed.

Stand-by.—Place your hands on the projectile in the hoist. Rest left foot on bracket just above foot release pedal. *Don't step on the pedal yet!*

Load.—The powder loader loads a powder cartridge into the gun tray.

Fire.—Step sharply on the foot release pedal; swing the projectile out of the hoist and roll it into the tray. Stop it from bouncing with your closed fists. Remove your hands from the breech housing and operate the rammer handle with your right hand.

Observe the indicator marks on the breech block and the breech housing; if the breech block fails to close fully notify the gun captain.

When gun fires remove another projectile from the hoist.

Observe indicator marks on slide and breech housing to see that gun has returned to battery.

If the gun is as much as one-fourth inch out of battery call "Silence" and notify gun captain.

Load as before.

Casualties.

Rammer failure.—Ram by hand—assisted by the powder loader. Study carefully chapter 17, "Casualties."

Relief.

Normally the spademan is your relief. Learn his duties thoroughly so that you can handle his job properly when so ordered by the gun captain.

Chapter 10. POWDER LOADER

As the powder loader it is your responsibility to load powder cartridges quickly and safely into the tray. You handle a 28-pound cartridge of high explosives. Loaded correctly it can punch a 54-pound projectile for a distance of 9 nautical miles. Handled carelessly it can put you and the entire gun crew out of commission. Dangerous?—Only to the target. But be sure that you study and understand the following safety precautions and instructions:

Preparation.

Safety precautions: 1. *Exercise extreme care at all times to prevent the primer being struck.*—The exposed primer is safe when the base of the cartridge is protected by the palm of your hand. It is safe when the cartridge is placed in the tray with its base against the smooth face of the shell guard. But *never* drop or rest the base of a cartridge on deck—or anywhere else! Hold it in your arms.

2. Keep the fresh powder cartridge away from the ejected hot cases. *Protect it from flames or flying shrapnel with your body!*

3. *Don't load a cartridge into the tray before the spade is dropped.*—It might jam under the spade and delay loading at a time when seconds count. Or—it could slip out of the tray and strike its primer upon some rough edge of the gun platform.

4. Hold the powder cartridge close to your chest except when actually loading it into the tray. *Keep clear of the breech housing when the gun is loaded.* As the gun fires and recoils the breech housing comes back *Fast* about 15 inches and could knock a carelessly held cartridge out of your hands. *Be sure that this space to rear of the housing is clear for recoil.*

5. Exercise extreme care to protect case of cartridge and cork plugs from being struck or injured. A broken piece of cork could jam in the breech.

6. Observe position of the *differential piston* and notify gun captain immediately if it sticks out more than *2 inches*.

Loading the 5-Inch 38-Caliber Gun.

Let's analyze the powder loader's job and see what your duties are step by step:

Stations.—At the command "Stations" quickly check the muzzle of the gun to make sure that the tompon is removed. Then—immediately after—man your station on the gun platform.

NOTE.—1. *On mounts equipped with powder shuttle secured to base ring of the mount stand aft and outboard of the powder hoist—facing toward the breech mechanism.*

2. *On mounts using powder passing crew topside—stand abreast of the rammer shell guard in the retract position; facing the shell guard, and at arm's length distance away from it. In this position your forward shoulder should touch the shell loader's back.*

Check the position of the differential piston.

Stand-by.—1. *On powder shuttle mounts—wipe primer protecting cap from base of powder projectile topmost in the hoist. Kick cap clear of platform. With eyes on the tray lift cartridge out of hoist and hold it firmly in both hands—close to your chest. Face the tray. Stay at arm's length distance from the spade.*

2. *On powder passer mounts—keep your eyes on the tray while holding your hands aft and 18 inches apart at lower chest level. The powder passer will place a cartridge in your hands and give it a slight push forward. Bring the cartridge into the safety position against your chest. Hold it firmly with both hands.*

Be certain that the primer protecting cap has been removed and that the PRIMER end of the cartridge faces AFT.

Load.—Place the cartridge in the tray, using both hands to check bouncing and to move it to the rear against the face of the rammer shell guard. Exercise care that primer or cork plug is not struck. Step back and clear of breech housing. Check to see if space to rear of housing is clear for recoil. Get another cartridge as in "Stand-by."

Fire.—Watch operation of breech mechanism; return of gun to battery; ejection of hot case. Do not reload until ejected case is clear of the gun, and spade has been dropped into the tray.

Casualties.

Rammer failure.—Assist shell loader to ram by hand by giving load its first push up the tray.

Powder cartridge jammed under spade.—You can prevent this by not loading until the spade is down.

Chapter 11. HOT CASEMAN

A. DUTIES OF THE HOT CASEMAN STATIONED ON SINGLE GUN MOUNT, OPEN OR ENCLOSED, NOT EQUIPPED WITH CASE EJECTION CHUTES

As hot caseman it is up to you to get rid of the ejected empty cartridge cases, and to prevent the fresh powder cartridges, crew and breakable fixtures on the gun mount from coming into contact with the *hot* cases.

Preparation.

Wear a full suit of flameproof clothing and a pair of asbestos gloves whenever you man your station. If possible get a stowage place for these articles near the gun, so that you can always be fully outfitted when general quarters sounds. If you cannot catch an ejected hot case you must be prepared to stop it with any part of your body. Your flameproof clothing will protect you from burns. It is your responsibility and yours alone to stop the hot case and to get rid of it safely. Don't depend on the other members of the crew to help you. They will be busy carrying out their own duties.

In addition to the above duties you are charged with the responsibility of seeing that the fire-fighting equipment is on station and in working condition. Your gun will be assigned all or some of the following gear:

1. *Fire hose.*—Learn where this is and how and when to use it.
2. *Foamite hoppers.*—Find out where the foamite containers are stored. Be certain you understand how to use them. Know the operation of the foamite hopper valves.
3. *Portable CO₂ extinguishers.*—These are carbon dioxide gas fire extinguishers. CO₂ is heavier than air—but it will blow away and be useless in a strong breeze. Learn operation.
4. *Buckets of sand.*—Prevent the crew from using the sand buckets as ash trays. They are great for putting out gun platform fires and for sanding down a slick deck during battle!

Remember—during action the fire equipment should always be ready for instant use—but you don't fight fires until so ordered by the gun captain or senior man present. *It is more important to keep the gun firing while an enemy target remains.*

Now—to get back to your main job:

Firing the 5-inch 38-Caliber Gun (Surface Targets and Torpedo Planes).

Check-off.—Before manning your station check your gun's fire-fighting gear to see that it is in the proper place and condition of readiness. Put on your flameproof clothing and asbestos gloves.

Stations.—At the command "Stations" take position slightly astern and to left of the breech end of the gun, looking up the bore. Inspect for clear bore. Call "Silence" and notify the gun captain if:

1. The breech is closed.
2. The tompion is still in the muzzle (and you can't see daylight through the bore).
3. The bore is fouled.

Place your feet about 20 inches apart, left foot forward and pointing towards the gun; right foot aft and at an angle of 45° to right of a line passing through the center of the bore. Hold open right hand over the after end of the tray; fingers extended and pointing up. Hold left arm relaxed and close to the chest. You are now ready to "catch."

Stand-by.—Check to see that the cartridge case stop is in its proper position:

1. *Housed* for firing on surface targets.
2. *Out* in the tray for AA firing above 40°.

Notify the rammerman (or spademan) if the case stop is in the wrong position.

Load.—The powder loader places a cartridge in the tray.

Fire.—The gun recoils and a hot case is ejected. Catch the base of the hot case on the asbestos glove covering your right hand. Let the case carry your right hand back with it. Bring up your left hand to complete your hold on the hot case. Step back and toss it to a place previously designated by the gun captain as safe. Keep the hot case clear of the gun crew. Throw it clear of the gun. Step forward into position for the next round. Inspect the bore. Carry on as before.

Aircraft Targets.

Remember that the *cartridge case stop must be out in the tray when the gun is elevated beyond 40°*. You are wearing heavy asbestos gloves and probably cannot operate the small case stop latch yourself. So—be sure that you don't let the rammerman (or spademan) forget it!

The stop prevents the hot case from jamming between the slide and the gun platform at high angles of fire. It also prevents the hot case from leaving the tray normally. You must change your position.

As soon as the powder loader completes his load and steps back from the tray you jump up on the gun platform between him and the gun. Face the tray. *Keep your hands clear of the space abaft the breech housing during recoil.* When the hot shell is ejected and bounces against the case stop—*grab it on the first bounce!* Take the base of the hot shell in your right hand and the open forward end in your left hand. *Keep your body between the hot case and the powder loader's fresh cartridge.* Step aft and clear of the gun platform carrying the hot case with you. Throw it clear of the gun as before. Return to the gun platform as the powder loader completes another load.

NOTE.—Get the hot case out of the tray *on the first bounce!* If the hot case jams between spade and case stop push the spade *up* and bring the hot case *forward*—into the tray—and *out*. Don't try to force it to the rear through the after end of the tray.

Securing.

Upon securing the gun—

1. Assist the gunner's mate in storing or disposing of the ejected cases.
2. Inspect the fire-fighting equipment to see that it is secured properly.
3. Stow your asbestos gloves and flameproof clothing near the gun.

B. DUTIES OF THE HOT CASEMAN STATIONED ON ENCLOSED SINGLE OR TWIN MOUNT GUN WITH CASE EJECTION CHUTE INSTALLED. RIGHT-HAND GUN:

Case ejection chute.—The case ejection chute is a metal trough hinged like an apron to the rear of the gun slide in position to receive ejected cases, at varying angles of gun elevation, and guide them down to a door in the rear plate of the shield through which they are ejected. At angles of gun elevation above 40° hot cases cannot be ejected through the chute. They are then lifted out of the tray and ejected by hand through an auxiliary ejection chute and door directly above the main chute.

NOTE.—On airplane carrier installations there is a difference in location of the ejection ends of the chutes in that the hot cases are not directed out on deck.

As hot caseman it is up to you to get rid of the ejected empty cartridge cases, and to prevent the fresh powder cartridges, crew and breakable fixtures on the gun mount from coming into contact with the *hot* cases.

Preparation.

Wear a full suit of flameproof clothing and a pair of asbestos gloves whenever you man your station.—If possible get a stowage place for these articles near the gun, so that you can always

be fully outfitted when general quarters sounds. It is your responsibility to keep the ejected cases moving through the cartridge chute, and out through the lower port, at all angles of elevation up to 40°. At angles of elevation above 40° you must see that the spademan pushes the cartridge case stop out into the tray. You must then lift the hot cases out of the tray by hand and eject them through the upper port. If at any time the cartridge chute does not work right you must be prepared to stop the hot cases with your hands, or any part of your body, and eject them from the mount by the quickest safe means. It is your responsibility, and yours alone, to get rid of the hot cases. Do not depend on the other members of the crew to help you. They will be busy carrying out their own duties.

