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WAR DEPARTMENT

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

TACTICS AND TECHNIQUE OF CONTROLLED SUBMARINE MINES

May 1, 1942

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U.S. Office of Chief of Coast Artillery

COAST ARTILLERY

FIELD MANUAL

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SEACOAST ARTILLERY

TACTICS AND TECHNIQUE OF CONTROLLED SUBMARINE MINES

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G. C. MARSHALL,
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COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

TACTICS AND TECHNIQUE OF CONTROLLED SUBMARINE MINES

(This manual, together with TM 4-220, April 27, 1942, supersedes TM 2160-20, October 15, 1930, including C 1, Jan. 3, 1933, C 2, Jan. 3, 1939, and C 3, Jan. 1, 1940.)

SECTION I

GENERAL

■ 1. PURPOSE.—The purpose of this manual is to familiarize the coast artillery officer, assigned to the service of submarine mines, with the tactical employment of this weapon and the technique involved in laying out, planting, operation, maintenance of, and picking up a controlled mine field.

■ 2. RESPONSIBILITY FOR CONTROLLED SUBMARINE MINES.—The Coast Artillery Corps is charged with the responsibility for the design and tactical operation of all controlled submarine mine equipment to be used in coast defense.

■ 3. SCOPE.—Controlled submarine mines constitute an essentially passive means of defense to supplement other measures employed for the immediate local defense of the important harbor entrances. Therefore, in this manual treatment of the tactical fundamentals involved in coast defense is limited to their application to the employment and coordination of controlled mines as one element of harbor defense.

■ 4. ARMY AND NAVY FUNCTIONS IN COAST DEFENSE.—The specific functions in coast defense assigned to the Army and those assigned to the Navy are enumerated in "Joint Action of the Army and Navy" prepared by the joint board.

■ 5. JOINT PLANNING.—In view of the coordination required between the Army and the Navy in harbor defense during war the closest liaison should be maintained in all peacetime planning leading to the establishment of new controlled mine projects or the revision of existing projects. The peacetime coordination between Army and Navy should include—

a. Determination of the location of clear channels through the controlled mine fields.

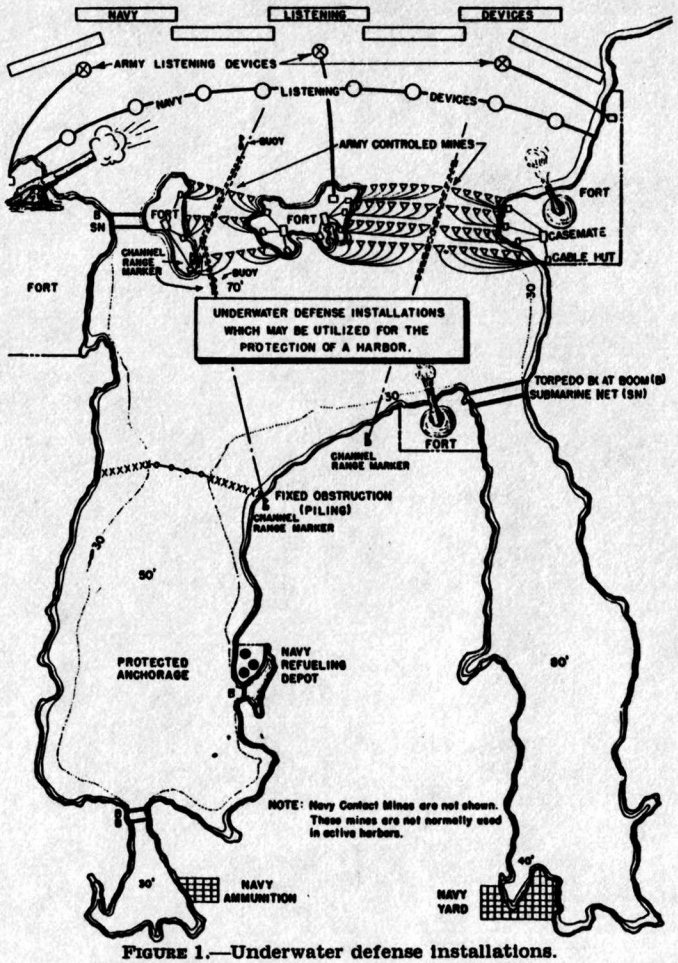


FIGURE 1.—Underwater defense installations.

b. Establishment of a working plan for installation of the underwater defense, which will include accurate location of each element, agreement as to time and space factors, and routing of cables for mine groups, communications, and listening devices of each service. (See fig. 1.)

SECTION II

DEFINITIONS AND POLICIES PERTAINING TO CONTROLLED MINES

■ 6. FUNCTIONS OF SUBMARINE MINES.—In general, the functions of submarine mines, whether the controlled mines of the Army or the contact mines of the Navy, are as follows:

a. To effect the destruction or serious damage of hostile vessels which approach within effective range.

b. To supplement the offensive action of other weapons in repelling hostile naval attack.

c. To prevent the close approach or entry into a harbor of hostile surface vessels under cover of night, fog, or smoke when, by reason of the invisibility of the ships from the shore, other weapons of the Army and Navy are wholly or partially ineffective.

d. To limit or prevent the navigation by hostile submarines of channels or water areas.

e. To restrict the freedom of maneuver of hostile naval forces in formation.

f. By the moral effect of an unseen threat, to enforce a constant element of caution and uncertainty in the planning and execution of all hostile naval operations within the water areas known or believed to be protected by mine fields.

g. To give warning of hostile submarine activities or of the presence of hostile surface vessels.

■ 7. FUNDAMENTALS GOVERNING EMPLOYMENT OF CONTROLLED AND CONTACT MINES.—Consideration of the characteristics of the two types of mines leads to the formulation of the following fundamentals for the employment of controlled and contact mines, so far as harbor defense is concerned:

a. Controlled mines should be used to close such portions of harbor entrances as lead to channels required for the use of friendly naval forces and friendly commercial shipping. In addition, controlled mine fields should normally be limited to distances of 10,000 yards from the shore and in no case should they be planted beyond the effective range of guns assigned to defend the field or where the depth of water exceeds 300 feet.

b. Contact mines may be used to close all portions of harbor entrances navigable by hostile naval forces, not required for

use by friendly naval forces or commercial shipping, particularly to block off large areas or routes of access in deep water or far offshore.

■ 8. DEFINITION OF CONTROLLED MINE.—A controlled submarine mine, as employed by the United States Army, may be defined as a watertight steel case, containing explosive and a firing device, with means for control of fire by electrical connection to shore. Controlled submarine mines are of the buoyant or ground type. The buoyant mine has a case of such size that its free buoyancy would cause it to float on the surface but for the fact that it is attached by a mooring rope to an anchor. The steel mooring rope, which is used to connect the mine case to the anchor, is cut to a length that will hold the mine case at a predetermined submergence. The ground mine, as its name implies, is constructed and loaded so that it rests on the bottom after planting.

■ 9. COMPONENTS OF CONTROLLED MINE PROJECT.—The essential components of an Army controlled mine project are—

a. Mines.—Each mine consists of explosive, compound plug, firing device, moorings, cable, and anchor. The unit for planting and control is a group of 19 mines, planted at intervals of 100 feet across the waterway to be defended, with submergence as required by tactical conditions. The mines in each group are numbered from left to right as viewed by an observer on the inshore side of the group, No. 1 being on the left, No. 10 in the center, and No. 19 on the right. One group of mines thus defends a frontage of about 1,900 feet (18 intervals plus 50 feet to each flank). The defense required for a particular water area, in width and depth, is provided by the appropriate number of complete groups of mines. The groups of mines themselves are numbered normally from left to right looking offshore, beginning with the most advanced line if the project includes two or more lines of mines. (See fig. 22.)

b. Control devices.—In the present standard single-conductor system, these consist, external to the mine itself, of the 19 lengths of single-conductor cable leading from the several mines of a group of mines back to the distribution box, which contains the selector and accessories; the single-conductor cable leading back from the distribution box to the cable ter-

minal hut on shore; the lead-covered cable running in conduit from the cable terminal hut to the mining casemate; and the instruments and wiring included on the mine control system panels. In new or revised projects, where the casemate is less than 300 feet from the water line, shore cables are brought directly into the casemate. Where cable ducts have not been previously constructed, steel-armored, lead-covered, land cable is laid in trenches between the cable terminal hut and the casemate.

c. Power and mine system control equipment.—This includes two 5-kva Diesel engine driven generating sets and the necessary control panels for the type of system installed in the casemate.

d. Tools, supplies, and equipment.—Those required in the handling and maintenance of mine equipment.

e. Structures.—These include for each project one or more of each of the following types of structures (see fig. 2, back of manual):

(1) Mine casemate which houses the power and control equipment.

(2) Mine storehouse for the storage of mine cases, compound plugs, mooring ropes, accessories, tools, and supplies. Anchors are stored indoors when local conditions require such protection.

(3) Loading room for loading and assembling mines.

(4) Magazine for storage of explosive.

(5) Cable tank for storage of cable.

(6) Mine wharf and derricks for use in loading mine planters and servicing mine flotilla.

(7) Trackage or surfaced roads connecting structures listed in (2), (3), (4), (5), and (6) above.

(8) Mine group commander's station.

(9) Base end stations.

(10) Plotting room.

(11) Cable terminal huts. One hut for each eight or less shore cables.

(12) Boathouses, mine yawl, and distribution box (DB) boat anchorage.

f. Mine planting vessels.—These include regular and auxiliary mine planters, DB-boats, and motor mine yawls.

g. Position finding equipment.—This includes the necessary base end observation instruments, mine group commander's telescope, plotting board, predicting device, stop watch, telephones, and telephone lines.

h. Searchlights.—For illuminating the mine field at night. These may or may not be separately assigned to the mine group command.

i. Rapid fire guns.—For protecting the mine field.

j. Radiotelephone equipment.—Two-way radiotelephone equipment for mine command station, mine planters, and DB-boats to control and coordinate operations in the mine field.

■ 10. FUNDAMENTAL OF DESIGN.—The outstanding characteristic feature of the Army type of controlled mine is that by the simple application or removal of the proper power source at the casemate, the mine field can be set either *to fire* or can be made absolutely *safe*. When set on "safe" the mines may be struck by a vessel passing through the mine field without danger of an explosion of the charge. This fundamental of operation should be borne in mind in connection with every consideration, either tactical or technical, which arises concerning the employment of Army type of controlled mines.

■ 11. POLICY FOR STORAGE OF EQUIPMENT.—*a.* Upon the imminence of war one of the first defensive measures may be to put down the controlled mine projects. Therefore it is essential that controlled mines, with accessory items required to plant and operate them, be stored locally, insofar as facilities permit, contiguous to the projects to which they pertain, in readiness for immediate use and in quantities sufficient to plant the authorized projects and provide maintenance of these projects after planting. In making plans for storage of controlled submarine mine equipment, the following should be kept in mind:

(1) The matériel for each group of equipment weighs approximately 50 tons.

(2) Mechanical devices for moving weights up to 5 tons are essential for the proper handling of this equipment.

(3) The component parts of controlled submarine mines are issued to mine organizations and must be assembled at the station from which they are to be planted.

b. The assembly and loading of controlled mines involve

handling large quantities of explosives. The structures for a mine project should be dispersed on the same general plan as is used for reducing losses in a shell loading plant by separation of units of the project. The placing of loading rooms on wharves, railroads, highways, or in congested areas is to be avoided whenever possible. The location within a mine project of storehouses, loading rooms, and cable tanks should be made with a view to meeting the following requirements:

(1) Accessibility to rail, water, or motor transportation facilities of sufficient capacity to handle the heavy equipment included in a mine project.

(2) Roads or railroads from storehouses and loading rooms to wharves should have a minimum grade. Where this grade exceeds 1 percent transportation equipment with its continued maintenance is involved.

(3) Shore installations for mine projects will be located at positions where wharves can be maintained and where the loading of mine planters is practical at any period of the year.

(4) The life of the mine flotilla will be materially increased and the maintenance, time, labor, and cost very greatly reduced where wharves and boathouses are located in protected harbor areas.

(5) The concentration of mine storage facilities in one protected area, with individual buildings sufficiently separated, will result in better maintenance of equipment, reduction in maintenance personnel, reduction in building costs, and materially expedite planting of the project.

SECTION III

TACTICAL FUNDAMENTALS FOR PREDETERMINATION OF CONTROLLED MINE PROJECT

■ 12. TACTICAL FUNDAMENTALS.—The specific fundamentals governing the tactical employment of controlled mines are divided into two categories: the first involves the predetermination of the project and its relation to other measures for harbor defense; the second involves the actual conduct of the mine defense during war. The problems involved in the first category are generally solved in time of peace, and as a result of joint Army and Navy plans the details are incor-

porated in the authorized underwater defense projects for the several harbor defenses.

■ 13. TACTICAL CONSIDERATIONS FOR PREDETERMINATION OF MINE PROJECT.—The problems which must be considered and harmonized involve the following:

a. Location of mine field.

b. Number, sizes, and types of mines, with weight of explosive charge.

c. Types and sizes of anchors.

d. Disposition of groups of mines within the field, which involves joint planning and actual test operations in the mine field by local Army and Navy organizations, to investigate and determine the detailed procedure necessary to install the controlled mine field in relation to other elements of the underwater defense. These elements include—

(1) Free channels.

(2) Navigational aids.

(3) Devices for detection and location of enemy vessels.

(4) Reefs, wrecks, and natural obstructions which affect mine planting operations.

(5) Contact mines.

(6) Submarine nets.

(7) Antimotorboat booms.

(8) Fixed artificial obstructions.

(9) Communication systems and stations for rapid and positive exchange of information and coordination of action.

(10) Military and commercial cable areas.

(11) Restricted anchorage areas.

(12) Navy underwater installations.

e. Routing of cables to shore.

f. Availability and location of searchlights and guns for the protection of the mine field.

g. Provision of necessary mine planting vessels.

h. Shore installations. The necessary buildings, wharves, boathouses, railways, roads, utilities, and equipment to store, service, and supply the mine flotilla and controlled submarine mine equipment.

i. Hydrographic conditions.

■ 14. LOCATION OF CONTROLLED MINE FIELDS.—The location of the controlled mine field, or fields, for a particular harbor defense is based upon the following considerations:

a. Specific mission to be fulfilled.—If the required mission is to prevent the penetration of a harbor entrance by way of one or more narrow channels which are needed for our own use, the controlled mine field should have its inner limit far enough in advance of the channel mouths so that a hostile blocking vessel run through the mine field at high speed, if hit by a mine, will be unable to reach the channel before sinking. The maximum distance ordinarily allowable for this advance of the inner limit of the mine field beyond the channel mouths is 2,000 yards. If the mission is similar, but the channels are so wide that they cannot thus be blocked, this advancing of the mine field is not necessary.

b. Protection by fire of secondary armament and by searchlights.—Except where radio type fire control equipment is available, the outer limit of a mine field is restricted to about 8,000 yards from the positions of the most advanced searchlights. The distance to the inner limit of the mine field or to its nearest flank should not be so reduced that any part of the mine field is inside the limit of minimum range of the armament that will be made available to protect it. In certain places where the armament is sited unusually high, this is a matter of importance.

c. Hydrographic conditions.—These include the depth of water, the type of bottom, the velocity and set of currents, tidal variations, and the presence of reefs and other obstructions to navigation. Detailed information regarding all phases of the effects of local hydrographic conditions on planted controlled mines must be secured by careful surveys and extended test plantings *before* the exact location of a mine field is specified. The information essential to proper location of mine fields includes—

(1) An accurate, large scale, contour map of the bottom of the water area to be mined and of cable routes.

(2) Profiles of each line of mines which show slope, type of bottom, obstacles, and water depths.

(3) Accurate maps, United States Coast and Geodetic Survey publications, and detailed information as to velocity and direction of currents, with particular attention to the location, direction, and intensity of eddy currents which will quickly twist and break mines free from their cables and mooring ropes.

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(4) Detailed study of the annual weather records for the area in which the mine field is to be located. Care must be taken to prevent location of lines of mines in areas which are swept by frequent storms that produce waves which will tear out buoyant mines. Areas in which the Lighthouse Service has difficulty in maintaining channel marking buoys or must use exceptionally heavy moorings must be avoided, unless the necessity for a mine field in the area warrants frequent replacement of mines, anchors, moorings, and cables.

(5) The minimum depth of water in which buoyant or ground mines may be planted is limited, by the material used and draft of vessels employed in planting, to about 15 feet at low tide. In a particular project, the minimum depth at which mines will be planted is determined from a study of the conditions peculiar to that project. On the other hand, with the most favorable conditions as to current and tide, the maximum practicable depth of water for buoyant controlled mines is about 250 feet, due to the weight of cable and mooring rope. The maximum depth at which ground mines may be planted is 110 feet. Excessive currents reduce the efficiency of controlled mines in two ways: first by increasing the normal or intended submergence of the mines, and second by twisting and eventually breaking the cables and mooring ropes. In general, controlled buoyant mines should not be planted in water areas where the maximum current velocities exceed 3 knots, unless the importance of the area to be defended warrants extensive and continuous replacement of mines that have twisted free of their moorings. Even in those harbor entrances where such excessive current velocities occur, there are generally to be found water areas where the maximum current velocities are less than 3 knots. Such water areas should be sought for the location of the controlled mine field, and if lacking, the use of controlled mines may be rejected as impracticable. While in general the range of tidal variation is not sufficient to prevent the efficient employment of controlled mines, there are a few localities where the tidal variation presents a problem calling for special consideration. The submergence for controlled submarine mines is dependent on the type of vessels against which the mines are planted and the tidal variations in the mine field. Submergence may vary from 3 feet at low water, when the tidal change exceeds

10 feet, to 50 feet or more where mines are planted as defense against submerged submarines. The following general rules should be observed in determining the submergence of controlled buoyant mines:

(*a*) Mines should be submerged sufficiently to prevent easy location by observation. Observation tests indicate that in most harbors having mine projects it is practically impossible to locate mines which are painted black and submerged over 3 feet.

(*b*) Submergence should, when possible, be sufficient to prevent damage by wave action. When mines are planted in areas where waves are encountered of sufficient height to cause the mines to break the surface at the wave trough, such mines will fire if set for contact fire. When the height of waves from crest to trough is equal to or greater than the submergence, the accidental firing of mines is very probable. The force exerted by this wave slap on a mine case is so great that no satisfactory firing device has so far been designed that will prevent accidental arming and firing. When such conditions are encountered the following steps will be taken:

1. Increase the submergence of the affected groups sufficiently to insure that even under the most severe wave action likely to be encountered, no mines will break the surface.
2. Where the depth of the water is insufficient to permit a substantial increase in submergence the affected groups may be habitually set for *delayed contact fire.*

(*c*) The submergence should be such that the mines will be effective against the type of enemy vessels to which the project is designed to deny entry (see fig. 3).

(6) The presence of reefs, shoals, or natural obstructions to navigation should be considered from the following standpoints:

(*a*) Employment of natural obstacles to reduce quantity of mine material required to fulfill the mission of the defense. Too much reliance must not be placed on shoal areas as obstacles to stop hostile vessels. Lines of mines should extend to the 15-foot water line at high tide, except where this planting would expose the mines at low tide.

(*b*) Obstructions which interfere with operation of the

b. Selection.—The selection of the sizes and types of mines to be employed depends on tactical considerations and on the local hydrography. The mine case charts, appendix I, may be used as a guide in determining the size of the mine case required for a buoyant mine. Extended test plantings should be made in the project area to determine whether local conditions require special types or sizes of mine cases.

c. Minimum charge.—The minimum charge for each mine is 300 pounds of granulated TNT. To secure the maximum destructive effect from an exploding mine, the charge should be as large as the free buoyancy of the mine case and the location of adjacent underwater equipment will permit.

d. Types.—Three general types of mine cases have been issued to the service: spherical, sphero-cylindrical, and commercial tank. As between the types of mine cases, the spherical case will be affected less by strong currents than the sphero-cylindrical or commercial tank case of the same displacement, for the reason that a spherical structure exposes the least surface of any form of equal cubic capacity. In practice this factor has not been found to be of sufficient importance to warrant the extra cost of procuring large spherical mine cases.

e. Spherical case No. 32.—The spherical No. 32 mine case may be used when no larger sizes are available, where additional lines of mines are planted at submergences of 50 or more feet for protection against submarines. When used for this purpose they will be loaded with 150 pounds of TNT.

f. General rule.—The general rule to be followed in the determination of a project is to select the size of mine case which will adequately meet all requirements of the local situation. In planting a project it may be necessary to assign to the various groups the sizes and types of mines that can be made available, in such a way as to put spherical mines (other than size 32) in the swiftest currents and largest mines in the deepest water.

■ 16. Types and Sizes of Anchors.—The types and sizes of anchors and sizes of mooring ropes are dependent on the hydrographic conditions existing in each project area.

a. Extended surveys and tests have indicated that cast iron anchors can be used to advantage in all existing projects.

With modern depth measuring instruments (fathometers), sea bottoms in mine fields can be quickly and accurately surveyed to located positions for mine groups.

b. Mooring rope sizes depend on the weight of anchor, velocity and disturbance of water, and the free buoyancy of the mine cases used in the project. Extended planting tests in project areas are necessary to determine the size of mooring rope required for each project.

c. The size of anchor depends upon the size of mine, depth of water, strength of current, and character of bottom. So much depends on this last factor that the actual selection of anchors to be used should result from experiment in each water area.

■ 17. Disposition of Groups of Mines.—Within the mine field the groups must be so disposed as to meet the following requirements:

a. The fundamental basis for the arrangement of groups of mines is to insure that a hostile vessel approaching an entrance channel or water area to be protected by the mine field will be sure to pass over at least one mine and, if possible, several other mines. This object is attained in part by the use of at least two and preferably four lines of mines.

b. One or more passageways through each controlled submarine mine field are necessary for the movement of friendly vessels. The width and location of a passageway is dependent on the local hydrographic conditions, control of commercial ship traffic, and naval operating requirements. The exact location, marking, and width of a passageway should be determined only after actual navigation has demonstrated that the selected route can be traversed safely by friendly vessels. Final determination of the number and location of passageways through a mine field is a function of the local joint Army-Navy planning committee.

c. The scope of this manual does not properly include a discussion of the conditions which may make the use of torpedo nets, submarine nets, and booms necessary or desirable. However, when the use of any or all of these types of obstruction has been decided upon, their location and the disposition of mine groups must be mutually determined so as to insure the following conditions:

(1) The distance from a mine group to a fixed obstruction will be the minimum distance at which a mine planter can operate safely under all weather conditions. The distance depends on local conditions and varies from 300 to 800 yards.

(2) Operations of gate vessels or net patrols must not be rendered impossible or hazardous by too close proximity of controlled mines.

(3) The moorings of nets and booms must not interfere with controlled mine cables.

d. Contact mines used to supplement the controlled mine field in the underwater defense of a harbor entrance must be so disposed that none of the mine planting vessels used for planting and maintaining the controlled mines will be imperiled by the contact mines. The problem involves a consideration of prevailing currents and other hydrographic features, but in general it requires that at no point should contact mines and controlled mines be nearer than 1,000 yards.

e. The successive lines of mines in the controlled mine field must be far enough apart so as to give the mine planter ample seaway during planting operations and to permit separation of shore cables in the vicinity of the cable huts. In general it is desirable to separate successive lines by 1,400 yards. Distances between lines, when local conditions restrict the area available for controlled mining operations, may be reduced to 750 yards and in extremely quiet or extremely congested water areas distances between lines as small as 400 yards may be permitted. The distance between lines should be sufficient—

(1) To allow the planting vessel sufficient maneuvering room between lines of mines while planting to prevent it from running into a line of mines already planted while planting the next line in rear.

(2) To facilitate traffic control and safeguard friendly shipping by allowing sufficient time to return firing power to groups in one line before removing it from the next line, when friendly shipping is entering the harbor.

(3) To enable the shore cables to each line of mines to be laid sufficiently far apart to prevent overlapping of the individual shore cables.

■ 18. ROUTING OF CABLES.—The routing of controlled mine cables between the shore and the distribution boxes should be planned so as to meet the following requirements:

a. The cables should land at a point where the terminal hut may be concealed and protected from observation and fire.

b. The route should be as short as possible, so as to economize cable and reduce the lengths exposed to injury.

c. The route should be outside of ship channels, but must follow channels or depths which can be navigated by a mine planter. This requires at least 15 feet at low water.

d. Where possible, the route should be in water that can be traversed by a mine planter while laying cable in any weather short of a severe storm, and such that there is not a serious scour of current along a rocky bottom or exposure to broken ice in northern water.

e. There must be a minimum of crossing of mine cables with fire control and commercial cables. In some locations cable terminal huts can be relocated to eliminate any crossing of commercial and fire control cables.

f. Shore cables should not be laid in advance of the front line of mines or in navigable water areas which are not protected by some type of underwater defense or obstruction.

g. Shore cable routes should be laid out so as to provide for each cable an area having a minimum width of 100 yards.

■ 19. GUNS AND SEARCHLIGHTS.—In the determination of a controlled mine project it should be recognized that it is futile to place controlled mines in water areas which cannot be covered by fire of secondary armament and which cannot be illuminated by searchlights. From the standpoint of location of controlled mine fields, this fundamental has been considered in paragraph 14*b*. From another standpoint it is necessary to consider whether sufficient guns and searchlights are available or can be made available to provide adequately for the protection of all parts of the mine field which conceivably can be attacked simultaneously by mine sweeping or countermining operations. This is a question which must be determined for each local situation. Its controlling effect is to limit the employment of controlled mines to the areas covered by guns and searchlights.

■ 20. MINE PLANTING VESSELS.—Necessary mine planting vessels must be provided in units, each designated as a mine planting flotilla and consisting of 1 mine planter, 1 DB-boat, and 3 motor mine yawls for planters built prior to 1940. Planters built after 1940 have capacity for loading a minimum of three groups of mines at one time. To utilize the capacity of these planters two DB-boats and five mine yawls are required for each flotilla. The number of mine planting flotillas to be provided will depend upon the time limit within which the mine project is required to be put down, the number of mine batteries assigned, and the average rate at which one unit can put down one group of mines, including laying and marking location of line of mines, laying the shore cable, loading mine matériel aboard the planter, proceeding to the mine field, planting the group of mines, and returning to the mine wharf. This rate will vary in accordance with numerous factors, among which are the distance from shore to the mine field, the state of the weather, tide and currents, depth of water, and availability and training of the personnel. The rate will vary between 10 and 30 working hours per group of mines. Experience has shown that time will be saved and replanting will be avoided if the mine field and passageways through the field are carefully laid out, plotted, and marked by buoys before any shore cables are laid or groups are planted.

SECTION IV

TACTICAL FUNDAMENTALS FOR CONDUCT OF MINE DEFENSE

■ 21. GENERAL PROBLEMS INVOLVED.—The second category of fundamentals governing the tactical employment of controlled mines is concerned with the actual conduct of the mine defense during war. The conduct of mine defense, based upon a predetermined project for which the matériel and installations are available, presents the following general problems:

a. Time and manner of planting the project.

b. Surveillance of the mine field and attack of hostile vessels.

c. Protection of the mine field.

■ 22. TIME AND MANNER OF PLANTING THE PROJECT.—Each mine project will be planted when so directed by the War Department, or as provided for in approved joint local defense plans. The controlling element in the coordination of this work is to insure that matériel is ready for the mine planter so that it can fully utilize the hours of daylight for work on the water. Little time will be saved by attempting to lay cable or plant mines in extreme darkness. The plan for putting down the project should include the sequence to be followed in planting. In general the groups of mines farthest offshore should be planted first, so that these mines need not be crossed or passed around while planting subsequent groups of mines. In certain projects it may be prescribed that designated groups will not be planted until called for by the Navy, or until the port is closed. In such cases, in planting the groups of mines first to go down, care must be taken to leave ample seaway for the planter in the subsequent planting of the delayed groups.

■ 23. SURVEILLANCE OF MINE FIELD.—Surveillance of the mine field must be continuous throughout the 24 hours of the day during the continuance of hostilities. This surveillance has three purposes: first, as a basis for tactical decisions in the attack of hostile vessels; second, to insure that the mine field is rendered safe for the passage of friendly naval forces and commercial shipping; and third, to insure the protection of the mine field itself. Thus, surveillance of the mine field calls for two complete reliefs in the manning table for the mine group commander's station, base end stations, plotting room, and casemate.

■ 24. NATURE OF TACTICAL DECISIONS.—On the approach of a hostile vessel or naval force, the tactical decisions which must be made are—

a. Whether to fire or to withhold fire.

b. Whether to fire by observation, by contact, or by delayed contact.

■ 25. DECISIONS AS TO FIRE.—*a.* The decision as to whether to fire or to withhold fire should be covered by instructions contained in the battle orders of the harbor defense commander. The considerations involved are—

(1) The fact that whenever a mine is fired, the field is to that extent weakened until the mine can be replaced.

(2) The relative importance of the enemy element, or the seriousness of its threat to the defense.

b. Consequently, it may occur that an unimportant vessel should be allowed to pass, especially if it is being followed by more important vessels. Furthermore, if the hostile operation is a reconnaissance precedent to an attack in force, the attack of a reconnoitering element will disclose the location of the mine field. On the other hand, it is a general rule that during night or fog when surveillance by observation is impossible, all hostile elements traversing the mine field should be attacked by contact fire. This rule is subject to the qualifications that whenever a controlled mine field is to be set for contact fire during a period of nonvisibility, advance notice must be given through the commander of the naval local defense force to all elements thereof.

■ 26. METHODS OF FIRE.—The methods of fire in the order of their tactical importance are contact fire, delayed contact fire, and observation fire.

a. Contact fire.—This method will normally be employed. It is unlikely that enemy vessels will attempt to penetrate a harbor to the mine field area without utilizing the protection of fog, smoke screens, or darkness. Such attacks probably will be accompanied by heavy aerial bombardment. Under these conditions contact fire is necessary to insure that the maximum destructive fire of mines is delivered at the earliest possible moment.

b. Delayed contact fire.—(1) In exceptional circumstances when ideal conditions exist, sufficient visibility and information may be available on which to make a decision as to speed, course, and the portion of the ship which has caused the mine to signal. If this information is available, delayed contact fire may be used. This method offers the greatest assurance of serious injury to a capital ship or any other type of vessel provided with "blisters" or other form of torpedo protection. By delayed contact fire it is possible not only to insure that the mine explodes in direct contact with the hostile ship but also to increase the likelihood that before the explosion occurs the mine will have been dragged underneath the "blister" protection, thus firing against the vulnerable bottom section of the ship. Under certain exceptional circumstances, the use of delayed contact fire may be dictated by physical rather than tactical considerations. In certain harbor defenses, unusual combinations of hydrographic, wind, and tidal conditions will produce for periods of several hours wave action that will arm the M4 firing device in buoyant mines. For these short periods, it will be necessary to set the mine system on delayed contact fire to prevent useless firing of mines.

(2) Delayed contact fire is executed by giving the command: DELAYED CONTACT FIRE—GROUP ------, -------- seconds' delay. At the expiration of the prescribed number of seconds' delay the firing switch on the group panel is closed. When fire is directed with a prescribed number of seconds' delay, the delay to be prescribed will depend on the type and speed of the hostile vessel being attacked. In this connection it should be borne in mind that when employing the standard single-conductor mine system an inherent delay varying from 0 to 3 seconds occurs between the actual hitting of the mine and the stopping of the selector contact arm on the mine contact of the mine hit. The prescribed delay should be computed for each known type of vessel that it may be necessary to attack and for the tactical and cruising speeds of each type. In general, these delays will vary from 0 second for the most modern destroyers at tactical speed to 13 seconds for a battleship at cruising speed. The effort in each case is to secure an explosion directly under the bottom amidships.

c. Observation fire.—(1) This method of fire is of extremely limited application. Ordinarily it should be resorted to only to meet one of three tactical conditions: first, when it is necessary to attack one hostile vessel at a time when a friendly vessel or other hostile vessel of types not to be attacked are either in, about to enter, or have just left the mine field; second, when by reason of mines damaged or previously fired, such gap exists in the mine field that from the predicted course of a hostile vessel either form of contact fire would be ineffective and yet a mine can be fired by observation near enough to a vessel's course to gain destructive effect; or third, when it is known that hostile elements are employing paravanes to sweep and explode controlled mines.

(2) Except in the cases above noted, if a mine field is properly laid out, a ship should not be able to enter and traverse the field without hitting a mine, and as the destructive effect of a mine explosion is greatest when it occurs in direct contact with a vessel's hull, either method of contact fire is more certain to be effective than observation fire. Furthermore, it should be remembered that the accuracy of observation fire diminishes with the lapse of time after the mines are planted, due to dragging of mines by storms or boats.

■ 27. MEASURES FOR PROTECTION OF CASEMATE AND OF MINE FIELDS.—*a.* In addition to the hazard of injury by hostile fire, mining casemates (and the cables connecting them to the shore) are especially vulnerable to sabotage. For this reason these vital elements should be protected constantly by adequate guard from the very imminence of hostilities.

b. Protection of controlled mine fields depends upon the following measures:

(1) Surveillance from shore, utilizing the observation stations of the mine group command as well as other fire control stations of the harbor defense, assisted by the harbor defense searchlights.

(2) Surveillance by elements of the naval inshore patrol.

(3) Surveillance by subaqueous listening devices operated by the Army or the Navy or both.

(4) The fire of the secondary armament of the harbor defense against hostile surface vessels attempting mine sweeping or countermining.

(5) The attack of hostile airplanes engaged in observation or countermining with depth bombs, by the antiaircraft artillery or the air forces or both.

(6) The attack of hostile surface vessels by gunfire, or of hostile submarines by depth bombs, by vessels of the naval inshore patrol.

(7) Concealment of mines from aerial observation.

(8) In some cases the protection afforded by antisubmarine nets and contact mine barrages.

■ 28. PROTECTIVE SURVEILLANCE FROM SHORE.—The protective surveillance from shore will be maintained in connection with tactical surveillance continuously except when poor visibility renders it impossible. Its utility is predicated not only on

constant vigilance, but equally on the maintenance of effective communications with the batteries of the secondary armament, the antiaircraft artillery, the searchlights, and supporting units of the air forces.

■ 29. NAVAL SURVEILLANCE.—The surveillance of the controlled mine field by elements of the inshore patrol of the naval local defense force will at all times be of great importance, and especially so at times when poor visibility renders ineffective the surveillance from shore. Regulations governing coordination are covered in "Joint Action of the Army and the Navy."

■ 30. SUBAQUEOUS SURVEILLANCE.—Wherever installed, subaqueous listening devices should be used to supplement the surveillance from shore and from the inshore patrol. To render this service effective, direct telephone communication should be established between the headquarters of the subaqueous installation and the mine group commander's station.

■ 31. SECONDARY ARMAMENT.—The fire of the secondary armament of the harbor defense is the principal means for the prevention of mine sweeping and countermining. Success depends upon the training and constant readiness of the gun groups assigned the mission and upon the maintenance of communication between the mine group and the gun groups.

■ 32. ANTIAIRCRAFT DEFENSE.—The prevention of hostile air observation and countermining with depth bombs may prove to be of great importance and calls for the successful cooperation of the antiaircraft artillery and units of the air forces.

■ 33. CONCEALMENT OF MINES.—The only effective method of concealment of mines from aerial observation is sufficient submergence. In the Tropics a combination of bright sunlight, unruffled water surface, clear water, moderate depth, and light-colored bottom reveals the location of the mines to an aerial observer, not so much by his ability to see the mines themselves as by his ability to see their shadows on the bottom. Experiments so far conducted in the direction of protective coloration of mines have indicated that mines painted black are the most difficult to locate.

■ 34. PROTECTION BY NETS AND CONTACT MINES.—Although the desirable location of an antisubmarine net is to landward of

a controlled mine field, the placing of the net to seaward may occasionally be required by local conditions, in which case such placing has the advantage of restricting very considerably hostile mine sweeping or countermining by surface vessels. In projects where the controlled mine field is supplemented by an adjacent or outer barrage of contact mines, the presence of these contact mines serves to some extent to limit the access of hostile vessels intended to attack the controlled mine field.

■ 35. COUNTERMINING AND MINE SWEEPING.—*a. Ground mines.*—A ground mine which arms and fires either by magnetic, acoustic, contact, pressure, or a combination of these circuit closing influences with delay action firing devices has been developed and used in large quantities by foreign powers. This type of offensive mine is dropped by airplanes or planted by submarines in harbor channels with charges varying from 500 to 5,000 pounds of explosive. Ground mines of this type are very difficult to locate, to render inoperative, or to destroy without serious loss of friendly vessels. Enemy influence operated ground mines planted in a buoyant controlled mine field present the following problems:

(1) Repairs to the controlled field cannot be safely made until the enemy ground mines are neutralized.

(2) The passageways through the harbor channel must be swept continuously to remove or destroy the delay action ground mine. To provide sufficient area for operation of minesweepers it may be necessary to blow off parts of or entire groups of controlled buoyant mines.

(3) Delayed action enemy ground mines will countermine, that is, arm and cause controlled buoyant mines to fire when the field is set for contact fire.

(4) The destruction caused by detonation of an enemy ground mine in a controlled buoyant mine field may vary from the loss of one mine to a group, depending on how near a distribution box the enemy ground mine is detonated.

b. Mine sweeping.—All mine sweeping operations are conducted under the direction of the U. S. Navy. The procedure to be used insofar as it affects controlled mine fields should be determined by the local joint board prior to the installation of the controlled mine field. Rapid progress in the development and tactical use of offensive mines will necessitate continuous liaison with the Navy regarding measures to be taken to sweep channels in harbors.

c. Enemy mines.—The mine command will be on the alert to detect the presence of enemy aerial, surface, or submarine mine layers in a harbor area. The area of operation, and wherever possible, the definite location of enemy mines will be determined. This information will be transmitted immediately to the U. S. Navy office charged with identification, removal, and disposition of enemy mines. Normally only U. S. Navy personnel will make any effort to remove or destroy enemy mines. When enemy buoyant mines afloat in open sea areas, washed ashore on unoccupied beaches, or ground mines are found, the U. S. Navy will be notified and guards or guard ships posted at a safe distance to prevent danger to friendly personnel and equipment. This procedure is ordered to insure the securing of information regarding enemy mine construction and operation by personnel trained in identification and dismantling of enemy mines. In an emergency, where the immediate removal or destruction of an enemy mine is necessary to prevent loss of life or destruction of vital installations, the harbor defense commander may order destruction of enemy mines. Floating enemy mines which have drifted near Army wharves and vessels in harbors are examples of the type of mine which requires immediate action. Destruction of this type of mine by sinking with rifle or machine-gun fire from a distance of at least 200 feet may be ordered when such enemy mines are an immediate menace to personnel and important structures.

SECTION V

MINE GROUP

■ 36. DEFINITION AND ORGANIZATION.—*a. Definition.*—A mine group is a tactical unit composed of the personnel, submarine mine matériel, structures, vessels, and armament necessary to plant, operate, maintain, and protect part or all of the controlled mine fields of a harbor defense. It is also an administrative and supply unit in respect to mine property. The mine group should not be confused with the group of mines defined in paragraph 9*a*.

b. Organization.—The personnel of the mine group is organized as follows:

(1) Mine group commander.
(2) Mine group staff.
(3) Mine group section.
(4) Mine property section.
(5) One or more mine batteries.
(6) One or more rapid fire gun batteries.
(7) One or more mine planting flotillas.

c. Number of mine batteries.—The number of mine groups, the distribution of mine fields in the project, the location of shore installations, and the local hydrographic conditions determine the number of batteries required. Experience has demonstrated that one battery in peacetime can maintain 16 groups planted from one casemate. Under actual war conditions it is estimated that one battery will be required for each 10 groups of buoyant mines.

d. Gun batteries.—Gun batteries assigned to the mine group are organized and employed according to the fundamentals applicable to the type of armament available.

e. Searchlights.—Searchlights and personnel therefor will not generally be included in the organization of the mine group. Searchlights are operated under the direction of the searchlight officer of the harbor defense, groupment, or group to which they pertain.

f. Manning table.—A manning table for each unit and section thereof, exhibiting the actual assignments of all personnel to duty therein, will be prepared and kept up to date. A copy will be posted in the command post or station of the corresponding element.

■ 37. COMMANDER.—*a.* The duties of the mine group commander are prescribed in FM 4–5.

b. The mine group commander will normally be the representative of the harbor defense commander in the coordination of Army and Navy operations connected with the planning, installation, maintenance, and conduct of the underwater defense elements of a harbor.

■ 38. STAFF.—*a. Composition.*—The mine group staff is normally selected from the officers of the battalion assigned to the mine group. This staff includes an intelligence and plans

and training officer, a communications and searchlight officer, a gas officer, and a mine property officer.

b. Duties.—The duties of all mine group staff officers except those of the mine property officer are outlined in FM 4–5.

c. Mine property officer.—(1) The mine property officer is responsible for the procurement, storage, care, preservation, issue, and accounting for all property designated as submarine mine property, in accordance with pertinent Army Regulations, and has direct charge of all mine structures. He should maintain in the mine property office a complete file of detail and assembly drawings of such mine equipment as may be available. He directly supervises the training and duties of the mine property section.

(2) The mine property officer will issue in serviceable condition all tools, supplies, and equipment authorized by Tables of Allowance for Submarine Mine Projects for each installation and each section of the mine batteries assigned to the harbor defense. He will make frequent inspections of this equipment to determine its condition, and will take the necessary steps to secure timely replacements.

The mine property officer will be responsible that all instructions for modification and changes in equipment issued by the submarine mine depot are complied with and that the depot is promptly informed when changes are completed or when any unusual delay is anticipated in connection with a modification or change of equipment. Before mine planting operations are started, the mine property officer will inspect all tools, supplies, and equipment issued to mine batteries or in the mine warehouses to determine the adequacy and serviceability of these articles of submarine mine equipment.

(3) *Noncommissioned staff officer, electrical* (T/O 4–69).—He is normally a selected electrician who has had a special course of instruction at the submarine mine depot. He should not be included in any of the component details of the mine group detachment *nor be given any tactical assignment.* His principal duties under the direct supervision of the mine property officer are—

(*a*) Technical inspection, care, and repair of all electrical submarine mine equipment assigned to the mine battery.

(*b*) Instruction of casemate personnel in care and maintenance and operation of casemate equipment.

(c) Conduct maintenance tests.

(d) Repair and test of submarine mine cables in accordance with TM 4–215.

■ 39. SECTION.—The group section consists of the enlisted personnel necessary to assist the group commander and his staff in exercise of their tactical, technical, and training functions, and in a mine group, a mine property section. Organization and duties where applicable are similar to those of the harbor defense section. Personnel of this section are provided by appropriate battalion headquarters batteries.

■ 40. MINE PROPERTY SECTION.—The personnel for the mine property section is permanently assigned from the mine battery or mine batteries pertaining to the mine group, and normally consists of the mine property section from each mine battery. This section, under the supervision of the mine property officer, receives, issues, repairs, and maintains all mine property until it is turned over to mine batteries for planting. When the need arises, personnel from this section may be detailed to assist in planting and maintaining mine fields.

■ 41. COMMAND AND ADMINISTRATION.—*a.* The mine group is a tactical unit the tactical efficiency of which depends not only upon properly coordinated employment when in action, but also to a unique extent upon a great amount and variety of technical operations prior to battle. These technical operations include the preparation and preservation of mine equipment in time of peace, and the assembly and planting of the mines and accessories during or upon the imminence of war. By reason of the very bulk and weight of the matériel to be handled—approximately 50 tons per group of mines—a vast amount of physical labor is involved. Furthermore, the planting of a mine project demands the simultaneous prosecution of numerous operations at separate places on shore and on the water, each of which must be correctly and quickly executed. At certain stages of the work it is necessary that some of the sections be temporarily augmented by men from other sections. All of these conditions impose the requirement that tactical command be closely related to and supported by a high standard of technical and administrative command.

b. Among the problems to be solved to attain effective command in the mine group, the more important are the following:

(1) The transfer down of responsibility for immediate control of the several parts of the program.

(2) The testing of the working program and familiarizing of mine personnel with its details during peace training.

(3) Effective supervision by the mine group commander of the execution of the working program.

(4) Careful preparation of a working program for the installation of a controlled mine project, which should be concise and based on practical tests in the area which is to be mined. The narrative section of a program can be held to a minimum by employing graphical charts, tabulations, and an altered stock report, W. D., O. C. C. A. Form No. 79. The program will be reviewed annually and revised when necessary to meet changes in the project, Tables of Allowances, submarine mine equipment, mine flotilla, shore installations, or Tables of Organization. Forms which may be used in recording details of the program are illustrated in appendix II.

c. The working program for the installation of the project will include—

(1) A detailed bill of material and basic information for each group of mines showing the following information and any additional items that local conditions render essential:

(*a*) *For each mine.*

Anchor and mine case size.
Depth of water in feet at low water.
Length in feet of mine cable.
Mooring rope and raising rope length and size.
Explosive type and weight.

(*b*) *For the group.*—The quantity of anchors, mine cases, mine cable, shore cable, mooring rope, raising rope, clips, thimbles, shackles, cable clamps, compound plugs, firing devices, circuit closers, junction boxes, distribution boxes, selector boxes, and explosives.

(*c*) *Information.*—Azimuths and distances from each station to position of distribution box, mines Nos. 1 to 10 and 19, and of control buoys for line of mines. The distance, where

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critical, from any other element of underwater defense, that is, nets, booms, and listening devices.

(2) Exact locations for distribution boxes, and a workable control system from shore to insure putting them at these locations.

(3) Routings for cables.

(4) Sequence for planting the groups of mines.

(5) Allocation of berthing space at the mine wharf for the mine planters and the distribution box boats to be used.

(6) Schedule for mine planters to refuel and blow boilers.

(7) Detailed schedule showing the sequence of work for the various sections, covering the duties of each so that the uninterrupted planting of groups may proceed in the order determined upon.

(8) Provision for necessary reinforcement and reliefs for the various sections at the times required.

(9) Provision for surveillance of the mine field from the time planting begins.

(10) Arrangements for hot meals at regular hours, particularly for men in small boats who cannot leave the mine field.

d. In order to prepare the working program, the following data must be determined, based upon actual local conditions:

(1) Man-hours of labor for the different kinds of work to be performed.

(2) Number of men required to carry on each operation, considering the space, utensils, lifting gear, trackage, and rolling stock available.

(3) Time to lay shore cable to each distribution box.

(4) Time from dock back to dock to plant each mine group, considering distance from shore, depths, currents, and rough water.

(5) Time per trip for each loaded car from cable tank, storehouse, and loading room to mine wharf, including turnaround.

(6) Accurate soundings for each group of mines, kept up to date by annual survey, with record of type of bottom—mud, sand, or rock. This record will include sufficient information on which to construct contour maps of the bottom and profiles for each group.

(7) Matériel supplied for the project.

e. The following rules should govern as to responsibility for the handling of mine equipment by personnel of the mine group:

(1) When the equipment is being used in connection with training or with the planting and maintenance of the project in war, responsibility for the proper handling and care of the equipment rests with the tactical chief of subdivision which requires the use of the equipment.

(2) When the equipment is being repaired, adjusted, painted, or otherwise handled in connection with necessary storage and maintenance, the mine property officer retains responsibility for the equipment and for the work to be done, even if the work is being performed by details from the mine batteries, under the direct supervision of their own officers.

f. When the war project fields are planted in harbors where there is active use of the harbor by Navy and commercial vessels, local conditions may require restrictions on the application of firing power to the mine field for contact fire. When such conditions arise it may be necessary to arrange the wiring so that the availability of firing power to the mine fields is controlled by a switch in the harbor defense station occupied by the Army and Navy Officers who are empowered to make decisions as to action to be taken in hostilities.

g. In the exercise of tactical command, typical lines of telephone communcation are shown in figure 4.

h. In the projects where the mine group command includes two or more mine fields so remote from each other that separate installations of observation and control stations are necessary to operate each mine field, the necessary modifications in communications and manning parties are effected to enable the mine group commander to retain tactical command over all mine fields, with a battery commander or other officer conducting the fire from each battery command post.

i. Project requirements for submarine mine property for each harbor defense for which there is authorized a controlled submarine mine installation will be prepared on W. D., O. C. C. A. Form No. 79. On this form is entered a compilation of all submarine mine equipment and supplies required for installation and maintenance of the mine project for 1 year. The computation of the requirements for submarine mine property is based on the approved Joint Army

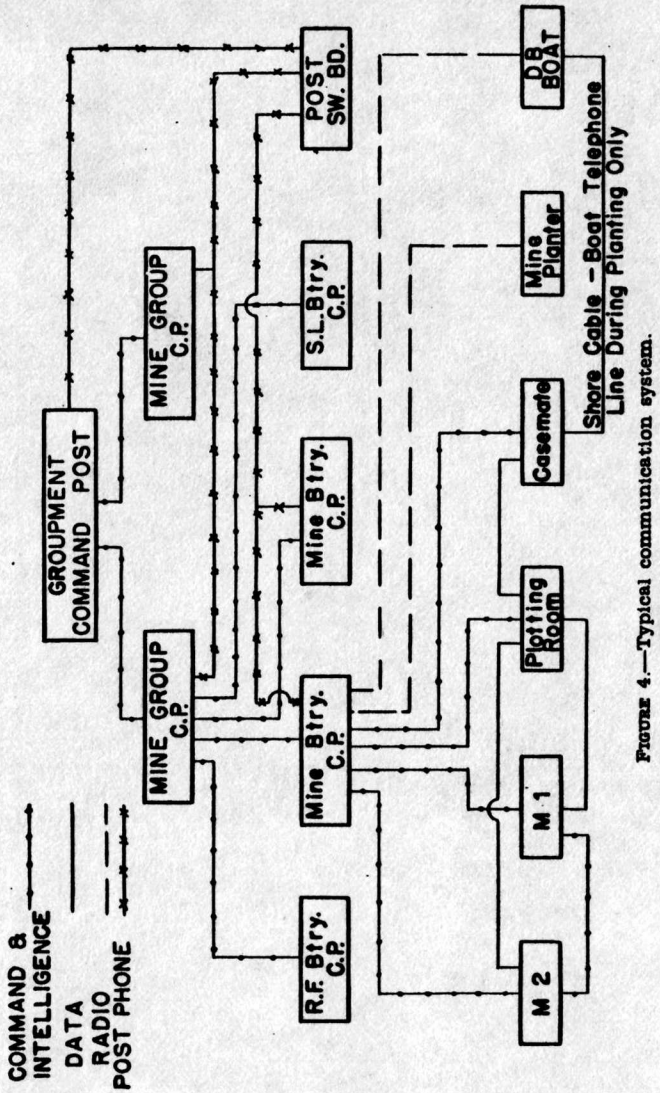


FIGURE 4.—Typical communication system.

and Navy underwater defense project and the Table of Allowances for submarine mine projects. The steps involved in preparing the project requirements are—

(1) Preparation at the submarine mine depot of a pencil copy of the estimated requirements based on records of experience available at the depot.

(2) Consideration, by the local harbor defense board charged with preparation of plans for underwater defense, of the estimate prepared at the submarine mine depot. The local board is responsible for the determination by actual plantings in the war field of the sizes, lengths, weights, shapes, and models of various articles of submarine mine equipment which will adequately meet the requirements of the local controlled mine project.

(3) Coordination by the submarine mine depot of the requirements as determined by the local board and the availability of standard articles authorized by Tables of Allowances.

(4) Preparation by the local mine property officer of four typewritten or ink copies of the project requirements as agreed on by the submarine mine depot and the local board charged with preparation of plans for underwater defense.

(5) Submission by the submarine mine depot of the four copies to the Chief of Ordnance for necessary action.

(6) Distribution of one copy of the project requirements as approved by Chief of Ordnance to the coast artillery section, Office Chief of Engineers, commanding officer, submarine mine depot, coast artillery district or sector commander, and mine property officer of the harbor defense concerned.

(7) The mine property officer is responsible for the initiation of any changes in the project requirements for submarine mine property which are made necessary by changes in the size or location of the controlled mine defense, revision of Table of Allowances, or changes in local hydrographic conditions which necessitate different types of submarine mine equipment.

SECTION VI

MINE BATTERY

■ 42. DEFINITION.—The mine battery is the smallest administrative unit assigned to controlled mine defense from a coast artillery harbor defense regiment, and is also a tactical

unit used in the installation, operation, and maintenance of the mine project of a harbor defense.

■ 43. TYPE ORGANIZATION.—The mine battery (T/O 4–69) is a type battery provided for the operation of a harbor defense mine field. Its strength will vary depending upon the particular mine field to which it is assigned. It consists of a battery headquarters, composed of a command detail and a range section; a battery maintenance section; and a mining section composed of mine property, loading, planting, flotilla (less mine planter), and casemate sections.

■ 44. FORMATIONS AND MARCHING MANEUVERS.—The mine battery is formed and marched in the manner prescribed in FM 4–20.

SECTION VII

MINE PLANTING FLOTILLA

■ 45. DEFINITION AND COMPOSITION.—*a.* The mine planting flotilla is a tactical unit within the mine group, consisting of at least one mine planter, one DB-boat, and three mine yawls, together with the personnel to man these vessels. Harbor defenses may require an additional flotilla if the number of mine groups exceeds 16 or if there are two mine fields so widely separated that they cannot be planted and serviced by one flotilla. Mine planters constructed after 1940 have capacity of from three to four groups of mines and will require the services of at least two DB-boats and five mine yawls for the most expeditious planting of mine projects.

b. The personnel of the mine planting flotilla consists of one or more mine planter crews (T/O 4–104), one or more planting sections, one or more DB-boat crews, and three or more mine yawl crews (T/O 4–69).

■ 46. MINE PLANTER COMMANDER.—The mine planter commander is the senior commissioned officer of the Coast Artillery Corps assigned to duty with a ship of the Army Mine Planter Service. He commands and is responsible for the operation of the mine planter and all boats of the mine flotilla to which assigned. He is charged with the tactical and technical training of their crews and of the mine planting sections attached to his flotilla. His duties with regard to the operation and administration of the mine planter are prescribed in AR 90–150 and 90–155. Instructions governing the operation of DB-boats and mine yawls are included in AR 90–160.

■ 47. EXECUTIVE OFFICER.—When two commissioned officers are available for assignment to a mine planter, the junior will be assigned as executive officer. The duties of the executive officer will be to assist the mine planter commander in such manner as the latter may direct, in the administration, operation, and training of the mine planter and the mine planting flotilla.

■ 48. MINE PLANTER PERSONNEL.—The personnel complement of a mine planter is prescribed in T/O 4–104, and their duties are prescribed in AR 90–150.

■ 49. PLANTING SECTION.—For mining operations, in addition to the crew of the mine planter there is available in each mine battery a mine planting section (T/O 4–69). The planting section is charged with the preparation of mines and accessories aboard the planter and with planting and taking up mines and laying cable. During work pertaining to its tactical assignment, the planting section is under the control of the mine planter commander, and for the time being becomes a part of the crew of the mine planter.

■ 50. DISTRIBUTION BOX BOAT AND MINE YAWL CREWS.—Personnel for operation of the DB-boats and mine yawls are included in the mine flotilla section of the mine battery (T/O 4–69). Duties of the crews in connection with the care and maintenance of these boats are prescribed in AR 90–160.

■ 51. ADMINISTRATION.—*a.* The organization of the mine planting flotilla is such as to concentrate under the control of one competent officer the administration, operation, maintenance, and training of the ship and boat service required in the mine group. Operations on the water require special training and knowledge. Divided responsibility or dual control of vessels of the mine flotilla is incompatible with successful mine planting and maintenance of mine fields. In each harbor defense the necessary instructions will be issued and operating procedure established to insure proper division of responsibility for operations ashore and afloat.

b. As a unit, the technical specialists and crews of all its

component vessels are available to meet any emergency for the repair and upkeep of any vessel.

c. The training of all crews should be such as to insure the maximum degree of interchangeability between crews.

d. When the mine planter is required to leave station for fueling, repairs, or transportation service, the control of the DB-boat and mine yawls will be taken over by an officer of the mine group detailed by the mine group commander.

e. Whenever boats of any type are assigned to the mine group in excess of the normal quota for the mine planting flotilla, such boats and their crews are assigned to the flotilla.

SECTION VIII

SUBMARINE MINE MATÉRIEL

■ 52. CONTROL SYSTEM.—The standard submarine mine control system is designated as M3. The assembled control panels of an M3 system for control of 10 mine groups is illustrated in figure 5. The details of the construction and maintenance of this system are covered in special instructions issued by the submarine mine depot.

■ 53. POWER EQUIPMENT.—Two sources of power, fortification and post power, are normally available for the operation of the standard M3 control system. Fortification power, supplied by 5-kva., 120-volt, 60-cycle engine generator sets, is the only source which is considered in connection with project requirements.

■ 54. CABLE.—All submarine mine cable will be kept under water in cable tanks when not in use. The mine property officer is responsible for the storage and maintenance of all cable and for preparation and submission of required reports. Direct labor for these activities will be furnished by the mine property section under the technical supervision of the noncommissioned staff officer (electrical). Instructions covering storage and care of cable are contained in TM 4–215.

■ 55. EXPLOSIVES.—*a.* Explosives for use in controlled submarine mines are trinitrotoluene (TNT) in crystalline form and commercial waterproof electric blasting caps containing a mixture of fulminate of mercury and tetryl.

b. Neither of these explosives is excessively dangerous to

handle if proper precautions are observed. The mine group commander will make an annual inspection of all submarine mine explosives stored within his jurisdiction. A report of this inspection will be submitted, through the fort and harbor defense commanders, to the Commanding Officer, Submarine Mine Depot, Fort Monroe, Virginia.

■ 56. COMPONENT PARTS OF BUOYANT MINE.—The allowance of parts authorized for the assembly of buoyant mines is stated in Table of Allowances for submarine mine projects, Coast Artillery Corps, and a detailed description of each part of a controlled buoy and mine is contained in TM 4–220. The manner in which the component parts of a buoyant controlled submarine mine are assembled and planted is shown in figures 27 and 28.

SECTION IX

MINE CASEMATE

■ 57. SUBMARINE MINE CASEMATE.—The term "casemate" as used in controlled submarine mining signifies the structure which houses the control equipment of the mine system. This structure is one of the most vital elements of the controlled mine system. The operating room should be bombproof, gasproof, defiladed from gunfire, and adequately protected against attack by landing parties. It is connected to the harbor defense fire control switchboard. It contains a fortification power plant for operation of the controlled mine system, switchboards, control apparatus, and instruments for operating, testing, and maintaining the electrical circuits of the mine system.

■ 58. DUTIES IN CASEMATE DURING PLANTING.—*a. General.*—Immediately upon entering the casemate for duty, tests of power plant, voltages, and general circuit conditions will be made by the casemate electrician.

b. Communication test.—Connect a boat telephone to the casemate end of the land cable, which is attached to the group shore cable, and have a man stationed at this telephone ready to receive calls from the DB-boat.

c. Air test of shore cable.—This consists in testing the insulation of the shore cable after it has been laid. When the

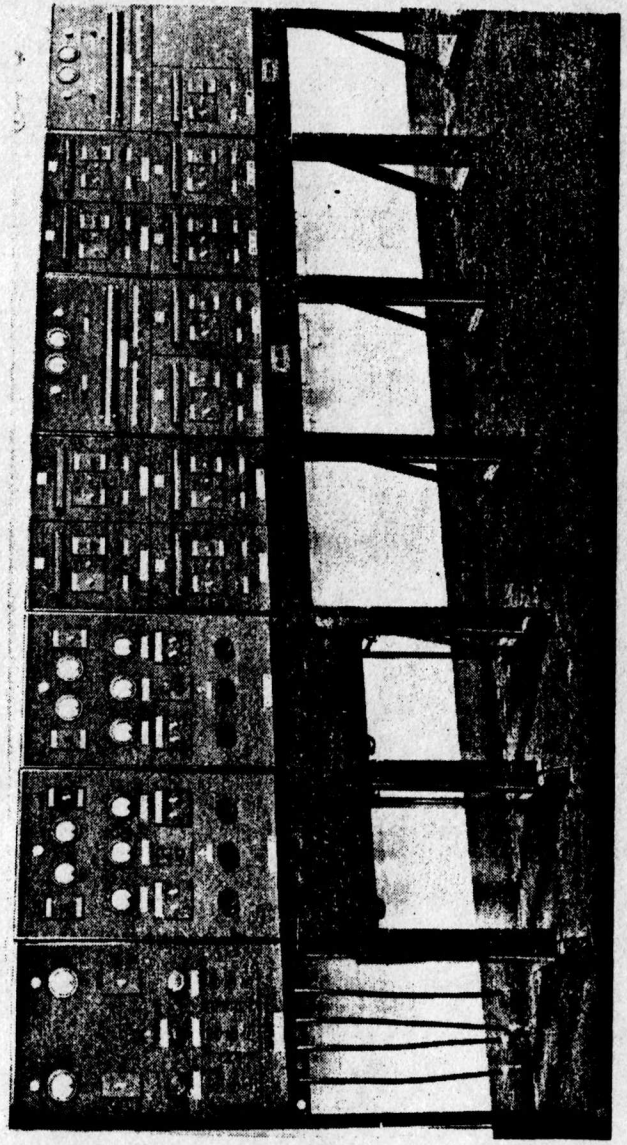


FIGURE 5.—Ten-group unit, M3 system.

casemate operator has notified the DB-boat to prepare the cable end for insulation test, the end of the single-conductor shore cable is dried and held in the air, and a megger test taken in the casemate. For instructions covering the use of the megger, see TM 4–215. In case multiple cable is used, the conductors should be carefully separated, dried, and held in the air.

d. Dry test.—After all of the mines of the group have been planted and connected to the selector box, and the mine field is clear, a dry test of the mine circuits is made. This consists in taking milliammeter readings on the mines with the shore cable temporarily connected to the selector box and with the distribution box on the DB-boat. Upon notification from the DB-boat that they are ready for the test, wait 2 minutes (to give the boat time to disconnect telephone and temporarily connect shore cable to selector box), then test each mine circuit by selection, and finally step the system through the field. At the expiration of 10 minutes from the time the DB-boat reported ready for the tests, attach the boat telephone and report the results of the test to the DB-boat. This time may be varied to suit circumstances.

e. Wet test.—This consists in taking milliammeter readings on each mine circuit at least 1 hour after the distribution box has been lowered, by operation of the supervisory panel as prescribed for the dry test.

■ 59. TESTS AND RECORDS.—*a.* Periodic and specific tests for submarine mine equipment are necessary to insure that the system is always ready for action and in condition to withstand the continuous service required for wartime operation. Forms for recording these tests to provide a guide as to the methods of procedure. The original records of each routine or special test will be retained at the casemate or other installation where the test is made for a period of at least 1 year after the test is completed. Inspecting officers will include information as to the status of test records in their reports.

b. The submarine mine depot is authorized to call for reports of any test or for operation records necessary to secure information as to service life of controlled mine equipment or matériel.

TEST OF EQUIPMENT

Required tests	When made	Recorded	Reported to SMD
Diesel generators:			
Operation, 5 minutes	Daily	Yes	Monthly.
Storage battery	Daily — continuous operation.	Yes	Do.
	Weekly—intermittent operation.		
Control system:			
General operation	Daily	No	No.
8-hour continuous operation.	Monthly	Yes	No.
Relays and rotary switches	Quarterly	Yes	No.
Mine circuits—planted mines:			
Dry test	Before distribution box is planted.	Yes	No.
Wet test	After each planting	Yes	No.
Operation test	Daily	Yes	Monthly.
Cable insulation and conductor resistance:			
Mine	Before each planting	Yes	No.
Shore	Before and during each planting.	Yes	No.
Land	Weekly	Yes	Annually.
All types	Annually	Yes	Do.
Firing devices:			
25 percent of total number on hand.	Weekly	Yes	Do.
Casemate ground:			
Resistance	Quarterly	Yes	Do.

SECTION X

MINE LOADING ROOM

■ 60. MAKING WATERTIGHT JOINTS.—The procedure for making watertight connections and joints is contained in TM 4–220.

■ 61. TESTING DETONATING CAPS.—Detonating caps will be tested prior to assembly in compound plugs by connecting them to the bridge megger as shown in figure 6. The megger ratio switch will be set to "Bridge÷100" and the measured resistance for serviceable detonating caps must not exceed 1.6 ohms. Detailed procedure for testing caps is included in TM 4–220.

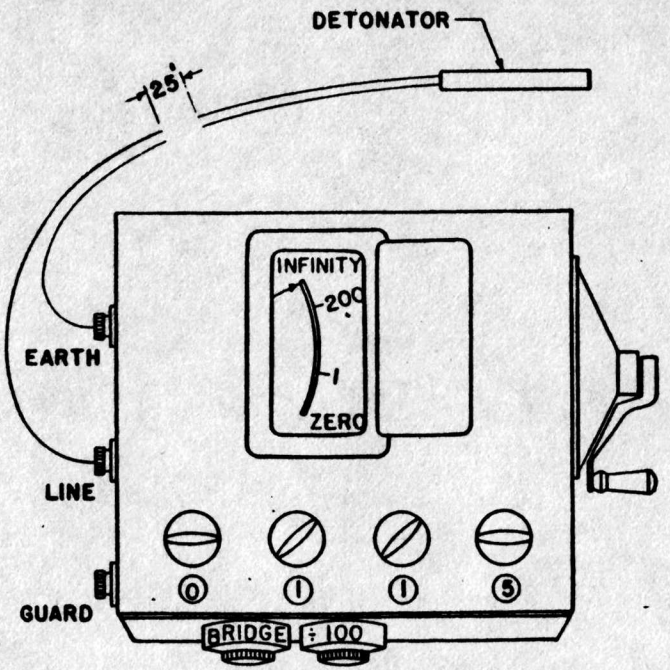


FIGURE 6.—Hookup for detonator test.

■ 62. PREPARING FIRING DEVICES.—Firing devices will be tested by the casemate personnel as prescribed in instructions issued by the submarine mine depot, and will be delivered to the loading room in serviceable condition ready for assembly.

■ 63. COMPOUND PLUGS—GENERAL INSTRUCTIONS.—*a. All models.*—Compound plugs will be stored in the mine storehouse completely assembled, except for rubber packings and brass glands. They will be rotated in use, and after each planting all compound plugs used will be completely disassembled and each part carefully examined.

b. Old model.—To provide compound plugs for target practice expenditures, 20 complete old model compound plugs will be issued to each harbor defense having a mine project. For submine practice there will be issued to each submarine mine

battery 10 complete old model submine compound plugs each fitted with a submine plug proper, and a submine fuze can.

c. M1910.—This model compound plug will not be used for target practice expenditure without the prior approval of the commanding officer, submarine mine depot.

■ 64. ASSEMBLING COMPOUND PLUGS WITH M1 CASES.—The sequence of operations for assembling M1910 compound plugs for use with M1 mine cases is as follows (see fig. 7).

a. Screw in followers to see that they fit recess.

b. Cut a piece of loading wire 4 feet long and bare the ends. Thread this wire into fuze can cap and fuze can. Screw the fuze can into the fuze can cap.

c. Screw the connecting collar down against the shoulder of the fuze can.

d. Thread a rubber packing, a brass gland, and a brass follower over the loading wire, and screw the follower into the fuze can cap with moderate pressure.

e. Place the plug proper upright in an assembling support or vise. Thread the loading wire through the hole in the plug proper and screw the assembled can into the plug proper with the spanner wrench.

f. Cut the leads of two tested detonating caps to about 12 inches and splice them together in parallel.

g. Put the detonating caps in the fuze can, holding them by the leads, and fill the fuze can to the top with TNT.

h. Screw the brass collar on the firing device case.

i. Hang the firing device and brass collar assembly in the inverted position on two of the connecting bolts.

j. Splice the upper end of the loading wire to the mine cable (black) lead from the firing device. Splice the leads of the detonating caps to the detonator (red) leads from the firing device. Tape the splices with one layer each of rubber and friction tape.

k. Place the firing device in its upright position, and screw the connecting collar up against the brass collar.

l. Place the nuts and cotter pins on the connecting bolts.

m. Thread a rubber packing, a brass gland, and a steel follower on the loading wire, and screw the steel follower into place in the base of the plug proper. *No electrical tests will be made of an assembled compound plug which contains*



FIGURE 7.—Compound plug, M3 (M1910).

TNT and detonating caps until after the mines have been planted and the line of mines is clear and safe.

■ 65. ASSEMBLING COMPOUND PLUGS WITH M2 CASES.—*a. Watertight joint.*—The sequence of operations for assembly of M1910 compound plugs with M2 mine cases is identical with that for M1 cases for steps *a* to *l*, inclusive (par. 64), except that, instead of the plug proper, the M2 mine cover cap and corrosion-resistant follower will be used. In operation (13), substitute *two* ⅝-inch cylindrical rubber packings for the one conical rubber packing used with the M1 plug proper.

b. Rosette joint.—The sequence of operations for assembling M1910 compound plugs with the M2 mine cases with a rosette type connection between the loading wire and the mine cable is as follows:

(1) Cut a piece of loading wire 14 inches long, bare both ends, and put a rosette on one end.

(2) Assemble the fuze can, fuze can cap, connecting collar, and connecting bolts as one assembly.

(3) Assemble the firing device and brass collar.

(4) Thread one end of the loading wire with the rosette on one of its ends through ⅝-inch cylindrical rubber packing, and then thread this same end through the follower insert of the cover of the M2 mine case and through the loading wire hole in the cover.

(5) Pull the wire through until stopped by the rubber packing and rosette, which should now be resting in the follower insert and against the bottom of the cover.

(6) Thread the brass follower of the fuze can cap, a brass gland, and a conical rubber packing onto the loading wire.

(7) Thread the loading wire through the hole in the bottom of the fuze can cap, and pull the loading wire upward through the fuze can and connecting collar, leaving just enough loading wire between the cover and the fuze can cap to enable the brass follower to be screwed home in the fuze can cap, thus seating the rubber packing and brass gland.

(8) The brass follower need be screwed in only moderately as this connection is intended to be only a powder-tight connection to prevent escape of TNT.

(9) Then screw the fuze can assembly into the threaded recess of the cap cover, checking to see that the loading wire is turning freely by observing the rosette in the stainless

steel insert; check to see that the rosette and rubber packing are in the stainless steel insert as far as they will go.

(10) Complete the assembly of compound plug as for the M1 mine case (see fig. 7).

■ 66. LOADING MINES WITHOUT SPECIAL EQUIPMENT.—*a. M1 mine case.*—(1) Spread a piece of canvas or a tarpaulin on the loading room floor and place a loading skid upon it.

(2) Bring a mine case from the mine storehouse to the loading room and place it upon the loading skid with the loading hole up.

(3) Remove the wooden plug, inspect the interior of the mine case for rust, moisture, or any foreign matter, removing same if discovered, and thoroughly clean the screw threads into which the plug proper is to be fitted.

(4) Put an iron bar through the holes in the loading skid and through the maneuvering ring of the mine case to prevent its tipping over or turning while the compound plug is being screwed home.

(5) Bring the required amount of TNT from the explosive storehouse. Insert a loading funnel into the loading hole of the mine case.

(6) With the aluminum or copper scoop, load the TNT into the mine case and again thoroughly clean the threads of the loading hole to prevent the possibility of TNT's being retained in the thread recesses.

(7) Place a steel retainer on the plug proper with its flat side next to the shoulder of the plug proper.

(8) Fit a rubber gasket, M2, onto the plug proper so that it rests inside the steel retainer and fits snugly into the recessed portion of the plug proper.

(9) Insert the assembled compound plug into the loaded mine case and screw it home, being careful that the rubber gasket and steel retainer are properly alined so as to give an even distribution of pressure all the way around.

(10) Rubber gaskets will be used once and only once. Steel retainers may be used as long as they are serviceable for training. New gaskets and retainers will be used when mine projects are planted for wartime use.

(11) During all operation, care must be taken to prevent damage to insulation of loading wire.

b. M2 mine case.—(1) Spread a piece of canvas or a tar-

paulin on the loading room floor and place a loading skid upon it.

(2) Bring a mine case from the mine storehouse to the loading room and place it upon the loading skid with the loading hole up.

(3) Remove the cover cap and inspect the interior of the mine case for rust, moisture, or any foreign matter, removing them if discovered; thoroughly clean the machined surface around the loading hole and the gasket groove.

(4) Screw *all* the cover holding and cap holding screws into their holes to prevent TNT from fouling the screw threads of these holes during loading and to make certain that all screws will screw all the way down.

(5) Bring the required amount of TNT from the explosive storehouse. Insert a loading funnel into the loading hole of the mine case.

(6) With the aluminum or copper scoop, load the TNT into the mine case, again thoroughly clean the machined surface and the gasket groove to remove any particles of TNT, and remove all cap screws.

(7) Fit into the gasket groove one round rubber mine case gasket, SMD No. 2966.

(8) Insert the compound plug (assembled with the steel cap cover for M2 mine cases) into the loading hole, and bring the tongue of the mine cap cover into the groove in the mine case, making contact with the mine case gasket.

(9) Start by hand each of the 12 cap screws which hold the cover in place.

(10) Tighten diametrically opposite screws with a socket wrench until the face of the cover is in contact with the face of the mine case at all points.

(11) Care must be taken not to cross thread any cap screws and to avoid twisting off any cap screws by using excessive pressure with the wrench.

(12) A watertight seal is insured when the cover is in contact with the mine case.

(13) The rubber gaskets may be used more than once for training purposes. A new gasket will be used each time a mine is planted for service practice for wartime use.

(14) During all operations care must be taken to prevent damage to insulation of loading wire.

■ 67. SPECIAL MINE LOADING EQUIPMENT.—*a.* The above procedures may be altered in loading rooms equipped with special loading facilities such as loading wells or elevated loading platforms. The steps and precautions listed in paragraph 66, plus additional steps made necessary by the nature of the special equipment, will be observed in loading mines.

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

■ 68. UNLOADING MINES.—*a. General.*—TNT may be unloaded from mines without danger when the usual precautions in handling high explosives are observed.

b. Procedure.—(1) Place a piece of canvas or a tarpaulin on the floor of the loading room.

(2) Remove the mine cap and the compound plug from the mine to be unloaded (see *d* below).

(3) By means of a triplex block raise the mine case by its maneuvering ring and pour the TNT out onto the canvas.

(4) Replace the TNT in the original boxes and close the boxes.

c. Damaged TNT.—Carefully examine the TNT when it is being removed from the mine case. If there is any indication that it has undergone a change, a detailed report will be made to the submarine mine depot.

d. Removing cap screws.—In disassembling M2 mine cases, all of the cover holding cap screws should be loosened before any are unscrewed and taken out. The expansion of the rubber gasket and the weight of the compound plug combine to develop stresses which will break a cap screw if applied suddenly.

■ 69. DISASSEMBLING COMPOUND PLUGS.—*a.* After the compound plug has been removed from the mine case, remove the follower and set the compound plug in the assembling support, firing device end up.

b. Remove the connecting bolt securing nuts.

c. Remove the setscrews and unscrew the connecting collars.

d. Raise the firing device until the joints connecting the

detonator leads (red leads) the the leads of the detonating caps, as well as the joint between the loading wire and the mine lead (black lead) come out of the fuze can.

e. Cut all three leads at the joints.

f. Remove the detonating caps, tag with date used, and place caps in the original container which will be marked to indicate the number of used caps.

g. Remove the firing device.

h. Empty the TNT out of the fuze can into the proper container.

i. Complete the disassembly of the compound plug.

SECTION XI

WATERTIGHT CONNECTIONS AND JOINTS

■ 70. GENERAL.—All submarine mine control equipment which is used under water must be protected by positive watertight joints and connections. The success or failure of the entire controlled submarine mine system depends on the quality of the watertight connections and joints. The large number of such connections and joints and the importance of these elements in submarine mining necessitate that particular attention be paid to this phase of training.

■ 71. WATERTIGHT CONNECTIONS.—A watertight connection or joint may be considered both from a mechanical or electrical point of view. A joint which is mechanically watertight prevents moisture from entering a compartment, while electrical watertightness signifies the passage of current through a submerged joint or connection without loss of insulation resistance and without developing grounds.

■ 72. SPECIAL PRECAUTIONS.—*a.* Age, sunlight, oil, grease, moisture, and heat are enemies of rubber. Rubber tape should be kept in cool, dry storage whenever practicable. Tape that is over 4 years old should be examined and tested carefully before it is used in installation of any mine project. Canvas covers or spray shields should be provided on mine planters and DB-boats for use when there is a probability of moistures falling on joints while they are being made.

b. In extremely cold climates the rubber tape should be warmed in the engine room just before it is applied to the

joint. The cable splicer and all personnel engaged in work on watertight electric joints should keep their hands free of grease, dirt, or paint. They should avoid letting perspiration fall on joints during their construction.

■ 73. TRAINING OF PERSONNEL.—Particular emphasis must be placed by responsible officers on the instruction and training of personnel engaged in making watertight connections and joints. Men become proficient in this very important phase of submarine mine work only through detailed instruction as to methods and procedure. Careful workmanship under all weather conditions will be verified by exacting inspection of practice joints. These practice joints should be submerged in test tanks or in sea water at mine wharves. Frequent insulation and conductor resistance tests will demonstrate the field efficiency of each cable splicer.

SECTION XII

PREPARATION OF EQUIPMENT FOR PLANTING

■ 74. ANCHORS.—Cast iron anchors should, in general, require no preparation for use in planting. They should be inspected however, to make sure that the mooring rope and raising rope bails are in serviceable condition.

NOTE.—All anchors which have bail recess in which a trip hook will not fit will be provided with a shackle and anchor ring. Rope grommets will not be used for tripping or picking up anchors when rings are available.

■ 75. FIGURES-OF-EIGHT.—*a.* Take a reel of tested single-conductor cable from the cable tank and place it on cable reel jacks. Cut about 20 feet from the end so as to eliminate that part which was above water during storage. Unreel the cable and cut it to the following lengths:

Mine numbers	*Length cut*
1 and 19	1,425 feet plus twice the depth of water.
2 and 18	1,225 feet plus twice the depth of water.
3 and 17	1,025 feet plus twice the depth of water.
4 and 16	825 feet plus twice the depth of water.
5 and 15	725 feet plus twice the depth of water.
6 and 14	625 feet plus twice the depth of water.
7 and 13	525 feet plus twice the depth of water.

Mine numbers	*Length cut*
8 and 12	475 feet plus twice the depth of water.
9 and 11	425 feet plus twice the depth of water.
10	375 feet plus twice the depth of water.

Tag each end of each cable with the reel number, length, and number of the mine for which it is cut (see fig. 8), and work

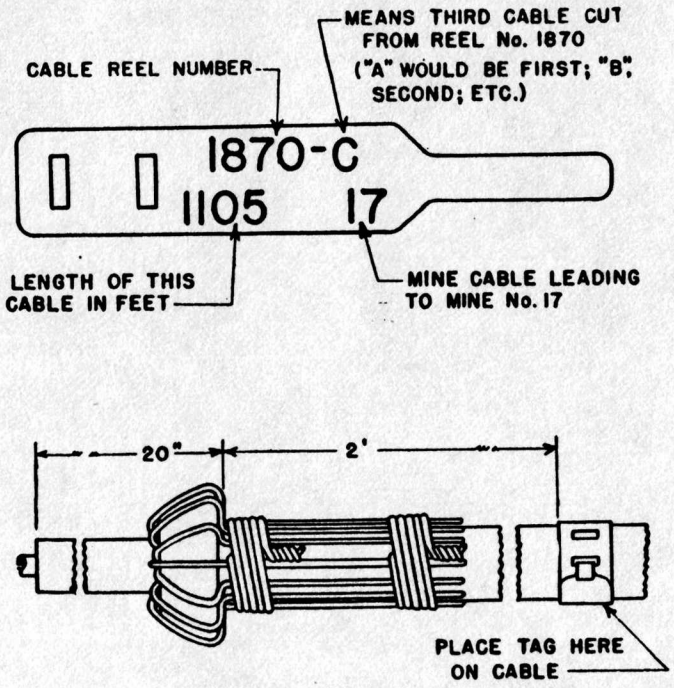


FIGURE 8.—Cable tag, band type.

a turkshead on each end of each length as described in paragraph 76.

b. Coil each length in a figure-of-eight by the use of a rack, in order to secure uniformity in the size of the coils. This rack is made of a 4- by 6-inch timber 12 feet long crossed at right angles by two 4- by 6-inch timbers 6 feet long placed 5 feet apart with each crosspiece 3½ feet from the nearer end

of the 12-foot timber. A hole is bored through each of the timbers about 2 feet from each crossing (a total of 8 holes), and a 4-foot length of pipe inserted in each hole. These pipes make the form on which the coils are made. The diameter of the holes depends upon the diameter of pipe to be used; 2½-inch pipe is better than 2-inch pipe as the larger size will not bend so easily. The holes should be large enough to permit inserting and removing the pipes easily, as the easiest way to remove the figure-of-eight from the rack is to remove the pipes. A type of figure-of-eight frame which has proved to be satisfactory is shown in figure 9. One coil of a figure-of-eight is approximately 26 feet.

c. A cable must be coiled for planting so that both ends are free, one end to be passed to the DB-boat and the other to be carried forward on the planter and attached to the mine. This is accomplished by starting the figure-of-eight about 135 feet from the mine cap end which is the approximate length required to run forward to attach to a mine when using a mine planter. Coil the cable on the form, spreading out the laps at the center to reduce the height at that point, until the entire length is coiled. Lash the outer loops and the center of the figure-of-eight, leaving ends of the lashings of sufficient length to lash the 135 feet of cable remaining uncoiled. To retain the coil in proper shape for planting, each figure-of-eight is securely tied with 5 or more lashings. Coil the 135 feet of cable for the mine end on top of the coil and lash it with the ends of the lashings. Use old measuring and heaving lines for lashing cable (see fig. 10).

d. Test the figure-of-eight for continuity of circuit and grounds by the use of a bridge-megger, before placing them aboard the planter. For instructions covering the testing of cables see TM 4–215.

e. After the cable has been coiled and tested, it should be handled carefully so as not to disarrange the various coils in the figure-of-eight. *Never allow the insulated conductors to hang loose* but have someone carry them. Much trouble is caused by letting the turkshead bob around and strike objects, which often breaks the conductor and injures the insulation.

f. Figures-of-eight are raised and lowered into the cable tank by means of a cable yoke, which is made locally. One type of yoke consists of an 11-foot length of 4- by 6-inch

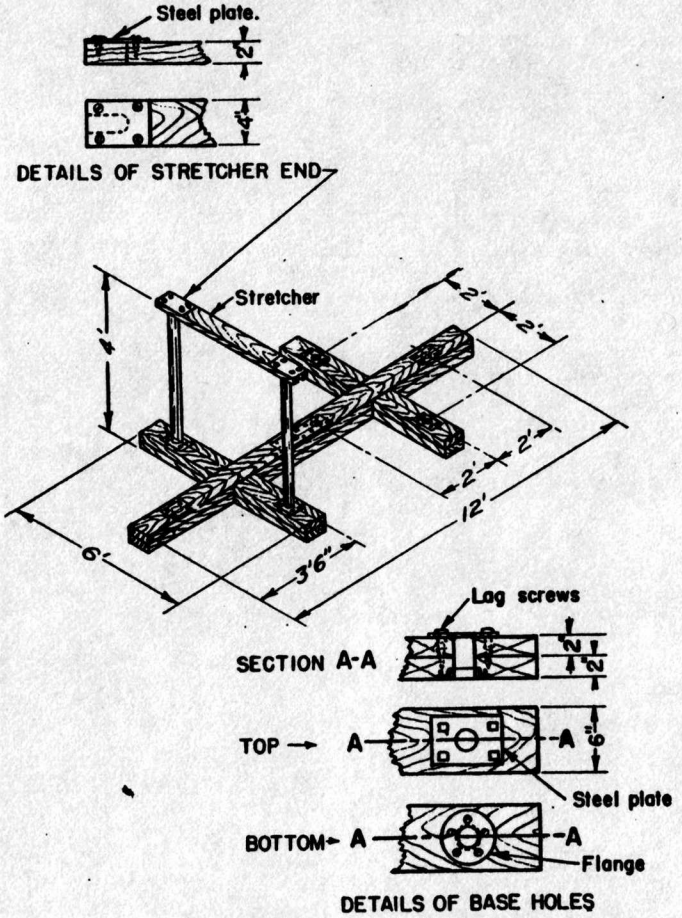


FIGURE 9.—Figure-of-eight frame.

scantling with three hooks on the lower side (one near each end and one in the center) and a ring on the upper side at the center for hoisting. The three lower hooks, which are secured to the scantling by bolts and rings, hook into the lashings on the cable. Washers should be placed under the bolt heads. A traveling crane with a triplex block is used to raise and

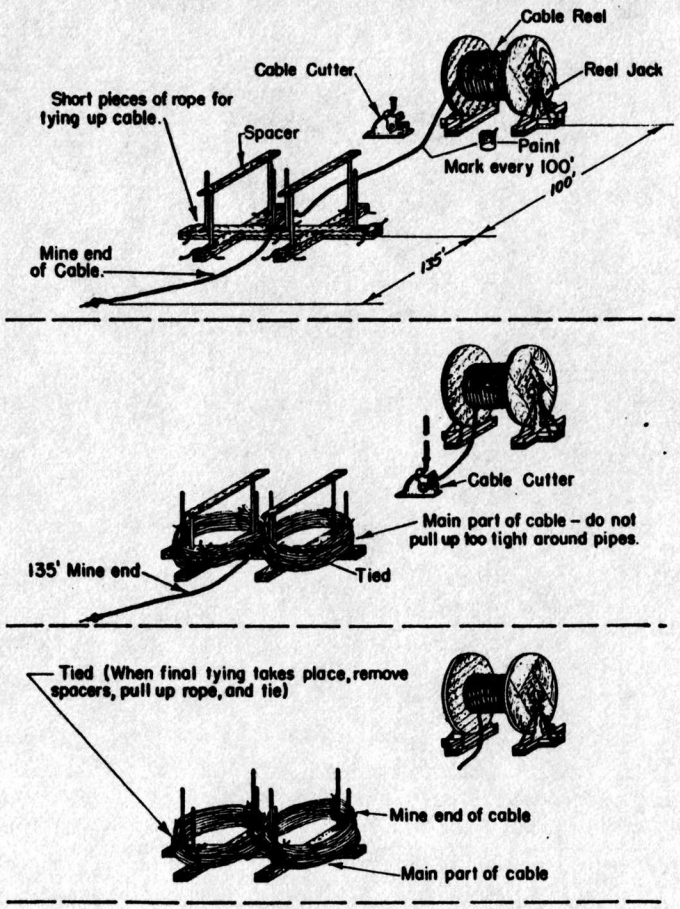


FIGURE 10.—Forming a figure-of-eight.

lower the yoke figure-of-eight. A yoke which has a spreader arm of 4- by 6-inch timber at each end with 5 hooks for supporting the figure-of-eight will handle cable with less danger of disarranging the coils. This type, shown in figure 11, requires more materials for construction; however, it is decidedly better for handling mine cables that have been used more than once.

■ 76. MAKING A TURKSHEAD.—Trim the ends of the cable square and place a wrapping of four or five turns of friction tape about 20 inches from the end (see fig. 12). Slip a turkshead collar, flat side first, on the cable until it rests against the friction tape wrapping. Bend back regularly the armor wires

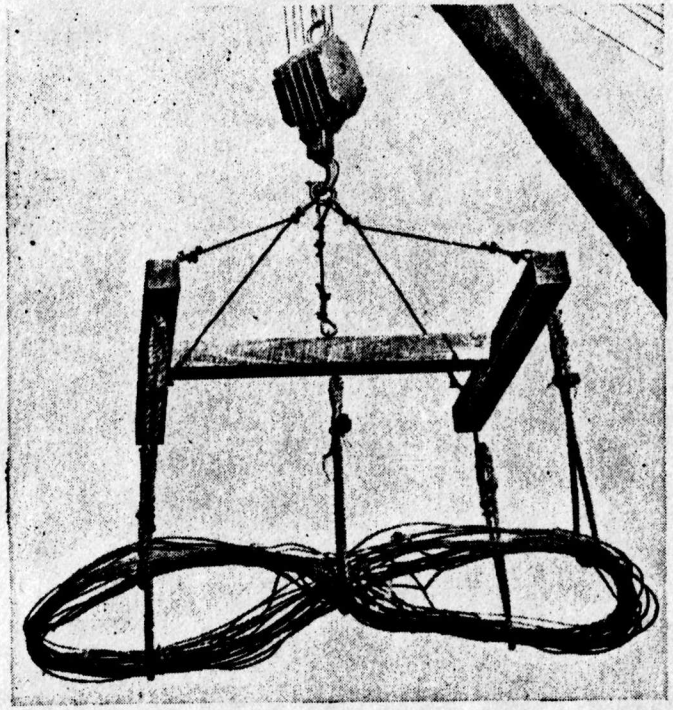


FIGURE 11.—Yoke for handling mine cables in figure-of-eight form.

over the collar. Cut all the armor wires with pliers so as to remove all but about 8 inches from the strands. Bend the armor wires separately to fit the collar closely, making two right angles with the pliers, and arrange the ends smoothly along the cable. Wrap with No. 14 galvanized wire from the turkshead collar back along the cable to cover the bent back

armor wires. The wrapping may be made to conform to either type shown in figure 13. The primary function of the wire wrapping on a turkshead is to hold the bent back armor wires until the cable end is inserted into a cable clamp or slot.

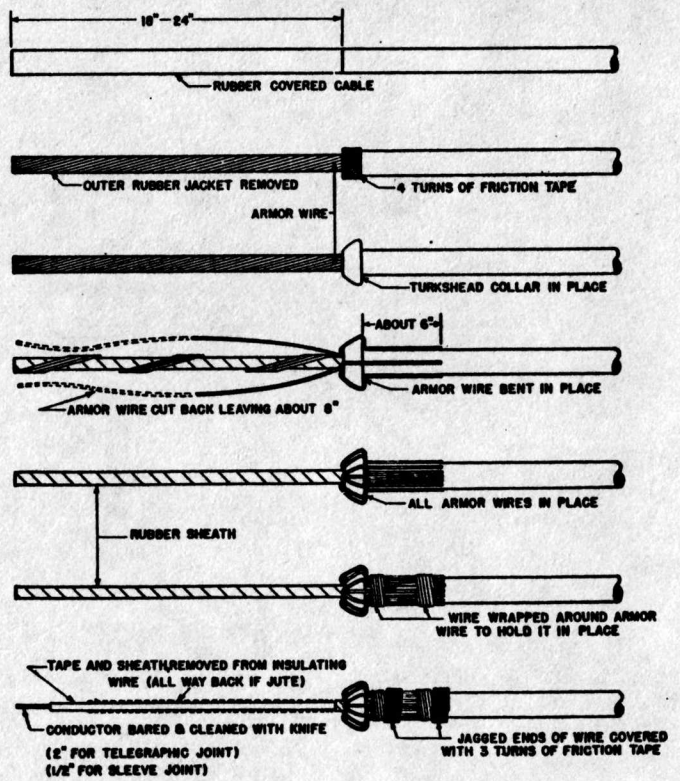


FIGURE 12.—Steps in making a turkshead.

Thereafter this wrapping does no actual work. The method of wrapping turksheads which uses the smaller quantity of #14 galvanized wire is favored from the standpoint of time, service, and economy of materials.

■ 77. CARE AND USE OF FIGURES-OF-EIGHT.—Figures-of-eight of submarine mine cable which have been cut for previous plantings and which are in storage in cable tanks should be used insofar as possible before cable stored on reels is cut. Figures-of-eight of cable will be tested for conductor and insulation resistance when picked up, and any faults will be cut out and repaired. These cables should be carefully coiled and lashed with ⅝-inch manila line before being stored in the cable tank. The ends of the cable should be secured above the water level and tagged for easy identification. Whenever figures-of-eight of cables stored in cable tanks are to be

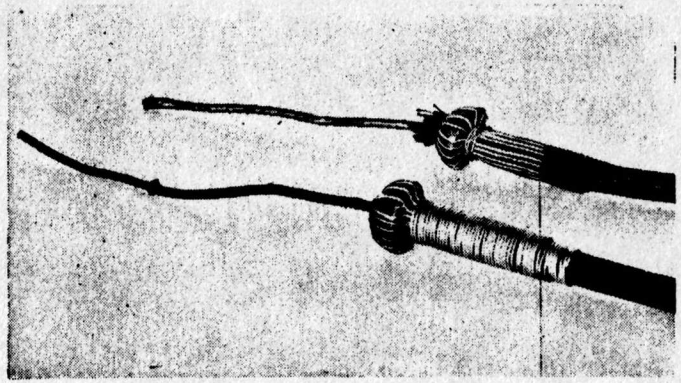


FIGURE 13.—Turksheads (two types of wrapping).

used, each cable will be tested for conductor and insulation resistance and will have new turksheads made on the ends.