In addition to the above duties, you are charged with the responsibility of seeing that the fire-fighting equipment is on station and in working condition. Your gun will be assigned all or some of the following gear:

1. *Fire hose*.—Learn where this is and how and when to use it.
2. *Foamite hoppers*.—Find out where the foamite containers are stored. Be certain you understand how to use them. Know the operation of the foamite hopper valves.
3. *Portable CO₂ extinguishers*.—These are carbon dioxide gas fire extinguishers. CO₂ is heavier than air—but it will blow away and be useless in a strong breeze. Learn operation.
4. *Buckets of sand*.—Prevent the crew from using the sand buckets as ash trays. They are great for putting out gun platform fires and for sanding down a slick deck during battle!

Remember—during action the fire equipment should always be ready for instant use—but you don't fight fires until so ordered by the gun captain or senior man present. *It is more important to keep the gun firing while an enemy target remains.*

Now—to get back to your main job:

Firing the 5-Inch 38-Caliber Gun (Surface Targets and Torpedo Planes).

Check-off.—Before manning your station carry out the following preliminary duties:

1. Check your gun's fire-fighting gear to see that it is in the proper place and condition of readiness.
2. See that ejector tray is hooked on and ejector flaps—upper and lower ports—open (at night open ejector flaps at "Commence firing").
3. Put on your flameproof clothing and asbestos gloves.

Stations.—At the command "Stations" take position abaft breech and to left of the case ejector chute looking up the bore of the gun. Inspect for clean bore. Call "Silence" and notify the gun captain if:

1. The breech is closed.
2. The tompon is still in the muzzle (and you can't see daylight through the bore.)
3. The bore is fouled.

Stand-by.—Check to see that the cartridge case stop is in its proper position:

1. *Housed* for firing on surface targets.
2. *Out* in the tray for AA firing above 40°.

Notify the rammerman (or spademan) if the case stop is in the wrong position.

Load.—The powder loader places a cartridge in the tray.

Fire.—The gun recoils and a hot case is ejected into the case ejection chute. If necessary, push the hot case out through the lower port. Inspect the bore. Carry on as before.

Aircraft Targets.

Remember that the *cartridge case stop must be out in the tray when the gun is elevated beyond 40°*. You are wearing heavy asbestos gloves and probably cannot operate the small case stop latch yourself. So—be sure that you don't let the rammerman (or spademan) forget it!

The stop prevents the hot case from jamming between the slide and the gun platform at high angles of fire. It also prevents the hot case from leaving the tray normally. You must change your position.

As soon as the powder loader completes his load and steps back from the tray you jump up on the gun platform between him and the gun. Face the tray. *Keep your hands clear of the space abaft the breech housing during recoil.* When the hot shell is ejected and bounces against the case stop—*grab it on the first bounce.* Take the base of the hot shell in your right hand and the open forward end in your left hand. *Keep your body between the hot case and the powder loader's fresh cartridge.* Step aft and clear of the gun platform carrying the hot case with you. Eject it through the upper port. Return to the gun platform as the powder loader completes another load.

NOTE.—Get the hot case out of the tray *on the first bounce.* If the hot case jams between spade and case stop push the spade *up* and bring the hot case *forward*—into the tray—and *out.* Don't try to force it to the rear through the after end of the tray.

Securing.

Upon securing the gun—

1. Assist the gunner's mate in storing or disposing of the ejected cases.
2. Inspect the fire-fighting equipment to see that it is secured properly.
3. Close and lock the ejector flaps.
4. Stow your asbestos gloves and flameproof clothing near the gun.

Chapter 12. AMMUNITION TRAIN

NOTE.—The organization of the 5-inch 38-caliber ammunition train varies with each type of man-of-war, and sometimes it varies between different vessels of the same type. It would complicate this pamphlet needlessly to explain each method of supplying projectiles and powder to the gun. Therefore—this chapter deals with the subject of ammunition supply in general only.

Shellmen, powdermen, and hoistmen make up the ammunition supply system.

The shellman supplies properly fuzeed projectiles to the shell loader via the fuze pots. On all twin mount guns and on some single mount guns the fuze pots are a part of the projectile hoist. In this case the shellman loads a projectile into the fuze pot and fills the projectile hoist simultaneously. At "secure" the shellman replaces the safety pins, nose caps, and grommets after checking that all nose fuzes are set on "Safe."

The powderman supplies fresh powder cartridges to the powder loader directly or by means of a powder scuttle. At "Secure" the powderman replaces the primer protecting caps on the cartridges and stows them in the powder tanks.

The hoistman operates a projectile hoist or powder hoist, or a combination projectile-and-powder hoist, to hoist ammunition up to the gun. At "Secure" the hoistman secures hoist in accordance with ship's doctrine and turns off power motor.

Sometimes the shellman or the powderman acts as a hoistman, too. Without proper knowledge this would lead to confusion. *If you are in the ammunition supply crew, know all three jobs well: shellman, powderman, and hoistman.*

Handling fuzeed projectiles.—During daytime action you will supply the shell loader with AA common projectiles—which may be used against either aircraft or surface targets. They are 4.15 calibers (20.75 inches) long, weigh 54 pounds, and are fitted with Mark 16 and mods. nose fuzes.

Nose fuzes being sensitive, care shall be taken to prevent them from being struck as by the gun in recoil, by ejected cases, by dropping, etc.

Time fuzes which have been set shall be reset on "Safety" before sending them below.

In handling projectiles fitted with tracers, care shall be taken not to strike the tracer, as such a blow may ignite it.

During night action another type of projectile is used to illuminate the area above and behind a surface target. This is the *illuminating projectile*—or *star shell*, Mark 30, Mods. 1, 2, and 3. It has the same length and weight and is equipped like the AA common projectile with a time fuze. Star shells can easily be recognized by means of a white star painted on a blue band passing around the body of the projectile.

Star shells are not used against aircraft targets. They are good only to illuminate a surface target. Don't get them mixed with the AA common projectiles.

When carrying a fuzeed projectile hold it close to your chest with both hands. Grip the base of the projectile with your right hand—covering and protecting the tracer with your palm. Hold the forward end with the fingers of your left hand wrapped about the body of the projectile and the thumb extended—pointing down the white painted line towards the *standing lug* on the nose fuze. Your thumbnail should be 6 inches from the tip of the nose fuze.

At night—when you cannot see the white stripe painted in line with the standing lug—*feel* the nose fuze with your fingers. The *larger* of the two lugs will be the *standing lug*.

Fuze pot procedure.—When correctly used the fuze pot sets a time limit in seconds on the nose fuze of a projectile. At the end of this time the projectile—if it is still in the air—bursts.

With AA common projectiles the burst caused by the nose fuze will detonate a main charge within the projectile and throw out a mushroom of shell fragments. In star shells the burst causes a parachute and flare to be released from the shell.

Should a fuzed projectile strike a solid target or the ground before the time set on its fuze it will burst immediately because of the shock of impact. Even a fuze set on *Safe* will burst when it collides with a solid target.

It is almost impossible to score a *direct hit* on an airplane with the 5-inch gun. The idea of firing a projectile with a *timed fuze* is to make the projectile burst *in the vicinity of the target*. That is the next best thing.

Now—if the fuze is not correctly set—the projectile will not burst near the target. It's up to you to set that fuze *exactly* right.

A. *Loading fuze pots*.—1. Place the nose of the projectile in the fuze pot at an angle of 45° holding it with both hands. Line up your left thumb, the white line, the standing lug and a red painted V-slot in the fuze pot. (If you regard the fuze pot as a target the V-slot is at 7 o'clock.)

2. With your right hand shove the base of the projectile over and into a vertical position in the fuze pot. *Keep your right hand on the base! Keep your eyes on the standing lug* (to make sure that it doesn't jump out)! Remove your left hand.

3. With your left hand grip the fuze setter handle. Pull it towards you and rotate the handle in a clockwise direction until it hits a stop. The fuze is set.

Now you can take your eyes off the standing lug, your right hand off the base of the projectile, and your left hand off the fuze setter handle. If you had taken your right hand away too soon the shell loader could have taken the projectile before its fuze was properly set. Removing your right hand from the base of the projectile is your signal to the shell loader that it is ready to be loaded and fired.

B. *Loading fuze sockets in a dredger type projectile hoist*.—1. Place the nose of the projectile in the fuze socket so that the standing lug is engaged in the V-slot. Push the base of the projectile over and into the hoist. Remove your hands instantly.

CAUTION: *Keep hands out of hoist at all times.*

2. The fuze will be set automatically as the hoist ascends with a projectile.

Setting fuzes by hand.—When the fuze pot or fuze socket installed in a projectile hoist fails, fuzes are set by hand: A hand fuze setting tool is kept near the gun for this purpose.

Handling powder cartridges.—One type of powder cartridge is used. Its total weight is 28 pounds; this includes a service powder charge weighing 14.75 pounds. In the base of the brass cartridge case is a combination primer that can be fired either by electricity or percussion.

A metal primer protecting cap is removed from the cartridge base just before firing. After this cap is removed take extreme care to prevent the exposed primer from being struck.

When carrying the powder cartridge hold it close to your chest with one hand holding the forward end of the case and the other hand locked over the base protecting the primer. Protect the cartridge case from flames and flying shrapnel with your body.

When cartridges are outside the magazine, whenever practicable, each flameproof compartment or space which forms a stage of the ammunition train, including the magazines and gun compartments (in or out of turrets) shall be kept closed from all other compartments or spaces, except when the actual passage of ammunition requires it to be opened. When practicable, no flameproof stage of the ammunition train shall be opened to both the preceding and the following stages at the same time.

When passing ammunition by hand do not release the cartridge until the man you are passing it to has a firm grip on it.

Operation of hoists.—The hoist is the primary method of getting ammunition up to the gun from magazines and handling rooms. When it fails ammunition must be passed up by hand. This method is difficult and slow. The rate of fire of your gun will fall off to a minimum. As

a member of the ammunition supply crew it is your duty to learn the correct way to operate the hoist so that casualties due to mishandling will not occur.

1. Ask your gunner's mate to explain and demonstrate the operation of all hoists on your battle station.

2. Study the pamphlets in the gunnery office concerning the hoists you may operate.

3. Learn the safety precautions bearing on hoist operation. (These should be posted on or near each hoist.) Above all—*keep your hands out of the hoist!*

Chapter 13. BATTLE LOOKOUT

At some time or another every sailor will eventually stand a battle lookout watch. The importance of an alert lookout watch is so great that even the captain and officer-of-the-deck must spend a major portion of each day and night searching the horizon and the sky for enemy targets.

In time of war a lookout's report can mean the difference between a quick victory or a severe defeat. In this war most of our losses have occurred when we didn't see the enemy first!