■ 78. MOORING ROPES.—Mooring ropes of the proper size and length should be previously prepared (see fig. 14). Each mooring rope will be equipped with thimbles and clips and the ends of the ropes will be served with marline or wire. They should be coiled and lashed and tagged with the appropriate mine number.

■ 79. RAISING ROPES.—When the variation in depths of water is not in excess of 20 feet, raising ropes for each group of mines may be cut to the average depth of water in which the

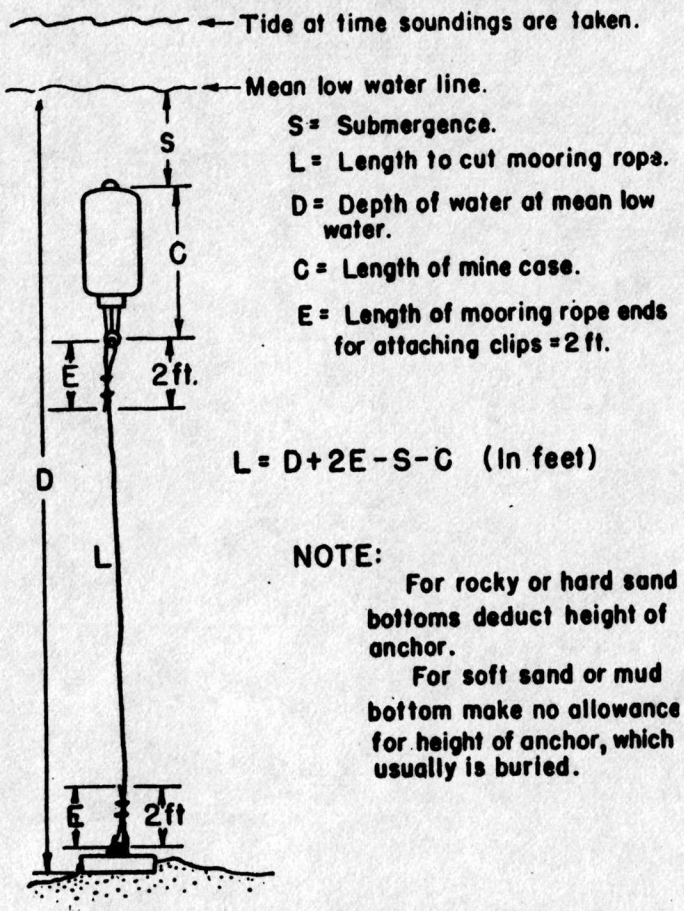


FIGURE 14.—Computing length to cut mooring ropes.

group is to be planted plus 100 feet to allow for carrying the rope over the cathead and around the gypsy head of the winch when picking up mines. These ropes will be fitted with thimbles and clips on one end for attachment to the anchor and both ends will be seized with marline or wire.

■ 80. SHACKLES.—The shackles will be carefully inspected to make sure that the pins will fit and that the necessary cotter pins are available and serviceable.

NOTE.—All cotter pins are made with one split half slightly longer than the other. This is to facilitate spreading the pin. New cotter pins for shackles will be used each time the shackle is planted with underwater equipment.

■ 81. MINE BUOYS.—The tactical numbers of each buoy will be painted with black paint on each red mine buoy so as to permit easy identification of mines. A steel marking buoy, cast iron anchor, and wire mooring rope twice the length of the deepest water in the field will always be available for immediate connection to a submarine cable in case it becomes necessary to let the cable go before laying operations are completed.

■ 82. BUOY ROPES.—Buoy ropes of either 60- or 120-foot lengths will be cut from ⅝-inch manila rope, one for each mine. The length to be cut will depend upon local hydrographic conditions.

■ 83. MARKING BUOYS.—Steel marking buoys will be prepared and painted with appropriate markings. For ready location in the water the upper half of the buoy is painted yellow. After testing, the test plug is replaced by the steel buoy plug and buoy cap. The test plug will be screwed into place and the assembled buoys tested for watertightness. (See fig. 21.)

SECTION XIII

PREPARATION AND USE OF SUBMINE EQUIPMENT

■ 84. MATERIAL USED.—*a. Compound plugs.*—Old model compound plugs, altered so as to be suitable for use with submines, are supplied by the submarine mine depot on the basis of 10 plugs, submine, SMD No. 3400–A, per mine battery.

b. Mine cases.—For use as submine, No. 32 spherical mine cases or, if these are not available, the smallest cases on hand will be used.

c. Other equipment.—Mine cables, mooring ropes, raising ropes, and other equipment required for use in planting submines will be the same as is used in service mining and training operation.

■ 85. PREPARATION OF COMPOUND PLUG FOR SUBMINES.—*a. Test of firing device.*—Firing devices for use with submines will be tested and delivered to the loading room in serviceable condition by the casemate personnel.

b. Cleaning of compound plug.—Compound plugs will be thoroughly cleaned by the property section and turned over to the loading room in serviceable condition ready for assembly with firing devices.

c. Assembly of submine compound plug—procedure A.—(1) Disassemble the fuze can from the fuze can cap.

(2) Cut two pieces of loading wire about 17 feet long and one piece about 3 feet long.

(3) Attach the 3-foot piece of loading wire to the mine lead (black lead) of the firing device and tape the joint.

(4) Attach the 17-foot pieces of loading wire, one to each detonator lead (red lead) of the firing device and tape the joints.

(5) Thread all three loading wires through the fuze can and screw it onto the firing device.

(6) Push the free ends of the 17-foot pieces of loading wire through the two holes in the sides of the fuze can until there are only a few inches of slack between the taped joints and the holes.

(7) Coil up these 17-foot lead wires.

(8) Thread the 3-foot piece of loading wire through the follower recesses in the fuze can cap and the plug proper.

(9) Screw the fuze can and firing device thus assembled into the fuze can cap, being careful not to twist off the loading wire where it passes through the follower recess.

(10) Uncoil the 17-foot leads and pass them through the two follower recesses which are on each side of the center hole.

(11) Assemble rubber packings, glands, and steel followers on each wire and screw followers into recesses, being careful not to twist off the lead wires by excess tightening of the followers.

(12) Recoil the 17-foot leads.

(13) Proceed to assemble the compound plug with a mine case, being careful not to bruise or injure the loading wires with the special socket for plugs proper.

(14) After the mine cap has been fastened into place,

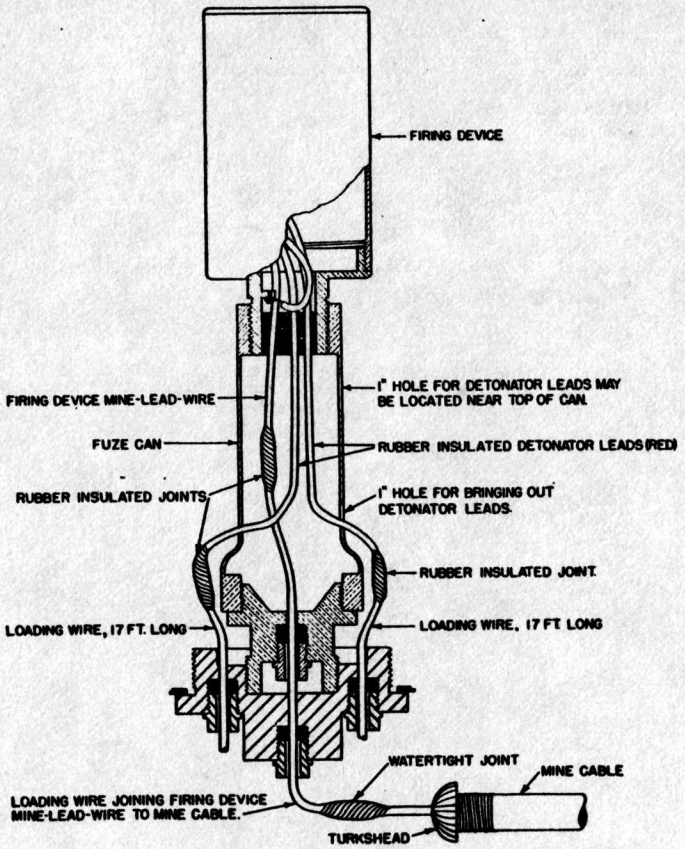


FIGURE 15.—Firing device and compound plug assembled for submine practice.

bring the 17-foot leads out through the handhole (hole over which side or center apron fits) in the mine cap.

(15) Wrap friction tape around the two leads where they come through the handhole and at point of contact with the flange to prevent chafing.

(16) Thumb-joint the ends of all three leads (see fig. 16).

d. Assembly of submine compound plug—procedure B (fig. 15.).—(1) Cut two pieces of loading wire about 17 feet long.

These wires will be used to connect the detonator leads from the firing device to the electric detonator caps in the bottle containing TNT. When the ends have been bared they are threaded through the two outer holes in the plug proper.

(2) A 3-foot length of loading wire is connected to the mine lead (black) of the firing device by a rubber taped telegraph or sleeve joint.

(3) The mine lead is then carried through the fuze can and out the bottom of the plug proper through the center hole.

(4) Screw the firing device into the fuze can, with the three wires inside the can. Care must be exercised not to twist off the wires. When the firing device is in place, tighten the setscrews.

(5) The detonator leads (red) are then "fished out" through the holes in the side of the fuze can.

(6) These red leads are attached to each of the bared ends of the 17-foot wire by a telegraph or sleeve joint which is wrapped with rubber tape.

(7) Watertight connections by use of a rubber packing, brass gland, and follower, are made in the plug proper on each of the three wires. Check the depth of the follower recess to see that the rubber packing will be compressed sufficiently to make a watertight joint.

(8) Clean the threads and the machined surface around the threads of the mine case.

(9) Insert the assembled plug in the mine case, coil the wires on top of the plug, and screw it home in the usual way, taking care not to injure the insulation at any point on the wires. This can best be done by passing the mine cable lead wire through the center of the wrench, then coiling both the mine cable and detonator wires. One man holds these coils as the other tightens plug.

(10) Pass the detonator leads through the mine cap from the inside.

(11) Fasten the cap to the mine in the usual manner. At this time it is advisable to place friction tape on the detonator leads at the places where there is likely to be chafing from the center rim of the mine case and at the handhole of the mine cap.

(12) A temporary thumb joint is made on the mine cable

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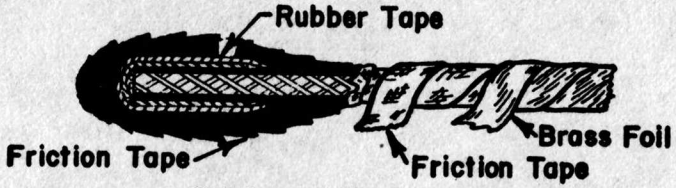
end in order to keep the end dry, should the mine stand in the rain (see fig. 16).

■ 86. PREPARATION OF SUBMINE.—*a.* Obtain a clean, strong glass, quart bottle which has a small mouth and neck. An empty liquor bottle is satisfactory.

b. Cut lead wires on detonators to 3 inches. Clean wires and connect in parallel in same manner as for loading service mines.



① Start. Remove friction tape and brass foil (if any) from cable before making thumb joint.



② Cut-away of finished joint.



③ Finished joint.

FIGURE 16.—Thumb joint.

c. Bare about 1 inch on the two detonator wires (17-foot length). Connect these wires by a rubber-taped telegraph or sleeve joint to the detonators.

d. With the small scoop and funnel fill bottle one-quarter full of TNT. Carefully insert detonators.

e. Finish filling bottle with TNT, lightly tamping the explosive with a wooden stick. Leave a 3-inch space in neck of bottle for the stopper.

f. Wrap the secondary wires near the neck of the bottle with rubber tape in such way that the wrapping will serve as a cork for the bottle. Force this rubber cork tightly into the neck of the bottle so as to make the bottle watertight, and secure the cork to the bottle with friction tape in such way that any strain on the leads will not loosen or extract the cork. It is advisable to take two turns around the bottle with the detonator wires and tape these wires to the bottle with several turns of friction tape (see fig. 17).

g. Wrap the bottle of explosive with burlap to prevent breaking, and attach the wrapped bottle to an improvised buoy of sufficient size to keep the bottle and attached wires afloat.

h. A piece of 2- by 6-inch planking about 2 feet long makes a satisfactory float for the charge of TNT in the bottle. Bore two or more holes through the plank for marline, which is used to lash the burlap-covered bottle to the plank. The burlap may also be tacked to the float near both ends of the bottle by small nails. Attach this improvised buoy to the mine bail with an old heaving line, or its equivalent, a hole having been bored through one end of the buoy for this purpose. The length of the submine mooring line should be such that there will be no pull on the detonator wires leading to the bottle.

i. Lash the secondary leads with marline to the maneuvering ring of the mine case.

j. Place the bottle of explosive in a safe place near the mine. Attach the regular mine buoy to the mine in the usual way. When handling the mines, both before and while planting, take care not to injure the exposed wires (see fig. 17).

■ 87. PLANTING SUBMINE PRACTICE.—*a.* The planting procedure is the same as for planting service mines. Care must be exercised to prevent breaking the bottle while throwing the submine clear of the mine planter. One man should be detailed to have the submine on the rail when the command is given to "remove locking pin." Only when the mine has actually struck the water should the submine be thrown clear of the side of the planter and the mine itself. As an added precaution, the buoy blocks should be kept clear of the submine when these are allowed to fall into the water.

b. If, for any reason, it is necessary to pick up a mine with a submine attached, the submine will be cut loose by a yawl

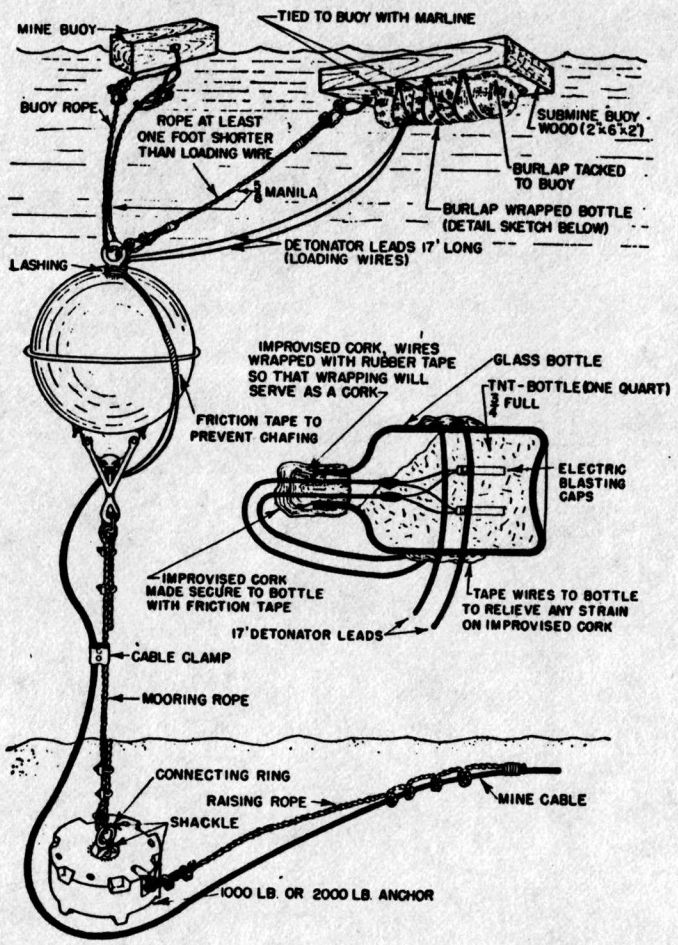


FIGURE 17.—Planted submine.

and brought aboard the planter before actual picking up operations begin.

■ 88. DISPOSITION OF EQUIPMENT AFTER SUBMINE PRACTICE.—*a.* All equipment used in connection with submine practice

will be cleaned and replaced in proper storeroom on completion of work on the water.

b. Any unused TNT will be replaced in the box from which the explosive was taken and the box stored in the magazine.

SECTION XIV

LOADING THE MINE PLANTING FLOTILLA

■ 89. RESPONSIBILITY OF FLOTILLA COMMANDERS.—*a. Mine planter commander.*—The mine planter commander is responsible for the proper and complete loading of the mine planter when engaged in submarine mine work. Matériel, tools, and supplies are loaded by the planting section, assisted by the loading and property sections.

b. Mine property officer.—The mine property officer is responsible for delivery in serviceable condition to mine wharf or small boat landing area all submarine mine equipment, tools, and supplies required to plant and maintain controlled submarine mines.

c. Personnel.—The crew of the mine planter and the planting section normally load the mine equipment, tools, and supplies required to plant each group of mines. However, when the expeditious loading of the mine planter is necessary to insure maximum available time of the planter in the mine field, all personnel of the mine planter and mine batteries not actively engaged in essential mine work will be available to assist in loading operations.

d. Distribution box boat coxswain.—The coxswain of the DB-boat is responsible for the loading of his vessel with all tools, supplies, and equipment for work in the mine field, and equipment required by Department of Commerce Regulations for safety of personnel.

e. Yawl boat coxswain.—Each coxswain of a yawl boat is individually responsible that, whenever his boat leaves the boathouse, it contains a complete and serviceable set of the tools, stores, and equipment used on yawl boats in mine work and the equipment required by the U. S. Department of Commerce, Bureau of Marine Inspection and Navigation.

■ 90. ARRANGEMENT OF MATÉRIEL ON PLANTER.—*a.* Due to the difference in size and design of the various mine planters in service, it is impossible to lay down any fixed deck arrange-

ment of matériel for planting mines. Therefore, loading will be done in the most suitable manner possible with regard to local conditions and the design of the mine planter concerned.

b. Any loading of a mine planter must permit the mine cases and anchors to be available to their respective davits in the order in which they are to be planted. Similarly, mine cables must be placed on the aft deck so as to be available in the order of planting. Ordinarily mines Nos. 10 to 19, inclusive, are planted from the left side of the vessel and mines Nos. 1 to 9, inclusive, are planted from the right side. They are planted beginning with No. 10 and working outward from the center, alternately on each side to the flanks. Therefore mines and cables must be loaded in inverse order of planting (on left side, port, load Nos. 19 to 10, in that order, and on right side, starboard, load Nos. 1 to 9, in that order).

c. Mooring ropes and raising ropes must be loaded in inverse order of planting similar to mines and cables.

d. Clips, clamps, thimbles, shackles, marline, and other small articles should be so placed on the deck as to be readily available at the point of use.

e. Mine planter loading plans.—Sample arrangements of matériel on decks of planters are shown in figures 18 and 19. These arrangements are not mandatory and may be altered to meet local requirements.

■ 91. COORDINATION OF LOADING ACTIVITIES.—*a.* Loading a mine planter is composed basically of three steps—loading cables on the after deck with a boom or derrick, loading mines and anchors on the forward deck with a boom or derrick, and loading of the remainder of the equipment by hand. No detailed plan for the coordination of these activities can be set up, as this is dependent upon the power equipment available.

b. Where mine wharves are equipped with loading cranes, the after deck may be loaded with the dock crane at the same time that the forward deck is being loaded with the boom of the planter. Light equipment may be loaded by hand while the derrick and boom loading is going on. Where mine wharf derricks are not installed, local personnel will conduct the loading of the flotilla in the most expeditious manner practical.

■ 92. LOADING THE MINE PLANTER.—*a. Mine cables (figures-*

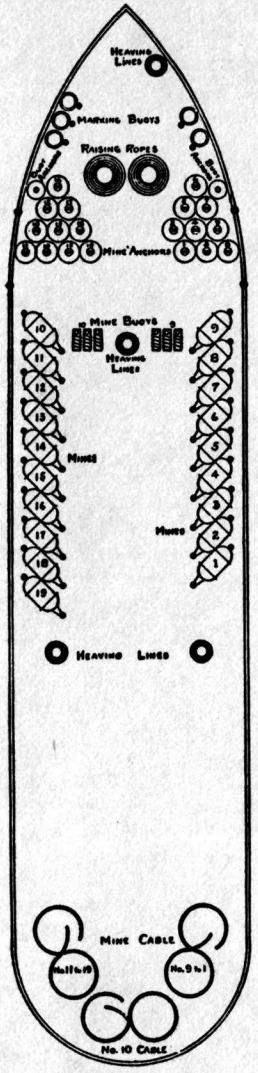


FIGURE 18.—Arrangement of matériel on deck of 165-foot mine planter.

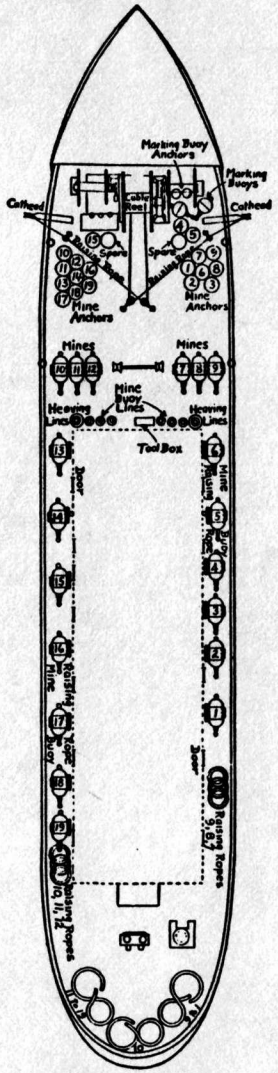


FIGURE 19.—Arrangement of matériel on deck of 172-foot mine planter.

of-eight).—(1) Carry the single-conductor cables, coiled and lashed in figures-of-eight to the after deck, or lower them to the after deck by means of the cable yoke and a derrick if available. Place coils Nos. 1 to 9 in one pile on the starboard side (right) with No. 1 on the bottom (loaded first) and No. 9 on top (loaded last), and Nos. 11 to 19 in one pile on the port side (left) with No. 19 on the bottom (loaded first) and No. 11 on top (loaded last). In piling figures-of-eight on each side of the after deck, as described above, the top coils should be so placed that the pile is pyramided inboard to prevent cables from sliding over the side; also, enough space should be left in the rear center of the after deck to permit placing one figure-of-eight clear of the two piles. No. 10 cable should be

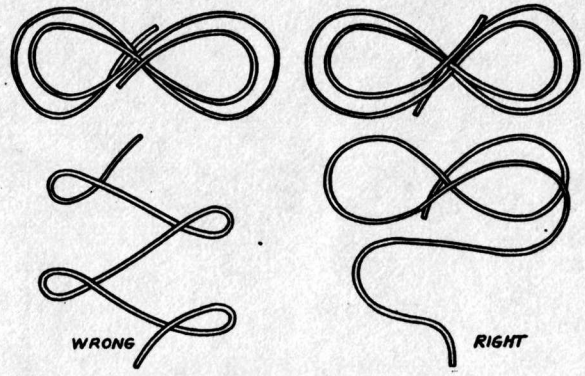


FIGURE 20.—Paying out mine cables.

so laid in this space as to permit it to uncoil properly, without kinks, over the stern rail to the DB-boat (see fig. 20).

(2) As each coil is placed in position on the planter, check both ends to see that they are properly tagged, then carry the mine cap end forward on the cable brackets close to the mine and lash each cable to each bracket with marline. To do this, use a piece of marline for each bracket long enough to lash each cable, in succession, to the bracket by means of a square knot. This permits each cable to be removed from the brackets by cutting the lashings of that particular cable without loosening the adjacent cable. Care should be taken that

cables do not cross under in the process of carrying them forward on the cable brackets.

b. Mine cases.—As loaded and completely assembled mine cases are brought to the mine wharf, they may be loaded onto the deck of the planter by means of its own boom. In this operation, as with the loading of mine cables, due care must be taken in arrangement of matériel on deck so that the mine cases will be available to the mine davits in order of planting. When lifting mine cases from the wharf and lowering them to the deck of the mine planter, guidelines of ⅝-inch manila should be attached and properly manned to prevent swinging and to facilitate the placing of cases in their proper place. They should be lowered gently, *not dropped.*

c. Anchors.—In general, all anchors in a group will be of one size and therefore will be interchangeable. Consequently, the only precaution in loading is to make sure that all anchors can be reached by the load chain on the anchor davit block. Exceptions to the above are—

(1) Service target practice, where automatic anchors, M1910, are used as dead weight anchors for those mines which are to be fired.

(2) Projects which require use of old class B (2,800-lb.) or M1916 automatic anchors without automatic features as substitutes for cast iron anchors.

d. Other equipment.—Mooring and raising ropes, mine buoy ropes, tools, and other equipment may be carried on board the mine planter by the members of the planting section. These items are normally not large or heavy enough to require the use of power loading equipment. TM 4–220 contains a check list of supplies, tools, and equipment required on the various units of the flotilla.

SECTION XV

OPERATIONS OF MINE FLOTILLA

■ 93. CYCLE OF PLANTING.—The complete cycle of operations involved in planting one group of mines is listed below in the sequence in which they should be performed.

a. Lay out, with marking buoys, the line of mines and the location of the distribution box.

b. Lay the shore cable.

c. Load the mine planter and the DB-boat with the neces-

sary underwater equipment for one or more groups of mines.

d. Plant the group of mines, and indicate the position of each mine to the range section, which plots position of each mine immediately after it is planted.

e. Test the mines of the group with operating power only.

f. Complete all permanent electrical connections at the selector box, and close selector and distribution boxes.

g. Lower the distribution box to the bottom.

■ 94. EFFECT OF TIDES ON MINE PLANTING.—Normally mine planting will be done with tide and current running toward the distribution box from the line of mines. In an emergency situation, however, it is possible, though often dangerous, to plant mines during either tidal condition. In harbors where currents are less than 2 miles per hour, planting with the tide may be tedious and difficult work, but not dangerous. Where currents are in excess of 2 miles per hour decisions to plant with the tide should be made only after due consideration of the saving of time as opposed to the danger to equipment and operating personnel involved.

■ 95. METHODS OF PLANTING UNDER VARIOUS TIDES.—In the next several sections two sets of conditions have been considered, and two different procedures of operations have been drawn up. The first procedure is applicable in any harbor defense; the second is applicable only in those harbor defenses where tide and current are not important factors. Only a detailed study of local conditions, both hydrographic and tactical, will determine which system is to be used. The essential differences between the two procedures are as follows:

a. In procedure No. 1 both channel limits and at least four groups of mines in the projects are completely marked out before any other operations are attempted. After these groups are marked out, the shore cable to each is laid. After both marking of the field and laying of shore cable is completed, the remainder of the time is devoted to planting the mines with a view to taking as much advantage as possible of favorable hydrographic conditions.

b. In procedure No. 2, on the other hand, each day's work represents the complete cycle of operations as listed in paragraph 93 necessary to plant one complete group of mines.

SECTION XVI

DUTIES OF MINE FLOTILLA

■ 96. TACTICAL WORK OF EACH VESSEL.—Before attempting to discuss the operation of a flotilla, a detailed knowledge of the duties to be performed by each craft and their capabilities and limitations is necessary.

a. Mine planter.—(1) Locates approximate position of, and plants, marking buoys necessary to lay out a mine field, if conditions are such that a DB-boat cannot perform this operation. The use of the DB-boat for this purpose is desirable from a standpoint of economy. Furthermore, a mine planter, because of its size and weight, cannot drag buoys and their anchors with any degree of accuracy, and it is desired to locate the marking buoys with the maximum precision.

(2) Lays, repairs, and picks up shore cable.

(3) Plants, repairs, and picks up mines, anchors, and mine cables.

b. DB-boat.—(1) Under favorable conditions this boat may locate the positions of and plant control buoys.

(2) It is used as a working platform at sea for attaching the cable's turksheads to the distribution box and for making watertight joints between mine cables and the selector box leads, and the shore cable and the selector box lead.

(3) It is used to lower or pick up the assembled selector box, cables, and distribution box for planting, repairing, and picking up a group of mines.

(4) May be used to move individual planted mines to rectify alinement of the line of mines.

(5) It may serve as a patrol boat after the field is planted in projects where Navy patrols are not available.

c. Mine yawls.—(1) Assist mine planter and DB-boat in laying out mine field.

(2) Obtain submergence of each mine planted.

(3) Assist range section in locating and plotting the position of each mine and control buoy.

(4) Assist mine planter in planting, repairing, and picking up mines.

(5) Act as safety boat during all operations on the water.

(6) Serve as a utility boat in the transfer of men and supplies; carry messages between planter, DB-boat, and shore installations.

(7) Under very favorable conditions mine yawls may be used to install junction boxes and make watertight joints between lengths of shore cable.

(8) Take soundings on line of mines if no fathometer (sonic depth finder) is available on planter.

(9) Assist in landing shore cable at or near cable hut.

(10) Drag grapnel for locating cables and lost equipment. (See fig. 33.)

■ 97. AVAILABLE VESSELS.—The maximum number of boats available at any time will vary with the organization of the flotilla. For operations with a mine planter built prior to 1941, the flotilla includes one mine planter, one DB-boat, and three mine yawls. For operation with planters built after 1941, the flotilla includes 1 planter, 2 DB-boats, and 5 mine yawls. Mine planters built prior to 1941 can carry but one group of mines. Those built after 1941 are able to carry from two to four groups depending on the size of mine cases and anchors. This type of planter is best adapted for planting in the manner described as procedure No. 1.

SECTION XVII

PROCEDURE FOR MINE PLANTING OPERATIONS

■ 98. MINE PROJECT.—*a. Approved project.*—For each harbor which has a controlled submarine mine installation there has been prepared by a joint Army-Navy planning board a project which describes, with other elements of the defense, the size, location, and type of controlled submarine mine fields. This project is classified as a "secret" document and is usually kept in the harbor defense commander's safe. The officers charged with installation of the controlled mine fields will be provided details regarding the location of each mine group, and information regarding the nature and location of any other elements of the underwater defense which may affect the mine planting operations. This information is best provided by making an overlay from the approved project. This overlay must be studied in connection with large scale harbor charts with a view to determining the effect on planting operations of local hydrography, cable routes, buoys, obstructions, and installations installed or to be installed by the United States Navy. The local artillery engineer should be

consulted regarding changes in fire control and communication cable locations, and for information concerning harbor improvement dredging operations. The submarine mine depot will be informed of any changes which affect the requirements for submarine mine equipment. Any changes that permanently affect the project will be made the subject of a letter to the harbor defense commander, requesting that action be instituted for the purpose of making a change in the approved project.

b. Locating groups.—Transpose the project to harbor chart and mark the position of No. 10 mine of each group. On this chart also locate the position of base end stations. With the use of a parallel rule or two drawing triangles, determine the true (use compass rose on chart and true bearings) azimuths and locate positions on plotting board. Check distances and, if necessary, relocate No. 10 mine so that tactical frontage is covered. The plotting board azimuths are much more accurate than those obtained from chart; therefore, record the plotting board azimuths and keep records in safe place for future reference. The chart and data must be kept in a safe when not in use.

c. Cable routes.—(1) The proper routing of shore cable is very important and in selecting the location for cables the following factors will be considered:

(*a*) Existing cables and underwater installations.

(*b*) Cable installations which will be made to complete Army and Navy projects in the harbor area.

(*c*) Placement of shore cables, wherever practicable, should be separated by a distance of 50 or more yards. The repair and replacement of shore cables is exceedingly difficult where cables are not separated by sufficient distance to prevent tangling.

(*d*) Depth of water. Before planting any shore cable, the mine planter should run the proposed course at low water to check the depths and to ascertain whether all turns or changes in direction can be made when actually laying shore cable. The course of the mine planter will be plotted by the range section and the actual length of cable required for planting a shore cable will be determined on the basis of the course of the planter.

(*e*) Obstructions, rocks, and reefs. The shore cable routes

will be selected to avoid areas where submarine mine shore cables may be damaged by fouling, abrasion on rocks or dumping areas, or cut by ice jams.

(2) Arrangements with other Government agencies responsible for fixed obstructions, navigation beacons, or channel markers must be made before planting, in order to establish priorities, distances, and procedures where two or more installations occupy the same water area.

■ 99. LAYING OUT FIELD AND PLANTING, PROCEDURE No. 1.—*a. Numbering mines.*—Mines are numbered facing outward, the group of mines being numbered from left to right and from front (out) to rear (in). The mines of a group of mines are numbered from left to right. To indicate a mine, first give the group of mines number in Roman numerals and then the mine number in Arabic, thus: group III, mine No. 10 (see figs. 21 and 22).

b. Marking out mine field.—In this procedure of operations all or several groups of mines of the project are marked out one after the other. Three control buoys planted on the line of mines at approximately the positions of Nos. 1, 10, and 19 mines must be in position before a group can be planted. Because of the much greater carrying capacity of the mine planter it is preferable to use it rather than the DB-boat in this procedure. It should, however, be assisted in this work by the latter boat and at least one mine yawl.

c. Equipment loaded aboard planter.—For each group to be marked out, load planter with—

4 marking buoys, SMD No. 2110 (when not available use No. 32 mine cases), 3 with tops painted red for marking the line of mines, and 1 black to mark position of distribution box buoy (see fig. 21).
4 cast iron anchors, 1,000 pounds, or heavier if required.
4 mooring ropes to secure buoys to anchors (see fig. 21).
1 measuring line (No. 16 cotton line or $\frac{5}{16}$-inch diameter manila rope) with reel and frame.

If any trouble is anticipated, an extra buoy, anchor, mooring rope, marline, shackles, and tools should be included.

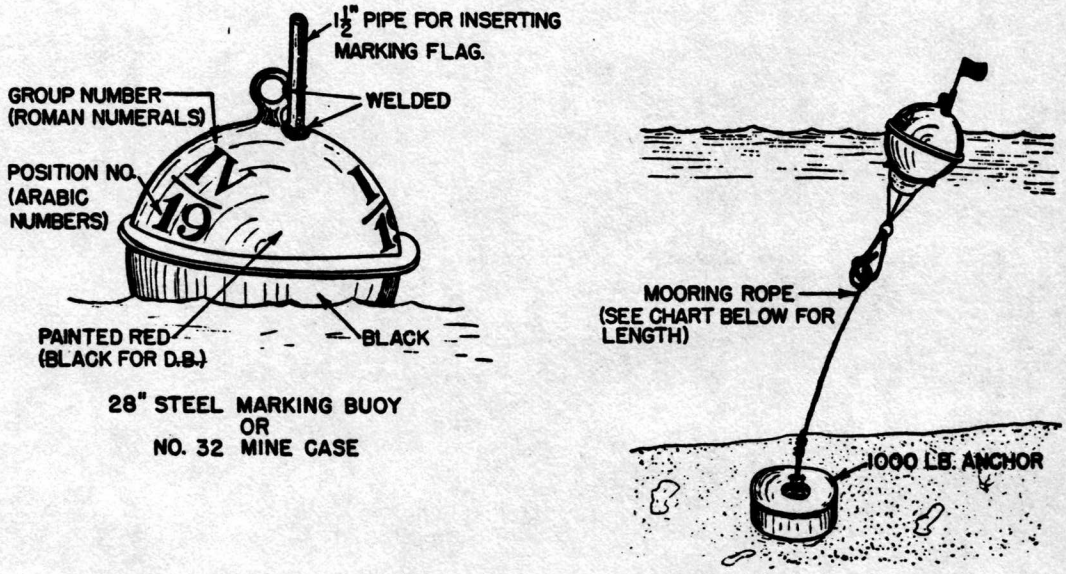
d. Mine planter proceeds to field.—The planter, with the above equipment, accompanied by the DB-boat and one mine yawl equipped with at least five marking flags (one for each

buoy and one for use on yawl), proceeds to the mine field. Experience has shown that the master of a mine planter, using the most accurate sextant and protractor issued to a mine planter, and using bearings to three landmarks taken from a harbor chart on which the desired location of a buoy has been plotted, can come within 50 yards of the desired point in dropping a buoy, but such a procedure is a lengthy and tedious one. A method which works better and requires less time is given in *e* below.

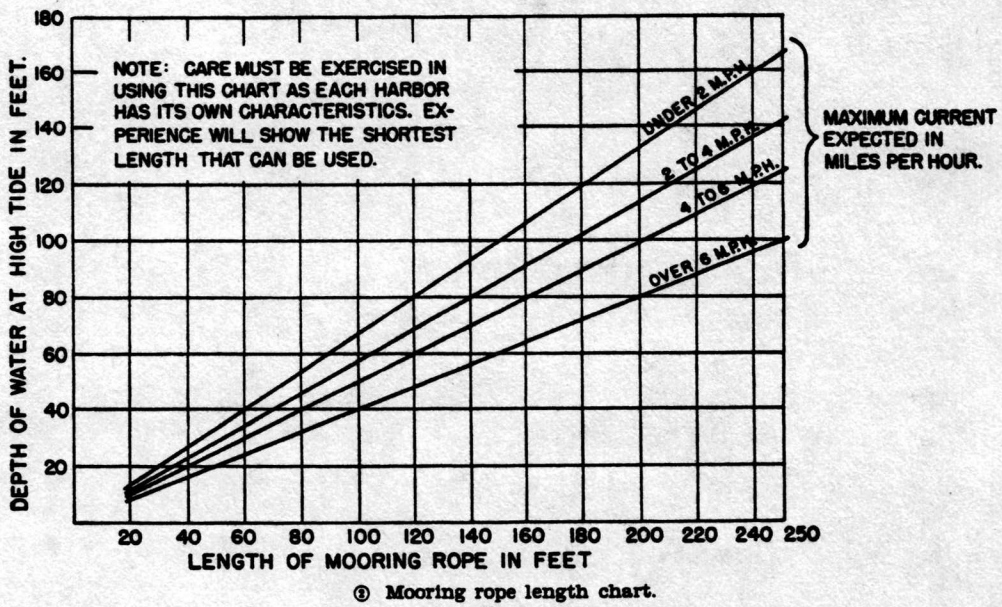
e. Planting No. 10 buoy.—Furnish the master of the planter an overlay of chart with a bearing from each No. 10 marking buoy to a well defined landmark. Orient M′ instrument and set on the azimuth from M′ station to the No. 10 buoy. Have planter to go out beyond the mine field, turn, and set his course on the assigned bearing to the given landmark. Just before the anchor davit passes the vertical hair on the M′ azimuth instrument, the range officer gives the order to the planter by radiotelephone to let go the anchor and marking buoy. If this method of planting buoys has not been tried, the planter should run over the course twice before actually letting the buoy and anchor go. On these trial runs the planter should signal with a flag when it receives the command LET GO. This will give the M′ observer an idea how long it takes his command to reach the planter.

f. Planting and marking position of other buoys.—(1) (*a*) After the anchor and buoy are dropped, a mine yawl proceeds to the buoy (it is not necessary to take up on slack, but each buoy should be plotted with the same tide), raises a flag, and the position of the buoy is plotted and checked with its desired position. It will often be found that the initial error, using this method, may be as great as 100 yards. The coxswain of the DB-boat is instructed by radiotelephone as to the distance and direction to drag the anchor. The instructions must be simple and the range officer must realize that in dragging an anchor across a strong tide, the actual course will deviate from that covered by instruction. (See fig. 42.)

(*b*) When anchors are embedded in mud, it may be necessary to use the planter to drag the anchor short distances to bring a buoy on line. After several draggings the buoy should be within 50 feet of the ideal position. This is close



① Typical marking or control buoy.



② Mooring rope length chart.

FIGURE 21.—Marking or control buoy and chart for determining length of mooring rope.

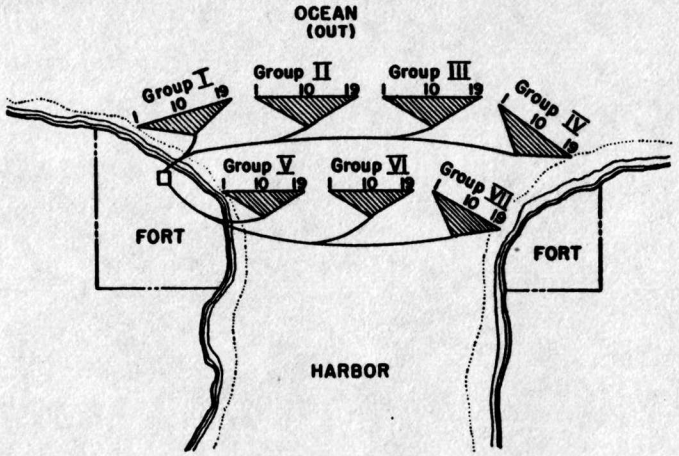


FIGURE 22.—Numbering mine groups and mines.

enough. Repeat the operation with No. 1 and No. 19 buoys. Nos. 1, 10, and 19 should now make a fairly straight line. The proper location of the distribution box buoy is very important. Once the line of mines is established, the master of the planter can, with a fair degree of accuracy, determine the bearing from No. 10 to the distribution box. The final location, however, must be made with more accuracy than the position of No. 10. The distance must not be less than 350 feet and not more than 400 feet. The limiting factors are damaging shock caused by firing mine and length of the mine cable, respectively.

(c) This distance is determined by passing the end of a measuring line from the mine planter to a mine yawl at the No. 10 buoy position. The distribution box buoy, with anchor, is dropped when the planter is on a course at right angles to the line of mines and between 350 and 400 feet from the No. 10 buoy.

(2) An alternate method of locating the distribution box buoy, without the use of a measuring line, which has been found satisfactory and has the advantage of saving a great deal of time is as follows:

The mine planter goes out to sea beyond the line of mines and, knowing the bearing of the line of mines, gets on a bearing perpendicular to the line and passing through No. 10 marking buoy. During the run across the line of mines the planter's speed must be constant, but not necessarily known. One member of the crew stationed at the bow of the planter, and another at the stern, signal the master at the exact moment that the bow and stern, respectively, pass No. 10 buoy. The master, knowing the over-all length of his vessel, can quickly compute mentally the total elapsed time after the bow clears No. 10 buoy until the distribution box buoy should be released, and using his stop watch, signals LET GO at the proper time. With a little practice, this method is quite satisfactory and has the added advantage of requiring much less time than that involving the use of a measuring line.

g. Consideration of adjoining groups.—When several groups are to be planted in one continuous straight line, the work is greatly facilitated after the line of mines of one group is actually established, since marking buoys No. 19 and No. 1 in one group can be used as No. 1 and No. 19 in adjoining groups. Marking buoys No. 1 and No. 19 should be placed respectively as close to the desired position of similarly numbered mines as it is possible to get them. Thus located, they will prevent the mine planter, when planting, from overrunning the frontage allotted to each group, and remove the possibility that flank mines of one group are planted in the frontage belonging to another group. (See fig. 23.)

h. Refinements for marking out field.—(1) *Tactical frontage and cooperation.*—The accuracy with which marking buoys must be placed in laying out a wartime project is far greater than that required in ordinary practice planting or service target practice. Tactical frontage is the most important single factor to be considered. To attain the degree of accuracy necessary there must be coordination between the planter and the DB-boat on the one hand, and the range section on the other. The use of the radiotelephone for control and coordination requires considerable training for all elements involved.

(2) *Measuring line.*—(a) The measuring line is useful in laying out marking buoys. When the radiotelephone cannot be used to transmit information from the plotting room to the planter, a measuring line should be used to check distances between buoys when accuracy is required.

(*b*) The measuring line is No. 16 cotton line. Mark the measuring line at 320, 350, 880, and 900 feet from the free end, which may be done by painting at least 3 feet of the line some distinctive color at the designated points. A good system is to paint the 320- and 880-foot marks black and the 350- and 900-foot marks red, the black being warning marks and the red marks the ones at which marking buoys are dropped. Three men should be assigned to the measuring reel and frame, one to operate the brake and the other two the crank handle for winding in the line.

(*c*) Secure the measuring line frame to the forward deck of the planter, care being taken to see that the line will run over on the reel when paying out. Carry the end of the measuring line forward and pass it through the bow chock and back to the heaving line man amidships. In the meantime a yawl (or DB-boat) makes fast to the No. 10 buoy. As the planter passes the yawl the heaving line man casts the coiled end of the measuring line to the yawl where the end is made fast to a cleat, with a half turn, as quickly as possible. The planter proceeds in the direction of the location for distribution box position, the chief planter stands near the anchor davit and calls off the marks as they go by, and the mine planter commander gives the command to trip the anchor at the proper time so as to plant a buoyed anchor about 350 feet in rear of the No. 10 buoy. At a previously arranged signal from the planter, such as one short whistle blast, the end of the measuring line is cast free from the yawl and the line hauled in hand over hand and reeled upon the drum. The marks at 880 and 900 feet on the measuring line can be used to locate additional marking buoys on the line of mines.

(3) *Sounding.*—(*a*) *Taking soundings.*—After the line of mines has been established, the next step is to take soundings along this line. These soundings will be used for cutting mooring ropes. The soundings can be made in several ways.

1. For planters equipped with fathometers the process is to run down the line of mines at a constant speed, taking the fathometer readings every 5 or 10 seconds, noting the time and depth as the planter passes each buoy. As the fathometer readings are from the keel of the planter, the

amount of draught of the vessel must be added to these readings. The state of tide will be recorded, and all soundings corrected to mean low water.

2. Where the planter is not equipped with a fathometer, a mine yawl with a sounding line takes the depth of the water. The yawl starts at one of the flank marking buoys, where the depth is measured and recorded in a notebook. When the sounding is completed, a red flag is raised for 1 minute or as long as may be necessary for the range section to plot the position. The yawl then proceeds along the line of mines and at intervals of 100 feet the operation is repeated.

3. When poor visibility prevents plotting the position of the mine yawl, a measuring line, marked every 100 feet, is stretched between the marking buoys by the yawls and soundings taken by means of sounding lines at every 100-foot point. The soundings should be recorded in a notebook, together with number of the corresponding mine, the time, and the state of the tide. Another method of taking soundings is to hold one end of the measuring line at the buoy and circle across the line of mines with a yawl, taking the sounding at the point of crossing.

(*b*) *Effect of current on soundings.*—Whenever choice of time permits, hand lead soundings should be taken at low water slack and again at high water slack as a check. In taking soundings, cast the sounding lead well forward into the current, allow it to descend unimpeded, and take a reading at the instant the line is vertical. When using cast iron anchors exact results are always needed, and it is therefore of the greatest importance to have men in every mine battery who have been trained to take soundings accurately. Time is well spent in training a few leadsmen who can be relied upon.

i. Shore cable loaded aboard mine planter.—(1) *Cable capacity of planters.*—All mine planters in operation today are equipped with two sets of cable reel jacks for handling two reels of shore cable, or 20,000 feet. In addition, all 172-foot

planters are equipped with a king reel of 30,000-foot capacity. When a mine planter is engaged laying shore cable only, and has no mines or anchors aboard, an extra reel of shore cable can be placed aboard and transferred under favorable weather conditions to one set of cable reel jacks when needed. New mine planters under construction will be equipped with a king reel having a 50,000-foot capacity.