Don't let this happen to you. Protect your ship from surprise attacks by being an alert lookout and by reporting what you see to the proper person *promptly* and *accurately*.

Relative bearing.—In order to show the position of an object away from your ship, you could just sight down your arm and point at it with your forefinger. That would be easy to understand. But have you ever tried to point out an object in this way to a man who is on the other end of a telephone circuit? Naturally not! You must use some method to *describe* the position of the object so that another man will know where to look for it. The method used aboard ship is called *relative bearing*.

The relative bearing of an object is the angle that the line of sight to the object makes with the fore-and-aft line of the ship, it is measured (in degrees of arc) from the bow of the ship around to the right—in a clockwise direction.

Now look at the sketch entitled "relative bearing" at the end of this chapter. You will see that an object (O) *dead ahead* of the ship makes an angle of *zero degrees* with the bow. The relative bearing of this object is, then, 0° .

Notice the object that bears *broad on the starboard bow*. The line of sight from the ship to this object is 45° from the bow. The relative bearing of this object then is 45° .

And, an object that you see *broad on the port bow* has a relative bearing of 315° .

Remember, the relative bearing of anything to *starboard* will lie between 0° and 180° ; the relative bearing of anything on the *port* hand will lie between 180° and 360° (0°).

True bearing.—Installed aboard ship, for the purpose of navigating, is a gyrocompass. The needle of this compass points always towards the north pole. The compass card is marked off into 360° of *true bearing*—just as the ship is marked off into 360° of *relative bearing*.

But, true bearing is measured to the right—or clockwise—from the direction of the *north pole*, relative bearing is measured clockwise from the *bow* of your ship.

Look at the sketch entitled "true bearing" at the end of this chapter. You can see that the only time that the true bearing and relative bearing of an object will be equal is when the ship's bow is pointing due north. In this sketch a ship is shown on course NE., or 45° (t) ("t" for true). An object (O) is shown bearing 180° *relative*—but with *true bearing* 225° (t).

True bearing, then, is the angle between the north pole and the line of sight to an object; it is measured from the true north direction, clockwise to an object, in degrees of arc.

Now that you know what true bearing is—forget about it! Most lookout stations are not located near a gyrocompass—so it is almost impossible for lookouts to give true bearings. *All bearings to and from lookouts are relative bearings.*

Position angle.—Look at the stars some night and you will know what position angle is. Notice that one star is higher in the heavens than another. You cannot measure this difference in inches, feet, or miles. How then?

The position of an object in the sky can be described by its bearing and *position angle* in degrees of arc.

Position angle is the angle measured between a line of sight to the horizon and a line of sight to an elevated object. Thus, the position angle of a ship on the horizon is zero degrees. The position angle of an airplane or star directly overhead is 90° (from the horizon). See the sketch entitled "position angle" at the end of this chapter.

Learn how to estimate position angles quickly. Hold your right arm straight out before you; fingers clenched; thumb extended upwards. Sight along the lower edge of your little finger so that your hand appears to rest on the horizon.

Now, by sighting along the upper edges of your fingers you will be able to estimate position angles of 2° , 4° , 6° , and 8° , respectively, above the horizon. By sighting over the top of your thumb, you will estimate a position angle of 15° above the horizon. In the sketch the plane is at a position angle of 15° .

You can double or triple this 15° estimate by moving your hand up the sky in 15° steps—as you would move a foot ruler along several feet of material.

Pick a star and check your "thumb-rule" estimate against the director some night. You will be pleased with the accuracy you can attain.

Incidentally—you can always determine your (north) latitude by estimating the position angle of the North Star. The position angle of this star is always approximately equal to the (north) latitude of an observer.

Range.—The range to a target can be estimated accurately to within a few hundred yards by experienced observers. Learn to estimate the distances to various ships in your task force or convoy by checking your guesses against the range finder or radar ranges. As you acquire experience your "guesses" will be based on many previous observations—and will become "estimates."

Sun glasses.—You will be issued one or more pairs of plain and colored sun glasses. Observe the following precautions with them:

1. Use plain (colorless) glasses when the stack gases or deck dirt (as on carrier flight decks) is flying thick—and liable to get in your eyes.

2. Use dark colored glasses for searching in and around the sun. Use lighter colored glasses to match lesser degrees of brightness.

3. Keep your glasses clean! They are worthless if you can't see through them clearly.

4. Protect your glasses from damage. It takes time and labor to replace them. Out in the war zones there are no replacements. If you do damage a pair of glasses return them to the petty officer in charge immediately.

Binoculars.—Two delicately adjusted telescopes joined together form a pair of binoculars. They magnify an object, and increase the maximum range at which you can see it. Binoculars are fragile, expensive, and hard to replace. Take extreme care in handling and stowing them. Never clean the glass parts with a dirty handkerchief or a rag. Use a piece of clean, dry lens paper.

Interpupillary adjustment.—The two eyepieces should be separated by a distance equal to the separation between the pupils of your eyes. This is known as the interpupillary distance; it is measured in millimeters. Go to the optical shop and ask the man in charge to measure your pupillary distance. If it is, say, 67 millimeters, set that figure (67) on the interpupillary adjustment of your binoculars. Each time you use the binoculars check to see that *your own setting* is on it. This is important—don't forget it!

Focusing binoculars.—To focus a pair of binoculars on a given target, follow this procedure:

1. Set the correct interpupillary adjustment on the binoculars. Make sure this setting is *exact!*

2. Place both focusing rings in the extreme long range focus positions. Cover one eyepiece with your hand and focus the open telescope *in towards the target*. As soon as a clear, sharp image of the target is seen, stop focusing. Do the same with the other telescope. Note the settings on both left and right eyepiece focusing rings so that—if moved off—you can reset them quickly.

Focus the binoculars each time you use them. In an emergency or during a search you can put your average settings on the focus rings until there is more time to focus exactly.

Never focus out towards a target; your eyesight will be strained. *Always focus in* from beyond a target.

3. Some binoculars are equipped with colored filters. Use these as common sense demands for searching areas of brilliant light.

Clothing.—Make sure that you are properly clothed to combat inclement weather. In hot climates protect your head and body from stroke and sunburn by wearing a light helmet and complete suit of lightweight clothing. Take special pains to keep warm and dry in cold, wet regions.

It is great to be "rugged"—but don't ever overestimate your endurance. The Navy wants you to stay healthy. You can't take your share of a battle to a bed in sick bay.

If you don't have the proper clothing to stand an efficient battle lookout watch—see your division officer *immediately*. He will see that you get it.

General orders for battle lookouts.—These are the general orders for battle lookouts. You must know them thoroughly:

1. Be alert and attentive.
 2. Do not give your attention to anything but your own special duty.
 3. Remain at your station until you are properly relieved.
 4. Do not lounge.
 5. Do not talk with others except as required by your duty.
 6. When making a report, speak loudly and distinctly.
 7. Repeat a hail or report until it is acknowledged by the person or station receiving it.
 8. When you are stationed, be sure that you understand what you are supposed to do.
- If you don't understand your duty, ask the petty officer who stations you about it.

9. *When in doubt—make a report!*

Radar.—The search radar has certain mechanical and electrical limitations. It is usually operated—to search an area of 360°—by only *one man*. It cannot always pick up torpedo planes, small ships, or surfaced submarines before they are sighted by an alert lookout. Sometimes it cannot even locate aircraft flying directly over the ship!

However, the search radar, *when it is working efficiently*, can be a great aid to the lookouts. But, remember, it is an *aid* to the battle lookouts, and *does not replace them*. *Alert battle lookouts are the only positive means of search and identification.*

NOTE.—Although reports of objects sighted are not always made *directly* to gunnery control or the bridge, the text of this chapter will—for the sake of simplicity—treat all reports as being directed to control or the bridge.

SURFACE LOOKOUT

As a surface lookout you are the main defense of the ship in eluding attacks by submarines. The radar cannot "pick up" torpedoes; the guns cannot stop them. It is up to you to spot the periscope of a submarine, or the wake of a torpedo, and to notify the bridge in time for the ship to maneuver to safety.

Be especially vigilant when you receive information that enemy submarines are near.

Search zone.—You will be assigned a certain area in which to search. This area—or *zone*—will extend from the ship to the horizon, and will lie between two given relative bearings. The sides of your zone should overlap slightly the two zones to left and right of you.

When you are relieved make certain that your relief knows what zone he is to search.

Reports.—When you make a report speak clearly and loudly enough to be heard above ship-board noises. Observe the procedure outlined in chapter 14, "Telephone Talker." This is what control wants to know about the objects you find:

1. *Who sighted it?* If control cannot find the object reported, further information will be needed from the station that reported it.

2. *What* is it? Is it one object or a group of objects? Does it look like a submarine, ship, mine, torpedo, low flying plane, fish, etc. * * *? If you don't know, report it as an *object*.

3. *Where* is it? If it is a surface vessel, or any other water-borne object, give the following information concerning it:

- (a) Relative bearing (degrees).
- (b) Approximate distance (miles or yards).
- (c) Approximate height (in feet) above the water.

4. *Which way* is it going? Is it heading this way, going away, heading on parallel course, heading on opposite course, etc.?

As an example: Assume that you are a surface lookout stationed on gun No. 4, and sight three enemy torpedo boats broad on the port bow—about 4 miles away—and heading directly for your ship. This would be your report:

“Control! Gun FOUR reporting. THREE TORPEDO BOATS—bearing THREE ONE FIVE—distance THREE MILES—HEADING THIS WAY!”

Who—Gun No. 4 reporting.

What—Three torpedo boats.

Where—(a) Bearing 315.

(b) Distance 3 miles.

Which way—Heading this way.

Night.—Before relieving at night you must let your eyes become adjusted to the dark. This will take at least 15 minutes.

Be certain that the interpupillary adjustment of your binoculars is set exactly for your eyes. A small error here will decrease considerably your ability to see an enemy in the dark.

Avert your eyes from any bright light that may appear in your zone. Don't ruin your night vision by looking directly at a light.

Relieving.—Relieve the man at your station only after he has given you all the latest information and has pointed out whatever objects or suspected objects are in the zone. Be sure you can see them. Don't let another man relieve you until he has “the dope.”

SKY LOOKOUT

As a sky lookout you are on guard to protect your ship from being surprised by enemy aircraft. The radar is not infallible in detecting approaching airplanes. You know that we have already suffered unnecessary losses in this war due to surprise raids by enemy planes. Keep your eyes open for aerial attacks, and make reports promptly, so that the gun batteries will have a chance to bring down the enemy before they can damage your ship.

Search zone.—You will be assigned a certain area in which to search. This area—or *zone*—will extend from the horizon to a point directly overhead in the sky, and will lie between two relative bearings. The sides of your zone should overlap slightly the two zones, to left and right of you.

When you are relieved make certain that your relief knows what zone he is to search.

Reports.—When you make a report speak clearly and loudly enough to be heard above shipboard noises. Observe the procedure outlined in chapter 14, “Telephone Talker.” Here is what control wants to know about the aircraft you find.

1. *Who* sighted it? If control cannot find the plane sighted, further information will be needed from the station that sighted it.

2. *What* is it? Is it one or more airplanes? Can you tell whether it is a fighter plane; dive bomber; twin engine bomber; torpedo plane; etc.? If you aren't sure of the identity of the plane report it as a *plane* or *group of planes*—depending upon what you see.

3. *Where is it:* Give the following information as nearly accurate as possible:

- (a) Relative bearing (degrees).
- (b) Position angle (degrees).
- (c) Range (miles or yards).

If you can't estimate distances, tell whether the plane is *near* or *far away*.

4. *Which way* is it going? Is it heading this way; going away; climbing; diving; circling; etc.?

As an example: Assume that you are an air lookout stationed on AA gun No. 5, and sight a large group of horizontal bombers broad on the port quarter—about 10 miles away—position angle 10° —heading for the ship. This would be your report:

"Control! GUN FIVE reporting—LARGE GROUP of HORIZONTAL BOMBERS—bearing ONE THREE FIVE position angle TEN—distance—TEN MILES—HEADING THIS WAY!"

Who—Gun No. 5 reporting.

What—Large group of horizontal bombers.

Where—(a) Bearing 135° .

(b) Position angle 10° .

(c) Distance 10 miles.

Which way—Heading this way.

Relieving.—Relieve the man at your station only after he has given you all the latest information on airplanes sighted, radar warnings, etc.

IDENTIFICATION

During spare moments cultivate the habit of studying the outlines of various ships and airplanes. Make it a matter of pride to be able to identify as many different types as possible. Your efforts will not be wasted. Battles have been lost because units of the same fleet have failed to recognize one another, and have fired upon their own forces.

Ship identification.—First of all learn the major differences between the different classes of our Navy's warships. Be able to distinguish in a glance the difference between battleships; airplane carriers; heavy cruisers; light cruisers; destroyers; transports; tankers; supply ships; etc.

Then study the dissimilarity between different *types* of United States warships in the same *class*; such as the difference between, say, the *North Carolina* type of battleship and the *California* type.

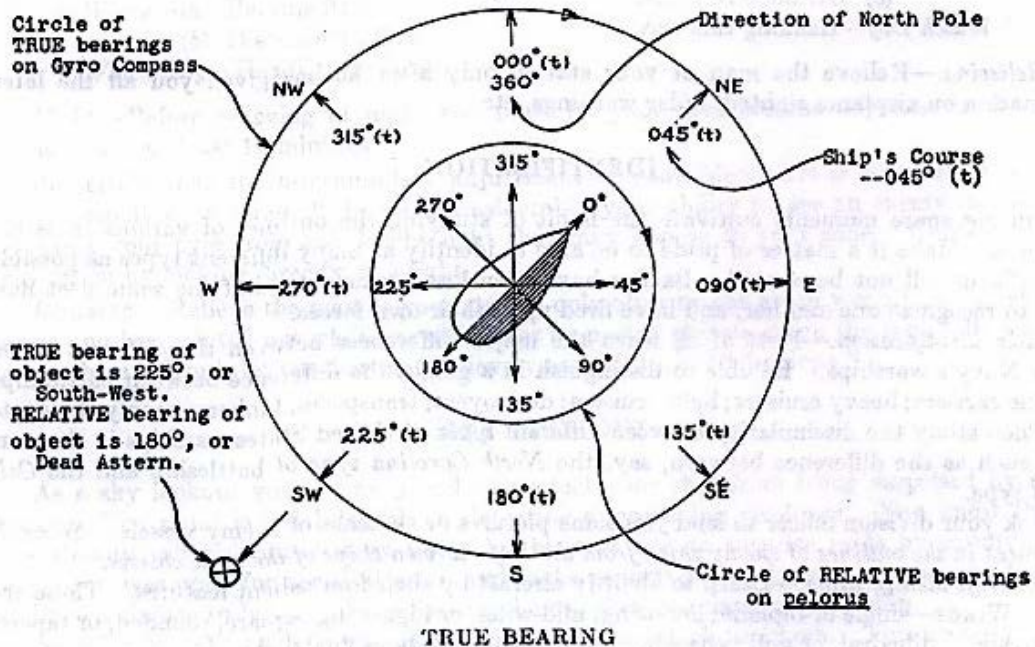
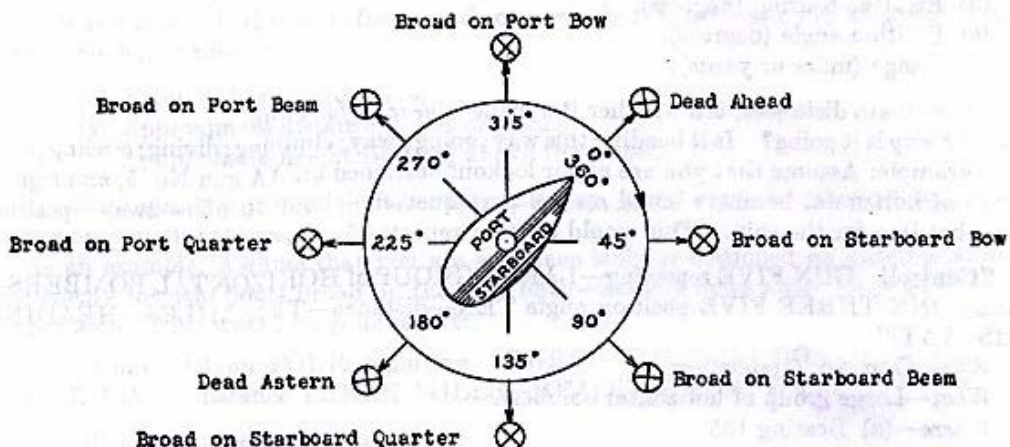
Ask your division officer to lend you some pictures or sketches of enemy vessels. Study the differences in the outlines of enemy ships from those of our own ships of the same classes.

Aircraft identification.—Learn to identify aircraft by their four salient features. These are:

1. **WINGS**—single or biplane; low-wing, mid-wing, or high-wing; square, rounded, or tapered tips; straight, dihedral, or gull type wing span; with or without floats, etc.
2. **ENGINE**—one or more; in-line or radial; etc.
3. **FUSELAGE**—single or multiple; slim or squat; streamlined or irregular in shape; etc.
4. **TAIL**—single or twin surfaces; what kind of shape?

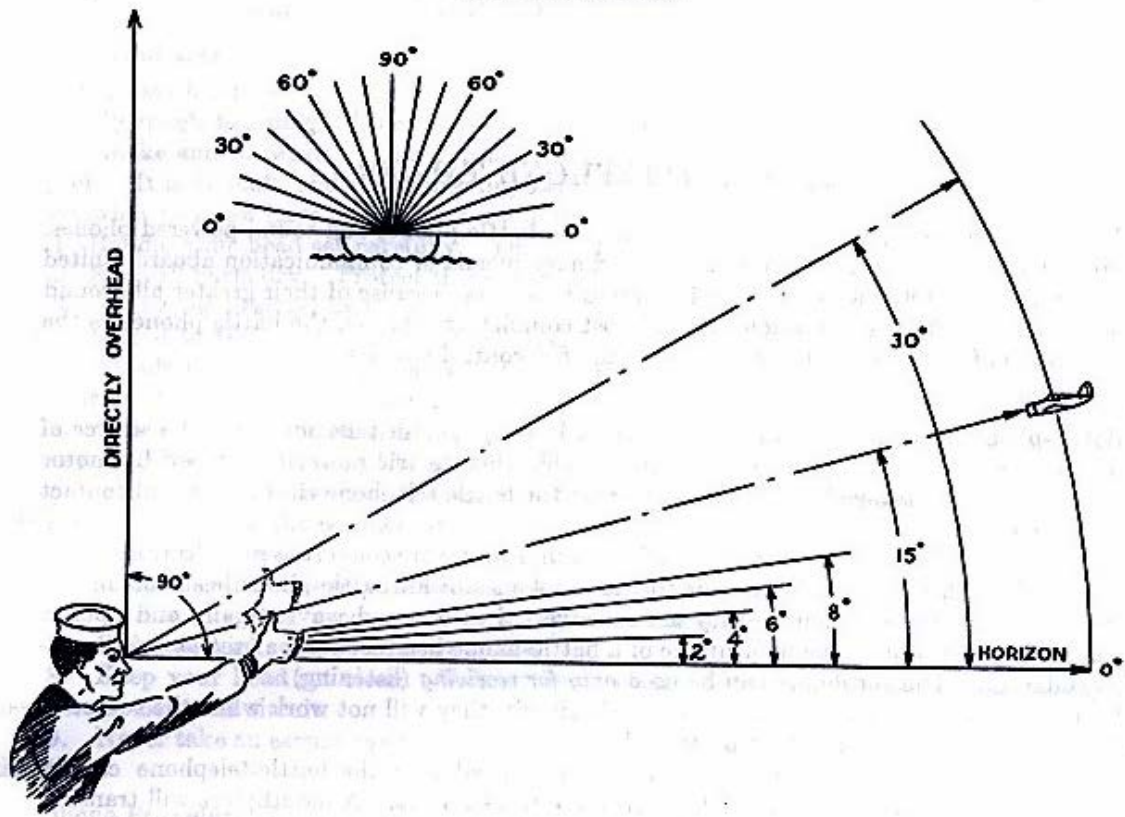
This is known as the WEFT system: Wing, engine, fuselage, tail.

RELATIVE BEARING



TRUE BEARING

POSITION ANGLE



Chapter 14. TELEPHONE TALKER

The Navy uses two types of telephone head sets: battle phones and sound-powered phones. Until recently battle phones were used as the primary means of communication aboard United States warships. Lately, however, sound-powered head sets, because of their greater all-around ruggedness and nonelectric operation, have almost completely replaced the battle phones as the primary means of shipboard communication in the fire control circuits.

Battle Phones.

Battle-phone head sets are similar to shore side telephone installations in that a source of electric power is necessary for operation. Aboard ship this electric power is supplied by motor generators or a set of storage batteries that energize the battle telephone circuit when all contact points are closed.

In the mouthpiece of a battle-phone head set sound waves are converted into electric signals, and carried through the energized circuit to the earphones of all battle-phone head sets on the circuit. There—in the earphones—they are reconverted into sound waves again, and spoken words or noises are heard. The mouthpiece of a battle-phone head set can be used *only for transmitting* (talking). The earphones can be used *only for receiving* (listening).

Because battle phones are units in an electric circuit, they will not work when the source of electric power is shorted, cut out, or destroyed.