(2) *Use of king reel.*—Where mine planters with king reels are available the unreeling of cable from storage reels to this king reel and making of watertight connection between each length of cable at the wharf has certain definite advantages. The unreeling of cable will disclose any weakness in the armor or bad kinks which might render the cable unserviceable, if planted. The watertight joint between two lengths of cable can be made, tested, and placed in a junction box at the wharf, and thus insure that the joint is satisfactory before the cable is planted. No connection between cables need be made on the water, so the planter can go direct to the distribution box position.

j. Landing shore cable at cable hut.—(1) *Preparation.*—The mine planter proceeds to the point along the shore line most convenient to the cable hut. During laying of cables shore terminal points should be marked so as to be easily located from the cable laying vessel. In the meantime unwind reel of cable to provide enough slack to place the end through the snatch block at the bow. Prepare the end of the cable with a thumb joint so that the conductor will not become wet (see fig. 16).

(2) *Methods of landing.*—In many harbors the depth of water and channel conditions are such that the mine planter frequently cannot approach closer than 1,000 feet from the cable hut. Conditions in harbors on the west coast are such that it is frequently impossible to approach closer than one-fourth mile because of reefs and high-running seas. These varied conditions make it necessary to employ different methods in passing the land end of the shore cable to the cable hut. The following methods have been used and found successful under various conditions:

(*a*) Where the planter can approach within approximately 500 feet of the shore and the weather conditions are favorable, it is generally practicable to land the shore cable by means of

mine yawls. Whenever mine yawls are employed in landing shore cables, the operators must be trained to avoid rocks or reefs which will damage the hull of the yawl. They must also be trained to keep the bow of the yawl headed into the waves beyond where they are breaking and not permit the yawl to be turned broadside, a position in which it would easily be capsized. The passing of the cable to the shore from the yawl may also present a problem. Attach a heaving line to the cable. If the distance is too great to throw the line, float it in on a block of wood, or, if the water conditions are safe, have a powerful swimmer carry the line ashore.

(*b*) Where it is impossible to approach within approximately 500 feet of the cable hut location, it will generally be found necessary to buoy the mine cable as it is passed to the mine yawl. This can be accomplished by tying empty watertight oil drums to the mine cable at intervals of approximately 150 feet. Buoying the mine cables will insure sufficient flotation to prevent dragging of lengths on the bottom, which would stall the mine yawls.

(*c*) In certain areas reefs, rocks, and shoals will be encountered which make it impossible to land a mine yawl under any weather conditions. Under such conditions the Lyle Gun, such as is used by vessels and Coast Guard Stations to shoot a line to vessel in distress, has been employed to shoot a line from the mine planter or DB-boat to the shore. This light line is fastened to a heavier line (1-inch manila), which in turn is fastened to the shore cable. Care must be exercised when shooting lines ashore that buildings and persons are not endangered by the falling weight which is discharged from the gun.

(3) *Handling cable ashore.*—As soon as the line is ashore a detail at the cable hut hauls in the lines attached to the shore cable. This operation may require as many as 50 men. If available, a tractor or truck with a winch can be used to advantage for hauling in shore cables. When the cable has been drawn in sufficiently, the turkshead is passed through the ports in the cable hut and made fast to the brackets within the hut. Before the actual splicing of the shore cable to the land cable, the latter should be tested back to the casemate with a bridge-megger. After the splice is made, the cable in the hut should be tagged with proper group number. Where

the cable hut is located at a distance from the shore line or sandy beaches, the detail on the shore will dig a shallow trench for the shore cable, which is then covered with sand.

k. Laying shore cable.—(1) *General precautions.*—After the end of the cable has been secured ashore, the planter proceeds toward the position of the distribution box, paying out the cable through the cable-laying snatch block in the bow of the planter. It is advisable to furnish the master of the planter with a chart overlay showing the approximate position of the shore cable routes. The cable routes will be separated by 100 yards in order to prevent cables from being laid one over the other. To prevent kinks keep the cable tight by use of a brake or two planks, 2 inches by 8 inches by 12 feet, used as brakes under the edge of the cable reel. The men holding the planks will stand aft of the reel in order to be in a safe position in case an accident should pull the reel away. The cable should be placed on the cable reel jacks so that it will pay out under the reel. When the tide is strong, always lay cable against the tide, as this assures that the vessel will be under control at all times. Laying of cable should be done from shore to sea to insure continuous possession of at lease one end of the cable. When any end of a cable is put into the water, its position *must be plotted* by the range section *and marked* by a buoy.

(2) *Plotting shore cable route.*—The wartime project will show the general area in which cable should be laid. As a rule it is advisable to keep the various shore cables from overlapping. It will be the duty of the range section to plot the position of the shore cable as it is being laid. The range officer should keep the master informed as to his relative position in relation to the proposed route. It is not necessary for the range section to plot every 15 seconds; every half minute will be sufficient. These data should be kept in safe place for future reference. Several precautions in laying shore cable are advisable: keep clear of channel buoys, stay out of channels that are anchorages or are constantly being dredged, and do not cross telephonic cables.

(3) *Planter with king reel.*—The planters with the king reels can proceed to the position of the distribution box without loss of time or deviation from the predetermined route. This can be done under all weather conditions, as the planter does

not have to stop to make watertight joint or put new reels on jacks.

(4) *Planter without king reel.*—(*a*) When using mine planters which are not equipped with king reels, the joints between two lengths of cable must be made at sea. Under favorable weather conditions the planter proceeds from the cable hut area toward the distribution box position. When there is but one layer of cable remaining on the reel, warn the master of the planter so that he may check the speed of the vessel, and when there are from but four to six turns left on the reel, the planter should be stopped in position. Secure a rope stopper to the cable, outward from the snatch block (a convenient method is by two half hitches and a seizing), unwind the remaining turns by hand, pull the end of the cable through the snatch block, attach one end of a heaving line to the end of the cable by means of a rolling hitch, remove the rope stopper, and pass the other end of the heaving line to the DB-boat, where it is made fast to a cleat. *Every time a cable is pulled aboard the DB-boat and made fast to a cleat have some member of the crew standing by ready to cut away fastening if the cable is pulled too tight.*

(*b*) When weather conditions are favorable and the depth of the water is not over 100 feet, a mine yawl can be advantageously employed for making the watertight joint. This procedure frees the DB-boat and assures its being in position when the shore cable is laid. The planter is then ready to start planting operations without further delay.

(*c*) In using a small boat to splice cable at sea one important precaution should be observed. Never pass the free end of an already paid out shore cable to a small boat. If for any reason the free end should be lost in the transfer, it may take hours, or even days, to recover it by dragging or underrunning. As soon as one reel of cable is paid out it should be held aboard the planter by a stopper knot until the end of the second reel can be clipped to it with mooring rope clips. Then by means of heaving lines bent on near the clipped-together-ends, pass the temporary clipped-together-ends to the small boat and pay out sufficient slack on the second reel so that it can be handled by the small boat without undue strain. If the heav-

ing lines fall short, the junction can easily be found by underrunning several feet of cable only.

(*d*) The DB-boat, using the boat telephone, now gets into communication with the casemate. A test is made of the section of cable laid before joining it to the end of the next reel, to determine its condition up to this point. A similar test should be made of each section after it is laid and joined to the preceding section. Unless each section is tested as laid, it will be difficult to locate faults subsequently.

(*e*) On the planter the cable of the next reel is placed in the cable-laying snatch block. The crew of the DB-boat work a turkshead (if one is not already provided) on each cable, fit the turkshead into clamps of the junction box, tighten bolts, make a watertight joint between the cables, attach the lid of the junction box, being careful no part of wire is caught between the top and bottom, and attach a buoy to mark the position of the box. The unit is then lowered overboard, the buoy cast into the water, and the DB-boat proceeds toward the planter to get ready for the next junction.

(*f*) All small boats engaged in splicing cable at sea should carry one steel marking buoy and one mooring rope with which to mark the location of each junction box on the shore cable. To have each junction box marked with a buoy will greatly facilitate repair of shore cable if such need arises.

(*g*) After passing the two cable ends to the DB-boat, the planter moves on in the direction of the mine field, laying the first hundred yards of cable fairly slack, so as not to pull it away from the DB-boat. The planter continues laying the cable until it reaches the distribution box position. If only a small amount of cable remains on the last reel, the planter can take a zigzag course, using up the extra cable. When considerable cable is left on the last reel, a loop of slack should be passed to the DB-boat and secured aboard, the planter still holding the free end. After the loop of slack is in the cable clamp of the DB-boat, the cable can be severed with an ax aboard the DB-boat, and the surplus re-reeled aboard the planter. In this manner, there is never at any time a free end to be lost.

(*h*) If the mines are to be planted immediately, the cable end is passed to the DB-boat, which, after making the last

junction box joint, has proceeded to the distribution box marking buoy and is awaiting the arrival of the planter. The DB-boat tests the cable through to the casemate and then connects the cable to the distribution box and gets ready for planting. If the mines are not to be planted at once, the cable is tested through to the DB-boat from the casemate, the conductor end sealed by a thumb joint, and the cable end moored to the anchor of the marking buoy as described in (*i*) below.

(*i*) It may be necessary to buoy an end of a shore cable because of interruption in the laying of the cable to the distribution box, or delay in connecting the cable to the distribution box due to delay in planting the mines. Fasten the end of the cable, by means of a piece of 1-inch manila rope, fairly close to the buoyed cast iron anchor in order to prevent damage to the cable due to the abrasion caused by tides and currents on the ocean floor. To do this, rig a cast iron anchor on the anchor davit (or crane of DB-boat) with one end of the anchor rope (100 feet plus depth of water) attached to it by a shackle. Fasten one end of a comparatively short piece of 1-inch manila rope to the end of the cable by a rolling hitch and the other end to the anchor by an anchor knot or bowline. Seize the ends of the rope with marline. Swing the anchor out. Carry a marking buoy aft, pass the anchor rope along the rail outside, and fasten it to the buoy by an anchor knot. Drop the anchor and cable and cast clear the marking buoy.

(*j*) If, for reasons unknown, the shore cable should not test satisfactorily, all connections should be inspected before underrunning the cable. The land cable from the casemate to the cable hut should be tested first, the junction box raised, and each piece of cable tested individually. A large percentage of the opens and grounds will be found to occur at the turkshead where the insulated conductor leaves the head. The wire bends more here than at any other point on the cable, causing the conductors to sever. If there is reason to believe that the trouble is here, cut off the present turkshead and work on a new one. If the cable is still bad, start underrunning it, looking for suspicious kinks or breaks. The DB-boat is best for this purpose, since yawls are usually too

difficult to maneuver, especially in rough water and heavy running tides. In many cases the easiest and quickest method of obtaining an electrically perfect shore cable is to lay a new section. This decision must be made by the mine planter commander. Before a second cable is laid near or over the first, the first one must be electrically perfect. A bad cable on the bottom of a series of shore cables may mean that all the subsequent cables must be taken up.

(*k*) In laying shore cable with the mine planters now under construction, on which shore cables can be carried already spliced, both of the allotted DB-boats can be used in the operation. The cables can be laid alternately from shore cable to one DB-boat, and then from the second DB-boat back to shore. This procedure will allow the maximum amount of cable to be laid with the minimum of travel by the planter.

l. Planting a group of mines.—(1) *Details of planting.*—The details of the duties on the planter, DB-boat, and yawls are given in subsequent sections.

(2) *Handling planter in planting mines.*—Regardless of what type of mine planter is used, the essential operation of getting the mines in the water on a predetermined and marked out line is the same, insofar as the actual handling of the flotilla is concerned. Figure 23 shows the complete course covered by a mine planter in planting four mines, Nos. 9, 10, 4, and 16 of a group. The remainder of the mines are planted in a similar manner, the planter's path developing into a series of loops, those on the side from 1 to 10 being formed counter-clockwise, and those on the 10 to 19 side being formed clockwise.

(3) *Precautions in planting.*—Paragraph 116 covers precautions to be observed by the master of the mine planter. Two safety precautions are of sufficient importance to include in this section.

(*a*) Where wind and current conditions make it unadvisable to stop both propellers, only the one on the side from which the mine is planted will be stopped. This step is taken to minimize the danger of fouling the propellers in the mine just planted. As soon as the mine has been planted, the ship's officer in the pilot house throws the stern of the planter away from the planted mine, and keeps the stern swinging

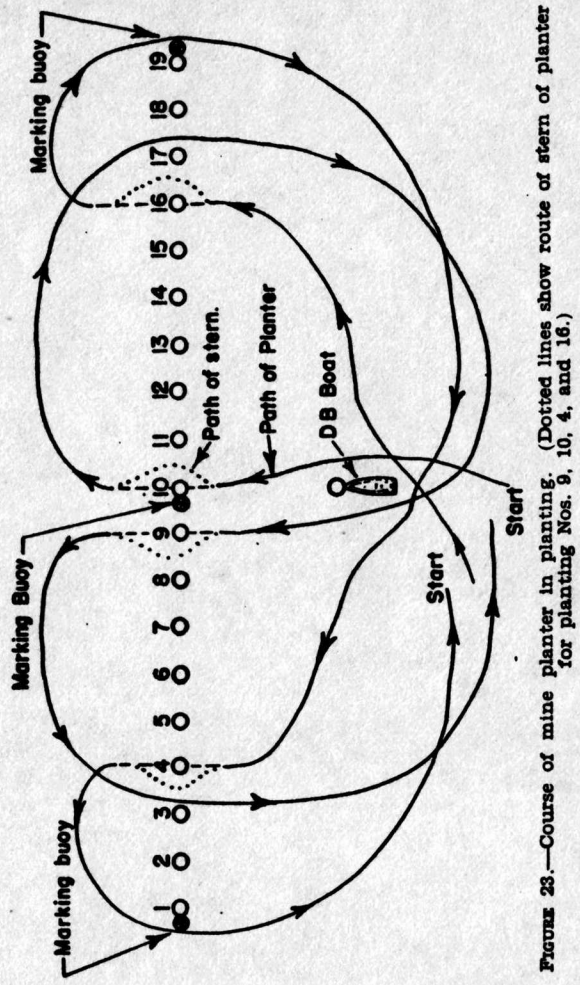


FIGURE 23.—Course of mine planter in planting. (Dotted lines show route of stern of planter for planting Nos. 9, 10, 4, and 16.)

away from the mine just planted until the word is passed from the deck officer in charge on the after deck that the mine buoy is clear of stern.

(*b*) In crossing the line of mines the officer navigating the

planter should endeavor to make the actual crossing of the line as near as possible at right angles to the line of marking buoys. The reasons for this are evident from the sketch (fig. 24). In crossing the line of mines the master should slow the speed of his vessel sufficiently so that the planting officer has sufficient time to locate accurately the mine to be planted. When the planter speed is near maximum, the tactical frontage is liable to be destroyed.

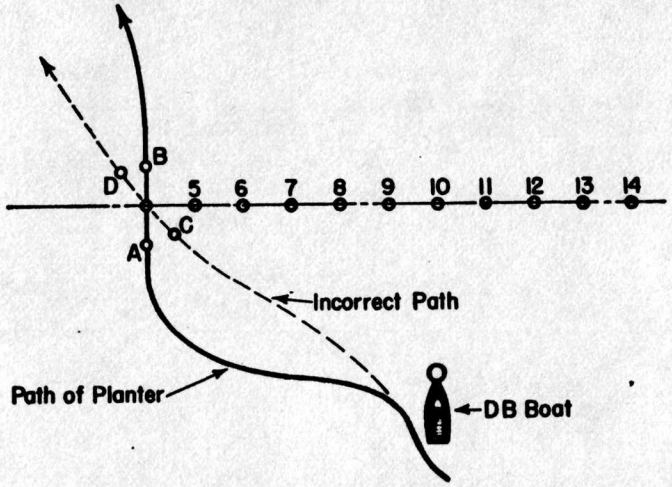


FIGURE 24.—Mine planter approach for planting mine.

NOTE.—The solid line shows the correct method of crossing the line of mines. Should the mine cable prove to be too short, the mine would be dropped at position *A*. If the trip hook should stick, or if the dropping of the mine was otherwise delayed, it would be dropped at some position such as *B*. Notice that a mine dropped at either *A* or *B* covers the tactical frontage assigned to it, while one dropped at *C* or *D*, on the incorrect path, does not.

■ 100. LAYING OUT FIELD AND PLANTING, PROCEDURE NO. 2.—*a. Planting regardless of tide.*—This procedure may be used in certain harbor defenses where hydrographic conditions are such that planting can be carried on regardless of tides, throughout daylight hours. It has been used successfully where it was desired to get mines down in a hurry, rather

than to wait until all groups were marked out and all shore cables laid.

b. Loading DB-boat.—Load the DB-boat preparatory to marking out the line of mines. The operation of marking out the line of mines should be performed by the DB-boat and not by the mine planter. This allows the planter to be loaded while the DB-boat is engaged in laying out the line of mines. Actually, the loading of both ships can begin at the same time. It should begin at such time as will allow the DB-boat to arrive at the mine field just as soon as there is sufficient daylight and visibility for the range section to observe on and plot the marking buoys. In harbors where the visibility is predominantly bad in the morning, such as in the more northern harbors, much time can be saved by consulting the weather maps the night before. If two loading cranes are available, one can be used in loading the DB-boat until its loading is completed, whereupon both cranes can be released to load the planter. If only one crane is available, priority should be given to the DB-boat.

c. Equipment loaded on DB-boat.—The equipment loaded aboard the DB-boat will be for one group of mines. In addition the following equipment should be added: one distribution box; one selector box; necessary tools and materials for making watertight joints and turksheads. Note that with this equipment stowed aboard, the boat is now loaded not only with the equipment necessary to mark out the mine field, but also with the equipment it will use in the actual planting of the mines. This is necessary, since the DB-boat will not return until the group has been planted.

d. Marking out field with DB-boat.—The DB-boat then departs for the mine field, where under the direction of the range officer, using ship-to-shore radiotelephone, the mine field is marked out. After the three buoys marking the line of mines are dropped, the DB-boat then drops the buoy marking the location of the distribution box, ties up to the mooring rope of the distribution box buoy, and awaits the arrival of the mine planter with the seaward end of the shore cable. In harbors where tidal currents are strong use anchors sufficiently heavy to hold DB-boat.

e. Loading mine planter.—The loading of the mine planter can begin at the same time as the loading of the DB-boat.

After the departure of the DB-boat, all facilities on the dock can be made available to the planter. If two cranes are available on the deck, both should be used simultaneously. The noncommissioned officer in charge of the after deck detail, assisted by one crane operator, supervises the loading of the after deck with the 19 mine cables, using the members of his detail for this work. The other crane and its operator assist in loading the shore cable and mine anchors. While this is being done the mine cases can be loaded aboard, using the mine davit and triplex block, and moved to their final positions by hand. Where there is only one crane available, use it to load after deck with the mine cables; the planter boom is then used to load the forward deck. If no cranes are available the planter boom is used to load the forward deck; with the help of several planks the cables can be slid on after deck.

f. Laying shore cable.—Loading completed, the planter, assisted by one or more mine yawls, puts the shore end of the cable ashore and proceeds to lay the shore cable, follows up to splice the cable, and installs and marks with buoys each junction box. If weather conditions do not permit the use of yawls for this purpose, the splicing and setting of cable into junction boxes may have to be made on the planter. While the planter loads, and lands and lays the shore cable, the DB-boat has completed its work in marking out the line of mines and is waiting at the distribution box buoy to receive the seaward end of the shore cable. Upon receiving it and completing tests with the casemate, planting is ready to begin immediately.

g. Time required to prepare and plant one group.—Repeated tests indicate that, barring unusual difficulties, a maximum of 9 hours is required to load and plant a group of 19 mines, using the procedure outlined above. Using this method, one mine battery of approximately 150 men put down five groups of mines in 1 week. The first 2 days were devoted to loading mines, cutting and preparing cable, and assembling the other accessories of underwater equipment.

SECTION XVIII

PREPARING AND PLANTING MINES

■ **101. PREPARING MINES FOR PLANTING.**—*a. Connecting cable end to mine.*—(1) *Procedure.*—As the equipment is

loaded aboard the mine planter it is arranged so that the anchors, mines, mooring ropes, and cables are on their respective sides for planting; 10 to 19 on port, 9 to 1 on starboard (see figs. 18 and 19). The mine end of No. 10 cable, which has been tied to the brackets along the port side of the vessel, is cut free from several of the brackets and brought to the bail of No. 10 mine. The loading wire of the mine is connected to the conductor of the cable with a watertight joint. Rosette joints may be made when using M2 mine cases. Telegraph and sleeve joints may be used with any type of mine case. Clamp the turkshead in place, taking care that no part of the loading wire is caught under the clamp. Attach No. 11 cable to No. 11 mine in the same manner, and so on with the rest of the mines on the port side. Simultaneously the starboard detail attach cable to mines. Cable will not be lashed to the bail of the mine.

(2) *Precautions.*—First, make sure that each cable is outside all the vessel's rigging; second, each cable which is attached to a mine must be free of all other cables. The noncommissioned officer in charge of the port and starboard details will check to see that these precautions are followed. Before leaving the wharf the senior noncommissioned officer should check the equipment aboard the planter. He then reports, "Sir, ready for mine planting," to the planting officer, who then directs the master of the planter to proceed to the mine field. The watertight joints can be made as the planter is proceeding to the field.

b. Attaching mooring ropes.—As the planter proceeds to the field, No. 10 mine on the port (first to be planted) and No. 9 on the starboard (second to be planted) are made ready for planting. No. 10 mooring rope is shackled at one end to the bail of the mine and at the other to the anchor bail or anchor bail ring. Clamp the cable to the mooring rope at a minimum of 5 feet from the bail of the mine. Leave about 30 inches of slack between cable and mooring rope. This loop of slack is to provide sufficient cable for the twisting and turning of the mine, caused by strong tides. Clamp the cable to the mooring rope at about 5 feet from the anchor. If the mooring rope is less than 15 feet long, one clamp is enough. For mines shackled

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directly to the anchor, no connection need be made between cable and mooring rope (see fig. 27).

c. Attaching raising rope.—Attach one end of a raising rope (100 feet plus depth of water) to the bail in the side of the anchor by a shackle or a bowline. The shackle is preferable to a bowline or anchor knot in cases where there is enough clearance for a shackle to be used. Seize the end of the knot with wire. Attach the other end of the raising rope to the mine cable near the figure-of-eight on the aft deck by two half hitches and a clamp or wire seizing (see fig. 27). Only one raising rope should be attached at a time to avoid confusion between the various ropes and cables. Care must be exercised that the raising rope is clear of all rigging, other mine cables, and davits.

d. Attaching mine buoys.—Attach the mine buoy which corresponds to the number of the mine. (See fig. 27.) Where tides run very strong it is advisable to attach 2 buoy blocks. The rope on the buoy is then rolled loosely around the buoy block so when the command LET GO is given, the buoy and rope can be thrown into the water.

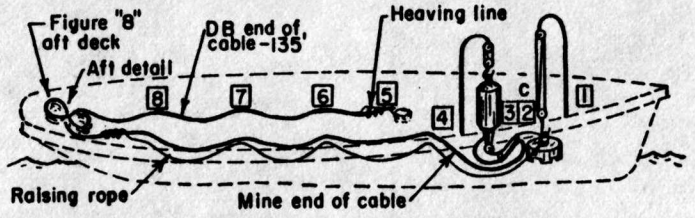
e. Mousing triplex block hooks.—Put a mousing around the upper hook of each triplex block to prevent the block from jumping off the davit when the mine and anchor are tripped.

f. Trip hook.—The trip hooks on the mine and anchor davits should have the safetypins in place before any lifting is done by the triplex block. The lanyards should not be attached to the tripping ring or eye until the command STAND BY is given. The trip hook should have sufficient space in which to operate. Under no circumstances should the cast iron anchor be tripped from the bail proper or the M1 mine cases from the maneuvering ring, as the clearance is too close and may cause the hook to "stick."

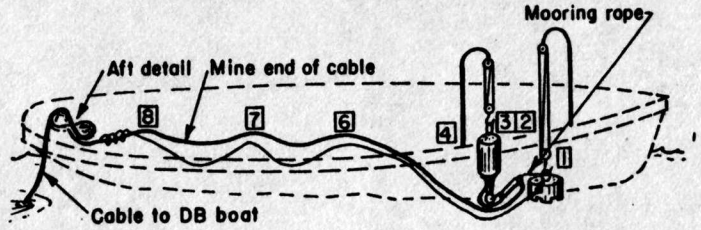
g. Swing anchor and mine outboard.—Pick up the anchor with the anchor bail ring (steel rope grommet can be used, but not advisable), using the triplex block on the forward davit, and swing it outboard clear of the rail. Pick up the mine by the maneuvering ring (if M2 case, older models, by a rope grommet through the maneuvering ring) with the triplex block on aft davit and swing it outboard, clear of the rail. (See fig. 25.)

h. Passing mine cable to DB–boat.—(1) Carry the dis-

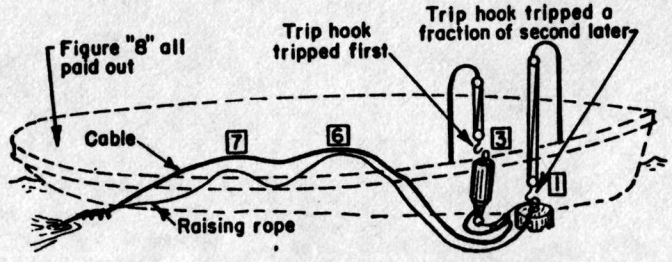
tribution box end of the mine cable forward to a point near mine davit. The cable must always be outside all ship stays and guy lines. Bend two heaving lines onto the cable about 3 feet and 6 feet, respectively, from the turkshead. These



① At instant of passing DB–boat.



② Between DB–boat and line of mines.



③ Instant after "let go."

FIGURE 25.—Cable and rope positions in planting.

lines will be fastened by clove hitches. The short end of the line will be drawn through the knot to form a loop as shown in No. 1, figure 26. Two heaving line men are required.

(2) When the mine planter is close enough to the DB–boat,

the heaving line nearest to the turkshead is cast. If the heave is successful, the heaver pulls the loop out of his clove hitch and draws it tight (see No. 2, fig. 26). At the same time the alternate heaver removes his line from the cable (see No. 3, fig. 26). If the first heave is unsuccessful, the second line is thrown. The first heaving line man then unties his line from the cable and pulls it aboard. Heaving line men should practice regularly so as to accomplish this procedure quickly and successfully.

i. Holding cable end along rail.—The end of the cable to be passed to the DB-boat should be held along the rail as the heaving line is being passed, and held slightly taut to prevent

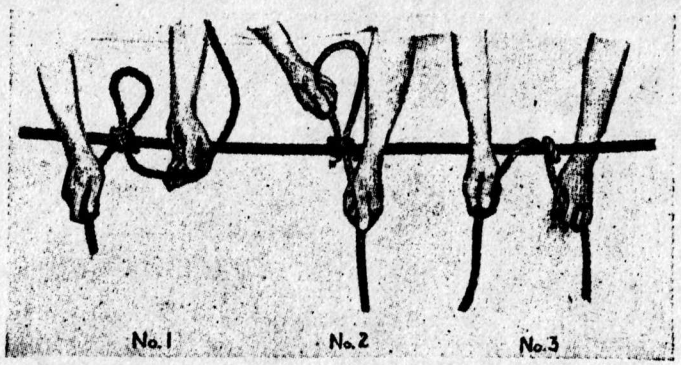


FIGURE 26.—Attaching heaving line to and releasing from cable.

a bight from getting into the propeller after the end has been passed to the boat and before the cable begins to pay out astern.

j. Holding cable and raising rope along rail.—The aft detail cuts the rope lashings of the mine cable, several men of the side detail hold the cable and raising rope on the rail, and a man stands by ready to throw the mine buoy clear of the planter when the mine is tripped.

k. Moving figure-of-eight.—After No. 10 mine is planted, the aft deck detail moves the figure-of-eight for the next mine to a position amidships aft, in proper position for paying out, and similarly places the figure-of-eight for each subsequent mine before planting: 9, 11, 8, 12, and so forth.

l. Knots and splices.—The usual knots and splices are described in FM 5–10.

■ 102. PLANTING THE GROUP OF MINES.—*a. Effect of tide on planting.*—Mines should be planted normally during periods of slack tide or when tide and current run from the line of mines toward the distribution box (against the tide). If, however, it is necessary to plant with the tide, the danger and difficulty will be reduced if the usual course of the mine planter is reversed, and if the DB-boat is firmly anchored at bow and stern. The mine planter will plant the mine first and then either lay cable from the mine to the DB-boat or transfer the cable to a yawl which will drag the end to the DB-boat. Under either of these conditions it is generally best to plant from one flank through the center to the other flank rather than from the center alternately toward each flank. Therefore cables and other gear must be loaded with this procedure in view.

b. Preparing mine before arriving at field.—Upon arrival at or near the mine field, No. 10 mine and anchor should be on the port mine and anchor davits ready for planting, at which time the chief planter reports, "Sir, No. 10 ready."

c. Planting mine.—(1) The mine planter passes close to the DB-boat with the latter to port, and, as it passes slowly by, No. 5 throws a heaving line to the DB-boat. The DB-boat detail immediately hauls in the mine cable, bends on a ⅝-inch rope stopper to prevent the cable end from becoming lost in case the first line breaks, and lashes the cable to the boat. If the water is rough, it may be necessary to pass the cable end to the DB-boat by a yawl.

(2) The planter moves forward to the position to be occupied by No. 10 mine, the cable paying out from the stern. Good cable properly coiled should pay out without difficulty, but if the cable is springy or improperly coiled, the utmost efforts of the after deck detail will be necessary to prevent kinking and bunching. Under no condition will the men be allowed to expose themselves to a figure-of-eight bight. As the planter approaches the position for No. 10 mine, the command STAND BY is given, at which time the locking pins are withdrawn from the trip hooks. As the anchor davit comes abreast of the position for No. 10 mine, the planting officer commands: LET GO. *The trip hook of the mine is*

released first and that of the anchor immediately thereafter. The mine buoy, cable, and raising rope are then thrown overboard. The second mate, who is stationed on the upper deck aft, watches the paying out of the mine cable. By buzzer, or calling verbally, he signals to the planting officer when

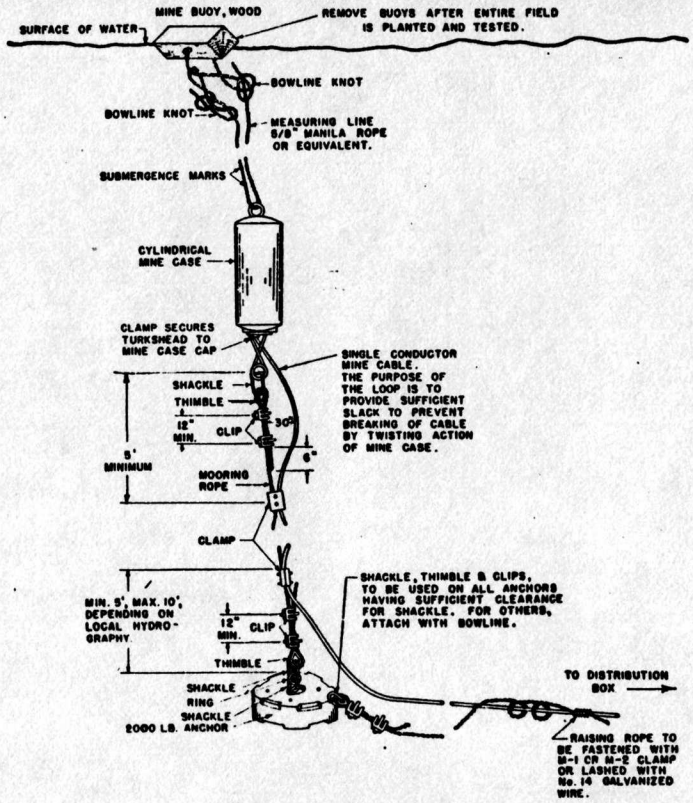


FIGURE 27.—Planted mine.

but *three turns* of cable remain to pay out. He again signals when at *two turns, one turn,* and when *all gone.* These signals are given irrespective of whether the planter is on line for planting. Mine cables should not be stretched taut before the mine is tripped. There should be sufficient slack

in each mine cable to permit the mine to swing freely with tidal changes without placing a strain on the mine cable. Failure to provide slack may cause damage to mine cables.

(3) The planter turns so that the stern will be thrown away from the planted mine, and when the stern is clear of

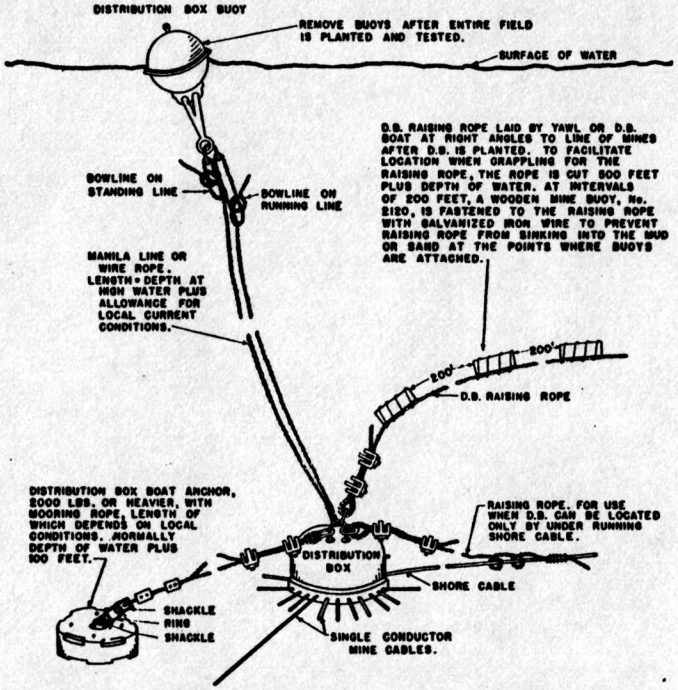


FIGURE 28.—Planted distribution box.

NOTE.—The small individual wires of marline covered wire rope are quickly worn when subjected to abrasion. Thimbles must be used to secure this rope to anchors, buoys, and distribution boxes for service planting wherever possible.

the mine buoy, ALL CLEAR is signaled from the stern by the second mate.

(4) The planter then executes a sweeping circle to starboard, passes to the rear, and comes up with the DB-boat to starboard. As it moves by, the free end of No. 9 mine cable

is passed to the DB-boat as before. The planter moves ahead to a point 100 feet to the left of No. 10 mine, and as it crosses the line, plants No. 9 mine, swings off to port, circles, and comes up from the rear with the DB-boat to port to plant No. 11 mine, and so on alternately until all the mines of the group are planted (see fig. 23).

(5) As each mine is planted the yawls take their positions and the location of the mine is plotted by the range section. The position of the mine is given to the planter by means of radiotelephone. In laying down a wartime project never use the word "mine", and omit all extraneous words when talking over the air. A report should be given thus: "Number nine one-hundred-ten over twenty"; which means that mine No. 9 is 110 feet from mine No. 10 and the distance over the proposed line of mines is 20 feet. A rough plot of the mine positions should be kept on the planter for use by the planting officer and the master.

(6) As soon as a mine is dropped, the detail for that side of the planter prepares another for planting. There is ample time to do this while the vessel is turning and planting the other mine.

(7) The interval between buoyant mines is normally 100 feet. Wind, weather, and hydrographic conditions in the mine field areas will almost always make it impracticable to plant on a straight line at exactly 100-foot intervals. For practical purposes of mine defense, mines planted with intervals of 75 to 125 feet and not more than 30 feet off the line should be considered satisfactory. Figure 31 illustrates the variations in intervals and distances that occur in actual mine field operations.

d. Records and tests.—(1) The submergence of each mine is reported to the planter by the yawl, either by writing on blackboard or by megaphone, as the planter passes near the yawl to plant the next mine.

(2) No mine will be tested from the casemate until after the entire group has been planted and the line of mines is clear of all boats. When the entire group has been planted, the planter moves off to one side of the field and receives a report by radiotelephone from the casemate regarding the condition of the mines.

(3) If a mine is planted out of line, if the submergence is

unsatisfactory, or if an unsatisfactory test is reported from the casemate, the mine must be taken up and replanted.

e. Removing buoys.—When azimuths, submergences, electrical tests, and positions of individual mines are considered satisfactory by the mine planter commander, he will order all identification marks in the field removed.

f. Safety precautions.—One blast of the planter's whistle should mean that the DB-boat is to let go of any rope or cable it may be working on at the time. This is important in case it is discovered suddenly that the mine is not ready for planting after the cable has been passed to the DB-boat, or in case the cable has bunched up in going over so that the mine can not be dropped in its proper place. One blast of the DB-boat's whistle should mean that the DB-boat has lost the cable end and for the planter not to let go of the mine.

g. Method of tripping anchors for straight line.—Figure 29 shows one method of tripping anchors to obtain a straight line of mines. The planting officer from his position on the bridge gives the command LET GO as his line of sight passes across the bows of the mine yawls. This method requires that at least two yawls be made fast to planted mines. It is applicable when the weather is rough and marking buoys are hard to locate. Since it is very easy to plant a line of mines askew using this method, however, it is preferable to use marking buoys for alining mines for planting.

■ **103. DUTIES OF PLANTER DETAILS WHEN PLANTING MINES.**—*a. Chief planter.*—In general charge of deck. Reports to planting officer when each mine is ready for planting.

b. Starboard detail (fig. 30).—(1) *Noncommissioned officer in charge.*—Reports to chief planter when each mine on his side is ready for planting.

(2) *Anchor davit men, Nos. 1 and 2.*—Prepare and handle anchors and perform all duties at anchor davit. No. 1 handles tripping lanyard; No. 2 lowers anchor and removes locking pin from trip hook.

(3) *Mine davit men, Nos. 3 and 4.*—Prepare and handle mines, make watertight joints between loading wires and cables, and perform all duties at mine davit. No. 3 handles tripping lanyard; No. 4 lowers mine and removes locking pin from trip hook.

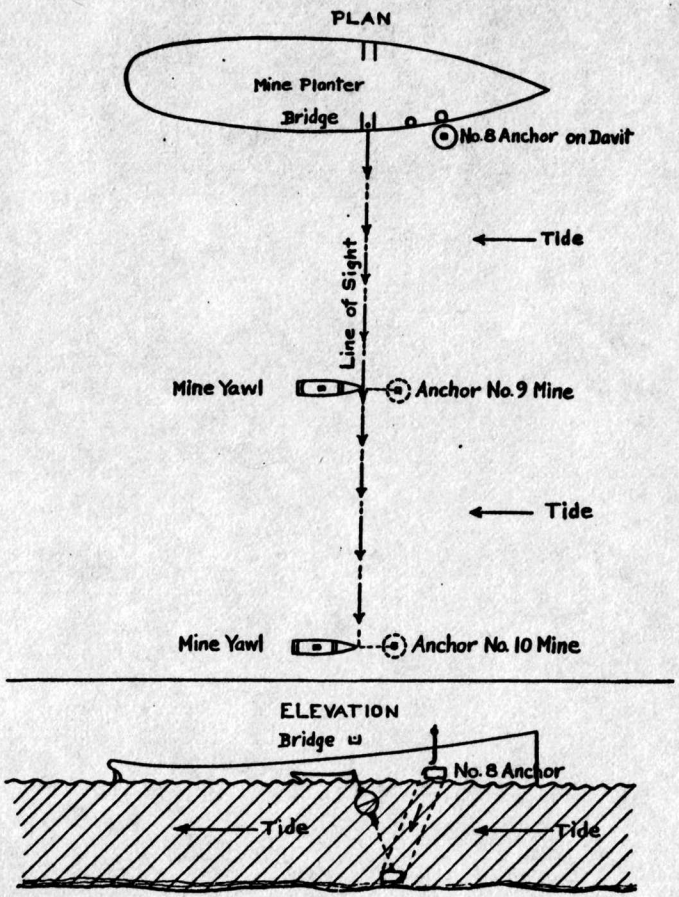


FIGURE 29.—Method of tripping anchor to obtain straight line of mines.

(4) *Heaving lineman, No. 5.*—Throws heaving line to DB-boat and handles mine buoy. Is backed up by No. 5 from port side, who handles second heaving line, and similarly backs up No. 5 on port side. Assists Nos. 6, 7, and 8 in cutting marline lashings holding cable to cable brackets, lifting cable

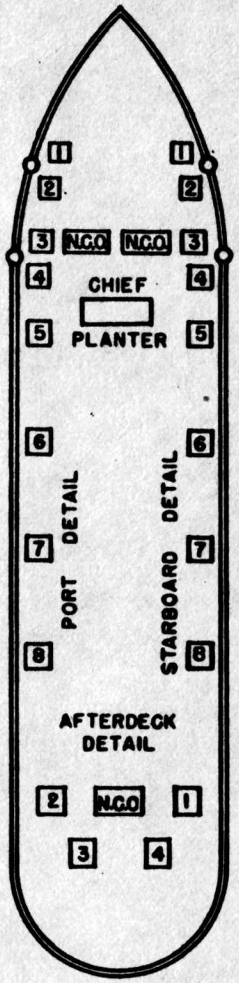


FIGURE 30.—Posts of mine planting details.

from brackets to rail, and attaching raising rope to cable. Assists in making watertight joints.

(5) *Cable men, Nos. 6, 7, and 8.*—Pass end of mine cable to DB-boat by holding it along the rail and keeping a slight

strain on the cable until it begins paying out astern. Handle cable and raising rope, holding them along the rail and casting them clear of the side. Assist No. 5 in cutting marline lashings, holding cable to cable brackets, lifting cable from brackets to rail, and attaching raising rope to cable. Both starboard and port numbers work both sides when necessary. Nos. 6 and 7 hold and manipulate loose hitches of heaving lines (see fig. 26). Assist in making watertight joints.

c. Port detail.—Similar in every respect to starboard detail.

d. After deck detail (fig. 30).—Noncommissioned officer in charge. Nos. 1, 2, and 3 pay out cable. No. 1 always keeps one coil ahead lifted clear and ready to pay out. After each mine is planted, move figure-of-eight for next mine to amidships position.

e. Recorder (noncommissioned officer or private).—Posted on upper deck. Keeps records of times, submergences, and distance between mines, and overs and shorts. (See app. II for forms.) Communicates with DB-boat by means of a radiotelephone, address system, or megaphone, when necessary.

■ 104. MINE SERVICE PRACTICE AND SUBMINE PRACTICE.—The necessary modifications in the preceding procedure for the conduct of mine service practice and submine practice are covered in TM 4–235.

SECTION XIX

MAINTENANCE OF MINE FIELD

■ 105. REPAIR OF GROUP OF MINES.—*a. General.*—If one or more mines develop faults, opens, or grounds which render them ineffective after the mines have been planted, correct the faults with the least possible delay.

b. Unsatisfactory electrical test.—Raise the distribution box and test the shore cable. If the fault is in the shore cable, underrun the cable, beginning at the distribution box and working toward the shore; carefully examine the cable and test it at each joint. If the shore cable tests satisfactorily, then look for the fault either in the distribution box or the individual mine circuits from the distribution box to the mines.

■ 106. REPLACING ONE OR MORE UNSERVICEABLE MINES.—*a. When buoys have been removed.*—All mine and marking buoys are removed from the mine field when the controlled mines of a war project are planted. Therefore, in replacing the mines, the planter will be starting the replacement work in a "blind" mine field. The following procedure has been used successfully in picking up and replacing over 100 mines in a wartime project and has given a reasonable degree of accuracy in the location of the replaced mines. The exact procedure will vary somewhat depending on the number and the position of the defective mines which must be picked up and replaced.

b. Procedure in water areas where current flow is not excessive.—(1) Load planter with the necessary equipment, except anchors, for each mine to be replaced. The anchors of the mines picked up can be used for planting the new mines. Load at least one anchor aboard as a replacement in the event that an anchor should be lost in the process of picking up. If five or six mines of a particular group are bad and the group has been down a considerable time, with the attendant deterioration of its mooring ropes, two or three anchors and mooring ropes may be loaded aboard the planter.

(2) Before departing for the mine field, the mine planter commander should obtain from the mine plotting room an overlay of the group undergoing repair. This overlay will show him the exact position of each mine in the group, and the distances between them. It will also show him which mines are on or very near the line, and which are considerably ahead or behind the line. Assume that mine No. 14 is a defective mine that must be picked up for repair, a new No. 14 to be planted in its place. This mine will be planted from the port side so that the planting officer, in alining himself, will be looking toward No. 1 mine. Assume that a study of the overlay discloses mine No. 9 to be very closely on line, and that positions of No. 13 and No. 9 will establish a good line upon which to plant the new No. 14. The mine planter commander then instructs the crews of the mine yawls and the DB-boat to proceed to the mine field, pick up the distribution box and underrun mine cables Nos. 9, 13, and 15, and mark them with buoys of one of the following

types: wooden mine buoys, galvanized iron pick-up buoys, or standard 28-inch steel marking buoys, depending on current and weather conditions. Note that Nos. 13 and 15 are the two adjoining mines to No. 14. When these two mines are marked with buoys, the center of the interval between them will mark the approximate location of No. 14. Mine cable No. 9 is underrun for the purpose of giving the mine planter commander one additional point with which to establish a line. The picture in the mine field is now as shown in figure 31. Mine No. 9 was selected because the overlay showed that it was on line and because its cable is short and can be more quickly underrun than any other cable except No. 10.

(3) The mine planter, after giving the DB-boat and the mine yawls sufficient time to raise the distribution box, to underrun the desired mine cable, and to buoy the proper mines, proceeds to the mine field and picks up the defective mine.