To prevent unnecessary noises from being transmitted over the battle-telephone circuit, push-button switches are installed on all mouthpiece transmitters. A mouthpiece will transmit sound only when its push button is held *down*, thereby closing the electric circuit. When a push button is *up* its mouthpiece is off the circuit. Thus, to talk over a battle-telephone circuit, you must hold the push button of your mouthpiece down continuously while you are speaking.

The earphones are always connected into the circuit, and will pick up sounds transmitted by any talker on the circuit as long as they are in good working condition.

Sound-Powered Phones.

Sound-powered head sets are not connected to an outside source of electricity. There are no electric leads, no motor generators, no storage batteries connected into a sound-powered system. It is—as the name implies—strictly *sound powered*.

The mouthpiece and both earphones of a sound-powered head set differ from the battle-phone headset in that you can *talk and hear* with all three pieces. The only difference between the mouthpiece and the earphones of a sound-powered head set is that a push button is installed on the mouthpiece. This push button is used to prevent unnecessary noises from being transmitted over the sound-powered circuit.

When a push button is *up* its mouthpiece is cut off the sound-powered circuit, and no unnecessary noises can be transmitted through the mouthpiece. To talk over a sound-powered circuit you must hold the push button of your mouthpiece *down* as long as you speak. Do not let it up until you are through speaking.

While you are wearing the sound-powered head set no noises are transmitted through the earphones because you will be wearing them on your ears. Each ear will act as a "plug" to prevent noises on your station from leaking through the earphones and into the circuit. Notice, however, that when a man on another station takes a pair of sound-powered phones off his head, but leaves the set plugged into a jack box, you can hear faintly various noises from his station. These noises are coming to you through the exposed earphones of his set.

Thus—in an emergency, or when one piece of the head set is damaged—you can use either earphone or the mouthpiece to both transmit and receive messages.

Care of Head sets.

Telephone head sets are built to withstand hard wear, but they will not hold up under unnecessarily rough handling. Like many other finely built mechanisms, they require time and labor to make and to repair. They contain materials that are growing more scarce as the war drags on. It is difficult, and sometimes impossible, to replace the head sets on your ship. Help to save what you now have on hand for use in the coming battles.

1. Handle your head set carefully. Do not drop or bang it against other objects.
2. Keep all parts dry. Protect them especially from salt spray, which corrodes.
3. Carry the head set by the chest plate, or chest plate strap, and the wide cloth or leather band attached to the earphones. Never carry or dangle the mouthpiece or earphones by the thin wire leads to which they are attached. These wire leads break easily; a broken lead will put your headset out of commission immediately.
4. When securing the head set, coil the wire neatly. Do not wrap it around the phone or put any sharp bends in it; it will break.
5. Always replace the jack-box cover when you have secured a phone. Moisture and salt spray can corrode the contacts in an open jack box, or destroy the insulation and ground the circuit in a few hours.
6. Keep the wire lead to your head set free from strain. Hold a few coils in your hand, if possible, to ease out when necessary to avoid strain in the wire.
7. Keep the kinks out of your wire lead.
8. Keep your head set clean. Take it down to the Repair Shop when you can't talk or hear clearly over the circuit.
9. Never take an earphone or mouthpiece apart. Only authorized repair men can work on them.

Telephone Procedure.

You could not expect an airplane to land readily on a carrier if it were necessary for the pilot and landing officer to hold lengthy discussions before each landing. A carrier-based plane must be landed *quickly*. There's no time for small talk! So—the landing officer uses a definite procedure—a system of hand signals. Each quick signal can take the place of a paragraph of words. By using a fixed procedure the pilot and landing officer save minutes at a time when seconds count.

It is the same with shipboard telephone communications. A definite, fixed procedure must be used when talking in order to save time. Every man on the telephone circuits must follow the established telephone procedure to the letter. One inexperienced or careless man, or "fouled up" report during action, can disrupt the whole fighting organization of your ship—and might even cause the loss of a battle. Think it over!

Here are some of the established principles of telephone procedure:

1. Push your mouthpiece push button down an instant before you start talking. Release the push button as soon as you are through.
2. To transmit a message (order, report, or question) to another station:
 - (a) Name the station being called.
 - (b) Name your own station.
 - (c) Immediately—give the message.

Example: "Control, gun 5 is manned and ready."

NOTE.—The above form is used only for routine or drill reports. *In an emergency the message is the important thing.* Give the *message* first, then, when you have time, name your own station. You will not have to name the station being called. The designation of an emergency report will make itself known by the very nature of the report.

Example: "Dive bombers attacking out of the sun!" Later—as time permits—"Gun — reporting."

3. When you have heard a message directed to your station, and you understand it and are able to repeat it word for word, acknowledge receipt of the message by answering—as in this example: "Aye, aye, gun —."

If you do not understand a message, do not acknowledge receipt of it. Say "Repeat!"

4. Learn the *telephone terminology* of your ship; that is—memorize the abbreviated names for the various gunnery stations aboard ship, and use these station names whenever you address the stations on the telephone circuits.

5. Never call the telephone talker of another station by his name. Use only the name of his station.

6. As soon as you man a head set, test it out immediately—as in this example: "Control, gun — testing."

7. Never take off the phones without permission, and even when permission has been granted, report as follows before securing: "Gun — taking off phones."

8. When guns (torpedo tubes, etc.) are acknowledging an order addressed to all of them, they will do so in numerical order. If a station is slow in answering, and misses its regular turn, it will wait until all other stations have answered before breaking in to report.

9. There will be no unofficial talking over fire-control circuits.

Chapter 15. METHODS OF CONTROL AND FIRE

Types of Control.

1. *Director control*—(*primary method*).—The director, in conjunction with plot, sends elevation and train signals to guns. A mount may follow this signal in either auto, local power, or manual.

NOTE.—In twin mounts there is a fourth means of control—hand power.

2. *Indirect control*.—The stable element controlling. Same procedure at guns as for director control.

3. *Telescope control*.—The guns are pointed and/or trained locally by telescope, but the values of range, deflection, and fuze setting are transmitted from a control station. It does not necessarily mean that the gun is fired locally. Note that a gun might be in director control on the pointer's side but, through casualty, in telescope control on the trainer's side, and vice versa.

4. *Local control*.—The gun is pointed and trained by telescope and the values of range, deflection, and fuze setting are determined at the gun. This method is the last resort.

Types of Fire.

1. *Salvo fire*—guns fired together, either by master key or on salvo signal.

2. *Continuous fire*—guns fired as soon as loaded.

3. *Rapid fire*—may be either salvo or continuous but no check fire for spots is used.

Method of Fire.

1. *Master key*—all guns fired from remote station.

2. *Pointer key*—gun fired by the pointer either on salvo signal or when ordered by the gun captain.

Chapter 16. TRAINING AND ELEVATING GEARS

There are, in the fleet, various systems for elevating and training the 5-inch 38-caliber gun and mount. All systems serve essentially the same purpose in that they provide a means to elevate the gun and train the mount:

1. With a power drive:

(a) *Automatically*—from a remote control station by electrically transmitted signals connected to a power drive.

(b) *Locally*—by moving handwheels connected to a power drive.

2. *Manually*—by handwheels and direct gearing.

Operational and control features of the various systems differ sufficiently to warrant four separate treatments of the outstanding representative types. They are listed here for convenience in classification under the following subchapter headings:

A. Thyatron system—single mount equipped with one-speed handwheels.

B. G. E. hydraulic system—single mount.

C. Ford hydraulic system—single mount.

D. Ford hydraulic system—twin mount.

NOTE.—Read only the section that applies to your gun's training and elevating system. Don't confuse yourself by reading about a type of system that you have not seen.

A. THYRATRON SYSTEM

In the Thyatron system an electrical signal from a remote station, or from the handwheels driving through a selsyn generator, is passed through a transformer and becomes the input to the grid of a Thyatron tube. This electrical input controls the tube output that trains or elevates the mount through a motor.

The system is controlled at the mount by the following devices:

1. A *selector switch* on both pointer's and trainer's sides with five positions: LOCAL AND INDICATING, INDICATING ONLY, OFF, AUTOMATIC ONLY, AUTOMATIC AND INDICATING.

2. A hand-and-power lever on both pointer's and trainer's sides with positions in *hand* and *power* drive. A contact switch to the motor driving the system is closed in the *power* position of the hand-and-power lever; it is opened in *hand*.

3. The handwheels.

Control selections.—The instructions of this paragraph prescribe the procedure for shifting the selector switch and hand-and-power lever to obtain each type of control. Special care must be taken to perform all operations in correct sequence.

1. *Manual.*—Pointer and trainer drive the gun by hand through gearing from their handwheels. To shift either drive to *manual*:

(a) Set the selector switch in INDICATING ONLY, energizing the synchro indicator dials.

(b) Place the hand-and-power lever in *hand*.

(c) Using the handwheels, match pointers or get on the target by telescope—as directed by gun captain.

2. *Local power.*—Pointer and trainer drive the gun by motor operating in electric circuit controlled by movements of their handwheels. To shift either drive to local power:

(a) With the selector switch in INDICATING ONLY, place the hand-and-power lever in *power*.

(b) Set the selector switch in LOCAL AND INDICATING, energizing synchro dials and power control system.

(c) Using the handwheels, match pointers or get on target by telescope—as directed by gun captain.

(d) To return to manual *stop moving the handwheels* and proceed as in paragraph 1.

3. *Automatic power.*—Director controls elevation and train of the mount. Pointer's and trainer's handwheels are disconnected from the system. To shift either drive to AUTOMATIC power:

(a) Go to *local power* first, using procedure as outlined in preceding paragraph 2.

(b) When pointers are matched, or approximately matched (within a few degrees of coincidence), shift selector switch from LOCAL AND INDICATING to AUTOMATIC AND INDICATING.

(c) Gun will follow director in train and elevation. Moving the handwheels will have no effect.

(d) To return to local power, shift selector switch to LOCAL AND INDICATING.

Safety precautions.—The following safety precautions must be adhered to rigidly in order to insure safe operation of the control gear:

1. The pointer and trainer must be at the handwheels whenever the elevating or training gear is in any type of power control, so that the equipment can be placed in manual immediately if an emergency arises.

2. Never shift the selector switch to AUTOMATIC ONLY or AUTOMATIC AND INDICATING unless you are sure that the synchro indicators are energized and working properly, and that the pointers are approximately matched.

3. To stop power drive of the gun immediately in local or automatic power shift selector switch to OFF.

4. Never shift hand-and-power lever to *hand* when the gun is moving.

Secured condition.—To secure the mount in a condition of readiness for action:

1. Train and elevate the gun to ready position.

2. Set selector switches in OFF.

3. Place hand-and-power levers in *hand*.

B. GENERAL ELECTRIC HYDRAULIC SYSTEM

In the General Electric system three methods of control are available for elevating and training the mount.

In *manual* the torques exerted at the pointer's and trainer's handwheels are applied directly through gears and shafts to elevate and train the mount.

When using local power, the gun is elevated and the mount is trained by power from the electric-hydraulic equipment in response to movements of the pointer's and trainer's handwheels.

In automatic power the mount is positioned in response to orders received electrically from the gun director, and this positioning of the mount is accomplished without any movement of the pointer's and trainer's handwheels.

The system is controlled by the following devices:

1. The "Start and emergency run" button on the master switch puts the motor in operation. It has positions in START and STOP, and is located near the trainer's station.

The master switch circuit is arranged so that by holding the "Start and emergency run" button in, the overload relays in the 440-volt power line to the main drive motor become ineffective. It is, therefore, possible to run the main motor with only the protection of the 100-ampere line fuses.

2. A brake switch on both pointer's and trainer's sides with RUN and STOP positions. In the STOP position the hydraulic system on that side cannot function.

The train and elevation brake switches must be in the *STOP* position whenever the "Start and emergency run" button on the master switch is depressed. The circuit is arranged to provide this safety feature so that starting the main drive motor cannot cause movement of the mount or handwheels, and also prevents the possibility of excessive load on the drive motor when starting.

3. Speed selector levers on both sides with *AUTO*, *HIGH*, and *LOW* positions.

4. Drive selector levers on both sides for *power* or *manual* drive.

When the drive selector lever is placed in *manual* the main drive motor is disconnected from the system and the handwheels are geared directly to the elevating arc or the training rack. The force required to move the gun is furnished by the pointer in elevation and by the trainer in hand.

5. The handwheels.

Control selections.—The instructions of this paragraph prescribe the procedure for shifting the switches and levers to obtain each type of control. Special care must be taken to perform all operations in proper sequence.

1. *Manual.*—Pointer and trainer drive the gun by hand through gearing from their handwheels. To shift either drive to manual:

(a) Place the drive selector lever in *manual*.

(b) Place the speed selector lever in *LOW*.

(c) Using the handwheels, match pointers or get on the target by telescope—as directed by gun captain.

2. *Local power.*—Pointer and trainer drive the gun by motor operating in electric-hydraulic system controlled by movements of their handwheels. To shift either drive to local power:

(a) Place the speed selector lever in *HIGH* or *LOW*. When on or near the target in local power *LOW* should normally be used because of greater smoothness in elevating and training.

(b) Place the drive selector lever in *POWER*.

(c) Check to see that brake switch is in *STOP* position. Set master switch to *START*.

(d) Set brake switch to *RUN*.

(e) Using the handwheels, match pointers or get on target by telescope—as directed by gun captain.

(f) To return to *manual* put brake switch in *STOP* and proceed as in paragraph 1.

3. *Automatic power.*—Director controls elevation and train of the mount. Pointer's and trainer's handwheels are disconnected from the system. To shift either drive to automatic power:

(a) Go to *local power* first, using procedure as outlined in preceding paragraph 2.

(b) When pointers are matched, or approximately matched (within a few degrees of coincidence), shift speed selector lever to *AUTOMATIC*.

(c) Gun will follow director in train and elevation. Moving the handwheels will have no effect.

(d) To return to local power, shift speed selector lever back to either *HIGH* or *LOW*.

Safety precautions.—The following safety precautions must be adhered to rigidly in order to insure safe operation of the control gear:

1. The pointer and trainer must be at the handwheels whenever the elevating or training gear is in any type of *power* control, so that the equipment can be placed in *manual* immediately if an emergency arises.

2. Never shift the speed selector lever to *AUTOMATIC* unless you are sure that the synchronic indicators are energized and working properly, and that the pointers are approximately matched.

3. To stop power drive of the gun *immediately* in local or automatic power, depress brake switch in *STOP*.

4. Never shift drive selector lever to *manual* while the gun is in motion.

5. The train and elevation brake switches must be in the STOP position whenever the "Start and emergency run" button on the master switch is depressed.

Secured condition.—To secure the mount in a condition of readiness for action:

1. Train and elevate the gun to ready position.
2. Put gun in local power.
3. Depress pointer's and trainer's brake switches in STOP.
4. Shut down electric power motor by depressing master switch in STOP.

The reason for securing the gun in local power is to have the mount ready to cast loose with the fewest number of operations.

C. FORD HYDRAULIC SYSTEM—SINGLE MOUNT

In the Ford system installed on single mounts three methods of control are available for elevating and training the mount.

In *manual* the hydraulic circuits of the speed gear are bypassed, and the torque exerted at the handwheels is applied directly to train or elevate the gun. Only low-speed operation can be used in *manual*.

In local power the gun is positioned in response to movement of the trainer's or pointer's handwheels. These may have either one of two values per revolution, so that the gun can be moved at either high speed or low speed.

When in automatic power the gun is trained and elevated automatically by the hydraulic equipment in accordance with electrical signals received from the director, and this positioning of the gun is accomplished without any movement of the pointer's and trainer's handwheels.

The system is controlled by the following devices:

1. The motor start-stop switch located on the trainer's side. This motor drives two oil pumps, one for elevation and one for train.
2. The hydraulic switches, one near the pointer's handwheels, and one near the trainer's. This switch has OFF and ON positions. In the OFF position the hydraulic system on that side cannot function.
3. The selector levers with AUTO, HIGH, and LOW positions.
4. The handwheels.

Control selections.—Detailed instructions for operating under each type of control are given below. Special care must be taken that no steps are omitted, and that they are taken in the order given. These instructions apply to both training and elevating equipment.

1. *Manual.*—Pointer and trainer drive the gun by hand through gearing from their handwheels. To put either drive in Manual starting with the gun secured:

- (a) Place selector lever in LOW.
- (b) Set hydraulic switch at OFF.

(c) Using the handwheels, match pointers or get on the target by telescope—as directed by gun captain.

2. *Local power.*—Pointer and trainer drive the gun by motor operating in electric-hydraulic system controlled by movements of their handwheels. To put either drive in local power starting with the gun secured:

- (a) Make sure both hydraulic switches are set at OFF. Start electric power motor.
- (b) Place selector lever in HIGH.
- (c) Set hydraulic switch at ON.

(d) Using the handwheels, match pointers or get on target—as directed by gun captain. When on or near the target shift selector switch to LOW because of greater smoothness in elevating and training at low speed.

(e) To return to manual, place the selector lever in LOW (if it is not already so set) and set the hydraulic switch at OFF.

3. *Automatic power.*—Director controls elevation and train of the mount. Pointer's and trainer's handwheels are disconnected from the system. To put either drive in automatic power, starting with the gun secured:

(a) Go to *local power* first, using procedure as outlined in preceding paragraph No. 2. Leave selector lever in HIGH.

(b) When pointers are matched, or approximately matched (within a few degrees of coincidence), shift selector lever to AUTO.

(c) Gun will follow director in train and elevation. Moving the handwheels will have no effect.

(d) To return to local power, place the selector lever in HIGH or LOW.

(e) To return to manual:

1. Place the selector lever in LOW.

2. Set the hydraulic switch at OFF.

Safety precautions.—The following safety precautions must be adhered to rigidly in order to insure safe operation of the control gear:

1. The pointer and trainer must be at the handwheels whenever the elevating or training gear is in any type of power control, so that the equipment can be placed in manual immediately if an emergency arises.

2. Never shift the selector lever to automatic unless you are sure that the synchro-indicators are energized and working properly, and that the pointers are approximately matched.

3. To stop power drive of the gun *immediately* in local or automatic power set the hydraulic switch at OFF.

4. Start the electric power motor only when the train and elevation hydraulic switches are at OFF.

5. Shut off power to electric motor only when the equipment is in manual.

Casualty operation.—In case the electric power fails, the hydraulic switches are set automatically at OFF. If the failure occurs while the selector lever is at LOW, the gun may be positioned immediately in manual control by rotating the handwheels. If the failure occurs while the selector lever is at HIGH or AUTO, the gun is locked in train and elevation, and should be put in manual control by setting the selector lever at LOW. When the casualty is cleared, the gun will remain in manual until it is put in local power or automatic power in the usual way.

Secured condition.—To secure the amount in a condition of readiness for action:

1. Train and elevate gun to ready position.

2. Put gun in manual.

3. Shut down electric power motor.

4. Place selector lever in HIGH.

The reason for shifting the lever to HIGH upon securing is to have the mount ready to cast loose with the fewest number of operations. With the lever at HIGH, the mount will be ready to operate (after circuits are energized) when the hydraulic switch is thrown from OFF to ON. If the lever were left in any other position than HIGH, it would be necessary to shift the lever to HIGH before throwing the hydraulic switch to ON in order to have the mount in an operative condition.

D. FORD HYDRAULIC SYSTEM—TWIN MOUNT

The Ford system installed on twin mounts contains two separate elements, each independent of the other, one of which controls the mount in train, the other in elevation, hereinafter designated as training gear and elevating gear. The parts of the training gear differ from those of the elevating gear only in size and minor details. Each consists of a variable speed hydraulic gear with electric drive equipment, electric-hydraulic devices for controlling the gear, synchro indicators which show the gun orders received, and a trainer's or pointer's handwheel drive.

The guns can be controlled by any one of four methods, namely: Automatic power, local power, hand power, and manual. Since the training and elevating gears are entirely independent, they can be operated simultaneously by different methods of control.

In automatic power the guns are trained or elevated by the speed gear, which is controlled automatically by the hydraulic control equipment in accordance with orders received electrically from the director.

In local and hand power the guns are positioned by the speed gear in response to movement of the trainer's or pointer's handwheels. In local power the handwheels control the speed gear through the hydraulic control devices. In hand power the hydraulic control devices are inoperative, and the handwheels control the speed gear by direct mechanical connection to the tilting box.

In manual the tilting box of the speed gear is fixed in neutral position so that no oil flows between the A end and the B end. Gearing in the handwheel mount connects the handwheels directly to the guns through a clutch, which is engaged only when in Manual, so that torque applied at the handwheels moves the guns.

Choice of the type of control for training or elevating the guns is made by shifting the control selector lever on the respective handwheel mount.

When using local, hand, or manual, two speeds of control are available, high and low. A lever located on the handwheel mount permits selection of the speed of control.

Control selections.—Detailed instructions for operating under each method of control are given below under separate headings. Special care should be taken to insure that no steps are omitted, and that they are taken in the order given. The instructions apply to both training and elevating equipment.

1. *Manual.*—To put the mount in manual, starting with the guns secured:

- (a) Set speed selector lever at LOW.
- (b) Set control selector lever at MANUAL.
- (c) Train or elevate by means of handwheels.