(4) From the overlay the interval between No. 13 and No. 15 mines is determined to be 230 feet. To assist the master of the planter in planting the replacement mine in the center of this interval, a buoy of either the "feather" or standard steel marking type is planted by a mine yawl. This position-indicating buoy is planted on the line established by mines Nos. 9 and 13 and at a distance of 95 feet from No. 13 in the direction of No. 15 mine. This leaves only a 20-foot distance to be estimated by the navigating officer of the planter as he crosses the line of mines. The position of this indicating buoy for No. 14 mine is determined by two mine yawls with a measuring line. After planting the position-indicating buoy, three mine yawls take position as shown in figure 32. (The type of position-indicating buoy or "feather" buoy used as a guide for planting No. 14 mine will depend on local conditions.) In water areas having less than 2-mile-an-hour currents a wooden mine buoy, a bamboo or wooden spar fastened to a 5/16-inch manila line with a 50-pound weight, may be used. In areas having swifter currents it may be necessary to use a steel marking buoy with a 500-pound anchor. The smallest buoy which will stay afloat under the existing tide and current should be used, since a steel marking buoy with 5/8-inch manila line presents a serious menace to the mine planted.

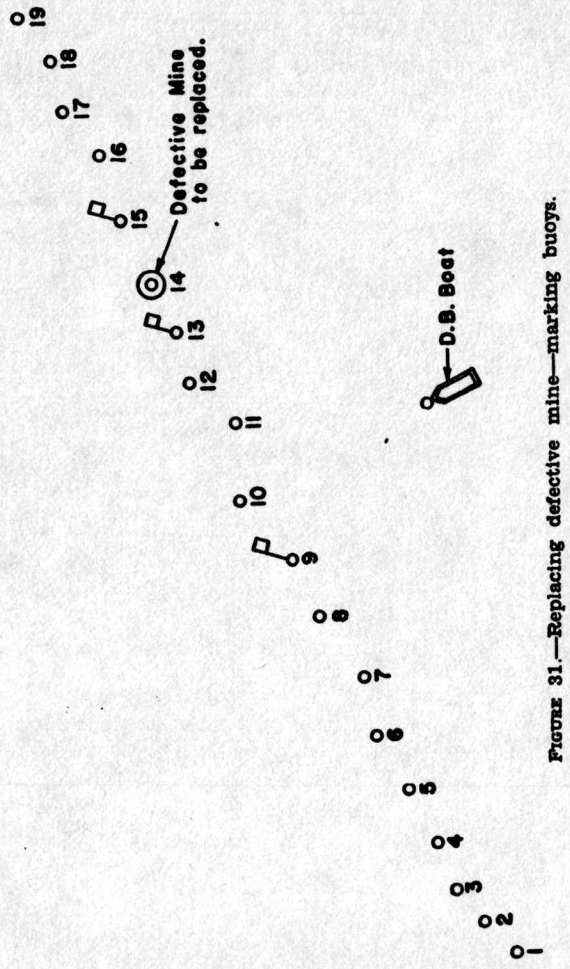


FIGURE 31.—Replacing defective mine—marking buoys.

(5) Two yawls now clearly mark the limits of the interval through which the planter must pass to plant No. 14 mine in its proper location. The feather buoy marks a spot 20 feet from the position in which No. 14 should be planted.

Mine yawls at No. 13 and No. 9 mines establish the line of mines. The new No. 14 mine can now be planted with accuracy. If mines No. 14 and No. 12 were defective, put out an additional feather buoy, using No. 13 mine as the control point. Modification and duplication of the above method can be made to apply to any situation.

(6) Where seven or more mines of a group are bad and are scattered throughout the group, time will be saved by picking up the whole group and replanting it.

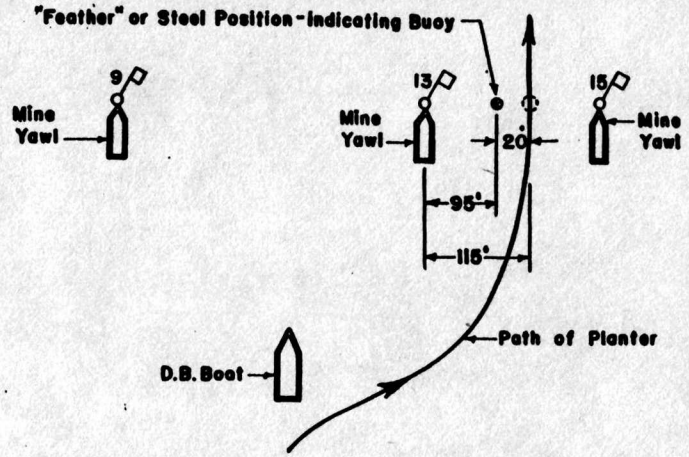


FIGURE 32.—Replacing defective mine—flotilla operations.

(7) As a general rule, in replacing a mine near the end of a line of mines, it is advisable to take up the mines outside of the one to be replaced and proceed with replanting in the normal manner.

c. Procedure where current flow in mine field is excessive.—(1) In some water areas it is dangerous to maneuver the mine planter in a field where mines are planted. In such areas unserviceable mines may be removed during the time the tide runs from the distribution box toward the line of mines, either by underrunning the cable from the mine, if the mine is a floater, or from the distribution box.

(2) When operating in the field while the tide is flowing

toward the line of mines, it is necessary to use a stern anchor to prevent the stern of the DB-boat from swinging into the mine cables and twisting them.

(3) The position of the line of mines and the mine to be replaced are marked as shown in figure 32.

(4) A mine yawl underruns the mine cable of the defective mine until the raising rope is reached, and ties a stopper line to the raising rope before it is unfastened from the mine cable. A heaving line, one end of which is fastened to the raising rope, is passed to the mine planter (the mine planter having nosed into the line from the side opposite the DB-boat). After the planter receives the heaving line, the yawl crew releases its stopper line from the raising rope.

(5) The mine planter, which is headed against the tide toward the line of mines (tide from distribution box to line of mines), holds its relative position by means of its engines, and raises the anchor and mine. The mine cable is disconnected from the mine and tested and if in class A condition (minimum insulation resistance 5 megohms and maximum conductor resistance 2.5 ohms per 1,000 feet), it is connected to the replacement mine.

(6) The mine planter maneuvers as near as practicable to the proper position and plants the mine.

(7) In some situations the most expeditious replacement procedure will be for a mine yawl to pass the DB-boat end of the mine cable to the planter, which is anchored in position in front of the line of mines. The planter pulls in the cable, and by means of the raising rope picks up the mine and anchor. A complete replacement mine with mine cable in figure-of-eight form is ready on the planter.

(8) A mine yawl takes the free end of the replacement mine cable and carries it to the DB-boat, where it is connected to the selector box in the distribution box. The mine planter in the meantime has picked up its anchor and moved into position for planting the replacement mine.

(9) Each mine flotilla will determine by training plantings the procedure best suited for replacement of mines in its mine field.

d. Broken moorings.—Broken moorings result in floating mines, which disclose the position of the mine field. A

floater is a mine, any part of which projects above the surface at mean low water. "Floaters" should be promptly removed and replaced.

e. Emergency replacement of mines.—(1) When no mine planter is available and it is necessary to fill gaps in the line of mines, replacement mines may be planted by using a small boat of approximately the size of a DB-boat.

(2) At the mine wharf a loaded mine with anchor and cable attached is placed on an improvised wooden platform which by means of a triplex block can be used to plant one complete mine from the stern. The figure-of-eight of the mine cable is placed in the bow with the distribution box end free. This is passed to the DB-boat, which has raised the box and removed the cable to the unserviceable mine. The boat with anchor and mine then proceeds to the position where the replacement mine is to be planted, paying out the mine cable from the bow. When in position, the anchor and mine are "dumped" off the platform on the stern of the boat.

f. Replacement of mines without picking up unserviceable mines or cables.—During active wartime operations or in emergencies when it is imperative that effective repairs to the mine defense be made in the minimum time, complete replacement mines with new mine cables will be planted in the position of the unserviceable mines. Picking up of unserviceable mines, which requires much more time than planting of new mines, will be deferred until the complete group of mines is renovated.

SECTION XX

TAKING UP MINES

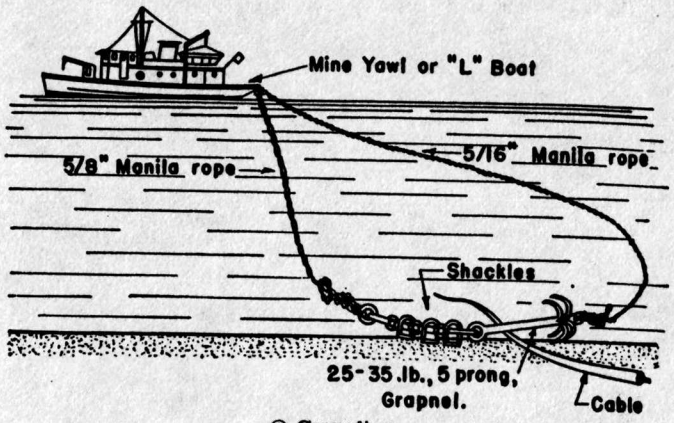
■ 107. TAKING UP MINES.—*a. Order of taking up.*—Under normal conditions the group of mines is taken up in the exact reverse order in which planted, and on the side from which planted. Generally the flow of the tide is from the line of mines toward the DB-boat. With a cross tide or a strong cross wind, the mines should be taken up in regular order from one side, so that the planter will not drift onto the mines. When the flow of the tide is from the distribution box to the line of mines, a stern anchor will be used to hold

DB-boat in place. Under this condition of tide, the planter should come up against the tide to the line of mines on either end or in the middle of the group. A yawl can be used to bring the mine cable to the planter.

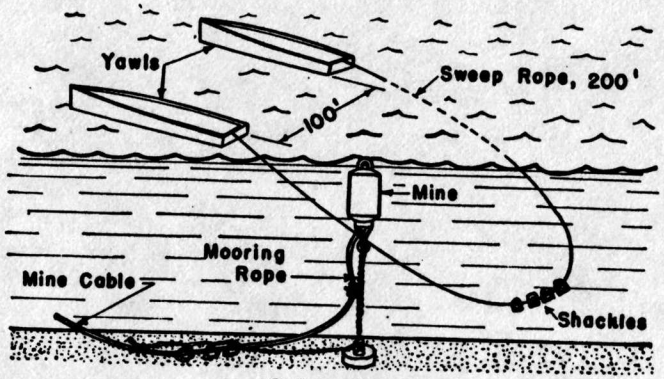
b. Locating blind group.—In a wartime project all markings and mine buoys have been removed. If the group has been down for some time, it will be necessary to obtain the azimuth figures from the file and to plot the group on an overlay. The planter, loaded with three marking buoys, anchors, and mooring ropes, the DB-boat, with a distribution box marking buoy, anchor, and mooring rope, and two yawls with grappling equipment start for the group. By radiotelephone the range officer can direct the master of the planter to drop buoys at the ends of the mine group. The DB-boat, directed by radiotelephone from the range section, approaches the vicinity of the distribution box. With the help of two yawls grappling starts for the shore cable or the distribution box raising rope. When distribution box is located, it is raised and opened, the first mine cable conductor is cut, and the turks-head is removed from the clamp in the distribution box. For any cable going into the water, put on a thumb joint. If for any reason the distribution box must be lowered into the water again with a number of cables removed, the holes through the rubber packing must be plugged up with a piece of loading wire. A thumb joint must be made on the outside of each (see fig. 16).

c. Grappling.—In grappling operations a ⅝-inch manila rope is attached to the grapple chain with the addition of sufficient shackles to insure that the chain will drag along the bottom. Also a 5/16-inch manila line is attached to the eye in the base of the grapnel. This line is for recovering the anchor when it hooks an immovable object (see fig. 33).

d. Sweeping.—When a mine in a group is to be located it may be necessary to sweep. About 200 feet of wire rope is strung between two yawls. The yawls keep abreast of each other about 100 feet apart and drag the loop about in the vicinity of a mine. The area which is to be swept should be covered systematically. The yawls should go slowly to allow the rope time to sink; if they go too fast or keep too far apart, the loop will be pulled to the surface. It is advisable to weight



① Grappling.



② Sweeping.

FIGURE 33.—Mine operations.

the sweep line with shackles to keep it submerged. When the sweep has been fouled, the yawl with the shorter end of the rope remains in position and the other one goes around the mine so as to get a complete turn around the mooring rope. This must be done carefully, making a slow sweep with plenty of slack line; otherwise the rope will slip off. Then pass the two ends of the rope to the planter to be hauled in (see fig. 33).

e. Handling mine cable.—Normally the mine cable of a mine on the extreme end of the line of mines is secured to a heaving line, which is thrown to the planter as this vessel passes close to the DB-boat. A man stands on the planter with a boathook over the side ready to receive the end of the heaving line. During rough weather it may be necessary to pass the heaving line to the planter by means of a yawl. When the heaving line is received, quickly pass it over the cathead, pull in the cable, and keep the cable leading ahead or straight down. A warrant officer posted near the planter railing where the cable is being pulled up can keep the master informed as to the direction or lead of the cable. If the cable leads astern, the bight will form a loop which may catch on any projection on the bottom, whereas if it is kept leading ahead and taut, it will slide up and free itself from most obstacles. Quick work on the part of the personnel and the cooperation of the master of the planter in adjusting the speed of the vessel are necessary to keep the cable ahead. If the cable fouls anything, keep it taut but do not put a strain on it. A man should always be on the cathead to keep the head pointed in the direction of the cable. This will keep the cable from slipping off and injuring someone. If the end is likely to pull away, bend a heaving line on and let the cable go; keep bending on lines until the planter can back up and get a new start ahead. Then keep the line and cable ahead and it will clear itself.

f. Picking up mine cable.—(1) As the cable is pulled aboard by hand, carry it across the vessel, through a snatch block in prolongation of the cathead, and aft on the opposite side. Remove any kinks from the cable as it comes in. Have a man walk along with each kink and straighten it out; do not stop pulling the cable in while this is being done. Take the end of the cable around the deck house to the mine davit on the other side (this is the 135-foot end); then begin coiling a figure-of-eight on aft deck. When the cable is handled in this way it will not have to be recoiled ashore for the next planting.

(2) When experienced, well-trained mine planter crews are available, the cable may be taken aboard by using the power driven cable reels. Unless carefully done this procedure may put excessive strains on the cable and will result in

sharp kinks and consequent destruction of cable. Picking up of cable by use of power driven equipment will be utilized *only when authorized by the mine group commander.* As the cable is pulled aboard by hand, pull in enough slack, placing the cable through two snatch blocks as in figure 34. On the first cable taken up it will be necessary to have enough slack so that the end can be slipped through the side hole in the cable reel. This end is fastened to the reel with pipe straps. When secure, strap insulated conductor down also. The reel is wound up with steam power. The cable should be rolled as neatly as possible. Kinks should be removed if this can be done easily. The reeling should be done with a slight tension on the cable. A loose coil on the reel may result in a kink when pressed down with later turns. A small snatch block can be used to guide the cable on the reel. Each mine cable is attached to the preceding cable with a grommet over the respective turksheads. The picking up of the mine cables on cable reels necessitates recoiling the cables into figures-of-eight ashore for next planting.

(3) The cable need not be brought over the cathead but can be passed through the forward cable-laying snatch block and attached direct to the cable reel.

(4) These procedures may be modified as necessitated by the various types of planters used.

g. Handling raising rope.—When the raising rope is sighted, that fact should be made known to the reel operator and the master. The raising rope is pulled over the cathead slowly with the cable. The slack rope is pulled up. The clamp holding the raising rope is unfastened (or the wire is cut) from the cable. Carry the rope through a snatch block (see fig. 34) and around the capstan (sometimes called niggerhead of the winch, winch drum, gypsy head), making at least four turns. In some harbors where tide and wind are exceptionally strong, there is danger of losing the raising rope before it can be reaved through the snatch blocks and carried around the capstan. Under these conditions it is advisable to rig a 200-foot length of raising rope with a hook attached to one end on the winch drum or capstan for use as a messenger line. Raising ropes will have a thimble and clips or a bowline on the end which is lashed to the mine cable. As soon as the raising rope is disengaged from the

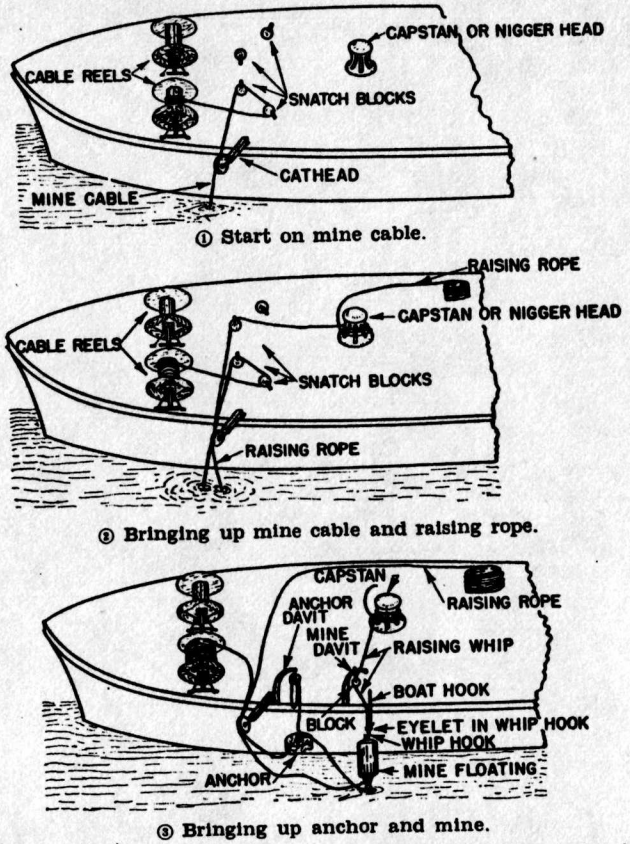


FIGURE 34.—Taking up mine cable, raising rope, anchor, and mine.

mine cable, the hook of the messenger line is attached to the thimble or bowline of the raising rope. This procedure will prevent losing raising ropes. Raise the anchor until within a few feet of the cathead. Engage the hook (if trip hook is used, lash pin well) of the triplex block of anchor davit in the anchor bail ring and bring the anchor inboard.

h. Handling mine.—(1) As the anchor is being brought up the mine will come to the surface. The hook of the raising

whip is engaged in the maneuvering ring, maneuvering ring grommet, or bail. The hook is guided by a boathook which is inserted in an eyelet in the whip hook (see fig. 35). When whip hook has been engaged, the slack is taken out of the rope, the boathook removed, and the mine then can be raised and pulled inboard. Considerable skill is required to hook a bobbing mine in rough sea. If the boathook method cannot

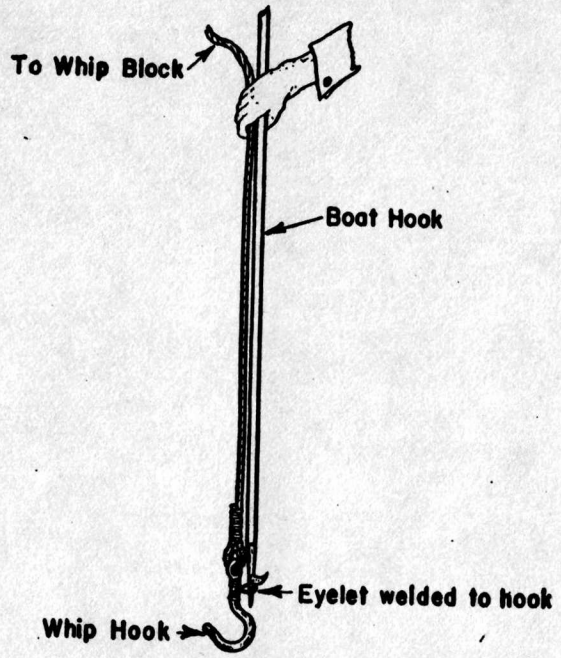


FIGURE 35.—Whip hook ready to pick up mine.

be used, a man sent over the side can engage the hook. Using a yawl is dangerous; the anchor is liable to fall or the yawl be crushed against side of planter. The block of the raising whip is attached to the mine davit, the rope running through the block to a winch or capstan.

(2) Instead of using a raising whip, the mine may be raised by means of the triplex block on the mine davit.

(3) In cases where the mooring rope is short, the whip on the planter boom can be used. The hook is inserted in the anchor bail ring and the anchor, mooring rope, and mine are all brought up together. The mine is pulled inboard as the whip is lowered, after which the anchor is pulled in.

i. Complications.—In taking up mines a great number of complications may occur. Two or more mines may be entangled to such an extent that all must be taken in simultaneously; cables or ropes may become entangled in the ship's propellers; cables, ropes, or anchors may become entangled with material lying on the sea bottom; and the DB-boat may be run down by the mine planter. It is necessary that the planting officer decide quickly the best procedure to follow as the complication arises and that he be able to deliver his instructions so that the planting detachment or any individual will thoroughly understand the instructions given. Do not hold back on a rope until it breaks; let it slack away, bending on additional ropes until the pull ceases, or in case the pull continues, buoy the end before it is finally released; this precaution will save a great amount of additional labor.

j. Using sling.—If the end of the cable is lost and the exact position of the mine is known, the planter takes position near the mine. Throw a sling made of raising rope over the mine; or pass one end of a long rope (two or more raising ropes tied together) to a yawl, which moves around the mine, allowing plenty of time for the rope to sink, and brings the end back to the planter. Place both ends over the cathead, through a snatch block, and around the capstan drum of a winch. Raise the mine until near the cathead, transfer it to the anchor davit, and pull in the mine cable until the raising rope is reached; or when the mine is raised above the surface of the water, take in the cable to the raising rope and pass the rope over the cathead. When the cable has been lost and the location of the mine is known only approximately, grapple for cable with a yawl, if the cable is long and the water shallow, as in *c* above; or sweep as in *d* above.

k. Broken raising rope.—If the raising rope breaks or is lost, sweep for the mooring rope, and when the mine has been raised above the surface, put a strong sling through the maneuvering ring and raise the mine and anchor with

the boom; or transfer the mine to the anchor davit as described in *j* above; then make fast a raising rope to the mooring rope of the anchor and carry it over the cathead and through a snatch block to the capstan drum of a winch. Unshackle the mine as soon as the strain is taken up by the raising rope, and take the anchor aboard in the usual manner.

■ 108. DUTIES OF PLANTING DETACHMENT WHEN TAKING UP MINES.—The duties as given below are for taking up a mine on the starboard side. In taking up one on the port side, the port detail performs the duties prescribed for the starboard detail, and the starboard detail those for the port detail.

a. Chief planter.—In general charge on deck.

b. Port detail.—(1) Noncommissioned officer in charge superintends clearing his own side, then assists starboard noncommissioned officer.

(2) No. 1 catches heaving line with boathook as it is passed from the DB-boat. Undoes clamp or cuts wire seizing from raising rope and cable after it comes over the cathead. Asists No. 2 in coiling raising rope.

(3) No. 2 grasps heaving line as No. 1 catches it with boathook and passes it over cathead. Handles raising rope to and around capstan drum of winch, making at least four turns. Assists No. 1 in coiling raising rope.

(4) No. 3 helps to pull in cable, and assists in coiling raising rope.

(5) No. 4 helps to pull in cable, then handles fall of raising whip around capstan for raising mine. (A raising whip consists of a single block through which a heavy manila rope, with an iron hook at one end, has been passed. The block is attached to the mine davit, the hook engaged in the maneuvering ring or strap of the mine, and the mine quickly raised to the deck.)

(6) No. 5 helps to pull in cable. Passes raising rope through snatch block in prolongation of cathead. Lifts cable off cathead when anchor is secured.

(7) Nos. 6 and 7 assist noncommissioned officer in clearing port side; then assist in hauling cable aft around port side.

(8) No. 8 coils loose end of heaving line as he walks aft,

then assists No. 8, starboard, hauling cable aft around port side.

c. Starboard detail.—(1) Noncommissioned officer in general charge.

(2) Nos. 1, 2, 3, and 4 at cathead haul in on cable until raising rope is up.

(3) Nos. 1 and 2 continue on raising rope and anchor.

(4) No. 3 goes over side on guard rail and places hook of raising whip in maneuvering ring, maneuvering ring grommet, or bail.

(5) No. 4 assists No. 3 by guiding hook of raising whip to him for mine. Is responsible for proper position of mine davit.

(6) No. 5 has heaving line ready to pass to DB-boats if necessary. Catches buoy rope as soon as possible and guides mine to No. 3. When anchor is aboard, removes raising rope.

(7) Nos. 6, 7, and 8 assist in hauling cable aft around port side, taking posts about 15 feet apart. No. 8 comes forward, receives turkshead end, and removes heaving line as he walks aft with turkshead.

d. After deck detail.—Noncommissioned officer in charge. Nos. 1, 2, and 3 coil cable in figure-of-eight as it comes to the after deck. In coiling cable for replanting, care should be taken that, with the turkshead pointing forward, the first bight lead aft on the side on which the mine is being raised. This will insure that when the coil is lashed and turned upside down the bights will be ready for paying out properly.

e. Capstan and reel operator.—The operator of the cable reel and the capstans will be personnel of the mine planter.

f. Using reels for taking up.—For taking up mines, using the reels, the schematic diagrams in figure 36 show the positions of the men during various phases of the operations. Twelve men, six on each side, are all that are necessary, with the exception of the capstan and reel operators.

g. Modifying taking-up procedures.—These procedures may be modified as necessitated by various types of planters in use in a harbor.

■ 109. TAKING UP SHORE CABLE.—*a. Manner of taking up.*—When it has been necessary for shore cables to be layed one

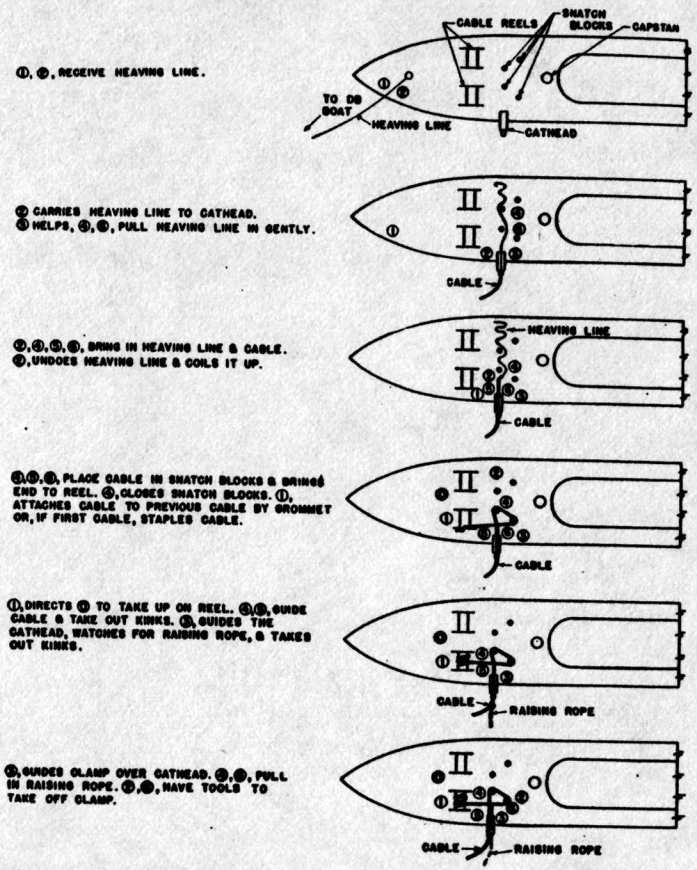


FIGURE 36.—Operations in taking up mines with trained crew—crew positions.

over the other, the last will be taken up first. A shore cable is taken up in the reverse manner from that in which laid; the planter should proceed against the tide when possible. Sections of the cable from the distribution box end to a junction box, between junction boxes, and from a junction box to the shore are taken up separately. Place the cable reel on the jacks so that the cable will be wound on over, and con-

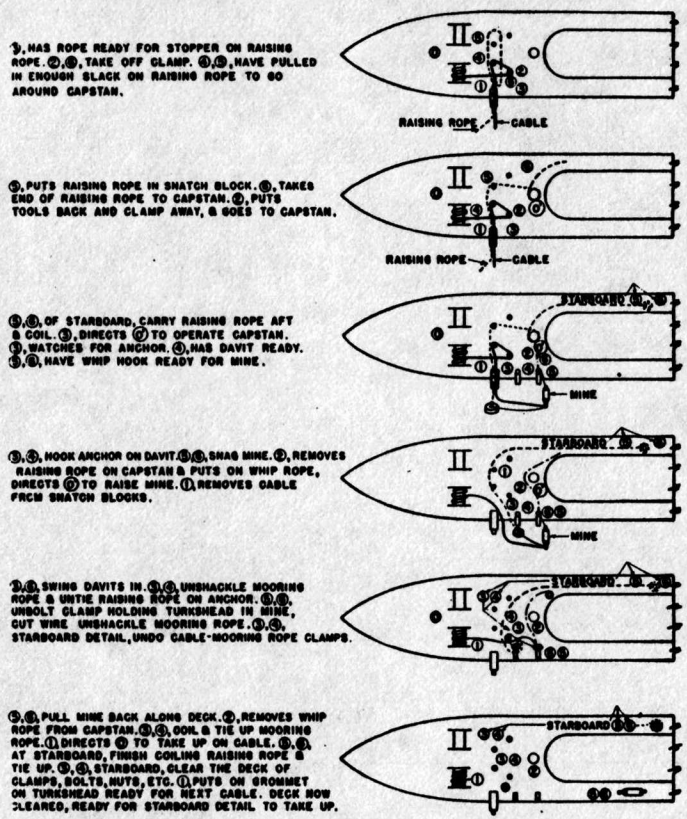


FIGURE 36.—Operations in taking up mines with trained crew—crew positions—Continued.

nect the sprocket wheels and chain so as to use the steam winch for winding the cable on the reel as it is taken up. Planters equipped with king reels can take cable up on this reel. It will be necessary to rewind the cable ashore for storage.

b. Handling cable on reels.—The end of the cable is passed to the planter, where it is carried forward through a large snatch block and through the hole in the reel; the hole should be large enough to pass a turkshead through. Pull

enough cable through the hole to permit the end to be above water when the cable is in the tank, and strap the loose end to the outside of the reel so that it will not be in the way when winding up. Strap insulated conductor down so that the conductor will not be injured. Wind the cable on the reel evenly if possible. Have a man stand by with a hammer to knock the turns against each other if necessary, or use a small snatch block to guide the turns on the reel.

c. Cable precautions.—If the cable gets caught on submerged obstacles, it may be necessary, in order to clear it, to take a turn around a cleat and to pull on it with the planter; but before doing this, try going to each side of the present course to see if the cable will clear itself. When cable will not come up, it may be necessary to cut it or pull until something gives. In the latter case place a stopper on cable, attach whip of boom to stopper, and take up on whip.

SECTION XXI

MINE PLANTER

■ 110. GENERAL.—The construction and maintenance of mine planters are responsibilities of The Quartermaster General (AR 30–1105). Administration and operation of these vessels are carried out in accordance with instructions from the Chief of the Services of Supply. The district, harbor defense, or group commanders direct the tactical operation of the vessel.

■ 111. REGULAR MINE PLANTERS.—Equipment for handling and planting mines is a part of the permanent installation on regular mine planting vessels. Two types of regular planters are in service, those built prior to 1940 and those built subsequent to that date.

■ 112. EMERGENCY MINE PLANTERS.—One set of emergency mine planting equipment is supplied to harbor defenses for each emergency mine planter required for the project. This equipment is intended for installation on some local vessel, to make planting of mines possible even though no regular planter is available. Until the necessity of actually making the installation of this equipment arises, it will be kept in storage by the mine property officer. A list of the various items in-

cluded in the emergency mine planting set is included in TM 4–220. This equipment should be inspected by the mine property officer to make sure that all items are present and in usable condition to perform the tasks for which designed. If, in a particular harbor defense, the vessel on which this emergency equipment is to be installed is known, it is highly desirable that an accurate scale drawing be made prior to installation to show the relative positions of the planting equipment and the existing equipment of the vessel. At this time necessary modifications of emergency mine equipment should be determined and estimates of time, labor, and cost of installation secured for future use.

■ 113. WARRANT OFFICERS.—*a. General.*—The duties of the warrant officers relative to operation of the vessel are prescribed in AR 90–150. During planting the master will pilot or direct the piloting of the vessel, one mate will be on the forward deck giving information to the master as to course, and one mate on the upper aft deck to give information as to the number of turns left in a figure-of-eight. In loading and unloading, a warrant officer will superintend the handling of deck equipment and the placing of mines, anchors, reels, and other mine equipment.

b. Master.—The master has the important function during planting of navigating his vessel close to the DB-boat, taking a course that will cause the vessel to cross the line of mines perpendicular to that line at the proper distance from the preceding mine, and then clearing the stern of the vessel from the planted mine (see fig. 24). In picking up mines, good judgment and expert handling of his vessel can not only save equipment from being lost or destroyed, but can also save many hours of time. On the skill of the navigator of the mine planter depends in a large measure the success or failure of the planting operations.

c. Training.—To insure proper training of junior warrant officers, the master and chief engineer of each mine planter will frequently require each of the assistants of their departments actually to take charge and perform all duties connected with operation of the vessel during mine planting operations. The peacetime training must prepare junior warrant officers to fill the position of master or chief en-

gineer of the additional mine planters which will be required in wartime operations.

■ 114. SAFETY AND INSPECTIONS.—*a. Precautions.*—All officers, warrant officers, and noncommissioned officers will exercise utmost precaution to prevent accidents in mine operations.

(1) In loading the vessel men must be kept at a safe distance from heavy equipment suspended from booms and cranes. *Do not allow any man to go under a suspended piece of equipment.*

(2) In planting keep men clear of bights in cables and ropes.

(3) Keep one yawl alerted for safety boat.

(4) When a man falls overboard immediate action must be taken. Notify the helmsman to stop the engines and throw over a life preserver.

(5) In picking up mines, do not send a man over the side unless it is absolutely necessary. No man will work over the side of a planter unless he is a qualified swimmer and unless there are adequate safety lines and life preservers available.

(6) Throw sand on slippery decks.

(7) Remove unnecessary equipment from decks.

(8) Take every precaution to preserve life and limb.

(9) Do not permit recklessness.

(10) Many accidents can be prevented by carefully selecting men for the planter and planting crew. The men should have superior physical stamina, excellent coordination, and ability to think and act quickly in emergencies. A physical weakling or a clumsy individual will eventually become a casualty. No man should be assigned to a planting section who suffers chronically from seasickness. All men should be qualified swimmers.

b. Signals.—(1) During planting and picking up operations the planter will hoist cable-laying signals. During the day this consists of the white diamond between two red balls; at night, a white mast light between 2 red (fig. 37).

(2) Flag signals are—

RK A mine in sight, bearing indicated if necessary.
MY Fairway is mined.
MZ Fairway is not mined.
RL I sight a mine in position indicated.
RM Mine field ahead of you. Heave to until you receive instructions.

RN Mines are reported to be in vicinity of ——.
RO *Used when planting mines.* There is danger from mines in this area, or area indicated. (See fig. 37.)
RP You should keep a lookout for mines.
RQ Is there any danger from mines?

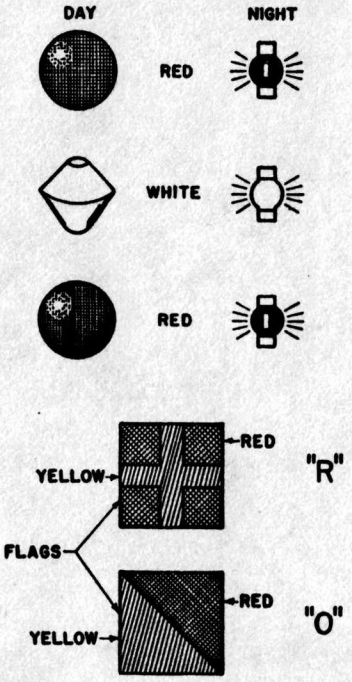


FIGURE 37.—Signals used in mine planting.

(3) See "The 1931 International Code of Signals," U. S. Government Printing Office.

c. Inspections.—Inspections of mine planters will be made as prescribed by the harbor defense commander to which the mine planter is assigned.

■ 115. RECORDS.—A record of all operations connected with mine planting is included in the ship's log. (AR 90–150.)

■ 116. PRECAUTIONS IN PLANTING.—*a.* If the current flows across the mine field, the mine planter, to avoid accidents, should pass on the *downstream* side of the yawl holding the measuring line.

b. Care should be taken that the measuring line and buoy ropes are not caught in the propellers. If the vessel has twin screws, stop the upstream propeller as soon as the measuring line has been passed to the marking boat. Post a man with a boathook near the planting davits, and another amidships, to hold the measuring line above the water and clear of the sides of the vessel. Hold marking buoys, and as much of the rope as possible, on the rail near the stern, and let the rope pay out slowly under tension until the propellers are past the rope; then throw the buoy and the remainder of the rope overboard.

c. As a general rule never back either propeller when buoy rope, measuring lines, or cables are being handled overboard at or near the stern of the vessel. If it becomes absolutely necessary to reverse the propellers when paying out cable, the men paying it out must haul it in taut and keep it above and clear of the propellers.

d. Do not pass nearer than 25 feet to the DB-boat when cable is leading out from that boat, and do not pass over any cable when it can be avoided if the depth is less than 16 feet.

e. After passing the DB-boat, proceed on such course that the cable will pay out smoothly without becoming entangled. If the cable becomes fouled and entangled, signal the DB-boat to let go at once, and proceed on—do not back the propellers. Mine cable should never be made fast in the distribution box until after the mine is dropped. It is much better to drop the mine out of position than to endanger the propellers of the vessel. Stop the propeller nearest the DB-boat the moment the bow passes that boat on its course to drop a mine.

f. If the vessel moves *against* the current when planting, there is little danger of overturning the DB-boat if ordinary caution is observed. Should it be necessary to plant against a cross current or with it, pass the cable end to the DB-boat by a yawl. In this way the planter need not pass nearer than 50 or 75 yards from the DB-boat.

g. To avoid fouling the buoy rope or mine after the mine is dropped, put over the helm so as to *throw the stern away from the mine.* Have the vessel under headway and stop the propellers until they are well past the buoy and buoy ropes of the mine. These points are important; failure to observe them may result disastrously.

h. In laying shore cable the course of the vessel should be against the current. Whenever possible it is advisable to postpone laying the cable until a change of tide causes a favorable direction of current. Where currents exceed 2 miles per hour time will be saved by waiting. If any cross current is running, pay off cable on the *upstream* side of the vessel. Every care must be taken that the cable does not get caught in the propellers.

i. Special care is necessary to avoid colliding with the yawls or the DB-boat, picking up cable in the propeller, getting the mine cable tangled, and drifting over the mine after it is dropped.

■ 117. TACTICAL WORK.—*a. Mission.*—The primary mission of a mine planter is to plant and maintain mine fields. When used for other purposes the effectiveness of the vessel may be impaired so that in an emergency the planter may be unable to plant and maintain the approved project.

b. Miscellaneous duties.—Assignments not connected with submarine mine training should be held to a minimum.

c. Armament.—The armament of the mine planter consists of two caliber .50 machine guns for antiaircraft defense and of pistols or rifles furnished to officers, warrant officers, and members of the crew. The mine planter commander is responsible for the training of the crew in handling their weapons.

d. Weather.—The safety of all personnel in the mine flotilla is frequently menaced by stormy weather. The master of the mine planter is in general the best trained and qualified officer to determine whether weather conditions are suitable for mine planting. The conditions under which mine planting operations will be undertaken or continued when the master of the vessel states that it is not safe for operations on the water are prescribed in AR 90–150.

SECTION XXII

DISTRIBUTION BOX BOAT

■ 118. TACTICAL WORK OF DISTRIBUTION BOX BOAT.—*a. Duties.*—The duties of the DB-boat are described in paragraph 96.

b. Loading.—The loading of the DB-boat for work in the mine fields varies with the procedure used in planting.

c. Marking buoys.—(1) Paragraph 99 covers the method of locating the marking buoy positions.

(2) In laying out the field and planting, procedure No. 2, the DB-boat is directed to drop marking buoys. Several methods of dropping these buoys have been employed. One is to place the marking buoy anchor on a plank on the aft deck of the DB-boat. The mooring rope is attached to anchor and buoy. When the order to drop is given from the shore over the radiotelephone, the long end of the plank, acting as a lever, is raised and the anchor is allowed to slide into the water. The buoy is thrown clear. Another method is to use the crane. The anchor is raised with a ⅝- or 1-inch diameter manila rope and held over the water. At the command LET GO, the rope is cut. A trip hook, used in conjunction with the crane, eliminates the necessity for cutting the manila rope and is a more satisfactory method of dropping the anchor.

(3) In dragging buoys into position the coxswain should keep in mind the following important considerations:

(*a*) First, in carrying a buoy across a strong tide the actual course will be in the direction of the tide.

(*b*) Second, the longer the length of the mooring rope, the more difficult it is to locate the buoy properly. All slack should be taken up before actually changing the position of the anchor.

(*c*) Third, the mooring rope is attached to the bow of the DB-boat to enable it to hold its course. Steering of the vessel is difficult when mooring rope is attached to the stern. Care must be taken to prevent fouling of the propeller by the mooring rope.

(*d*) Fourth, the weight of the anchor, the type of the bottom, and the length of time the anchor has been down (imbedded in sand) are factors that will affect the dragging of the anchor.

(*e*) Fifth, all changes in position of anchors should be made on the same tide whenever practicable.

(*f*) Sixth, close cooperation between DB-boat crew and the range section is essential to secure accurate placing and location of buoys.

d. Laying shore cable.—(1) *Never pass the free end of a shore cable which has been paid out to a small boat until a marking buoy with a line having a length of at least the depth of water plus 50 feet is secured to the cable.*

(2) As soon as the cables are aboard the DB-boat and the planter has proceeded on its course laying the next reel of cable, the cable splicer on the DB-boat removes the thumb joints on the shore cables. He contacts the casemate with the boat telephone. The cable splicer advises when the shore cables are ready for insulation and continuity tests. The telephone is removed for the agreed length of time necessary to make the tests. When radio communication is available, instructions for connecting the boat telephone may be transmitted by radio.

(3) If the boat telephone will not operate, the fault may be in either the cable or the telephone. Connect the spare telephone to the cable and, if communication is not possible, the casemate and mine planter are informed by radiotelephone. The cable conductor is grounded to the water, and a resistance test is run from the casemate. When it has been definitely established that the cable is at fault, start searching for the trouble. Often it will be found that the insulated conductor will be broken at the turkshead. Cutting 3 feet from each end will often remedy the trouble. If cutting back the ends does not remedy the fault, it is usually advisable to pick up the entire length and lay another piece. When the electrical tests show the length of cable to be electrically satisfactory, a turkshead will be worked on and secured in a junction box. To pull in enough slack cable to make a watertight joint in the junction box, it may be necessary to underrun the cable with a yawl. Do not sever the shore cable until it is secured by stoppers or special cable clamps on each side of the section to be cut out of the cable. Drop the DB-boat anchor. Do not use the cable to anchor the DB-boat. If no slack can be obtained, it may be necessary for the planter to pick up this length of shore cable and relay it with slack, or pick up the entire length of cable.

(4) A watertight joint is made, the insulated cable conductor wires carefully laid in the box, and the top screwed down. Check the depth of water from chart. Attach one end of a light mooring line, ⅝-inch Manila or equivalent, to the junction box bail, and a wooden marking buoy, spar, or feather buoy to the other. Lower the junction box and cable.

e. Anchoring at distribution box position.—(1) After making the last junction box connection, the DB-boat proceeds to and takes aboard the distribution box buoy, anchors, and awaits the arrival of the mine planter with the end of the cable.

(2) Anchoring the DB-boat at the distribution box position is important. If no change of tide is anticipated during the planting operations and the flow is from the line of mines to the distribution box position, the distribution box anchor is sufficient. Where there is a cross tide or strong cross wind, or reversal in direction of tide, the DB-boat must be anchored from the stern as well as the bow. This will keep the boat from reversing direction and twisting the mine cables.

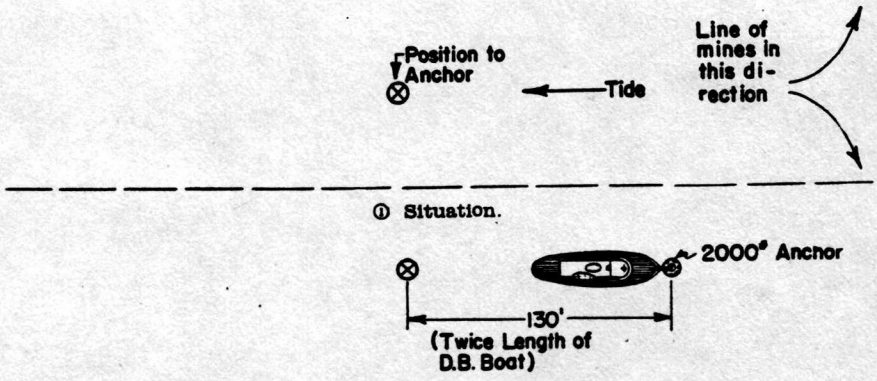
(*a*) One method of anchoring the stern is to drop the stern anchor (usually a 2,000-pound cast iron anchor) about 150 feet astern of the distribution box buoy and slowly come up to the buoy. The distribution box buoy is pulled aboard and the slack in its mooring rope taken up. The mooring rope attached to the stern anchor is made fast.

(*b*) Another method of anchoring is illustrated in figure 38. To allow for rise and fall of the tide, the DB-boat crew must leave some slack in the mooring ropes. If all the slack is taken from the distribution box mooring rope, the anchor will be "stepped" along the bottom with each rise and fall of the boat. Shifting of the bow anchor causes undesirable conditions. The distance from the DB-boat to the line of mines may increase to more than 400 feet and the mine cables begin to fall too short. The stern anchor will become loose and allow the boat to twist when the tide changes. Therefore, a constant check should be made on the forward mooring rope. The master of the planter should always be informed of the use of stern anchors and the direction in which lines lead from the DB-boat. The combined force of tidal currents, wave action, and winds on the DB-boat impose very severe strain on the rope attached to the boat's anchor. Breaking of this rope during planting will result in delays and twisted cables.

f. Preparation for planting mines.—(1) *Testing shore cable.*—The insulation resistance and conductor continuity of each shore cable *must be checked immediately* before the actual planting of mines starts. This test is in addition to all tests of the shore cable which are made when the cable is laid. When planting with procedure No. 1, as soon as the shore cable is laid, it is tested and sealed with a thumb joint. This end of the cable is made fast to the distribution box marking buoy by securing one end of a 1-inch manila rope or marline covered wire rope to the turkshead of the shore cable, and the other to the mooring rope of the marking buoy; care must be taken not to disturb the position of the distribution box anchor after it has been accurately located.