2. *Hand power.*—To put the mount in hand power, starting with the guns secured:

- (a) Start electric power motor.
- (b) Set control selector lever at HAND.
- (c) Train or elevate by means of handwheels.
- (d) To return to manual, set the speed selector lever at LOW and set the control selector lever at MANUAL.

3. *Local power.*—To put the mount in local power, starting with the guns secured:

- (a) Start electric power motor.
- (b) Set control selector lever at LOCAL.
- (c) Train or elevate by means of handwheels.
- (d) To return to hand power, set control selector lever at HAND.
- (e) To return to manual, set control selector lever at MANUAL.

4. *Automatic power.*—To put the mount in automatic power, starting with the guns secured:

- (a) Make sure that indicator regulator synchro-motor circuits are energized.
- (b) Start electric power motor.
- (c) Set control selector lever at LOCAL.
- (d) Train or elevate guns by means of handwheels until index on zero-reader dial in indicator regulator is approximately aligned with fixed index, and index on ring dial is aligned approximately with zero graduation of follow-the-pointer dial.
- (e) Shift control selector lever to AUTO.
- (f) To return to local power, set control selector lever at LOCAL.
- (g) To return to hand power, set control selector at HAND.
- (h) To return to manual, set control selector lever at MANUAL.

Safety precautions.—The following safety precautions must be adhered to rigidly in order to insure safe operation of the control gear:

1. The trainer and pointer must be at the handwheels whenever the training or elevating gear is in any type of power control, so that the equipment can be placed in manual immediately if an emergency arises.

2. Before shifting the control selector lever to auto, make sure that the mount is approximately synchronized with the gun order received from the Director, and that the synchro-motor circuits are energized.

3. Start the electric power motor only when the control selector lever is in either HAND or MANUAL position.

Casualty operation.—1. Failure of the primary circuit of the receiver regulator synchro motors will result in the guns being locked in a fixed position by the synchro power failure device if the equipment is in automatic power; but by shifting to any other type of control, the guns can be trained or elevated.

2. Upon failure of the power supply to the electric power motor, the equipment automatically stops the guns and holds them in a fixed position, by the action of the power failure and brake valves. It will then be necessary to shift to manual in order to move them.

Secured condition.—1. Train or elevate guns to the ready position.

2. Put equipment in hand power.

3. Shut down electric power motor.

Chapter 17.—CASUALTIES

Casualty	Cause	Correction
Breech mechanism fails to close completely.	(1) Imperfect rammer adjustment (spade being held against case with rammer relief valve pressure, combined with riding starting lever).	(a) Immediate: (1) Move starting lever to "withdraw." (2) Drive plug home with maul, if necessary. (b) Adjustment: As required.
Do.....	(2) Insufficient spring compression on breech operating spring.	(a) Immediate: (1) Drive plug home with rawhide maul. (b) Adjustment: Set additional spring tension.
Do.....	(3) Grit, foreign matter, or burrs in grooves between block and housing.	(a) Immediate: (1) Drive plug home with rawhide maul. (b) Adjustment: Remove plug; clean and oil-stone down burrs. (c) Precaution: Breechblocks must be kept clean.
Jammed (crimped) cartridge case.	(1) Case lip strikes breech face and jams in chamber—usually result of double ram which allows projectile to enter ahead of case.	(a) Immediate: (1) Extract damaged case. Set aside in cartridge case tank for later examination. (2) Reload with fresh cartridge. (b) Preventive: Inspect cork plugs prior to firing to insure a positive protective overhang of cork plug beyond case lip. Replace if necessary.
Do.....	(2) Loose objects. (In one instance a powder loader's glove was rammed with the load.)	(a) Immediate: (1) Extract and set aside. (b) Inspect gun and mount for loose objects before loading.
Do.....	(3) Failure to steady load before firing.	(a) Immediate: (1) Extract and set aside. (b) Preventive: Improve performance of loading crew.
Jammed load in tray...	(1) Shell loader places projectile atop cartridge case, and rammerman rams. (This frequently results in throwing projectiles out of tray.)	(a) Immediate: (1) Examine cartridge and projectile for damage. (2) Reload or dispose of round as condition warrants. (b) Preventive: Improve performance of loading crew.
Do.....	(2) Powder loader places cartridge atop projectile, and rammerman rams.	Do.
Rammer shell guard (spade) dropped on cartridge case jamming load.	(1) Powder loader loads before rammer is in ready-to-ram position.	(a) Same as above.
Rammering without load (usually running rammer forward on upper track).	(1) Rammerman's haste or carelessness. (2) Accidental striking of rammer handle—pushing it to "ram" position.	(a) Immediate: (1) Unlatch rammer by hand. Retract. (2) Drop spade. (b) Preventive: Improve performance of rammerman.
Rammer failure (electric) motor cuts out. This applies only to ships with separate electric rammer motors.	(1) Start-stop button jarred out as a result of shock.	(a) Immediate: (1) Push starting button. (2) Load by hand, if necessary. (b) Preventive: (1) Relocate or cushion button mounting. (2) Increase spring pressure holding "stop" button out.

RESTRICTED

CASUALTIES—Continued

Casualty	Cause	Correction
Rammer failure (electrical). Same as above.	(2) Relay failure (electrical)-----	(a) Immediate: (1) Push starting button. (2) Load by hand, if necessary. (b) Preventive: Examine and adjust relay contacts.
Rammer failure (hydraulic rammers).	(1) Various causes-----	(a) Immediate: (1) Load by hand. (b) Preventive: (1) Keep hydraulic system scrupulously clean. (2) Examine relief valve and set to proper pressure.
Rammer failure to retract fully. (Northern Pump Co. rammer.)	(1) Shock or vibration on starting lever and linkage knocking threeway valve out of the retract position. (2) Faulty adjustment of return and neutral levers.	(a) Immediate: (1) Strike starting lever a quick blow toward the "retract" position. (2) Drive spade back to full retract. (3) Load by hand, if necessary. (b) Adjustment: (1) Detent starting lever in positive "retract" position. (2) Adjust lever system. (3) Eliminate lost motion from linkage.
"Bale of hay." (Gun fired without projectile.)	(1) Haste, inexperience, carelessness.	(a) Immediate: (1) Reload if case ejected. If not, proceed as for hangfire. (b) Preventive: Improve performance of loading crew.
Misfire (electrical)-----	(1) Broken primer bridge. Probably the result of previous rough handling. Possibly originally defective.	(a) Immediate: (1) Fire by percussion. (b) Preventive: (1) Handle powder cases carefully at all times.
Do-----	(2) Broken firing circuit (wiring lead).	(a) Immediate: (1) Fire by percussion. (b) Preventive: (1) Careful inspection before firing. See firing leads of ample length. Inspect all contact points. (2) Repair break.
Do-----	(3) Grounded firing circuit (faulty insulation either in firing lock or wiring).	(a) Immediate: (1) Fire by percussion. (b) Preventive: (1) Test with megger after installing firing lock as part of preparation for firing.
Misfire (apparently electrical).	(1) Firing pointer fails to squeeze key. (2) Key not locked as in director fire. (3) Transfer switch thrown to wrong position.	(a) Immediate: (1) Fire by percussion. (b) Preventive: Improve performance of firing pointer.
Misfire (by percussion)-	(1) Defective percussion firing linkage.	(a) Immediate: (1) Recock; continue attempts to fire. (2) Carry out hangfire procedure, if necessary. (U. S. N. Regs., art. 972, pars. 67, 69.) (b) Preventive: (1) Overhaul percussion linkage as part of battery preparation for firing.
Do-----	(2) Defective primer-----	(a) Immediate: (1) Same as above. (b) Preventive: (1) Elimination of actually defective primers must originate with Naval ammunition depots.
Hoist stopped; will not deliver ammunition.	(1) Stop button jarred out by shock of gunfire. (Electrical failure.)	(a) Immediate: (1) Push starting button. (b) Preventive: (1) Relocate buttons or cushion against supports.

CASUALTIES—Continued

Casualty	Cause	Correction
Hoist stopped; will not deliver ammunition.	(2) Relay contacts open on shock . . .	(a) Immediate: (1) Push starting button. (2) Hoist by hand, if necessary. (b) Preventive: (1) Inspect contacts before firing. Test for possible effect of shock.
Dial illumination goes out at night.	(1) Broken wiring circuit. (2) Burned out bulbs.	(a) Immediate: (1) Use flashlight. (b) Preventive: (1) Check circuits and renew light bulbs periodically.
Telephone failure (of one set on the battery).	(1) Careless handling of headset	(a) Immediate: (1) Change head set. (b) Preventive: (1) Handle all head sets with extreme care. (2) Test headsets on every watch.
Telephone failure (all sets on the battery fail simultaneously).	(1) Electrical failure	(a) Immediate: (1) Shift to sound-powered phones, if available. (2) Stand by to receive orders via loud speakers or visuals. (b) Preventive: (1) Hold frequent drills in shifting telephones during battle drills.

Chapter 18. SAFETY PRECAUTIONS

The following safety precautions, as applicable to 5-inch 38-caliber guns, have been taken from United States Navy Regulations, article 972:

1. As familiarity with any work, no matter how dangerous, is apt to lead to carelessness, all persons who may supervise or perform work in connection with the inspection, care, preparation, or handling of ammunition or explosives—

(1) Shall exercise the utmost care that all regulations and instructions are rigidly observed.

(2) Shall carefully supervise those under them and frequently warn them of the necessity of using the utmost precaution in the performance of their work.

No relaxation of vigilance shall ever be permitted.

2. In each part of the ship where ammunition is stored or handled or where gunnery appliances are operated, such safety orders as apply shall be posted in conspicuous places easy of access, and the personnel concerned shall be frequently and thoroughly instructed and drilled in them.

3. Conditions not covered by these safety orders may arise which, in the opinion of the commanding officer, may render firing unsafe. Nothing in these safety orders shall be construed as authorizing firing under such conditions.

8. Changes, modifications in, or additions to ordnance material, or other material used in connection therewith, shall not be made without explicit authority from the bureau concerned.

9. Safety devices provided shall always be used to prevent possibility of accident, and shall be kept in good order and operative at all times.

10. No ammunition or explosive assembly shall be used in any gun or appliance for which it is not designated.

11. Handling of ammunition shall be reduced to the minimum to prevent immediate accident and the occurrence of leaky containers, damaged tanks and cartridge cases, loosened projectiles, torn powder bags, etc. Powder stored for a considerable period in a leaky container is likely to deteriorate rapidly, with the attendant danger of spontaneous combustion.

12. Service ammunition is supplied to ships for use in battle. It shall not be used for drill, for testing appliances, or for other similar purposes except upon the express authority of the Navy Department. It shall be regarded as a part of the vessel's outfit, shall be kept distinct from the ammunition used for gunnery exercises, and shall never be expended in gunnery exercises unless authorized in the orders for gunnery exercises or special instructions from the Bureau of Ordnance.