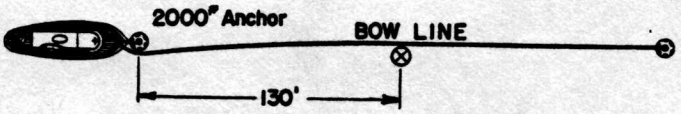
(2) *Operations preliminary to planting.*—The DB-boat should precede the planter to the mine field with the distribution box secured to the deck in a position where it will not interfere with the operation of the crane. Upon arrival at the position, the marking buoy is taken aboard at the bow, the boat anchored, and the shore cable end made fast to the boat, and disconnected from the mooring rope. The boat is anchored both fore and aft, perpendicular to the line of mines with its bow pointed toward the position of the center mine of the group. Secure the cable end to the distribution box and test the cable through to the casemate. After the cable end is connected to the distribution box and tested, a red flag is raised to indicate to the mine planter that the DB-boat is ready for the planting of mines; or the DB-boat may get into communication with the planter by means of the radiotelephone.

(3) *Distribution box.*—The distribution box will be connected to the shore cable only when the mine cables are to be connected to the distribution box. *Only to save life or very valuable Government property will the distribution box be lowered into the water without both the shore cable and mine cables connected thereto.* This is necessary to reduce to a minimum the chances of losing the selector box which is mounted in the distribution box, and to prevent damage to the selector by the entry of water into the selector box. When



① Situation.

② Dropping bow anchor.



③ Dropping stern anchor.



④ Anchored in position.

FIGURE 38.—Anchoring DB-boat at distribution box position where depth of water is approximately 50 feet.

the mines are taken up, the distribution box will be disconnected from the shore cable, the end of the conductor sealed, and the end of the shore cable fastened to the marking buoy anchor and lowered overboard. The distribution box is either kept aboard the DB-boat or is taken ashore until the mines are again ready to be planted.

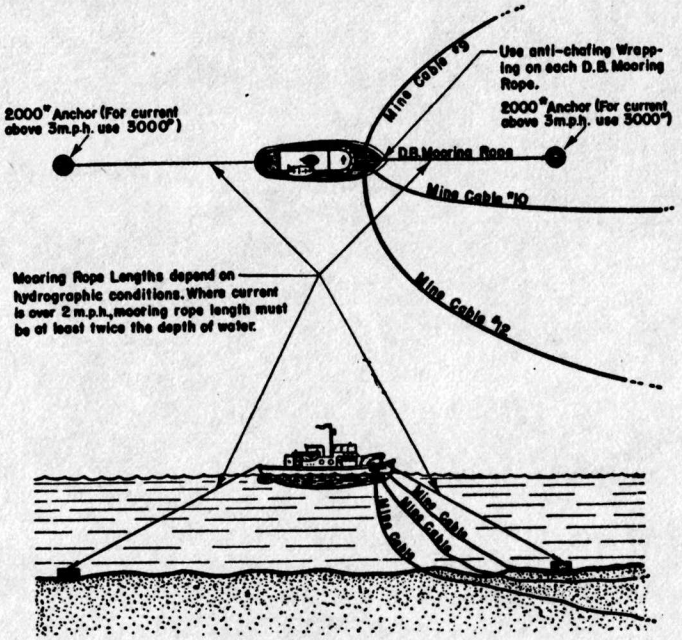


FIGURE 39.—Mooring DB-boat for planting mines.

g. Planting mines.—(1) When the shore cable has been tested and the distribution box, selector box, and tools are in place, the red flag is raised signifying that the DB-boat crew is ready for the first mine cable.

(2) A man stands by with a boathook ready to receive the end of the heaving line from the planter as it passes by. When the heaving line is received, the cable end is hauled aboard, a ⅝-inch rope stopper bent on to prevent losing the cable end if the first line should break, and the

lines made fast to a cleat on the forward deck. A man should stand by ready to release or cut the lines in case the cable is fouled or upon signal from the planter (one blast of the planter's whistle) to let go. In case the cable end should be lost, signal to the planter by one blast of the whistle not to drop the mine. *Do not secure the cable to the distribution box until after the mine has been dropped by the planter.*

(3) After each mine is dropped remove the heaving lines from the cable and slip the turkshead into place in the distribution box—No. 10 in the slot opposite the shore cable in a clockwise direction, No. 9 on the left side of No. 10,

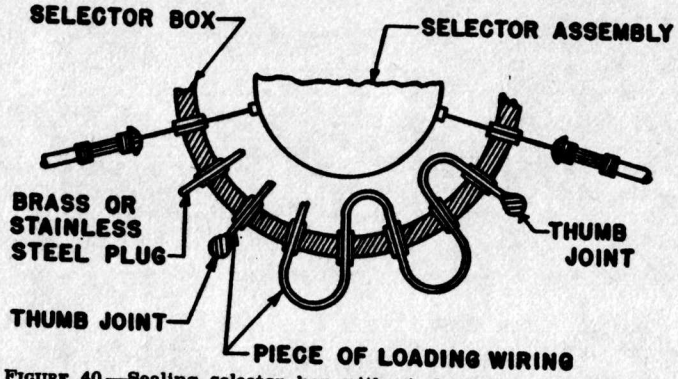


FIGURE 40.—Sealing selector box with steel plug or loading wire.

and so on. Check the tag on the cable end to see that it bears the proper number. (See fig. 41.)

(4) Remove the thumb joint. Slip on a follower, brass gland, and rubber packing. Pass the insulated cable conductor through the hole in the proper watertight connector. Tighten the follower with no more than a 20-pound pull at the end of a 9-inch wrench. Connect the mine cable to its correspondingly numbered selector box terminal leads. A watertight joint is not necessary, though advisable. It is also advisable to insert the selector in the distribution box as indicated in figure 41; that is, the shore cable in the slot between the two bolts and the "C" of selector adjacent to these two bolts. The connections of mine cables to selector

will be carefully checked when the selector box is not located in distribution box as indicated in figure 41. *Do not test any mine circuit from the casemate until after all the mines of a group of mines have been planted and the mine field is clear.*

(5) When the last mine of the group has been planted and connected to the selector box and the mine field is clear (planter and yawls at a safe distance from all mines), notify

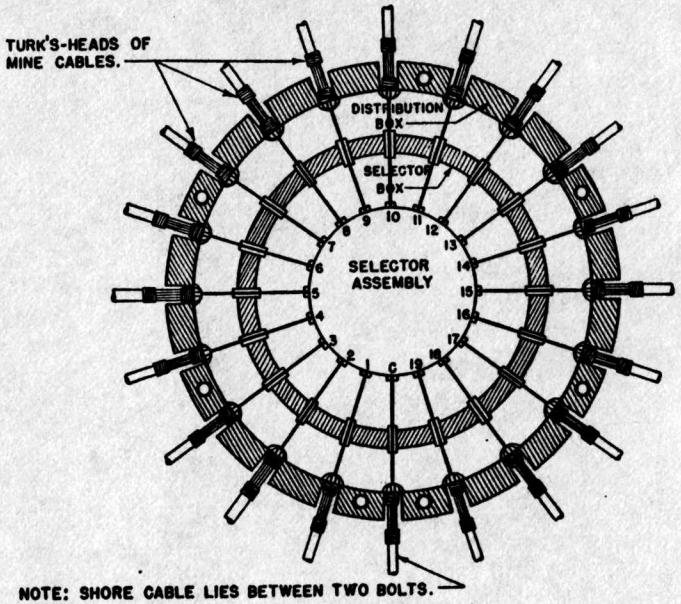


FIGURE 41.—Positions of shore and mine cables in selector and distribution box.

the casemate that the DB-boat is ready for the dry test, then disconnect the telephone and temporarily connect the shore cable to its selector box terminal. While this test is being made, check the tag on each cable end to see that it is connected to its correspondingly numbered selector box terminal. Test each follower to determine that it is sufficiently tight to insure a watertight connection. Check the air pressure. If the pressure is not sufficient, pump up with

DB-boat air pressure or by hand. When informed by radiotelephone or at the expiration of 10 minutes, disconnect the shore cable and reconnect the telephone to receive a report on the tests from the casemate; relay these readings to the mine planter. If the tests are satisfactory, remove telephone, connect the shore cable to the selector box, insert rubber gasket, and bolt the outer cover of the selector box in place. Check selector box holding screws to determine that the selector is securely bolted to the base of the distribution box. Place cover of the distribution box in position after checking position of each turkshead. Bolt the cover securely to the distribution box base.

(6) *Never place selector in water without sealing all watertight connectors.* During submine target practice or where less than 19 mines are planted, seal watertight connectors which are not used with short pieces of loading wire with a thumb joint on the outer side of the connector or with 3-inch lengths of brass or steel ¼-inch diameter rods. If several watertight connectors need to be sealed, a piece of loading wire may be "snaked" through the holes and in this way the connection made watertight (see fig. 40).

h. Lowering distribution box.—Attach mooring and raising ropes as shown in figure 28. Pass the mooring rope for the distribution box buoy through the bail in the distribution box. Even the ends of the rope and pass them through the end-pulley of crane to the rotating drum of the crane. Wind up slack, keeping the rope tight on the drum. Raise the distribution box from the deck. Move the crane forward, being careful at the same time to push the mine cables forward. When over the water lower the box *gently*. When the distribution box is on the bottom remove the remainder of the rope from the crane. With one end of the rope tie a bowline in the ring on the marking buoy cap (or shackle if buoy cap ring is too small) and tie the other end of the rope to the standing line with a bowline (see fig. 28). Heave the marking buoy overboard.

i. Mines with faults.—Occasionally in making a dry test it will be found that a mine or mines will test improperly. Where there is a definite open or ground, the mine planter commander will decide whether or not the defective mine is to be replaced at once. Time usually will be saved if unservice-

able mines are replaced immediately. If the unserviceable mine is to be replaced at a later date, the noncommissioned officer on the DB-boat will disconnect the unserviceable mine at the joint in the selector box, so that it will not be necessary for the casemate electrician to "blow" the mine fuze in the inner cover of the selector box.

j. Taking up mines.—(1) When the DB-boat enters a mine field where the buoys have been removed, the range section will direct the boat to a predetermined position not nearer than 100 feet from the distribution box. The DB-boat then drags a grapnel on a course at right angles to the line on which the long, buoyed, raising rope was planted (see fig. 28). As soon as any part of this rope is caught by the grapnel, the free end is pulled aboard the DB-boat. The wooden buoys are removed during this picking up process. The DB-boat is maneuvered toward the distribution box, and the remainder of the raising rope is hauled aboard the boat by hand or by use of a winch until the boat is over the box. Sufficient length of the raising rope is then doubled and passed over the sheave of the crane and enough layers are wrapped on the drum of the crane to prevent slipping of the rope when the box is raised. The crane is then moved forward in position to raise the distribution box. In the grappling operation a mine cable may be raised. This will not be used to raise the distribution box, but will assist in locating the position of the long raising rope. If the shore cable is picked up by the grapnel, it may be underrun until the raising rope attached thereto is reached. The raising rope is then used with the crane to raise the distribution box. After the box and cables have been raised, the crane is retracted. The box is lowered in position on the deck and lashed to the distribution box table in the cockpit.

(2) After taking up the distribution box, carefully examine it to see that it did not turn over in going down and twist the cables around one another. If this has happened, carefully sort out the cables to avoid tangles when taking up the mines. Haul the outer cables in as far as possible by hand to be sure that each cable leads directly to its mine. It may be necessary, before passing a cable to the planter, to have a yawl underrun it until assured that it leads clear to the mine.

(3) When all the mines are to be picked up, it is not necessary to open the selector box. The insulated cable conductor

can be cut with side cutting pliers between the turkshead and the selector follower. If this method is used, a new turkshead must be made on each cable before using it again. Where one or more mines are to be replaced, or where a fault has developed in the selector assembly, the cover of the selector will be removed. The joint between the mine cable and the selector lead is cut out, and the insulated cable conductor slipped out. The first cable to be removed is No. 19, then Nos. 1, 18, 2, and so forth, unless the mine planter commander directs otherwise. Seal the ends of each cable with thumb joint before passing to planter. Only one cable at a time is removed from the distribution box clamp. Secure the cable end to the boat with one line, bend a second heaving line on the cable, and throw it to the mine planter as it passes to pick up the first mine. When the heaving line is received by the planter, release the securing line. Similarly pass each cable end to the mine planter.

(4) When the last mine cable has been passed to the planter, disconnect the shore cable from the distribution box and seal the end of the conductor. If the cable end is not to be passed to the mine planter at once, make fast the end of the cable to the marking buoy by means of a rope tied at one end to the turkshead and the other to the cap. Always use a mooring rope and anchor for the marking buoy and do not use the cable to hold the buoy. The selector box will always be returned to the casemate electrician for checking and repairing after a group is picked up.

k. Taking up shore cable.—The DB-boat raises the distribution box marking-buoy anchor, disconnects the shore cable end, and remains in position until the cable end has been taken aboard the planter.

l. Moving and alining buoys and mines.—When the DB-boat is used to aline buoys and mines, cooperation with the range section is essential. A suggested procedure is to furnish the master of the DB-boat coordinate paper, prepared as that shown in figure 42, on which the desired location is taken as the center of the sheet. One inch on the coordinate paper equals 100 feet on the water. When the position is plotted, the range officer places the buoy position on his coordinate paper. By radiotelephone or visual signals he informs the master of the distance north or south and east or west. This

will give an intersection which gives the master his relative position from which he will drag until he estimates that the buoy or mine is in its proper position. The range section then plots the new position. The DB-boat is then advised that the position is correct or is given a new intersection at which the buoy was plotted (see fig. 42).

m. Towing.—The DB-boat is not designed for towing missions, but may be used in towing targets for mine target prac-

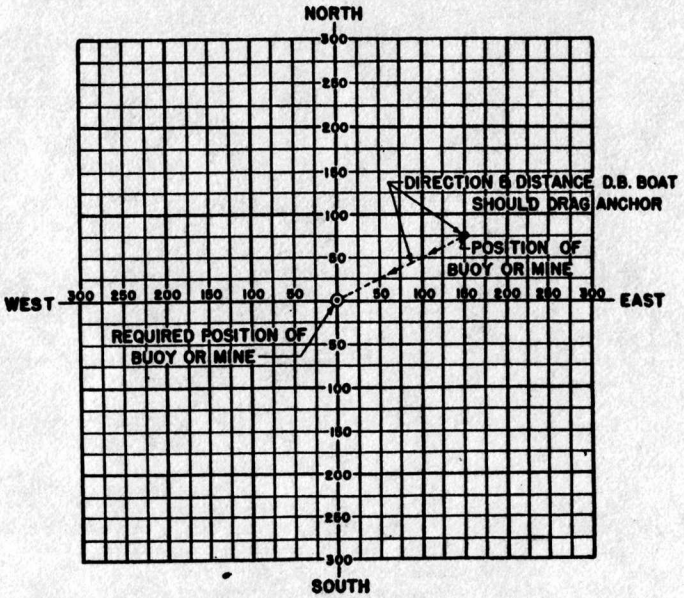


FIGURE 42.—Method of locating buoy or mine. (From plotting board it is found that position of buoy is north 75 feet east 150 feet. Scale: 1 inch equals 100 feet.)

tice and in towing disabled mine yawls. The use of DB-boat for other than mining operations will be restricted to tasks which will not strain or endanger the effectiveness of the boat for mine work and will not interfere with mine planting training schedules.

n. Patrolling.—(1) Frequently it will be necessary for the DB-boat to act as a patrol boat for the mine field. The vessel will either anchor in front of the outer line of mines or ac-

tively patrol the approaches to the field. The procedure for halting, examination, clearing, and piloting of vessels through the mine field is established by the harbor defense commander and communicated to the mine flotilla commander, who issues detailed instructions to patrol vessels operated by the Army.

(2) To enforce the patrol, the DB-boat is equipped with a caliber .30 machine gun, four rifles, and one pistol.

■ 119. PERSONNEL.—*a. Authorized strength.*—The number, grade, and ratings of personnel allotted to the DB-boat are specified in T/O 4–69. In general each boat will have available for duty a trained crew capable of performing all duties connected with operation and routine maintenance of the vessel, planting, repairing, and picking up matériel, and patrolling the mine field. Where weapons are issued the crew will man them for defense against attacks from the air and sea. Personnel assigned to DB-boats will insofar as practicable meet all requirements of the Department of Commerce for their position and duty assignment on vessels of this size and construction.

b. Duties of crew.—(1) *Master.*—The master (coxswain) is in general charge of the boat. He is responsible that the vessel is maintained in first-class operating condition and that its appearance is as good as working conditions permit. The master is normally the pilot of the vessel when it is under way. However, he is responsible for training of assistants who will be capable of maneuvering the vessel in the event of casualties. Inspection and supervision of maintenance operations, safety and fire equipment, signal equipment, and the maintenance of a daily log are responsibilities of the master. In mine planting operations the master (coxswain) under supervision and direction of the mine flotilla commander is responsible for the loading of supplies and equipment and for the proper performance of the DB-boat operations.

(2) *Engineer.*—The engineer is responsible for maintenance and operation of all engine room and ship machinery. He makes frequent inspections of the equipment under his care and maintains a log of operations connected with his department. He will daily supervise the policing of the engine room, check functioning of main and auxiliary engines by

running, check cooling and lubricating systems of main and auxiliary engines, check operation of air compressor, fire and bilge pump, and all auxiliary electric motors on maneuvering gear, check charging rate of all storage batteries and specific gravity and quantity of electrolyte of pilot cell and complete daily storage battery maintenance test and report, inspect the fuel, water, and lubricating oil tanks. At least once a week the engineer will inspect all fire fighting and lifesaving equipment and all bulkheads and compartments.

(3) *Cable splicers.*—The cable splicers under the supervision of the master are responsible for all DB-boat cable tests, watertight joints and connections, and for all operations connected with direct handling of selector and distribution boxes on the boat.

(4) *Radio operator.*—The radio operator operates and maintains all radio and signaling equipment in accordance with instructions from the harbor defense communication officer.

(5) *Deck hands.*—The deck hands perform the normal duties of policing the mess and quarters, scrubbing decks, removing rust, painting, and assisting in repair and adjustment of boat machinery and equipment. The primary mission of the deck force is to complete the team necessary to carry on successful mine planting operations. To this end at least one man of the deck crew will be trained for each of the following duties:

(*a*) Operate crane.

(*b*) Pilot boat in an emergency.

(*c*) Operate engine room machinery in an emergency.

During planting operations the deck force is primarily engaged in handling lines, cables, and mooring and raising ropes under the supervision of the master of the boat.

c. Training.—The training of the DB-boat crew is the responsibility of the mine flotilla commander or an officer designated by him. This officer will make daily inspections of the vessel, noting the condition of the safety equipment, fire fighting apparatus, cleanliness of the bilges, condition of lights, and the general thoroughness of the policing. Once a month he will cause the fire fighting hose to be operated, the safety hatch to be opened, the lifeboat to be launched, and will conduct drills necessary to insure safety

of personnel in compliance with Department of Commerce regulations. During active operations the crew may sleep and mess aboard the vessel. The mine flotilla commander will make the necessary arrangements with the organization to which the men are assigned for supplies required for quartering and rationing of the crew.

■ 120. SAFETY PRECAUTIONS.—*a. Fire prevention.*—Dirty bilges are serious fire hazards. The bilges should be pumped out daily and cleaned at least once a week. Fire hoses should be replaced whenever they fail to stand their rated pressure tests. The fire fighting equipment should be tested once a month under the supervision of an officer or warrant officer.

b. Life preservers.—Before any vessel of the mine flotilla leaves the wharf or boathouse, the senior officer, warrant officer, or enlisted man in charge of the vessel will assure himself that at least one life preserver per person in serviceable condition is on the vessel in a readily accessible location.

c. Safety regulations.—At least one copy of "Pilot Rules for Certain Inland Waters of the Atlantic and Pacific Coasts and of the Coast of the Gulf of Mexico," U .S. Department of Commerce, will be available aboard each vessel of the flotilla. DB-boats and mine yawls should also have a copy of Bulletin No. 10, United States Department of Commerce, Bureau of Marine Inspection and Navigation. This bulletin contains detailed explanations of Federal requirements regarding motorboats and contains valuable instructions and illustrations regarding boat equipment, safety precautions, and operating instructions. The mine flotilla commander is responsible that personnel of vessels are familiar with the requirements of the documents listed above, and that they are capable of handling each vessel in accordance with the rules. These documents are for free distribution and may be secured on request from local inspectors of the Bureau of Marine Inspection and Navigation or from Collectors of Customs.

d. Signals.—When the DB-boat is engaged in mine planting or picking up operations, the coxswain of the vessel will cause to be hoisted the proper warning signals, a white diamond between two red balls (see fig. 37). When this signal is not available, a red flag will be flown from the mast to warn shipping.

SECTION XXIII

MINE YAWL

■ 121. TACTICAL WORK.—*a. Duties.*—The duties of the mine yawls in planting and picking up operations are prescribed in paragraph 96.

b. Equipment.—TM 4–220 contains a list of the equipment normally carried by each mine yawl when engaged in mining operations. Extra marking flags, a snatch block, junction box, and a measuring line may be loaded aboard a yawl when conditions indicate a need for this equipment.

c. Marking buoys.—(1) In the operation of plotting mine field marking buoys, the yawls, depending on local tide and current conditions, will be instructed to pull aboard the buoy and take up the slack buoy mooring rope, or tie up to the buoy without taking up the slack. Whichever method is used, each buoy of the group will be plotted in the same manner. When ready for plotting, a member of the crew will raise a red flag. From a designated shore station a red or white flag, depending on the shore background, is raised to notify the yawl that the position has been plotted. The range officer notifies the mine planter, where radio communication is available, or else the DB-boat by telephone, and the message is relayed to the yawl crews. Before leaving the buoy the crew will assure themselves that the mooring rope is long enough, and will insert a small red flag in the pipe on the buoy (see fig. 21).

(2) When a buoy needs to be alined, the yawl will be used to drag anchor only when weather conditions are favorable.

(3) If the planter is not equipped with a fathometer, mine yawls may be used to take soundings along the line of mines.

(4) For refinements in marking out a field, the measuring line may be used.

d. Laying shore cable.—(1) Yawls are used to land shore cable on the shore, and adjacent to the cable hut.

(2) Where conditions are favorable a yawl may be employed to make a junction between two shore cables.

e. Planting mines.—(1) The method of operating a mine yawl during planting varies slightly depending on local conditions and the number of yawls available.

(2) A minimum of three yawls is required for expeditious

planting of mines. The general assignment of duties is as follows:

(*a*) One yawl to be a safety and general utility boat.

(*b*) One yawl to operate on the left side of the line (9 to 1, inclusive).

(*c*) One yawl to operate on the right side of the line (11 to 19, inclusive).

(3) As soon as No. 10 mine is planted, the safety yawl proceeds at once to it, takes and records the submergence, and then raises its flag over No. 10 so that the mine's position can be plotted. This yawl then remains in position tiled up to either No. 10 mine or No. 10 marking buoy, or, at the discretion of the mine planter commander, may follow the mine planter. If tied to the No. 10 mine buoy, care should be taken to see that the yawl does not position itself in such way as to obscure No. 10 marking buoy from the planting officer. Yawl No. 2, keeping clear of the planter until No. 9 is planted, proceeds to No. 9, takes and records submergence, raises its flag above No. 9, and having completed marking No. 9 remains there. Yawl No. 3 goes through the same cycle of operations on No. 11 mines as soon as No. 11 is planted. As the planter moves toward the DB-boat, preparatory to passing the mine cable for No. 8, the yawls are in a position as shown in figure 43. As the planter approaches the line of mines, the navigating officer has yawl No. 2 as a guide in obtaining his 100-foot interval for planting No. 8, and yawl No. 3 in position at No. 11 to assist him in the proper positioning of No. 12 mine. As mines No. 8 and No. 11 are planted, yawls Nos. 2 and 3, respectively, move over to mines No. 8 and No. 12, and continue as before (see fig. 43). When four yawls are available, the extra yawl is utilized for measuring the distance and planting feather buoys to mark the position of the next mine to be planted. The rigorous service required of yawl boats makes it advisable to have always the fourth yawl available in the mine field.

(4) *Submergence of mines.*—(*a*) In taking submergences one of the men aboard the mine yawl will pull the mine buoy ropes taut. When the yawl is over the mine the closest foot mark at the water level on the buoy rope is noted. It is necessary to have some means of making sure that the buoy rope actually measures the submergence. A special mark on

one line of the rope should be matched with a mark on the other line. The submergence marks on the line can be painted on with black paint (or friction tape if available), 1 foot apart; at 5 feet one red mark; at 10 feet, two red marks; and so on. This method requires that each buoy rope be individually marked.

(*b*) Submergences may be taken by allowing a shackle which is attached to a marking line to slide down the buoy rope (see fig. 44).

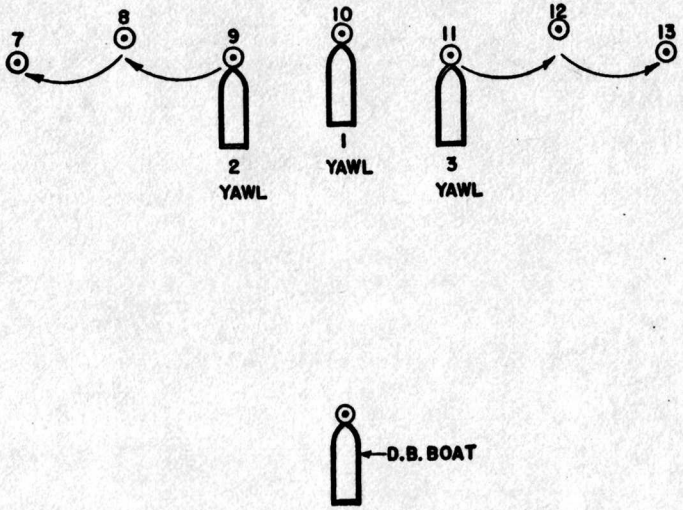


FIGURE 43.—Mine yawl planting positions.

(*c*) The submergence of each mine is transmitted to the planter by megaphone or by writing on a blackboard with chalk. This information will usually be transmitted when the planter passes the yawl when planting the adjacent mine.

(5) When all the mines have been planted and plotted, the yawls should move clear of the mine field in order that the dry test can be made.

(6) The mine buoys will be removed from the mines when directed by the mine flotilla commander. Usually the buoys are not taken off until the dry and wet tests are satisfactory and the alinement satisfies the tactical requirements. To re-

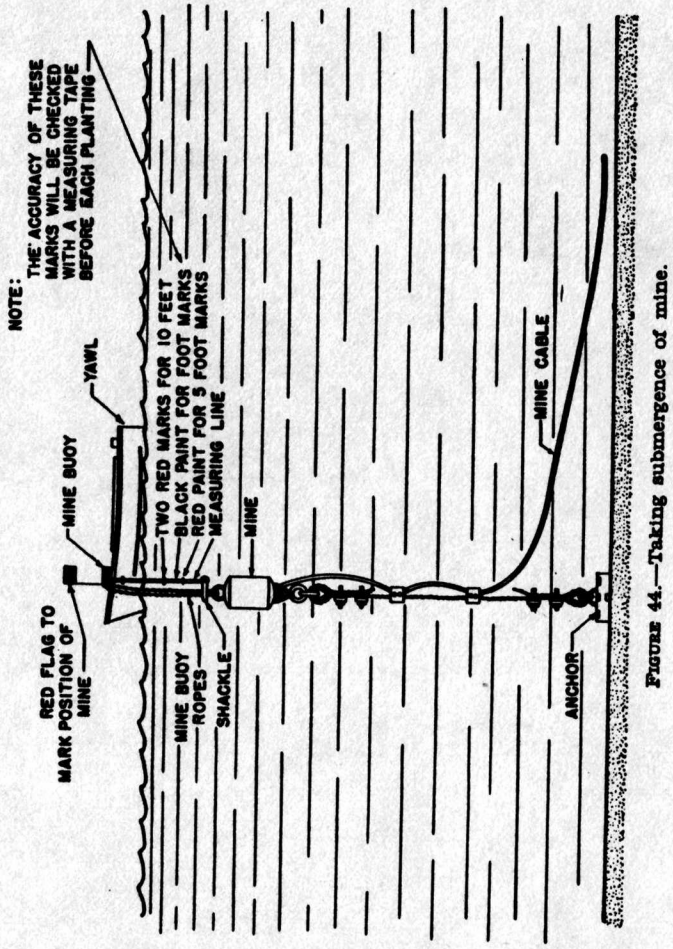


FIGURE 44.—Taking submergence of mine.

move the blocks the crew of the yawl pull the block aboard, untie the bowlines, and pull one end of the buoy rope from the maneuvering ring.

f. Taking up mines.—(1) The mine yawls are used to grapple or to sweep as directed from the DB-boat or the planter (fig. 33).

(2) When the weather conditions are satisfactory and depth of water not too great, the yawl will underrun cable. Raise the cable, take it aboard, and place it over one of the bits in the stern. Then carry the cable forward and place a loop of rope around it. This loop is secured forward by one turn on a cleat. The cable is then pulled by hand over the yawl, helped by the forward motion of the yawl. For safety reasons, the cable being underrun will be so held on the yawl that it can be cut loose without delay if it becomes fouled or the yawl is endangered in any way.

(3) Yawls may be used to help remove the tangles which occur in underruning or taking up cables. Care must be exercised that none of the crew is at any time in a bight.

(4) During rough weather, and in water areas having tidal currents in excess of 3 miles per hour, a yawl may be required to carry a heaving line to the planter or DB-boat.

(5) The yawl may be used to carry messages or men from shore to ship, or ship to ship.

g. Taking up shore cable.—(1) In taking up shore cable the yawl may be required to underrun a section of the cable.

(2) When junction boxes are reached and the water is not too deep, the yawl may be required to break the joints in the cable.

(3) Where the shore is approached in picking up shore cable, a mine yawl is sometimes used to underrun the cable to relieve excessive strain on it when the cable is being taken aboard the planter.

■ 122. DUTIES OF CREW ON YAWLS.—*a. Crew.*—The crew of the yawl operate the vessel, maintain its serviceable condition, and perform the duties prescribed for the mine yawl in planting operations.

b. Boat operation.—(1) The coxswain of the yawl is responsible for his boat. He will make reports to the boat officer of fuel needs and necessary repairs. He will see that the log of his boat is up to date.

(2) The coxswain is the pilot of the boat and will be familiar with instructions contained in "Pilot Rules for Certain Inland Waters of the Atlantic and Pacific Coasts and of the Coast of the Gulf of Mexico," U. S. Department of Commerce, and Bulletin No. 10, vol. 111, Bureau of Marine Inspection and Navigation, Department of Commerce, which pertain to motorboats of the size of yawl boats. He will allow only authorized personnel to operate the boat.

(3) The coxswain during planting operations will take his orders from the mine flotilla commander or his representative. He will, when danger to life and limb are imminent, use his own initiative in handling his boat.

(4) The coxswain will be familiar with mine planting operations: grappling, sweeping, making turksheads, splices, heaving lines, using stoppers, and underrunning cable.

(5) The engineer maintains the engine in running order and makes only such repairs as he is authorized to undertake. He will assist in mine planting operations when directed by the coxswain.

(6) The deck hand assists in the general maintenance of the boat, which includes cleaning the bilge, deck, glass, and bright metal parts. During mine planting operations he will assist the coxswain.

(7) The training of the crew is the responsibility of the mine flotilla commander, or an officer designated by him. Daily inspection of the yawls will be made. Special attention will be paid to the safety equipment and condition of the bilges.

(8) The crew should be quartered as near the small boat boathouse or anchorage as possible in order that they may be available to protect the yawls from sudden changes in weather affecting the security of mooring.

■ 123. BOAT OPERATIONS.—*a. Tactical usage.*—Mine yawls may be used for operations other than tactical only on approval of the harbor defense commander.

b. Miscellaneous duties on water.—(1) The yawls may be used to tow specially built small targets for mine practice when larger vessels are not available to tow the regular seacoast target.

(2) Yawls may be required to patrol a mine field. Reliefs should be frequent for men in open boats exposed to the elements.

(3) During planting operations it may be necessary to feed the planting detail on the planter. A yawl may be used to pick up food ashore and bring it to the planter. This method of feeding men should be used *only when it is impossible* to provide hot, wholesome food aboard the mine planter.

■ 124. SAFETY PRECAUTIONS.—*a. Fire.*—(1) The prevention of explosions and fires is of major importance in mine yawls, since these boats are constructed of wood and a majority of them are equipped with gasoline engines. Personnel assigned to gasoline engine driven yawls must be constantly on the alert for fire hazards.

(2) Fire extinguishers must always be aboard and in serviceable condition.

(3) Before starting the engine the bilges and engine cover will be opened for ventilation. An inspection will be made for gasoline or Diesel fuel leaks and for the presence of explosive vapors.

(4) Bilges will be pumped out daily and cleaned weekly.

(5) Fuel lines will be inspected daily for loose, broken, or leaky connections. All fuel lines should be readily accessible and should be protected from excessive vibration or provided with flexible sections adjacent to connections. Fuel lines will not be exposed to direct contact with exhaust pipes.

(6) Fuel tanks will be equipped with adequate air vents. These vents must be kept open.

(7) When a yawl is being refueled, the engine will be stopped, and smoking or the use of any equipment liable to produce sparks or flame is prohibited.

(8) The officer responsible for the mine flotilla boats will make the inspections necessary to insure that fire hazards are reduced to a minimum on all yawls. He is responsible that all personnel of the flotilla are familiar with the provisions of AR 30–1325.

b. Safety regulations.—(1) Safety regulations as prescribed by the Department of Commerce will be observed.

(2) The yawls will be equipped with running lights. Officer making inspections will check on the adequacy of these lights before permitting any yawl to leave on a mission that may require it to be at sea at night.

(3) Compasses should be available on each mine yawl operated in foggy weather.

(4) Yawls will always be supplied with anchors and serviceable anchor rope. The anchor rope will be of sufficient size and length to hold the yawl under the local hydrographic conditions.

(5) One life preserver will be aboard for each passenger and member of crew.

(6) Fuel tanks will be inspected and the coxswain will not leave the station until sufficient fuel is aboard to accomplish the assigned mission or adequate provision has been made for refueling.

■ 125. CARE OF YAWLS.—*a. Boathouses.*—A boathouse and small boat anchorage are necessary to provide protection of yawls from the elements and to furnish facilities for maintenance of hull and engine.

(1) The boathouse should be supplied with fresh water and electric power.

(2) The boathouse is equipped with a means of removing the vessels from the water. Mine yawls are lifted from the water only for repairs or when there is danger that ice will damage the hull or when storms will endanger the boats if left in the water.

(3) Constant lifting and long periods of hanging will weaken the frame of the vessel and should be avoided.

b. Maintenance.—(1) The hull of the vessel should be painted as frequently as necessary to prevent deterioration and excessive marine growths. The decking and sides are painted when necessary to prevent deterioration. Copper paint is recommended for below-the-water areas of wooden hulls.

(2) The engineer will make minor repairs. Lubricating oil will be changed as recommended in the manufacturer's handbook or in the absence of other instructions every 50 hours of running time. Batteries will be checked daily and charged when needed. Distilled water will be added when required.

(3) Supplies, equipment, and funds to operate and maintain the mine yawls are furnished by the local quartermaster.

c. Weather.—(1) The cooling system of yawls which are in service in winter will be filled with an adequate supply of approved antifreeze solution. When boats are to be stored during the winter months, particular care must be taken *to drain all liquid* from the radiator, engine block and water

pump. Failure to observe this precaution will result in serious damage to the engine.

(2) Close cooperation will be maintained with the Coast Guard. When storm warnings are hoisted, the yawls will be placed in a safe anchorage or taken to the boathouse and raised from the water.

(3) During winter, yawls will be protected from ice which would damage the hull.

d. Protection of sides.—To protect the sides of the yawls, bumpers or fenders will be provided and used whenever the yawl is alongside other vessels or wharves.

e. Speed.—For each mine yawl the mine flotilla commander will determine and have stenciled or otherwise marked in a conspicuous place near the boat operator's position the following information:

Normal safe engine speed _____ rpm.
Maximum emergency engine speed _____ rpm.

The normal operating engine speeds must be determined by actual mine yawl operation. This speed is selected to insure operation at engine speeds which will prevent destructive vibration of hull, auxiliary equipment, and the engine itself. Careful selection and training of mine yawl coxswains, with frequent check on their handling of boats by flotilla officers, is necessary to provide serviceable yawls for mine field operations. Particular attention will be devoted to instruction of boat crews in the proper speeds, courses, and handling of the small boats in rough weather.

SECTION XXIV

HANDLING SMALL BOATS

■ 126. GENERAL.—The term "small boats" will be used to include DB-boats and yawls.

■ 127. HANDLING BOAT IN CURRENT.—Considerable practice is needed to handle a boat well. In any harbor slack water lasts but a short time. The tidal currents vary from 2 to 5 knots, and in many harbors they change direction at different stages of the tide. Coxswains should be trained to use the current as an aid instead of a hindrance. The progress of a

boat in a current will be the resultant of the forward impulse of the boat and the effect of the tide and wind (fig. 45). Men should be taught to estimate the strength and direction of the tide from the inclination of buoys, the wake of piles, and by watching objects on the shore when drifting.

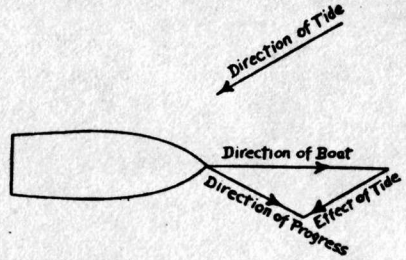


FIGURE 45.—Progress of boat due to direction of boat and tide.

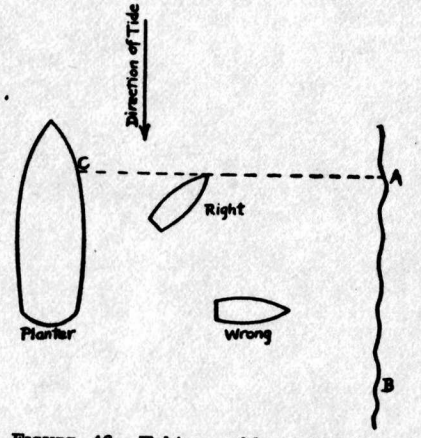


FIGURE 46.—Taking cable end ashore.

■ 128. TAKING CABLE END ASHORE.—Referring to figure 46, if it is desired to land the end of a cable at *A*, do not head the boat for *A* or the tide will carry it so that it will land somewhere in the vicinity of *B*. Turn the boat so that it will make an angle with the direction of the tide, move ahead just enough to keep the stem on the line *C–A*, and the current will carry it to the shore at *A*.

■ 129. Coming Alongside Ship.—Head into the tide at an angle, keep the stem abreast of the desired point, and let the current carry the boat over toward the ship. Go on the lee side, have a man ready to fend off, and put a fender out. Go alongside another small boat in the same manner. If men are standing up at work in either of the boats, it is important that they should be warned. Do not bump the adjoining boat hard.

■ 130. Picking up Buoy.—Come up to the buoy against the tide, take the buoy inboard, and keep the boat going ahead until all the slack mooring line is on board. Attempting to pick up the buoy while going with the tide results in all of the mooring lines being stretched out taut, which makes it impossible to take the buoy on board.

■ 131. Mooring to Buoy.—Lead the mooring rope through the bow chock; do not take it in amidships or the boat will yaw from side to side and probably turn beam to the sea; on a rough day this may cause swamping when the rope is taut. When a boat is moored in a tideway it will obey its helm to a certain extent the same as though going ahead. Use of this fact can be made in keeping it headed in the right direction or getting it in a more desirable position.

■ 132. Locating Position on Water.—Look around for two immovable objects in line. Two sets of such bearings intersecting at the boat are necessary to locate it. To hold this position without anchoring, keep head to the tide, and move ahead just enough to neutralize it. The accurate taking of a position is very important when grappling or sweeping to recover lost material.

■ 133. Anchoring at Required Point.—Go against the tide beyond the point, let go the anchor, and pay out line until the tide carries the boat back to the exact position. Be sure that the anchor is heavy enough, and lead the anchor line through a bow chock so that it leads straight ahead from the bow. It is important to be able to anchor in a position accurately when the boat is to be used as a marker or point of reference. Pay out line as the tide comes in. A mooring line from three to six times as long as the depth of the water is needed, depending upon the strength of the tide.

■ 134. Towing.—When towing a heavy object across the current, have plenty of spare line aboard the towing boat. If carried off the course, back the boat toward the towed object, take in the slack line and start off again on the right course, paying out enough towline to obtain room to maneuver. If it is desired to turn around, slack the towline, make it fast in the bow of the boat, and go ahead until the boat is turned around.

■ 135. General Instructions.—*a.* Never let slack line drag from a mine yawl; it will surely catch in the propeller. Always take on board the slack in a towline when backing toward the object towed. Always stop the propeller when near a line in the water. When casting over a mine buoy do not start the engine until the tide has drifted the boat clear.

b. In crossing the bow of a boat which heads into the tide, allow sufficient space for the current to drift you down and still allow you to keep clear.

c. The anchor rope, to withstand a storm, should be six times as long as the greatest depth likely to be used as an anchorage. A 1-inch diameter manila rope is sufficient for use on yawls in the mine field.

d. A boat must never go out at night without regulation running lights.

e. Before leaving the shore in foggy weather, provide the boat with a foghorn and a compass, and calculate as nearly as possible the bearings of the landing it is desired to make. Take the opposite of this upon returning, making due allowance for tide and wind in both cases.

f. To ride out a gale, make the boat take the seas head-on.

g. Remember, in making a landing, that the heavier the boat is laden the longer she will keep her way.

h. When being towed, make the towing vessel furnish a line instead of using your own, and fasten it so it can be cast off in a hurry. Carefully avoid weighing down the bow. Use a short towline when the boat is empty, and a long one when it is laden. If the boat's painter is being used for a towline, have a knife ready for cutting if it becomes necessary.

i. Never go close under a steamer's stern unless it is absolutely unavoidable.

j. The yawls will not be maneuvered under heavy objects suspended on the planter, such as anchors or mines.

k. Never run a yawl between two large vessels that are close together.

l. Underrunning of cables can best be accomplished by means of a single snatch block attached to or near the bow of a boat. Unless the underrunning boat or vessel is equipped with twin screws, a second block at the stern will only hamper operations and limit maneuverability.

SECTION XXV

FIRE CONTROL AND POSITION FINDING

■ 136. FIRE CONTROL AND FIRE DIRECTION.—Fire control in submarine mine defense includes the exercise of all the tactical and technical functions of command invested in the mine group commander. Primarily, it consists in the direction of fire to insure effective attack on all hostile elements which have been designated in battle orders from higher echelons as targets for controlled submarine mines, and the withholding of mine fire on enemy vessels which have not been designated as mine targets. Under circumstances where harbor defense, groupment, and fort commanders are casualties or are inoperative, the mine group commander will designate targets and direct fire of mines to accomplish the mission of the controlled mine defense.

■ 137. CONDUCT OF FIRE.—As applied to submarine mine defense, conduct of fire comprises the technical decisions, and the commands and means to put them in effect, necessary to secure effective attack on targets assigned by the mine group commander. Conduct of fire over a given mine field is a function of the mine battery commander charged with the operation of that mine field, and includes decisions as to method and time of fire and designation of mines to be fired. Whenever the casemate apparatus is set for delayed contact fire or contact fire, the mine group commander will insure that measures are taken first to notify all cooperating naval units of the fact.

■ 138. POSITION-FINDING SYSTEM.—*a. Necessity and use therefor.*—A position-finding system is required to plot the exact

locations of the mines as they are planted and for surveillance, fire control, and conduct of fire.

b. Different systems in use.—Since controlled mines ordinarily are located well within the range of visibility from shore, the position-finding system provided should be one which is well adapted to short range work. The three systems which have been installed for submarine mine purposes are, in the order of preference, the terrestrial horizontal base system, the vertical base system, and the self-contained horizontal base system. For discussion of these systems see FM 4–15. Vertical base and self-contained horizontal base systems, which involve visual tracking, are used only in an emergency when it is impossible to provide a horizontal base system.

■ 139. FIRE-CONTROL INSTRUMENTS AND EQUIPMENT.—*a. Communication.*—Equipment normally supplied for the use of mine batteries includes—

(1) *Boat telephones,* which consist of commercial sound-powered handsets incorporating a receiver and transmitter, and a buzzer signal set inclosed in a waterproof case. The details of construction and maintenance of this unit are contained in TM 4–220.

(2) *Fire control telephones,* which are common battery artillery type instruments drawing their operating power from the harbor defense fire control switchboard. Two types of instrument are in common use, types EE–8 and EE–91. Transmitter and receiver combined in either a handset or headset are used. The equipment is supplied by the Signal Corps and serviced by the harbor defense artillery engineer. Figure 4 illustrates typical communication system for a controlled submarine mine defense. The actual telephone lines of such a system will vary in individual installations.

(3) *Radiotelephones (SCR–281–A),* crystal controlled combination transmitters and receivers for use in establishing communication between shore installations and the units of the flotilla. These sets will not be used for transmitting confidential or secret information unless such information has been coded (AR 380–5).

b. Position finding instruments.—The authorized items of equipment for submarine mine use supplied by the Ordnance

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Department, and the publications describing the construction, adjustments, and use of each, are as follows:

(1) *Azimuth instrument M1910.*—FM 4–15.

(2) *Depression position finders.*—FM 4–15.

(3) *Submarine mine plotting board M1906.*—The submarine mine plotting board M1906 is similar in construction and operation to the Whistler-Hearn plotting board (FM 4–15) for guns except that it is not equipped with either gun arm or gun arm azimuth determining device.

(4) *Submarine mine plotting board M1918A1.*—TM 9–2571.

(5) *Mine prediction ruler.*—Ordnance Pamphlet No. 1946, revision of August 25, 1909.

(6) *Mine predictor M1916.*—The mine predictor M1916 consists of a series of similar triangles marked on a piece of xylonite, using any convenient scale. The radial lines are time lines. The horizontal distance between the index line and the zero line is equal to the observing interval. The predictor is constructed for an observing interval of 15 seconds (see fig. 47).