13. Special ammunition is issued for gunnery exercises, except when a part of the ship's allowance of service ammunition is designated for that purpose.

14. Only such of the ammunition issued for gunnery exercises as does not contain a primer, fuze, or detonator may (at the discretion of the commanding officer) be used for testing the fit in hoists, guns, and appliances. Paragraphs 70 (a) (2) shall be complied with. Case ammunition may be fitted in the guns as prescribed in paragraph 81.

15. No other than drill ammunition shall be used for drill.

17. Since the safety in handling and the disposition of ammunition depend upon the correctness of reports and records, care shall be taken not to obliterate identification marks on ammunition or to put it into incorrectly marked containers. When ammunition in other than normal condition is returned to an ammunition depot in compliance with these safety precautions, it shall be marked to indicate its condition and the reason for its return. If smokeless powder is involved, the weight of the smokeless powder returned shall also be indicated.

18. Projectiles shall not be altered, nor shall fuzes or any other parts be removed or disassembled on board ship without explicit instructions from the Bureau of Ordnance. Projectiles

shall not be allowed to rust or to become oversize through paint. Slings and grommets and other similar protective devices shall be removed before loading projectiles into guns. Since the slings are likely to jam the hoists, they shall be removed before sending up the projectiles.

19. A fuzed projectile, or a cartridge case, whether in a container or not, if dropped from a height exceeding 5 feet shall be set aside and turned into a naval ammunition depot at the first opportunity (see par. 17). Such ammunition shall be handled with the greatest care. However, if a shrapnel or an illuminating projectile with a 21-second fuze not set at "safety" is dropped or struck so as to deform the fuze, the complete cartridge, if it is fixed ammunition (otherwise the fuzed projectile only), shall at once be thrown overboard or immersed in water until this can be done.

22. Nose fuzes being sensitive, care shall be taken to prevent them from being struck as by the gun in recoil, by ejected cases, by dropping, etc.

23. Time fuzes which have been set shall be reset on "safety" before sending them below.

24. In handling projectiles fitted with tracers, care shall be taken not to strike the tracer, as such a blow involves danger of igniting it.

26. Smokeless powder shall not be exposed to the direct rays of the sun. Powder in bulk, in tanks, cartridge cases, ammunition boxes, ready-service boxes, or in any other containers shall be protected against abnormally high temperatures (over 100° F).

28. If any smokeless powder be exposed to temperature higher than 100° F., a special report shall be made to the Bureau of Ordnance immediately, explaining the circumstances in detail and stating the temperature and length of time the powder was so exposed.

29. Smokeless powder which has been wet from any cause whatever must be regarded as dangerous for dry storage. Such powder shall be completely immersed in fresh water and kept immersed and landed at an ammunition depot at the first opportunity. (See par. 17.)

30. Smokeless powder in leaky containers shall be transferred to airtight containers, and these marked "Transferred from leaky containers." If airtight containers are not available or if the container in use cannot be repaired properly, the powder shall be forwarded to an ammunition depot at the first opportunity, the container marked "Leaky container." (See par. 17.)

32. Naked lights, matches, or other flame-producing apparatus shall never be taken into magazines or other spaces used primarily as magazines while these compartments contain explosives.

33. Before performing any work which may cause either an abnormally high temperature or an intense local heat in a magazine or other compartment used primarily as a magazine, all explosives shall be removed to safe storage until normal conditions have been restored.

34. Magazines shall be kept scrupulously clean and dry at all times. Particular attention shall be paid that no oily rags, waste, or other materials susceptible to spontaneous combustion are stored in them.

35. Drill charges for bag guns soon become covered with oil and grease, and it is strictly forbidden to store such charges in magazines.

36. Nothing shall be stored in magazines except explosives, containers, and authorized magazine equipment.

37. During firing no other ammunition than that immediately required shall be permitted to remain outside of the magazines.

38. During action and during target practice magazine blowers shall be shut down, and covers of both supply and exhaust branches to magazines shall be closed.

42. When either cartridges or bag charges are outside the magazines, wherever practicable, each flame proof compartment or space which forms a stage of the ammunition train, including the magazines and gun compartments (in or out of turrets), shall be kept closed from all other compartments or spaces, except when the actual passage of ammunition requires it to be open. Where practicable, no flameproof stage of the ammunition train shall be open to both the preceding and the following stages at the same time.

43. (a) In a magazine or handling room in which powder is removed from tanks to be sent

to the guns in bags, not more than one charge per gun, for the guns being served by that magazine or handling room, shall be exposed by removal from tanks, by removal of tank tops, or by so loosening the tank tops that the bags may be exposed to flame.

(b) In each subsequent flameproof stage of the ammunition train, not more than one charge per gun, for the guns being supplied through that stage, shall be allowed to accumulate. For this purpose, the spaces or handling rooms at the tops and bottoms of continuous-chain powder hoists will be considered separate stages (whether or not separated from the hoists by flameproof doors, flaps, or shutters).

(c) In addition to the above, continuous-chain powder hoists may be kept filled; or if hand passing is used, there may be one bag of powder at the station of each man in the train.

(d) It is the intent of this article to permit sufficient powder to be exposed to provide an adequate supply for the guns being served. The maximum amount specified above should be exposed only if a smaller amount will not assure an adequate supply.

45. During gunnery exercises, charges in excess of the amount required to be available for one run shall not be assembled in the vicinity of guns mounted outside of turrets. No charge for a bag gun shall be removed from its tank, nor shall the tops of tanks be removed or so loosened that the bags may be exposed to flame until immediately before the charge is required for loading.

51. Except when using a power rammer, no force greater than that which can be applied by the hand alone shall be used in loading a live cartridge into a gun. Any cartridge which does not freely and fully enter the chamber of the gun shall be carefully extracted and put aside, and in peace time no further attempt shall be made to fire such a cartridge.

52. When firing flat-nosed projectiles from case guns, power rammers shall not be used.

53. As soon as a gun is loaded the breech shall be closed without delay.

56. The salvo latch shall be removed or made inoperative during the exercise which requires opening the breech, except when firing a loaded gun.

57. Effective measures shall be taken to guard against prematurely opening the breech of a loaded gun.

63. The utmost care shall be taken to insure that the firing pin and other parts of the firing mechanism of a case gun are in good condition and properly assembled in order to prevent premature discharge.

66. If a gun is loaded at the order "Cease firing"—

- (1) The gun shall remain loaded and shall be pointed and trained in a safe direction;
- (2) The breech mechanism shall be kept fully closed;
- (3) The firing key shall be opened and the firing circuit broken elsewhere;
- (4) The firing lanyard, if detachable, shall be unhooked;
- (5) The primer shall be removed from the lock of a bag gun.

The crew shall never leave a loaded gun until these precautions have been carried out.

67. The possibility of a serious accident due to opening the breech of a gun too soon after a misfire demands the constant exercise of the utmost prudence and caution. After an unsuccessful attempt to fire a gun, it shall be assumed that a hangfire is under way, and the procedure outlined below shall be followed:

- (1) Keep the gun pointed and trained in a safe direction.
- (2) Continue attempts to fire, if desired, provided such efforts do not involve any movement tending to open the breech.
- (3) Do not open the breech for 30 minutes (10 minutes for field and landing guns on shore) after the last attempt to fire. This, at the discretion of the commanding officer, is not obligatory in time of action.

69. Ammunition unloaded from a gun may be reloaded if the service of the gun is resumed within a reasonable time. When it is apparent that the service of the gun will not be resumed within a reasonable time, the powder unloaded from a gun shall be disposed of as follows:

(b) Powder in cartridges unloaded from a case gun. The cartridge shall be turned into an ammunition depot at the first opportunity if—

- (1) The gun was warm when loaded;
- (2) An attempt was made to fire the gun;
- (3) After careful examination the cartridge is found injured or out of alignment.

(Crimped cartridges shall not be broken down before being turned in. Uncrimped cartridges shall be broken down and the powder immersed in fresh water before being turned in.)

(c) When ammunition is returned to a depot in accordance with the above, paragraph 17 shall be complied with. When cartridges are broken down in accordance with subparagraph (b) above, all the ammunition details composing it, including primers, shall be similarly marked and turned in.

70. When a gun is being unloaded, all personnel not required for the unloading operation shall be kept at a safe distance from the gun. The division officer shall supervise the unloading.

72. Marks or indicators shall be provided to indicate whether or not the gun returns to battery, and a member of the gun crew shall be detailed to observe these marks or indicators after each shot. The service of the gun shall be stopped should the gun fail to return to battery.

73. On guns equipped with hydropneumatic counterrecoil systems, the safety link, locking the gun to the slide, shall be connected up at all times except when firing or when testing and overhauling the counterrecoil systems. These safety links shall be disconnected after checking the pressure on counterrecoil system and prior to firing.

79. Fired cartridge cases shall, before storing below, be stood on their bases in the open air for ten minutes in order to avoid danger from inflammable gases.

81. In testing primers outside of closed firing locks, no magneto or other device which can possibly supply current sufficient to fire the primer shall be used.

82. Whenever any motion of a power-driven unit is capable of inflicting injury on personnel or material not continuously visible to the person controlling such motion, the officer or petty officer who authorizes the unit to be moved by power shall, except at general quarters, insure that a safety watch is maintained in areas where such injury is possible both outside and inside the unit, and shall have telephone or other effective voice communication established and maintained between the station controlling the unit and the safety watch. These precautions are applicable to turrets, gun mounts, guns, directors, range finders, searchlights, torpedo tubes and similar units. Under the conditions stated above, the station controlling shall obtain a report "all clear" from each safety watch before starting the unit. Each safety watch shall keep his assigned area clear and if unable to do so shall immediately report his unit fouled, and the controlling station shall promptly stop the unit until again clear.

83. In turrets and multiple mounts of 5-inch and larger guns, a warning signal shall be installed outside the turret or mount and whenever power train is used, except at general quarters, the officer or petty officer in charge of the turret or mount shall cause warning signals to be sounded before using power and at intervals during its use.

84. When using director train while firing at gunnery exercises, an observer from the firing vessel for each gun or turret shall cause the firing circuit to be broken whenever the gun or turret is trained dangerously near any object other than the designated target.

85. Except in action or when specifically authorized, antiaircraft guns shall not be fired at elevations greater than those prescribed in the current Orders for Gunnery Exercises. When firing antiaircraft guns as such, all personnel not required to be exposed shall be kept under cover.

86. Except in action, whenever a circuit breaker becomes so sensitive as to function due to the shock of firing, the circuit breaker shall be either overhauled or replaced and shall not be tied or fixed in position so as to be inoperative for the purpose for which designed.

87. The covers of switches, circuit breakers, etc., shall be kept securely closed while powder is exposed in the vicinity.

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