■ 140. PERSONNEL FOR FIRE CONTROL AND POSITION FINDING.—T/O 4–69 shows the composition of the range section.

a. Base end station.—For the usual case where a horizontal two-station base line is used, the personnel required to operate the base end stations consists of two readers and two observers. This is a minimum crew and should be augmented by an assistant observer in each station when the mine stations are manned continuously.

b. Plotting room.—In the plotting room, the operating personnel consists of 1 plotter, 1 assistant plotter, 2 armsetters, and 2 recorders.

(1) *Plotter.*—(*a*) The plotter is in immediate charge of the plotting room. He is responsible to the range officer for the adjustment of the plotting-room devices and for the police of the plotting room. He receives the reports of the observers and individual members of his detail and reports to the range officer, "Sir, range section in order," or reports defects that cannot be remedied without delay.

(*b*) The plotter wears a headset connected to the mine battery command post (see fig. 4). When a target is assigned by the mine group commander (or by the battery commander), the plotter calls the plotting room and casemate to attention, repeats the target assignment, and with No. 2 and No. 3 (see (3) and (4) below) moves to a position at the plotting board covered by the designated target area, in readiness to plot the target position at the first reading. As soon as M′ and M″ observers have reported "on target," the plotter announces "Next bell—time one." In mine position finding time numbers are assigned successively to each 15-second observing interval. The plotter operates the mine predictor.

(2) *No. 1, assistant plotter.*—(*a*) No. 1 wears a headset on the line to the mining casemate and transmits commands and reports as indicated (see fig. 4).

(*b*) No. 1 operates the mine prediction ruler and assists the plotter in predicting for observation fire.

(3) *No. 2, primary armsetter.*—(*a*) No. 2 wears a headset connected to the reader's line to M′ (see fig. 4).

(*b*) No. 2 performs the following duties:

1. At assignment of target moves, with primary arm, to part of plotting board covered by the designated target areas.
2. In plotting mines or targets, sets primary arm at azimuth announced by M′ reader, and as soon as he has done so calls or signals "Set." After each setting he records the azimuth and the corresponding time number. In order to avoid errors due to backlash in the index box, the hundredths of a degree should always be set by moving the index pointer up to the proper graduation on the index dial in the same direction. For a right hand board this direction should be that of increasing azimuth and for a left hand board should be that of decreasing azimuth.
3. At the signal "Clear" given by the plotter, No. 2 quickly unlocks the index box and swings the primary arm to one side so as to clear the track and future course of the target.
4. In delayed contact fire, when a mine has been struck (or fired), No. 2, with the assistance of the plotter, determines the azimuth from M′ and reports to M′.

(4) *No. 3, secondary armsetter.*—(*a*) No. 3 wears a headset on the reader's line to M''.

(*b*) After the assignment of a target, when M'' observer reports over the intelligence line to M' "On target," this report is repeated by M'' reader and No. 3 (see fig. 4).

(*c*) When the plotter announces "Next bell—time one," the report is repeated by No. 3 to M'' reader.

(*d*) With respect to M'' readings and the secondary arm, No. 3 performs duties similar to those indicated for No. 2 in (3) (*b*) above.

(*e*) In plotting by the vertical base system, or by the self-contained horizontal base system, after the reader at the instrument has called the range, No. 3 repeats it to the plotter and then records the range and the corresponding time number.

(5) *Nos. 4 and 5, recorders.*—(*a*) No. 4 and No. 5, respectively, record the reports, announcements, and commands of the plotter and the assistant plotter, noting for each record the nearest corresponding time number, and in addition, during mine service practice and submine practice, under the direction of the plotter, record such additional data as are required in the conduct of practice and the submission of reports.

(*b*) No. 4 and No. 5 will be trained to substitute for No. 1, No. 2, or No. 3 whenever necessity requires.

■ 141. PLOTTING MINE FIELD.—*a*. After each mine is planted and the mine yawl has pulled alongside and raised a flag to mark the mine, the M' reader reports to the plotter "Mine marked," and a flag is raised at M', whereupon the plotter commands: READ, NEXT TWO BELLS. The two readings are taken as a check. At each reading, the plotter places the target accurately at the intersection of the arms and marks on the plotting board the position of the plotted point. If the two readings do not check within 10 yards, readings are repeated until two successive readings do so check. As soon as the mine plot has been made and checked, the plotter commands: LOWER FLAG, which is repeated by M' reader to the man at the halyards. Directions to yawl boats as to raising the flag may be relayed by radio to the flotilla for communication to the mine yawls when radio service is available.

b. After each mine is plotted, the plotter writes its number to the shoreward side of the plotted point and incloses the plotted point in a small circle. After the group is completed the plotter enters the group number in Roman numerals opposite the center of the group on the seaward side. After the entire mine field is plotted the whole plot is entered in drawing ink, two intersecting lines are drawn on the board along the station arms, and their azimuths entered for the purpose of subsequent reorientation of the plot.

■ 142. TRACKING A TARGET.—As soon as No. 2 and No. 3 have set their respective station arms and signaled "Set," the plotter places the target accurately at the intersection of the arms, and marks on the plotting board the position of the plotted point. When the track has approached sufficiently near to the mine field to warrant a prediction in observation fire, and if it is desired to predict, the plotter signals "Clear," after marking the last plotted point, when the armsetters quickly move their arms so as to clear the track and probable course of the target.

■ 143. PROCEDURE IN OBSERVATION FIRE.—*a*. At the command COMMENCE TRACKING by the mine group commander or battery commander, the plotter repeats the command, which is then repeated by the assistant plotter to the casemate electrician. Similarly, when the command OBSERVATION FIRE is received, this command is repeated, and when the target has approached to within 30 to 45 seconds of the mine field, the plotter, after signaling "Clear," quickly prolongs the track to the mine field, notes the group which will surely include the track of the target, and announces it, as for instance, "Group 3." This announcement is repeated by the assistant plotter to the casemate electrician. Then prior to the next bell, the plotter reads the travel of the target in yards during the observing interval, using a prediction scale with modified graduations, or a mine prediction ruler, and announces the travel to the assistant plotter. On the next bell, the assistant plotter starts the stop watch, and the plotter accurately predicts the course of the target and commands (for instance): NUMBER 9 MINE, READY, which is repeated by the assistant plotter to the casemate electrician. The plotter then measures the distance in yards from the last plotted position of

the target to the designated mine and calls this distance to the assistant plotter, who, using this distance as one argument, and the travel in 15 seconds, previously announced, as the other argument, obtains the time to fire. Using the stop watch, at 1 second less than the determined time, the assistant plotter gives to the casemate electrician the command: FIRE. Previously, the reader at M' will have heard the plotter announce the group and mine numbers, and repeats these announcements so that they can be heard by the mine group commander and battery commander. As soon as the assistant plotter has given the command FIRE, the plotter reports over the reader's line, "Mine fired," and this announcement is repeated by the reader at M'. Observation fire will not be conducted by use of the group commander's telescope set on a predicted point, with the command FIRE given from M' as the target crosses the vertical cross wire.

b. The procedure for use of the mine predictor M1916 is as follows (see fig. 47):

(1) When tracking a target, about 45 seconds before its course will cross a line of mines, the plotter will say, "Prediction next bell."

(2) At the next bell, the assistant plotter will start the stop watch.

(3) As soon as this point has been plotted, the arms will be cleared and the plotter will determine the time by placing the predictor on the track of the target so that the travel during the last plotted 15-second interval coincides with a rate line (radial line). The required time in seconds for the target to arrive at the line of mines and the mine which will be nearest to its course may be read directly (see fig. 47).

(4) When the time as determined above has elapsed, the assistant plotter commands: FIRE, over the telephone to the casemate operator. There is always a time lag in both transmitting a command over a telephone and preparing the system for firing. Therefore, this time lag should be determined in advance and due allowance made.

(5) Upon the command FIRE, the casemate operator will close the proper group firing switch. When the mine has fired and the system cleared and returned to the *home* position, he will report to the assistant plotter, "Mine No. ——— fired."

(6) The fired mine will be clearly marked on the plotting board.

■ 144. PROCEDURE WHEN MINE IS STRUCK BY SHIPPING.—Whenever a mine signals on the casemate operating board, the casemate operator will immediately record the mine number,

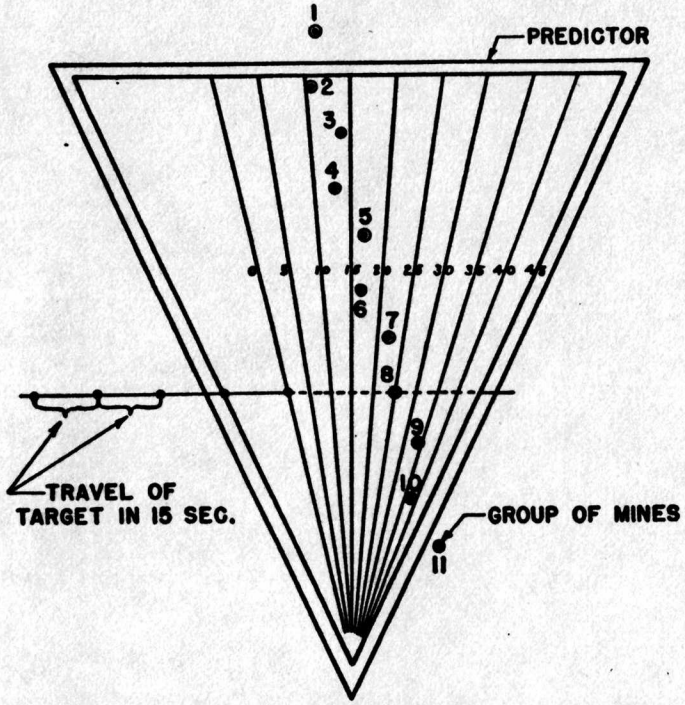


FIGURE 47.—Use of mine predictor M1916. Mine No. 8 will be fired in 25 seconds.

group number, time, and milliammeter reading. He will call the plotting room at once and inform the plotter as to group and mine number of the mine which signaled. The plotter will have the arms of the plotting board brought up so as to intersect on the plotted position of the mine and determine the azimuth from each station. This information will be

transmitted to the observers at each station. Each observer will immediately swing his instrument to the azimuth designated and inform the mine command post of the presence of any shipping in the mine field. The necessity for immediate action on the part of casemate, plotting room, and observation station personnel cannot be too strongly stressed. Any delay may result either in undue danger and possible damage to friendly shipping or in a successful passage of enemy craft through the mine field. When this situation occurs during the hours of darkness, orienting data on the mine in question will normally be transmitted to a searchlight battery and the field in that vicinity will be illuminated.

■ 145. COMMANDS AND REPORTS.—The principal commands and reports required in connection with the several systems of position-finding and plotting-room operations, as well as the regulations governing indication and identification of targets, are set forth in FM 4–5 and FM 4–15.

■ 146. MODIFICATIONS FOR TARGET PRACTICES.—The necessary modifications for the preceding plotting-room operations in the conduct of mine service practice and submine practice are covered in TM 4–235.

■ 147. RECORDS.—*a. General.*—A comprehensive picture of the status of all submarine mine matériel which is in active service should be available at all times in each harbor defense. This can be accomplished only by keeping records and reports of all tests and operations which are carried on. An officer will be designated to collect and compile these data into such form as to present a clear, complete picture of the conditions in the submarine mine project from day to day.

b. Appendix II contains samples of forms and record blanks furnished by the submarine mine depot for recording certain data and tests.

c. In addition to the records for which forms are shown it is desirable that—

(1) Each officer in a mine battery keep a daily log of operations carried out under his supervision.

(2) Overlay plots be prepared by the range section, to the scale of the plotting board, showing cable routes, positions of junction boxes, distribution boxes, and mines of each group planted. These data should be transferred

to the appropriate harbor chart and overlays of this chart furnished the mine flotilla commander for use in mine field repair operations.

(3) Loading room records should include, in addition to matériel report, the name of the man who made each watertight connection and joint.

■ 148. SUBMINE PRACTICE.—*a. Object.*—The object of submine practice is to provide, with a minimum expenditure of supplies and equipment, the maximum training of range, planting, and loading sections in their duties for target practice and in the installation and maintenance of the mine project.

b. When held.—When smoothness and accuracy have been attained in group drills, submine target practice should be made a part of the training schedule. It should be held as often as is necessary to attain sufficient smoothness and accuracy for holding service mine practice.

c. Supervision.—Submine practice will be conducted under the general supervision of the group commander.

d. Preparation of matériel.—See section XIII.

e. Planting.—The submine is planted exactly as the service mine except that the bottle buoy is carefully thrown into the water after the mine buoy has been cast overboard.

f. Rules for practice.—(1) Submine practice is held in the same manner and under the same general rules as service mine practice. The same safety precautions will be observed and, in addition, extreme care will be exercised in handling small boats in the vicinity of the mines so as not to foul the submines.

(2) In case a submine is not fired before the mine is taken up, the submine charge will be removed by a small boat as soon as the mine floats after the anchor leaves the bottom and before the mine is brought inboard.

g. Water ranges.—Prior to firing over water areas *or planting or firing submarine mines in water areas which are used by shipping of any kind,* the harbor defense, post, regimental, or similar commander of the firing unit will warn local naval officials and inform the public of the contemplated firings or submarine mine plantings through one or more of the following agencies: public press, public radio, Coast Guard, or interested public officials.

■ 149. SERVICE MINE PRACTICE.—The details for the conduct and scoring of service mine practice are prescribed in TM 4–235. Target practices must be conducted in the project mine field areas. Use of such areas will insure that all personnel are familiar with their wartime stations and duties, and that sizes and quantities of equipment are adequate to meet service conditions.

■ 150. REMINDER LISTS FOR SERVICE MINE PRACTICE.—Each unit and detachment commander should prepare a reminder list enumerating the necessary details of preparation and data to be recorded for service mine practice before the practice occurs in order to insure that no necessary action is overlooked.

■ 151. TARGET FOR SUBMINE AND SERVICE PRACTICE.—Targets for submine and service target practices are supplied by the Ordnance Department. (See AR 775–10.)

APPENDIX I

MINE CASE CHART

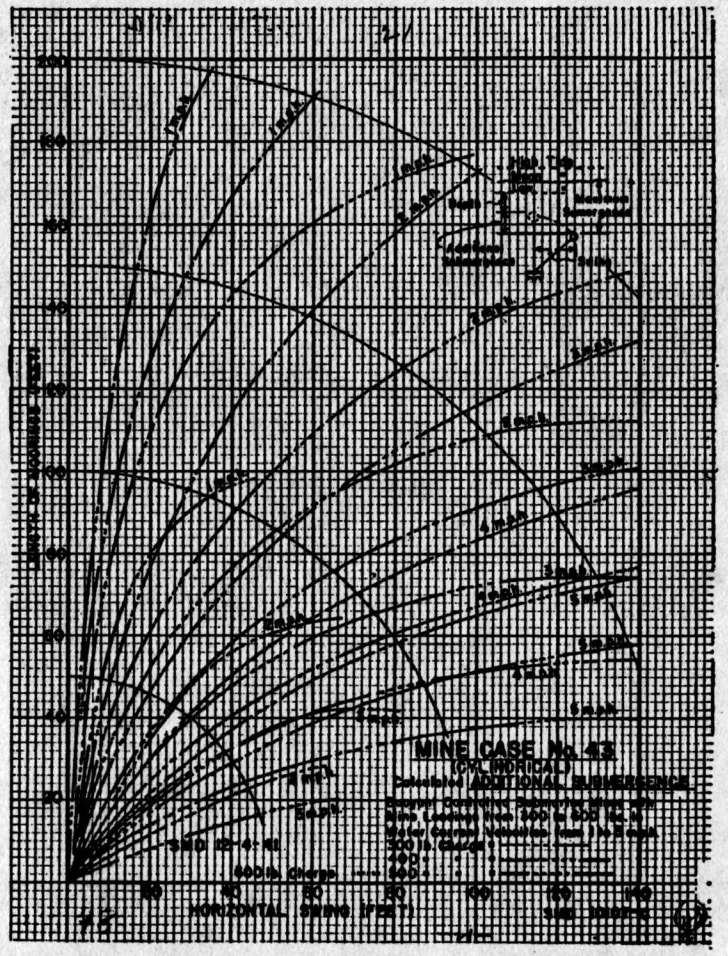


FIGURE 48.—Calculated additional submergence, mine case No. 43.

APPENDIX II

FORMS USED IN SUBMARINE MINE SERVICE

1. FORM 1.—*a. Front.*

CABLE OPERATIONS RECORD

SUBMARINE MINES—COAST ARTILLERY CORPS

Reel No._____ or figure-of-eight No._____
Manufactured by_____ Received from_____ Date_____
Original length_____feet. Tank No_____ Position No_____
Initial test: Per 1,000 feet at 60° F.: IR____megohms; CR_____ohms.

This record will be maintained at cable tank for each piece of cable. If the cable listed hereon is transferred, this record will be forwarded to the mine property officer at the harbor defense to which the cable is shipped.

Date	Operations affecting this cable (planted—picked up—unreeled —cut off—tested—transferred)	Present length (feet)	Meg-ohms (IR)	Ohms (CR)	Class	Initials of mine property officer

b. Back.

Date	Operations affecting this cable (planted—picked up—unreeled —cut off—tested—transferred)	Present length (feet)	Meg-ohms (IR)	Ohms (CR)	Class	Initials of mine property officer

2. FORM 2.—*a. Front.*

CABLE REQUIREMENTS

for

Harbor defenses of_____ Fort_____

Date_____

Group No.	Lengths in feet		
	To nearest 10 feet, land cable	To nearest hundred feet, submarine cable	
		Shore cable	Mine cable
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

b. Back.

Group No.	Lengths in feet		
	To nearest 10 feet, land cable	To nearest 100 feet, submarine cable	
		Shore cable	Mine cable
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
Initial installation			
30 percent reserve	None		
Total for fort			
Initial installation			
30 percent reserve	None		
Total for fort			
Harbor defense:			
Initial installation			
30 percent reserve	None		
Total harbor defense requirements			

_____

Mine property officer.

3. FORM 3.

BASIC INFORMATION
AND
BILL OF MATERIAL

Mine group No. ---------- Fort ----------

Amount	Unit	Article	Project requirement	Substitute requirement	Mine No.	Anchor type	Mine case size	Water depth (feet)	Mine cable (feet)	Mooring rope (feet)	Raising rope (feet)
	Each	Anchor			1						
	Each	Mine case			2						
	Foot	Mine cable			3						
	Foot	Shore cable			4						
	Foot	Mooring rope			5						
	Foot	Raising rope			6						
	Each	Clips			7						
	Each	Thimbles			8						
	Each	Shackles			9						
	Each	Cable clamps			10						
	Each	Compound plugs			11						
	Fach	Firing devices			12						
	Each	Circuit closers			13						
	Each	Junction box			14						
	Each	Distribution box			15						
	Each	Selector box			16						
	Pound	Explosive			17						
					18						
					19						
					T'l						

Azimuths to—	DB	No. 1	No. 10	No. 19
M'				
M''				

Date----------
Signature----------
----

4. FORM 4.

MONTHLY OPERATION REPORT OF SUBMARINE MINES

Mine group No._____ Fort_____
Date planted_____ Month of_____ 19____
Depth of water_____feet. Maximum current_____mph. Date picked up_____
In date column enter milliammeter reading of serviceable mines: "X" for unserviceable mines and explain under "Remarks".

Mine No.	Anc	Sub	Bot	MC	Days of month																										
					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1																																	
2																																	
3																																	
4																																	
5																																	
6																																	
7																																	
8																																	
9																																	
10																																	
11																																	
12																																	
13																																	
14																																	
15																																	
16																																	
17																																	
18																																	
19																																	
DB Sel																																	
S-cable																																	
Grp Pnl																																	

REMARKS

NOTE.—Anc—anchor weight, pounds; Sub—submergence in feet; Bot—bottom (R—rock; S—sand; M—mud); MC—mine case size; S—shore; Grp Pnl—group panel; DB Sel—distribution box selector.

_____
_____
Signature

5. FORM 5.

DISTRIBUTION OF SUBMARINE MINE PROPERTY

FOR PROJECT IN

HARBOR DEFENSES OF _____

_____ 19____

Item	Unit	Per group	Fort____ ____Mine Command groups	Fort____ ____Mine Command groups	Spare for HD	Project requirement	On hand

6. FORM 6.

OPERATION RECORD

Generating sets for the month of _____ 194__.

Rating _____ Fort _____

Manufacturer _____ _____ 194__

Generator rating (amps) ____ Volts ____ Serial No. _____

Engine rating (hp) _____ Serial No. _____

Date	Hours operated	Fuel used (gal.)	Amperes		Volts		Battery specific gravity	Remarks (include report of all maintenance—operations; repairs)
			Generator	Power panel	Generator	Power panel		

_____

Casemate officer.

7. FORM 7.

Fort_____
Date_____
Date of last test_____

RECORD OF TEST OF M4 FIRING DEVICES

(PLANTING) (CASEMATE) TEST, GROUP NO. _____

	Firing device serial No.	Resistances							Select on		Fire on			Remarks
		Disarmed						Armed, black lead to case	235 V. after arming	190 V. after disarming	475 V. firing power	290 V. Clearing power after firing	Mine Current	
		Lead to lead		Lead to case					These 6 readings should all be at least 100 megohms		Serviceable firing devices			
		Red1, black	Red, red	Red2, black	Case: Black	Case: R-1	Case: R-2	27 to 31 ohms	Yes	No	Yes	No	62 to 65 MA.	
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														

Tested by_____ Approved_____
Casemate Officer.

8. FORM 8.

WEEKLY REPORT OF LAND CABLE

Fort_____
Date_____

Week ending	Cable serial No.	Length	Type	Telephone test	IR	CR	Tested by—	Remarks
1/7/42	1263	1,675′	2 Cond.	OK	500-	5.0ᵐ	PAH	This cable is in excellent physical condition.

_____
Casemate officer.

Approved:
_____
Commanding battery.

APPENDIX III

EMERGENCY MINE PLANTING METHODS

1. GENERAL.—For emergency planting of mines where regular and emergency mine planters are not available and, where applicable, for servicing planted mines, the accompanying sketches and procedure may be used as a guide by local personnel. This method has been tried out and proven possible, although it must be understood that local conditions will require adaptation and modification of the construction of the equipment.

2. FLOTILLA REQUIREMENTS.—*a*. The primary flotilla requirements for this method are a barge, a tugboat, a DB–boat or boat of equivalent size without crane, and two or more yawl boats or motor launches of equal size.

b. The barge must be of sufficient size to contain all of the matériel for a group of mines and to transport it from the wharf to the mine field. It must be equipped with a power operated boom or derrick capable of transferring a loaded mine or an anchor from its deck to the deck of the DB–boat.

c. The tugboat must be capable of handling and maneuvering the barge under existing weather and hydrographic conditions. A twin-screw vessel is best adapted for this purpose.

d. The DB–boat is, in this case, used as a mine planter to actually drop the mines. A platform similar to that shown in figure 49 must be constructed locally and mounted on the after deck of the boat as shown in figure 50. A shears must also be improvised and mounted as shown in figure 50 to provide lifting power for tilting the platform.

e. The yawl boats are used only to perform their normal duties and require no equipment beyond that ordinarily carried for mine planting operations.

3. CONSTRUCTION OF PLATFORM.—General dimensions and construction details for the DB–boat platform are shown in figure 49. The material used should be carefully inspected for cracks, knots, or other flaws. It is more advisable to substitute heavier materials than to decrease the dimensions shown. The rectangular shape of the platform may, if de-

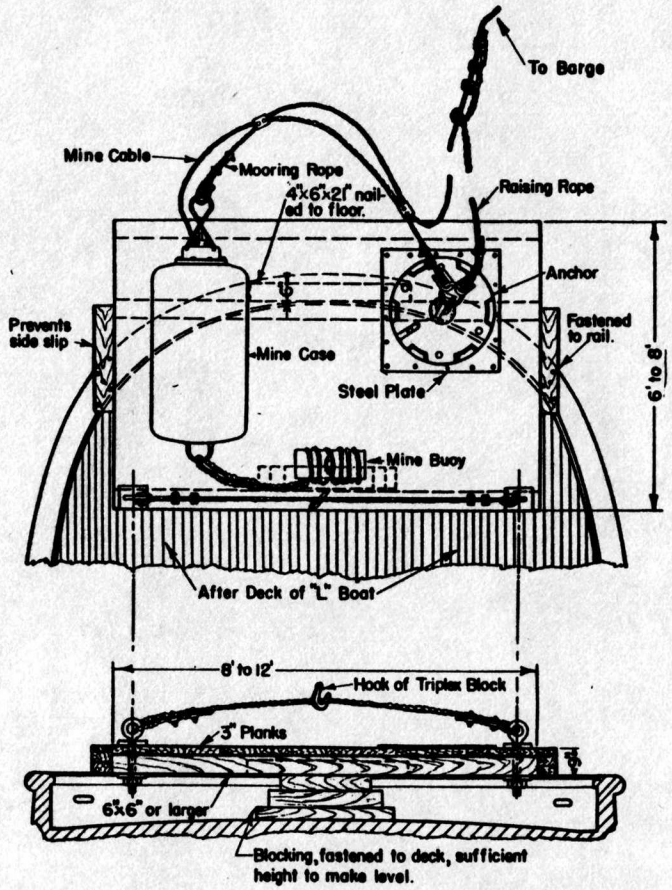


FIGURE 49.—Stern tripping platform—emergency planting, using L-boat as planter.

sired, be made roughly trapezoidal so as to permit less overhang over the sides of the vessel. Rings or hooks for attaching platform lifting gear should be made of not less than 1-inch diameter steel and should be carefully welded and firmly fastened to the platform. The stresses due to rocking of the boat and handling of the heavy weights in-

volved are very great. Breakage is most apt to occur in this lifting gear. In mounting the platform on the boat, blocks of wood or steel must be fastened to the boat's rail so as to prevent movement of the platform either sidewise or to the rear. Blocking must be built up under the timber through which the lifting rings pass to support the platform when horizontal. Stay ropes must be attached to limit the amount of tilting permissible. A piece of chain or marline covered

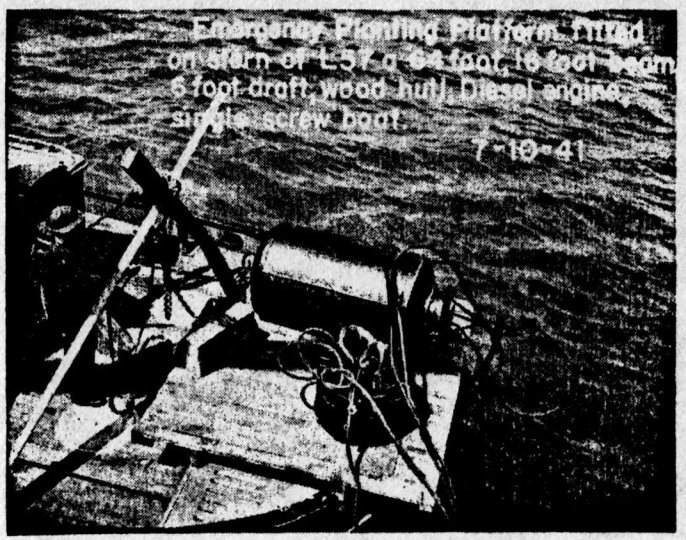


FIGURE 50.—Emergency mine planting platform fitted on stern of L-boat.

steel rope is used to connect the lifting rings. If marline covered steel rope is used, the ends should be fitted with thimbles and clips and attached to the lifting rings by means of shackles. There should be a minimum of slack in this connecting rope or chain.

4. LIFTING SHEARS.—The simplest way of providing power to tilt the loaded platform is by means of a shears and chain block. A 1-ton block is the minimum safe size, and a 2-ton

is more satisfactory. The shears may be made by taking two stout poles or timbers, approximately 4 by 4 inches or heavier and lashing their ends together loosely with several turns of rope. Spread the legs, wedge them against the inside of the rail of the boat (see fig. 50), and fasten them securely to prevent slipping. Attach a piece of chain or marline covered steel rope to the supporting hook of the block and pass the chain or rope several turns around the vertex of the shears, thus attaching the block to the vertex. Fasten the free end of the chain or rope securely to some point directly forward of the vertex of the shears, allowing sufficient slack so that the shears will lean toward the stern of the boat and so that the block will be directly above the rope or chain connecting the lifting rings of the platform.

5. TACTICAL EMPLOYMENT OF FLOTILLA.—*a. General.*—The procedure used for planting mines with this makeshift flotilla is slightly different from the usual one. No attempt will be made to discuss the details, but the general schedule of operations of the units of the flotilla are set forth below.

b. Barge and tug.—(1) The barge in this method serves as the vehicle for transporting mines, anchors, mine cables, and their attendant underwater gear from the wharf to the mine field. Reels of shore cable are mounted on jacks on its deck and are laid as the barge moves from shore to the field. Upon reaching the distribution box position, and before attempting to maneuver the barge into position, at least 200 feet of slack shore cable should be unreeled and transferred to the planting vessel (converted DB-boat). When the shore cable and the above mentioned slack have been secured on the planting vessel, the shore cable may be cut at the reel. Thus, the planting vessel will hold the end of the cable while the barge is being anchored. During this waiting period, a turkshead will be made on the free end. When the barge is in position and safely anchored, the planting vessel will approach and pass the shore cable back to the barge and prepare to receive the first mine to plant. Thereafter the barge serves as a working platform for attaching the cables to the distribution box and for making watertight joints between mine and shore cables and the selector box leads.

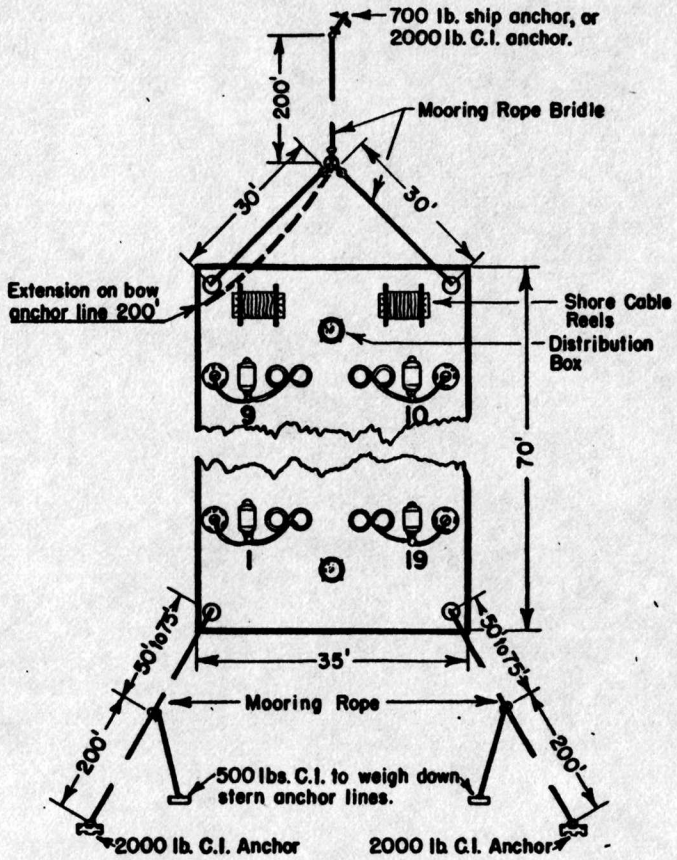


FIGURE 51.—Loading and anchoring barge for use in emergency planting.

(2) Before leaving the mine wharf, mine cables, mine cases, and anchors should be arranged on the deck of the barge in order of planting. It must be remembered that when the barge is anchored, the end on which the distribution box is placed is considered to be the bow and therefore gear for mines Nos. 1 to 9 will be on the left and for Nos. 10 to 19 on the right (see fig. 51).

(3) In anchoring, the barge is maneuvered into a position approximately 230 feet in front of the distribution box position. The bow anchor is dropped by the derrick on the barge and the barge is permitted to drift back, paying out the bow anchor and bow anchor extension lines until the barge stern is in position to drop the stern anchors and the 500-pound stern line weighting anchors. The tug then moves the barge forward until the stern anchor line is shackled to the bridle, and the barge permitted to drift back. After the bow anchor line is taut, the stern anchor lines are tightened and the barge is in position for planting. After planting it is necessary to cast off all anchor lines and mark them with buoys, until a vessel is available to pick them up or they are expended.

(4) In the actual planting of a mine, the mine cable and mooring rope are assembled to the mine case and the raising rope is attached to the anchor and clamped to the mine cable on the deck of the barge. Then the mine case and anchor are loaded onto the platform on the rear of the DB-boat. When the DB-boat moves up to the line to plant, the mine cable is paid off the deck of the barge. Suitable signals will be given by barge personnel to the planting officer on the DB-boat when nearly all of the cable has been paid off. When the mine has been dropped its cable will be put into the appropriate slot in the distribution box, the watertight joint made, and another mine prepared for loading.

(5) The personnel required for barge operation is the same as the planting detail for a mine planter. Port and starboard details perform the preparation for loading of mines on their respective sides and the after deck detail pays off the cable. One man may be taken from port and starboard details for making selector box watertight joints.

(6) The function of the tug during all of this planting operation is simply to tow and maneuver the barge so that it can perform its part in the schedule. To be able to maneuver, the tug must make itself fast alongside the barge with bow and stern lines as short as possible. While the barge is under way, there should be a man at each end of each line to tighten, loosen, or cast off such lines as the master of the boat may direct.

c. Planting vessel (converted DB-boat).—(1) During the laying of shore cable, junction boxes are attached to individual lengths of cable by this boat, thus permitting the barge and tug to continue with the laying of cable. When a junction has been made it should be buoyed, cast off, and plotted by means of yawl and flag from the plotting room. The DB-boat should immediately catch up with the rest of the flotilla to make the next junction.

(2) When the field is reached and the barge anchored, the field may be laid out and buoyed by the DB-boat if this has not been done previously.

(3) In the actual planting of mines, this boat ties up to the barge on the side to which the mine is to be planted—bow toward the line of mines. After a mine and anchor have been loaded on the platform as shown in figures 49 and 50, the mooring rope will be shackled to the anchor and the mine buoy and buoy ropes attached. Thereupon, the lines are cast off from the barge and the DB-boat moves away toward the mine position, towing the mine cable (paid off from the barge) behind it through the water. As the boat approaches the line of mines, the block is operated so as to tilt the platform slightly. When on line the platform is tilted rapidly until anchor, mine, and buoys slide off into the water. In general the anchor will slide first and take the mine after it. Immediately after planting, the boat turns and comes alongside the barge for the next mine to be loaded.

(4) Personnel required in addition to the regular operating crew are one noncommissioned officer and two enlisted men to assist in placing the matériel on the platform, connect the mooring rope and buoy ropes, and operate the platform tilting block.

d. Yawl boats.—The yawl boats are used in exactly the same manner as with a regular mine planter during planting of mines.

6. REPLACING MINES.—Weather and hydrographic conditions may make it dangerous for a full-sized mine planter to enter a line of loaded mines to replace a mine that has been picked up for repair or has been blown. Under such conditions a DB-boat equipped as described above may be used to very good advantage. The mine case anchor and gear may be loaded on the boat at the wharf. The boat can

then proceed to the mine field and plant the mine in question. If this method is to be used, either a barge or another DB-boat is required to raise and hold the distribution box.

7. PRECAUTIONS IN DERRICK OPERATION.—The handling of heavy weights such as mine cases and anchors by a derrick at sea is a task which is always dangerous. *Operators of such equipment must be skilled and dependable.* Only by exercising extreme care can this work be done without unduly endangering the safety of personnel.

APPENDIX IV

GLOSSARY

Ammeter.—Current measuring instrument used in the casemate.

Analyzer.—Instrument for determining electrical circuit conditions in submarine mine equipment.

Anchor.—Cast iron weight for holding buoyant mine in place.

Anchor bail.—Shaped steel bar to which are attached raising rope and mooring rope.

Anchor ring.—Auxiliary bail for attaching mooring rope and raising anchor.

Armsetter.—Member of range section; operates arms of plotting board.

Asphalt varnish.—Petroleum base paint used as coating on underwater submarine mine equipment.

Azimuth instrument.—Telescopic observing instrument used in base end stations for determining the azimuth from the station to a visible point.

Base end station.—Observing post for tracking target with observing instrument.

Boat telephone.—Sound powered telephone, used for communication between shore and boat through shore cable.

Boom.—Crane on mine planter, used to hoist equipment on deck.

Booster charge.—Small charge of TNT used in a mine to set off main charge.

Brackets.—Arms projecting from the mine planter superstructure to hold cable.

Brass glands.—Part of a watertight connection; antifriction device between steel follower and rubber packing.

Bridge-megger.—Instrument for measuring resistance up to 500 megohms; used by casemate personnel in testing cable.

Buoy, marking.—Hollow steel spherical buoy used to mark mine field.

Buoy, mine.—Wood block; attached to mine with manila line, for marking position of planted mine.

Burn out test.—Application of high voltage and heavy current to locate ground in cable.

Cable, land.—Cable that connects casemate to cable hut.

Cable, mine.—Cable that connects selector box to mine.

Cable, shore.—Cable that connects cable hut to selector box.

Cable fastener.—Common pipe clamp for attaching cable to cable reel.

Cable hut.—Dugout or manhole near beach where shore and land cables are joined.

Cable reel.—Reinforced wooden reel for holding cable; holds 10,000 feet of 1-conductor cable.

Cable reel jack.—Screw jack on a steel base; used in pairs with an axle to lift cable reels.

Cable reel sling.—Device made of a steel I-beam with two hooks which fit into axle holes for lifting cable reels.

Capstan.—Rotating drum on ship for pulling on ropes or cables.

Casemate.—Bombproof structure which houses the submarine mine control system.

Cathead.—Movable sheave mounted on an arm which extends over side of planter, for taking up mines.

Chart.—"Map" of water or shore area which gives certain hydrographic data: shore lines, depth of water, channels, etc.

Clamp.—Two metal plates which bolt together and hold cable to mooring rope.

Clip.—U-shaped bolt, plate, and nuts to hold mooring rope ends in place over thimble.

Collar, turkshead.—Cast steel ring that slips on cable for armor wire to be bent around.

Compound plug.—Assembly which contains firing device, detonators, and TNT booster charge and mine case cover or plug proper.

Contact fire.—Method of firing by which a mine is exploded when it is struck or influenced by a vessel.

Contact mine.—Watertight steel case containing explosive and a firing device, which after planting fires automatically when struck or influenced by a vessel.

Control system.—Equipment in casemate used to test, select, signal presence of vessel, or fire mine.

Controlled mine.—Watertight steel case containing explosive and a firing device with means for control of fire by electrical connection to shore.

453393°—42——7

Coxswain.—Master of small boat.

Crane, distribution box boat.—Electrically powered steel device used to raise and lower distribution box.

Crane, tractor.—Movable crane used to move heavy equipment on wharf, from wharf to planter, or planter to wharf.

Cutters, cable.—Commercial cable shears, used to cut cable and mooring and raising ropes.

Davit.—Curved arm with tackle used to pick up anchors and mines on planter and swing them over water.

DB-boat.—*See* Distribution box boat.

Delayed contact fire.—Mine firing system set to fire after a certain time interval.

Depression position finder.—Telescopic observing instrument used in base end station by observer to determine azimuth and range.

Detonator.—Commercial electric blasting cap; used to set off booster charge of TNT; sometimes referred to as fuze.

Derrick, wharf.—Fixed powered lift for handling mine equipment weighing up to 5 tons on the wharf.

Diesel electric generator.—Primary source of fortification power to operate mine system and fire mine or mines.

Distribution box.—Cast steel box for protecting selector box and for holding cable turksheads; planted near mine group.

Distribution box boat.—A 65-foot vessel used to connect cables to selector box and to plant and pick up distribution box.

Fastener, cable.—*See* Cable fastener.

Fathometer.—Device on mine planter used to obtain depth of water by sonic echo.

Faultfinder.—Electrical instrument for determining the position of "ground" or "open" in cable.

Figure-of-eight.—Method of coiling a cable which will permit planting without kinks.

Firing device.—Mechanism in mine used to close or open circuit through which electric current fires detonators; part of the compound plug.

Floater.—Mine which for some reason is not held submerged but is floating on surface of water.

Flotilla.—Vessels and boats used to plant, maintain, and pick up controlled mines; planter, DB-boat, yawls.

Follower.—Part of watertight connection which screws in recess to place rubber packing under compression.

Free buoyancy.—Amount of floating effort exerted by a submerged buoyant mine—weight of displaced water minus weight of complete mine case and charge.

Funnel.—Copper funnel used in loading TNT into mines.

Fuze.—*See* Detonator.

Fuze can.—Part of compound plug; holds booster charge of TNT and detonators.

Gasket, rubber.—Packing used in making watertight seals for mine cases and selector boxes.

Generator, primary.—See Diesel electric generator.

Grapnel.—Hook-like device with prongs used to drag along bottom to recover lost objects.

Grommet.—Small rope section spliced or clipped together to form a circular section; used to facilitate picking up buoys, mines, and anchors.

Ground.—Condition of electrical cable when the insulation has broken down and current passes to ground.

Ground mine.—Mine which rests on bottom of ocean.

Heaving line.—Light line used to throw from ship to ship, or ship to wharf; used to transfer end of cable, or heavier line.

Hydrography.—Science of determining the conditions of navigable waters; for mine projects it includes a study of the sea, contour at bottom, depth, shoals, channels, tides, obstructions, and all elements which affect submarine mine projects.

Junction box.—Steel box which holds turksheads of two cables, the conductors of which are joined by a watertight joint.

Key, split.—Cotter, split at one end for spreading, inserted in mine case studbolts to lock nuts in position.

King reel.—Special cable reel with capacity of 39,000 feet installed on a 172-foot mine planter; used for laying or taking up shore cable.

Lead line.—No. 10 cotton line attached to sounding lead; used in taking soundings, to measure depth of water.

M' station.—Designation given to primary base end or observing station of mine battery.

Marline, tarred.—Tarred cordage used for temporary lashing.

Measuring line.—Light line 5/16- to 5/8-inch diameter with dis-

tance marks; used to measure distance between elements of mine field and submergence of mines.

Megger.—*See* bridge-megger.

Messenger line.—Line used on ships for extending a rope or cable to avoid losing the cable end overboard.

Mine.—Metal container filled with explosive (TNT) used to destroy shipping.

Mine bail.—Part of mine cap; used to attach mooring rope.

Mine cap.—Part of mine; bolts on case; protects conductor; holds turkshead on cable in position.

Mine maneuvering ring.—Steel ring on top of mine case to facilitate handling.

Motor-generator.—Casemate electrical equipment which converts power from generating set or post power to various currents required to operate mine control system.

Niggerhead.—*See* Capstan.

Observation fire.—Method of firing mine when target is visible; target is tracked and mine is fired at will from casemate.

Observer.—Member of base end station personnel; operates azimuth instrument or depression position finder in locating planted mines and tracking target.

Open.—Condition of electrical cable when conductor is broken but not grounded.

Panels, distribution, group, jack, power, and supervisory.—Panels used in the control system of mines; installed in casemate.

Planter.—Vessel used to plant, maintain, and pick up mines in controlled submarine mine field.

Plotting board.—Type of drawing board used together with observing instruments for accurate scale reproduction of positions of mines or ships on water.

Predictor.—Device used in conjunction with plotting board to predict *time* when mine is to be fired, that is, when a target will be over a mine.

Reader.—Member of base end station personnel who works in conjunction with observer; reads azimuth (direction) of telescope, which is trained on target.

Reel, cable.—*See* Cable reel.

Relay test unit.—Device used in casemate to adjust electrical equipment.

Rope, manila.—Rope used for measuring heavy lines, stoppers, and general mine planter use.

Rope, wire marline covered.—Rope used primarily as mooring rope and raising rope; marline covering makes rope flexible.

Rossette.—Connection used in making an electrical watertight joint without use of rubber tape.

Rubber packing.—Part of watertight connection which is compressed by follower to form seal around insulated wire.

Scoop.—Aluminum or copper alloy utensil used in loading room for placing TNT in mine case and fuze cans.

Selector box.—Watertight steel box in which underwater control mechanism is connected to shore and mine cables of one group of mines.

Shackles.—U-shaped device with a pin through upper part of U; used for easy connection of mooring ropes and raising ropes to bails on mines and anchors.

Skid, loading.—Device for holding mine cases inverted while loading mines with TNT.

Sleeve.—Small copper cylinder in which ends of two wires are crimped to make an electrical connection.

Sling, cable reel.—*See* Cable reel sling.

Snatch block.—Block in which one cheek opens to allow insertion of rope or cable; used on mine planter for changing direction of lead of ropes and cables.

Stopper.—Type of knot used to hold mooring or raising rope and cable from slipping.

Stripper, wire.—Device for removing rubber insulation from conductor of loading wire or cable.

Submine.—Miniature mine; consists of quart bottle of TNT containing detonators attached electrically to a buoyant mine. The bottle floats near the mine case and is fired by the standard mine control system.

Swivel.—Device which allows mine case to rotate while mooring rope and cable remain stationary; used only in harbors where current rapidly twists off standard mooring rope with consequent breaking of cable.

Tag, cable, band type.—Corrosion-resistant steel marked with cable number, length, and mine number; attached to cable for identification and record of service.

Tape, friction.—Rubberized cotton tape used to protect and hold rubber tape in place on watertight joints.

Tape, rubber.—Partially cured rubber tape used to make a watertight joint between two rubber insulated wires or cables.

Targ.—Mechanical device used in plotting room in conjunction with plotting board to mark an intersection of station arms of board.

Telegraphic joint.—Method of joining conductors of two insulated wires by wrapping one wire around the other.

Telephone.—Instrument for wired communication between various elements of the mine command. *See also* Boat telephone.

Thimble.—Metal piece placed in bent-back end of rope to keep it from chaffing; held in place by a clip.

Thumb joint.—Watertight joint made on end of cable to seal end of conductor.

TNT.—Trinitrotoluene, a military explosive.

Tongue and groove.—Form of closure used on mine case and selector box covers with rubber gaskets to make watertight seals.

Trip hook.—Hook which will open and drop its load when tripped by a lanyard.

Triplex block.—Chain block for raising heavy weights.

Turkshead.—End of submarine cable on which armor wire is folded back over a collar to provide a means of holding cable end in position in distribution and junction boxes.

Underrun.—To raise cable from bottom of water by passing it over a vessel without picking it up; a method of inspecting a planted cable to locate faults.

Voltmeter.—Voltage measuring instrument used on mine system control panels.

Watertight joint.—Electrical splice which has been made waterproof by wrapping with rubber tape.

Whip.—Single line running through a pulley on mine planter boom for lifting weights.

Wire, loading.—Special rubber-covered stranded copper wire; primarily used in compound plug and selector box.

Yawl.—A 26- to 30-foot motorboat, used in mine planting and picking up operations.

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COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

TACTICS AND TECHNIQUE OF

CONTROLLED SUBMARINE MINES,

BUOYANT

CHANGES No. 1

WAR DEPARTMENT,
WASHINGTON 25, D. C., 19 June 1943.

FM 4–6, May 1, 1942, is changed as follows:

The title of this manual is changed to read, Tactics and Technique of Controlled Submarine Mines, Buoyant, wherever it appears.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 6. FUNCTIONS OF SUBMARINE MINES.—In general, the functions of submarine mines, whether the controlled mines of the Army or the uncontrolled mines of the Navy, are as follows:

* * * * * * *

■ 7. FUNDAMENTALS GOVERNING EMPLOYMENT OF CONTROLLED AND UNCONTROLLED MINES.—Consideration of the characteristics of the two types of mines leads to the formulation of the following fundamentals for the employment of controlled and uncontrolled mines, so far as harbor defense is concerned:

* * * * * * *

b. Uncontrolled mines may be used to close all portions of harbor entrances navigable by hostile naval forces, not required for use by friendly naval forces or commercial shipping, particularly to block off large areas or routes of access in deep water or far offshore.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 9. COMPONENTS OF CONTROLLED MINE PROJECT.

* * * * * * *

h. Searchlights.—For illuminating the mine field at night. These should not be separately assigned to the mine group command.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

533007°—43

■ 13. TACTICAL CONSIDERATIONS FOR PREDETERMINATION OF MINE PROJECT.

* * * * * * *

d.

* * * * * * *

(5) Uncontrolled mines.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 14. LOCATION OF CONTROLLED MINE FIELDS.

* * * * * * *

a. Specific mission to be fulfilled.—If the required * * * in advance of the channel mouths so that—

(1) A hostile blocking vessel run through the mine field at high speed, if hit by a mine, will be unable to reach the channel before sinking.

(2) Enemy submarines will be prevented from laying mines in narrow channels or channel mouths.

* * * * * * *

d. Economy.—The general rule is that controlled mines should be used only where and to the extent that uncontrolled mines or other available means of defense will not serve the purpose. When both controlled and uncontrolled mines must be used for the defense of portions of a harbor entrance, the project must be carefully laid out to eliminate or reduce to a minimum the possibility that uncontrolled mines which break loose will drift into the controlled mine field or into clear channels.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 17. DISPOSITION OF GROUPS OF MINES.

* * * * * * *

b. One or more * * * by friendly vessels. Final determination of the number and location of passageways through a mine field is a function of the local joint Army-Navy planning committee. Controlled mines should be planted at a depth of 45 feet or greater in the passageways to allow friendly surface craft to pass over without striking them. If mines are not planted across channels, submarines can easily locate the openings in the field with their mine detection devices.

c.

* * * * * * *

(3) Controlled mine cables should be laid so that they do not interfere with the moorings of nets and booms.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 19. GUNS AND SEARCHLIGHTS.—In the determination of a controlled mine project it should be recognized that it is futile to place controlled mines in water areas which cannot be covered by fire of secondary armament. From the standpoint of location of controlled mine fields, this fundamental has been considered in paragraph 14*b*. From another standpoint * * * each local situation. Its controlling effect is to limit the employment of controlled mines to the areas covered by guns. Searchlights may be used to illuminate the mine field, at the discretion of the harbor defense commander, but the range of illumination should not be a prime factor in the determination of the location of an area for the employment of controlled mines.

■ 20. MINE PLANTING VESSELS.—Necessary mine planting vessels must be provided in units, each designated as a mine planting flotilla and consisting of one mine planter, two DB-boats, and five motor mine yawls. Planters built after * * * groups are planted.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 22. TIME AND MANNER OF PLANTING THE PROJECT.—Each mine project will be planted when so directed by the War Department, or as provided for in approved joint local defense plans. The controlling element in the coordination of this work is to insure that matériel is ready for the mine planter so that it can fully utilize the hours of daylight for work on the water. The plan for * * * of the delayed groups.

■ 23. SURVEILLANCE OF MINE FIELD.—Surveillance of the * * * mine field itself. Thus, surveillance of the mine field calls for at least three, and preferably four complete reliefs in the manning table for the mine group commander's station, base end stations, plotting room, and casemate.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 25. DECISIONS AS TO FIRE.—*a.*

* * * * * * *

(2) The relative importance of the enemy element, or the seriousness of its threat to the defense. In general, however, all enemy vessels passing through the mine field will be fired upon.

b. It is a general rule that during night or fog when surveillance by observation is impossible, all hostile elements traversing the mine field should be attacked by contact fire. This rule is * * * all elements thereof.

■ 26. METHODS OF FIRE.

* * * * * * *

b. (Superseded.) *Delayed contact fire.*—In modern warfare, there will be times when the mined area will be subjected to enemy shelling or bombing. Under such circumstances, if the mine field were placed on contact fire, a great number of mines would be fired by the explosions of shells and bombs with little effect other than to weaken the field and to disclose the approximate position of the various lines of mines to the enemy. Firing of mines set on contact may also be caused by storms and incidental wave action. In order to control this promiscuous firing of mines in either of the above situations, it is possible to place the mines upon delayed contact fire, in which case an armed mine signals the casemate, and the decision to fire or withhold fire may then be made at the last second. This decision will, of course, be based upon the tactical situation at the time.

c. Observation fire.

* * * * * * *

(2) Except in the cases * * * storms or boats.

NOTE (added).—Following is a terminology of words used in Army controlled submarine mining:

Off—Mine field is safe for passage of vessels. All power is off and mine field is inoperative.

Safe—Mine field is safe for passage of vessels. Operating power only is on which will cause the mine to signal whenever struck or influenced by a vessel. Mines cannot be fired with operating power.

Contact fire—Mine field is operative and *not safe* for passage of vessels. All mines are set to fire automatically when struck or influenced by a vessel.

Delayed contact fire—Mine field is operative and *not safe* for passage of vessels. All mines are set to signal when struck or influenced by a vessel, but firing is done manually after being struck or being influenced by a vessel.

Observation fire—Mine field is operative and *not safe* for passage of vessels. Targets are tracked by observation stations ashore and course is plotted. Any desired mine is fired manually when target course crosses that mine.

[A. G. 300.7 (4-22-43).] (C 1, 19 June 1943.)

■ 28. PROTECTIVE SURVEILLANCE FROM SHORE.—The protective surveillance * * * the air forces. The courses of all ships passing through the mine field should be plotted.

[A. G. 300.7 (4-22-43).] (C 1, 19 June 1943.)

■ 34. PROTECTION BY NETS AND UNCONTROLLED MINES.—Although the desirable * * * by surface vessels. In projects where the controlled mine field is supplemented by an adjacent or outer field of uncontrolled mines, the presence of the uncontrolled mines serves to some extent to limit the access of hostile vessels intended to attack the controlled mine field.

■ 35. COUNTERMINING AND MINE SWEEPING.—*a. Ground mines.*—A ground mine * * * by foreign powers. This type of offensive mine is dropped by airplanes or planted by submarines in harbor channels with charges varying from 500 to 1,600 pounds of explosive. Ground mines of * * * the following problems.

* * * * * * *

c. Enemy mines.—The mine command * * * destroy enemy mines. When buoyant mines float in open sea areas, washed ashore on unoccupied beaches, or ground mines are found, the U. S. Navy will be notified and guards or guard ships posted at a safe distance to prevent danger to friendly personnel and equipment. This procedure is * * * dismantling of enemy mines. In an emergency, where the immediate removal or destruction of a mine is necessary to prevent loss of life or destruction of vital installations, the harbor defense commander may order the destruction of such mine. Floating mines which have drifted near Army wharves and vessels in harbors are examples of the type of mine which requires immediate action. Destruction of this type of mine with rifle or machine-gun fire from a distance of at least 300 yards, and preferably 500 yards, may be ordered when such mines are an immediate menace to personnel and important structures providing the possible explosion of such mines, when fired upon, will not endanger such personnel or structures.

[A. G. 300.7 (4-22-43).] (C 1, 19 June 1943.)

■ 36. DEFINITION AND ORGANIZATION.

* * * * * * *

d. Gun batteries.—Gun batteries assigned * * * of armament available. In general, not more than two rapid-fire gun batteries should be assigned to any one mine group.

e. Searchlights.—Searchlights and personnel * * * the mine group. Searchlights are operated under the direction of the searchlight officer of the harbor defense.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 38. STAFF.—*a.* Composition.—The mine group staff * * * to the mine group. This staff includes an intelligence and plans and training officer, a communications and boat officer, a gas officer, and a mine property officer.

* * * * * * *

c. Mine property officer.

* * * * * * *

(3) *Noncommissioned staff officer, electrical* (T/O 4–69).—He is normally a selected electrician who has had a special course of instruction at the Coast Artillery School. He should not * * * mine property officer are—

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 41. COMMAND AND ADMINISTRATION.

* * * * * * *

f.

* * * * * * *

(6) Distribution of one copy of the project requirements as approved by Chief of Ordnance to commanding officer, submarine mine depot, coast artillery district or sector commander, and mine property officer of the harbor defense concerned.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 45. DEFINITION AND COMPOSITION.—*a.* The mine planting flotilla is a tactical unit within the mine group, consisting of at least one mine planter, two DB-boats, and five mine yawls, together with the personnel to man these vessels. Harbor defenses may * * * of mine projects.

b. The personnel of the mine planting flotilla consists of one or more mine planter crews (T/O 4–104), one or more planting sections, two or more DB-boat crews, and five or more mine yawl crews (T/O 4–69).

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 50. DISTRIBUTION BOX BOAT AND MINE YAWL CREWS.—Personnel for operation * * * the mine battery (T/O 4–69). Duties of the crews in connection with the care and maintenance of these boats are prescribed in AR 90–160. These crews are trained by the mine planter commander or the boat officer on the mine group staff.

■ 51. Operation and Training.—*a.* The organization of the mine planting flotilla is such as to concentrate under the control of one competent officer the operation, maintenance, and training of the ship and boat service required in the mine group. Operations on the * * * ashore and afloat.

b. As a unit, officers, warrant officers, the technical specialists, and crews of all its component vessels are available to meet any emergency for repair and upkeep of any vessel.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 67. SPECIAL MINE LOADING EQCUIPMENT.

* * * * * * *

b. Loading rooms will * * * in loading rooms. Compound plugs or mines which have been loaded with TNT and detonators will not, under any circumstances, be tested electrically before they are planted in the mine field.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 69. DISASSEMBLING COMPOUND PLUGS.

* * * * * * *

f. Remove and test the detonating caps, tag those serviceable with date used, and place caps in the original container which will be marked to indicate the number of used caps. These used caps will be used for submine practices or demonstrations.

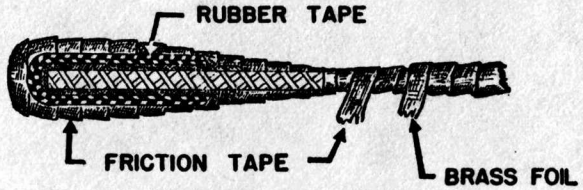
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[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

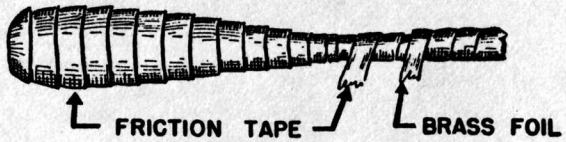
Figure 16 is rescinded and the following is substituted therefor:



① Start. Remove friction tape and brass foil (if any) from cable before making thumb joint.



② Cut-away of finished joint.



③ Finished joint.

FIGURE 16.—Thumb joint.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

SECTION XV

OPERATIONS OF MINE FLOTILLA

NOTE (added).—This section is devoted to the planting, maintaining, and picking up of buoyant mines. The methods set forth are based upon practical experience in the field. They are to be considered as workable only. The methods used in flotilla operations in any particular harbor defense will be entirely dependent upon the particular conditions, hydrographic, tactical, etc., of that harbor defense. Each harbor defense should have its own system of flotilla operations, based upon practical experience in that locality.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 96. TACTICAL WORK OF EACH VESSEL.

* * * * * * *

b. DB-boat.

* * * * * * *

(6) In case of emergency, may be used in maintaining the mine field and to lay shore cables of 10,000 feet or less.

(7) Drag grapnel for locating cables and lost equipment

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 99. LAYING OUT FIELD AND PLANTING, PROCEDURE NO. 1.

* * * * * * *

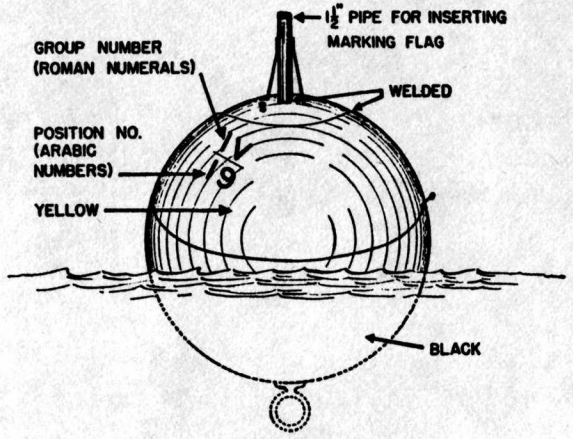
c. Equipment loaded aboard planter.—For each group to be marked out, load planter with—

4 marking buoys (when not available use No. 32 mine cases) painted black on bottom, yellow on top, and numbered to mark line of mines and distribution box position (see fig. 21).

4 cast iron anchors * * * should be included.

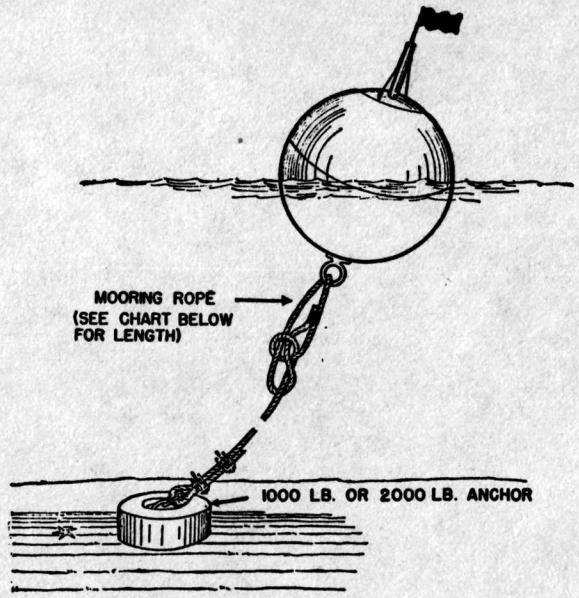
* * * * * * *

Figure 21① is rescinded and the following substituted therefor:



BUOY, MARKING, STEEL

① Typical marking or control buoy.



① Typical marking or control buoy—Continued

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

FIGURE 23.—Course of mine planter in planting. (Dotted lines show route of stern of planter for planting Nos. 9, 10, 4, and 16.)
NOTE (added).—Mine positions are ideal locations and are not expected to be achieved in actual practice. Covering the tactical frontage should never be neglected in order to obtain a straight line.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 100. LAYING OUT FIELD AND PLANTING, PROCEDURE No. 2.

* * * * * * *

c. Equipment loaded on DB-boat.—The equipment loaded aboard the DB-boat will be for one group of mines. In addition to marking buoys, mooring ropes, and anchors, the following

equipment should be added: one distribution box * * * has been planted.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 102. PLANTING THE GROUP OF MINES.

* * * * * * *

g. Method of tripping anchors for straight line.—Figure 29 shows * * * line of mines. The planting officer gives the command LET GO as his line of sight passes across the bows of the mine yawls. This method requires * * * mines for planting.

■ 103. DUTIES OF PLANTER DETAILS WHEN PLANTING MINES.

* * * * * * *

d. After deck detail (fig. 30).—Noncommissioned officer in charge. Nos. 1, 2, 3, and 4 pay out cable. No. 1 always * * * to amidships position.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 105. REPAIR OF GROUP OF MINES.—*a. General.*—If one or * * * least possible delay. All groups should be replaced at least once each year.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 107. TAKING UP MINES.

* * * * * * *

f. Picking up mine cable.

* * * * * * *

(2) When experienced, well-trained * * * driven cable reels. Unless carefully done this procedure may put excessive strains on the cable and will result in sharp kinks and consequent destruction of cable. As the cable is pulled aboard by hand, pull in enough slack, placing the cable through two snatch blocks as in figure 34. On the first * * * for next planting.

* * * * * * *

■ 108. DUTIES OF PLANTING DETACHMENT WHEN TAKING UP MINES.

* * * * * * *

d. After deck detail.—Noncommissioned officer in charge. Nos. 1, 2, 3, and 4 coil cable in figure-of-eight as it comes to the after deck. In coiling cable * * * paying out properly.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 109½. (Added.) NIGHT OPERATIONS.—In harbor defenses which are subjected to enemy shelling and aerial bombing, it may be necessary to plant, maintain, or pick up mines under cover of darkness. In order to meet such an emergency, all mine organizations should be trained in some procedure of night operations. This procedure should be developed under local conditions and will vary with the different harbor defenses. Successful night operations have been carried out with the use of lanterns placed on control buoys. Blinking spotlights aboard mine yawls indicate mine positions to the range section. The submergence record is kept by the yawls. Except for training purposes, night operations should be held to a minimum. Every precaution should be taken to prevent accidents while working at night.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 118. TACTICAL WORK OF DISTRIBUTION BOX BOAT.

* * * * * * *

e. Anchoring at distribution box position.

* * * * * * *

(2)

* * * * * * *

(*a*) One method of anchoring the stern is to drop the stern anchor (usually two 2,000-pound cast iron anchors in tandem) about 150 feet astern of the distribution box buoy and slowly come up to the buoy. The distribution box * * * is made fast.

* * * * * * *

f. Preparation for planting mines.

* * * * * * *

(3) *Distribution box.*—The distribution box * * * into the selector box. When the mines are taken up, the distribution box will be disconnected from the shore cable, the end of the

conductor sealed, and the end of the shore cable fastened to the marking buoy or anchor and lowered overboard. The distribution box * * * ready to be planted.

* * * * * * *

j. Taking up mines.

* * * * * * *

(3) Where one or more mines are to be replaced, or where a fault has developed in the selector assembly, the cover of the selector will be removed. The joint between * * * the mine planter.

* * * * * * *

n. Patrolling.

* * * * * * *

(2) To enforce the patrol, the DB-boat is equipped with a caliber .30 machine gun, eight rifles, and two pistols.

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 121. TACTICAL WORK.

* * * * * * *

e. Planting mines.

* * * * * * *

(3) As soon as * * * can be plotted. This yawl then remains in position tied up to either No. 10 mine or No. 10 marking buoy, or at the discretion of the mine planter commander, may follow the mine planter. If tied to * * * the mine field.

* * * * * * *

(6) The mine buoys * * * the tactical requirements. To remove the blocks the crew of the yawl pull the block aboard, untie the bowlines, and pull one end of the buoy rope from the maneuvering ring. If a single line of buoy rope is used, the rope is cut by means of the buoy rope cutter.

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

■ 140. PERSONNEL FOR FIRE CONTROL AND POSITION FINDING.

* * * * * * *

a. Base and station.—For the usual * * * are manned continuously. Furthermore, there should be at least three and preferably four details to mann all stations when on 24 hour a day alert status.

b. Plotting room.

* * * * * * *

(2) *No. 1 assistant plotter.*—(*a*) No. 1 wears a headset on the line to the mine casemate and transmits commands and reports as indicated (see fig. 4).

* * * * * * *

[A. G. 300.7 (4–22–43).] (C 1, 19 June 1943.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1943

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COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY TACTICS AND TECHNIQUE OF CONTROLLED SUBMARINE MINES, BUOYANT

CHANGES No. 2

WAR DEPARTMENT,
WASHINGTON 25, D. C., 31 AUGUST, 1943.

FM 4–6, 1 May 1942, is changed as follows:

SECTION XXVI (ADDED)

DESTRUCTION OF MATÉRIEL

■ 152. GENERAL.—The paragraphs below show but a few methods of destroying controlled mine equipment. A plan suited to local conditions should be formulated in each harbor defense as a preparedness measure.

■ 153. RESPONSIBILITY.—It is the responsibility of each harbor defense commander to provide a means for destroying all mine fields, casemate equipment, and any documents, diagrams, or papers under his jurisdiction which might otherwise fall into the hands of the enemy in case of evacuation or surrender of the position to the enemy.

■ 154. MINE FIELD.—The mine field may be destroyed as follows:

a. With M3 control system.—(1) Set up system for observation fire.

(2) Shut off operating power from all groups but one.

(3) Tie down interlock key.

(4) Select first mine.

(5) Hold down the three mine keys to the right of the mine which is to be fired.

(6) Close the group firing switch.

(7) Open the group firing switch after the mine has been fired and the fuze cleared.

(8) Open the group operating power switch.

(9) Close the group operating power switch; the system will step to the next mine.

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The Signal Corps Reference Library
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Washington, D. C.

(10) Repeat steps 5, 6, 7, 8, and 9.

(11) When the group has been destroyed, shut off operating power.

(12) Turn on the operating power to the next group and proceed as with the first group.

NOTE.—If mines are a type which arm from shock of explosion, merely cut the wire connection between the 2,700-ohm resistance and the No. 2 winding of the control relay on all group panels. Hold down the interlock key, select the first mine in each group, and close the group firing switch; the system will automatically step through the group of mines, firing each in turn.

b. With M3A1 control system.—(1) Take the back cover off the control panel.

(2) Block the limiting relay into OPERATE position with a wooden match or similar object. (The limiting relay is the lower right-hand relay in the right-hand set of control relays when facing the rear of the panel.)

(3) Select the first mine and fire as in normal procedure; green light indicates cleared fuze.

(4) Hold down the selection key of the next mine.

(5) Open the firing power switch.

(6) Close the firing power switch.

(7) Repeat steps 4, 5, and 6 until the group is completely destroyed.

(8) Hold down the selection key for the first mine of the next group. Depress the DISARM key and the system will step up to the first mine.

(9) Repeat steps 3, 4, 5, 6, and 7.

■ 155. DOCUMENTS, ETC.—To destroy documents, diagrams, or papers, place them on the floor of the casemate engine room near the fuel tanks. Open the fuel tank drain cocks and set fire to the saturated papers.

■ 156. CASEMATE.—In the meantime the plotting board may be placed in the operation room of the casemate and a 450-pound charge of TNT in a No. 32 spherical M1 mine case placed in the casemate so as to destroy the entire structure. It may be necessary to use two charges. In one method of firing, place two detonators, connected in parallel, in an old model submine compound plug with the fuze can filled with TNT (the firing device end of the fuze can must be plugged). The detonator leads extend through the two extra stuffing boxes in the plug proper. The leads are then attached to a 750-foot piece of 2-conductor wire or an acceptable substitute. This wire is unreeled to a distance of at least 500 feet from the casemate. The charge is then fired by means of a storage battery or a magneto. This casemate demolition is to be carried out only in the event of actual invasion and abandonment of the position to the enemy, or when surrender is imminent.

■ 157. STORAGE OF EQUIPMENT.—The equipment necessary for this destruction (except the mine charge and detonators) may be stored in the casemate. The charge and detonators should be stored where they are readily accessible to the casemate.

[A. G. 300.7 (14 Jul 43).] (C 2, 31 Aug 43.)

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

U. S. GOVERNMENT PRINTING OFFICE: 1944

RESTRICTED

FM 4–6
C 3

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY TACTICS AND TECHNIQUE OF CONTROLLED SUBMARINE MINES, BUOYANT

CHANGES No. 3

WAR DEPARTMENT,
WASHINGTON 25, D. C., 26 April 1944.

FM 4–6, May 1, 1942, is changed as follows:

■ 11.1 (Added.) POLICY FOR STORAGE AND HANDLING EXPLOSIVES.—*a. Storage.*—(1) The type and quantity of material which may be stored in any magazine is directly dependent upon quantity-distance requirements (see TM 9–1900). Magazines will not be loaded in excess of the limits specified in this manual. However it is desirable that advantage be taken of the maximum storage volume available in the magazine.

(2) Boxes of TNT should be segregated in piles by lot number and stored in upright position so that all sides are accessible for inspection, and offer no obstacle to the free circulation of air. The bottom layer should be raised off the floor about 2 inches and dunnage used throughout the piles to assure free circulation of air. Dunnage should be level and piles must not be stacked so high that containers in the lower layers will be crushed or deformed. Partly filled boxes should be closed securely, marked, and kept on the top of the pile.

(3) Interiors of magazines will be kept clean. Inflammable material, such as dunnage, empty boxes, damaged boxes, paint, oil, waste, rags, and other unnecessary items will be eliminated or reduced to an absolute minimum in magazines.

(4) Magazines for the storage of blasting caps should be small to limit the possible loss of this type of material. Storage of all on hand of any one type in a single magazine is to be avoided if possible. The quantity in any one magazine should be kept to a minimum consistent with the storage space available. Blasting caps are sensitive to shock, friction and heat. The temperature within the magazine should not exceed 100° F. Caps may be stored with fuzes and primers, but not other high explosives. Paper cartons which have been opened will be re-

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sealed. Containers will not be opened or repaired in a magazine containing explosives. This work will be done in a nearby empty magazine, an empty loading room, or during clear weather in the open at sufficient distance to comply with quantity-distance requirements but never closer than 100 feet from any building containing explosives.

(5) Magazines are not usually wired for electric lights but, when electric lights are used, the installation should conform with the specifications authorized for buildings containing explosives. No portable lights other than approved electric lanterns and flashlights will be used in magazines or around explosives.

(6) No operation in which hazardous materials are involved, other than operations incident to storage, will be permitted in any storage magazine.

b. Fires.—If fire occurs in a magazine where TNT is stored in wooden boxes, the explosives usually will burn quietly, but may detonate. If the fire has gained considerable headway before it is discovered, no attempt should be made to fight it. The efforts of fire-fighting forces should be directed toward preventing the spread of fire to other magazines. Fire-fighting forces will not go closer than adjacent magazines, and will protect themselves against a possible explosion by taking advantage of available cover, or by lying flat on the ground.

(2) An attempt should be made to put out a fire which occurs in a magazine in which blasting caps are stored. Tests with piles of blasting caps in boxes similar to magazine piles showed that in case of fire, blasting caps will detonate a box at a time. Missiles are light and have a very limited range, usually not over 200 yards. If the fire cannot be controlled, the magazine should be abandoned and the efforts of the fire-fighting forces directed toward protecting adjacent magazines. Personnel fighting the fire should seek such cover as is available, or protect themselves against missiles by lying flat on the ground.

c. Handling TNT.—(1) TNT must be handled carefully. Bale hooks will not be used. Containers filled with TNT will not be tumbled, dragged, thrown, walked, or dropped on each other or on the floor.

(2) Never open containers in a magazine in which other explosives or ammunition are stored. Contents of a container may be transferred only at a distance greater than 100 feet from the magazine.

(3) All tools used when opening, repairing, or closing containers filled with TNT should be nonferrous or nonsparking materials.

(4) Shovels and scoops made of copper or aluminum will be used when handling granulated TNT.

d. Exposure.—(1) TNT is toxic when inhaled or absorbed. Therefore, it is necessary that precautions be taken by those continuously engaged in loading or unloading mines.

(2) New structures provided for handling TNT and loading mines will be provided with exhaust ventilation to prevent accumulation of dangerous concentrations.

(3) Personnel engaged in loading mines will be limited in numbers consistent with operating necessity. Personnel not essential to the operation will not be allowed in the vicinity of that operation.

(4) Mechanical filter respirators approved by the U. S. Bureau of Mines will be worn by all personnel continuously engaged in loading or unloading mines. Such respirators must be serviced and cleaned daily.

(5) Shoes with soft soles and heels of leather or rubber, free from metal plates or nails, will be worn by all personnel handling or loading TNT.

(6) Personnel will change all clothing upon starting work and and the clothing worn during loading operations laundered daily.

(7) Personnel working with TNT will be required to take a shower with an approved TNT neutralizing soap (such as sodium sulphite soap) upon completion of the work.

(8) A physical examination will be given personnel continuously engaged in handling TNT every 3 weeks or at the conclusion of any shorter periods of exposure.

e. Trucking.—(1) Trucks used for transportation of explosives must be kept in good operating condition. TNT and blasting caps (detonators) will not be transported on the same

truck at the same time. Trucks with metal body floors or metal strips in the body floors must not be used in the transportation of TNT unless a wooden floor or lattice is provided. Trucks loaded with TNT will display a sign marked "EXPLOSIVES" on each side and the rear of the truck in letters at least 3 inches high on a background of sharply contrasting color. When loaded with explosives trucks must not stop at any point where a fire may be burning, or near administrative buildings, quarters and barracks. A truck so loaded will not be left unguarded. The proper maintenance and inspection of such vehicles will be prescribed by the commanding officer.

(2) Motor vehicles or other equipment using an internal combustion engine or other equipment capable of producing sparks will not be taken into loading rooms.

f. Handling detonators.—(1) Detonators are sensitive to shock. They must be handled carefully. They will not be thrown or dropped on the floor or on other containers.

(2) Detonating caps will not be disassembled for any purpose, as such action by inexperienced persons is likely to result in explosion.

g. Smoking.—Smoking will be prohibited in buildings or in the vicinity of buildings containing explosives, or other hazardous materials. Smoking while wearing clothing which has been contaminated by explosives is prohibited. Smoking areas will be designated and strictly regulated by the commanding officer.

h. Inflammable devices in magazine area.—No person will be allowed to take matches, lighters, or other fire, flame, or spark-producing devices into any magazine, magazine area, or buildings containing explosives except by written authority of the commanding officer.

■ 55. EXPLOSIVES.

* * * * *

b. Neither of these * * * precautions are observed. The mine battalion commander will make periodic inspections (never less than two each year) to insure that proper measures are taken in the storage and handling of all submarine mine explosives. Reports of these inspections will be submitted

to the harbor defense commanders who will initiate appropriate action to correct any deficiencies noted therein.

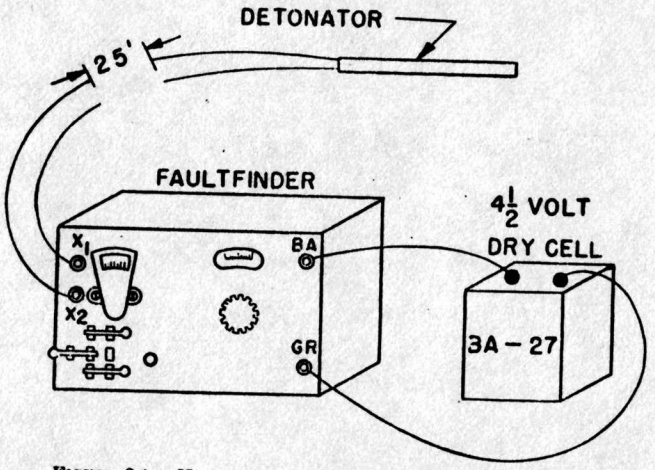


FIGURE 6.1.—Hookup for detonator test using faultfinder.

■ 61. TESTING DETONATING CAPS (Superseded.)—Detonating caps will be tested prior to assembly in compound plugs by connecting them to the bridge megger as shown in figure 6 or to a Leeds and Northrup faultfinder as shown in figure 6.1. The megger ratio switch will be set to "Bridge ÷ 100". The faultfinder switches will be positioned as shown. Then proceed to test as though measuring an unknown resistance. The measured resistance for serviceable detonating caps, SMD No. 5541, manufactured in accordance with U. S. Army Specification No. 50–78–2A, must not exceed 1.6 ohms nor be less than 1.2 ohms. When labels on containers indicate that caps are manufactured under any other specification, the normal resistance and the tolerances therefrom will be secured from the submarine mine depot prior to making tests of the caps. Caps will be tested, one at a time, behind an isolated barricade. A 1-inch thick wooden wall will be a satisfactory barricade in this case.

■ 63. COMPOUND PLUGS — GENERAL INSTRUCTIONS—*a. All models.*—Compound plugs will * * * part carefully examined. Compound plugs or mines which have been loaded with TNT and detonators will not, under any circumstances, be tested electrically before they are planted in the mine field. The storage of compound plugs loaded with TNT or blasting caps is prohibited.

* * * * *

■ 66. LOADING MINES WITHOUT SPECIAL EQUIPMENT.—*a. M1 mine case.*

* * * * *

(5) Bring the required amount of TNT from the explosive storehouse. Insert a nonsparking type loading funnel into the loading hole of the mine case.

* * * * *

(12) (Added.) Waste materials, sweepings, or refuse contaminated with hazardous materials must not be left in or near loading rooms. They should be taken, as soon as practicable, in closed containers, to the burning ground designated by the commanding officer to be destroyed in small quantities under careful supervision. Such material must not be buried or thrown in any stream or tidewater unless it is decomposed by or is soluble in water.

(13) (Added.) Paints, oils, and waste unnecessary to operations will not be permitted to remain in loading buildings. Oily waste must be kept in approved waste cans.

(14) (Added.) All loading buildings must be kept clean and orderly, and their immediate surroundings must be maintained clear of rubbish, undergrowth, or other combustible material. Explosive or highly inflammable dust will not be permitted to accumulate.

b. M2 mine case.

* * * * *

(5) Bring the required amount of TNT from the explosive storehouse. Insert a nonsparking loading funnel into the loading hole of the mine case.

(6) With the aluminum or copper scoop, load the TNT into the mine case, again thoroughly clean the machined surface and the gasket groove with a soft paint brush or nonsparking metal wire brush to remove any particles of TNT, and remove all cap screws.

* * * * *

(10) Tighten diametrically opposite screws with a bronze or other nonsparking alloy socket wrench until the face of the cover is in contact with the face of the mine case at all points.

* * * * *

■ 67. SPECIAL MINE LOADING EQUIPMENT.

* * * * *

b. (1) Loading rooms will not be heated by any heating system employing an open flame or which produces a room temperature in excess of 100° F., or which produces a temperature on the heated surface of the equipment greater than 228° F. A free circulation * * * the mine field.

(2) (Added.) During loading and unloading operations, the aisles and exits of loading buildings will not be blocked and the doors must not be fastened except with antipanic hardware.

(3) (Added.) The floors of the loading room should be kept wet during loading and unloading operations. The entire room should be washed down periodically to prevent accumulation of TNT dust.

c. (Added.) Lighting installations for rooms containing explosives or explosive dust should be equipped with fixtures designed and constructed to prevent adequately the entrance of dust to the interior of the fixture. The fixtures should be of such design or construction that the maximum temperature, at any point on the exterior surface of the fixture, should not exceed 228° F., at 80° F. ambient temperature. Lighting fixtures should have approval of Underwriters' Laboratories, Inc., or any other approved testing laboratory. No portable lights other than approved electric lanterns and flashlights will be used in magazines or around explosives in cars, motor trucks, or boats.

■ 68. UNLOADING MINES.—*a. General.*—TNT may be * * * explosives are observed. When disassembly operations are performed on loaded mines or loaded components requiring

more force to be exerted than in assembly, such work should be done behind proper barricades on one mine at a time. Such disassembly will be done in a separate area. Special care must be exercised to remove all TNT from the mine case. This is necessary to eliminate the hazards of explosions or fire that may exist while the mine case is being handled as in storage. Water, under pressure, should be used to assure complete removal of TNT from within the mine case.

* * * * *

c. Damaged TNT.—(1) Carefully examine the * * * submarine mine depot.

(2) (Added.) TNT, to be destroyed, will be destroyed by burning. Explosives, such as TNT, must not be dumped into water as they will poison it and loose TNT will wash up on adjacent shores. The explosive to be burned will be removed from containers and spread in a thin layer not more than 3 or 4 inches thick. A train of inflammable material will be used to ignite the explosive. Not more than 500 pounds will be burned at one time. Safety precautions prescribed in TM 9–1900 will be observed.

* * * * *

■ 69. DISASSEMBLING COMPOUND PLUGS.—*a.* After the compound plug has been removed from the mine case, remove the follower and set the compound plug in the assembling support, firing end up. The disassembly of compound plugs should not be done when explosives or loaded mines are present.

* * * * *

[A. G. 300.7 (30 Mar 44).]

BY ORDER OF THE SECRETARY OF WAR:

OFFICIAL:
J. A. ULIO,
Major General,
The Adjutant General.

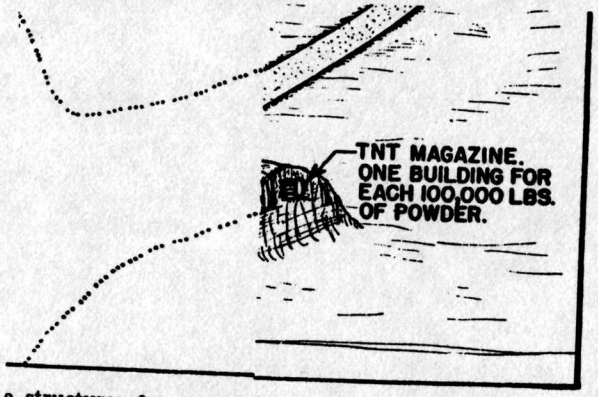
G. C. MARSHALL,
Chief of Staff.

DISTRIBUTION:

As prescribed in paragraph 9a, FM 21–6 for 1, 2, 3, 4, and 9th Sv C only; hq of HDs (10); def comds (10); mine planters (25); mine btrys (25) (allow 2 for each HD).

For explanation of symbols, see FM 21–6.

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e structures for controll53393°—42 (Face p. 204)

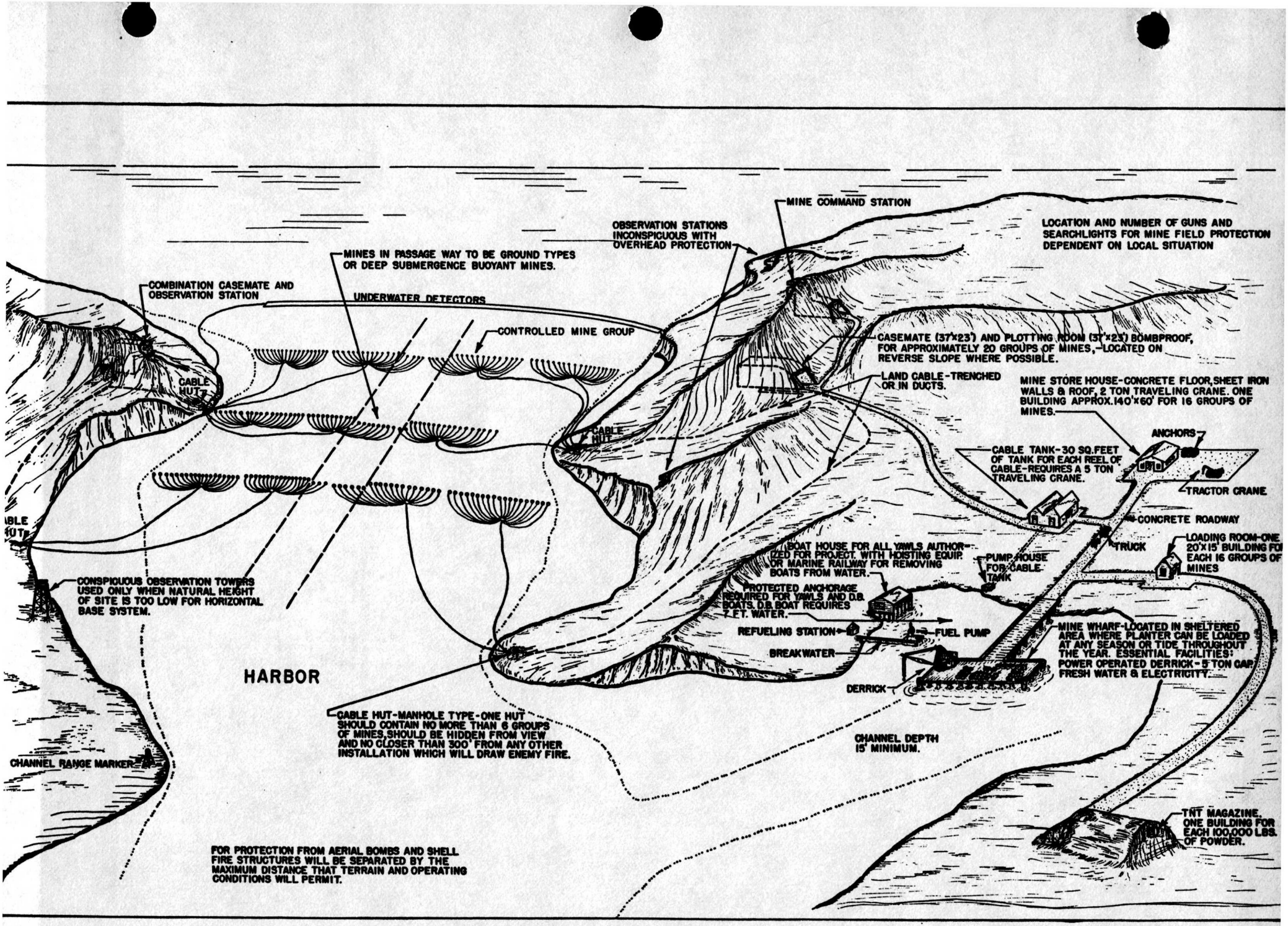
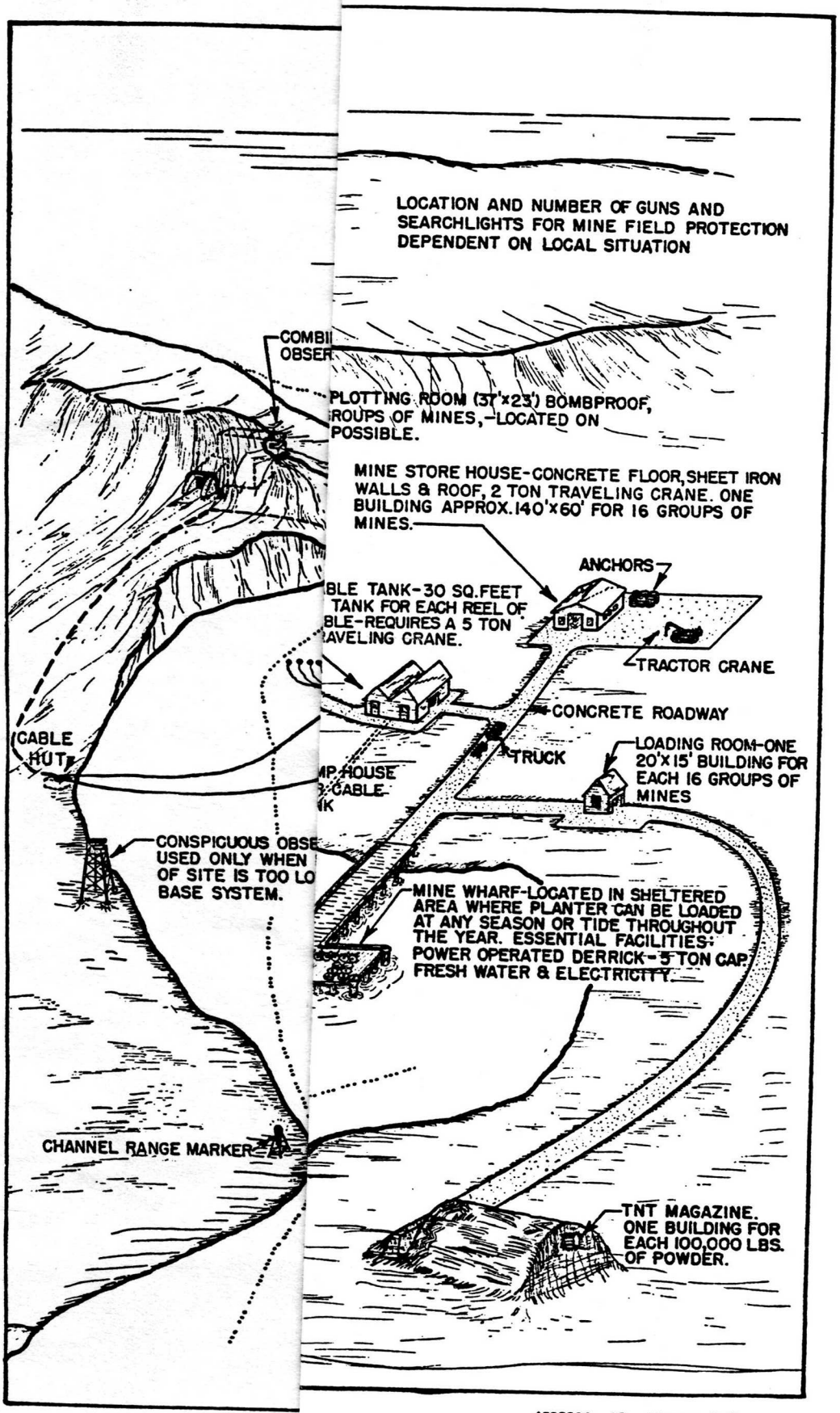


FIGURE 2.—Typical installation of shore structures for controlled submarine mine projects.

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LOCATION AND NUMBER OF GUNS AND SEARCHLIGHTS FOR MINE FIELD PROTECTION DEPENDENT ON LOCAL SITUATION
COMBI
OBSER
PLOTTING ROOM (31'x23') BOMBPROOF, ROUPS OF MINES,—LOCATED ON POSSIBLE.
MINE STORE HOUSE-CONCRETE FLOOR, SHEET IRON WALLS & ROOF, 2 TON TRAVELING CRANE. ONE BUILDING APPROX. 140'x60' FOR 16 GROUPS OF MINES.
ANCHORS
BLE TANK-30 SQ. FEET TANK FOR EACH REEL OF BLE-REQUIRES A 5 TON AVELING CRANE.
TRACTOR CRANE
CONCRETE ROADWAY
CABLE HUT
TRUCK
LOADING ROOM-ONE 20'x15' BUILDING FOR EACH 16 GROUPS OF MINES
MP HOUSE
CABLE
NK
CONSPICUOUS OBSE
USED ONLY WHEN
OF SITE IS TOO LO
BASE SYSTEM.
MINE WHARF-LOCATED IN SHELTERED AREA WHERE PLANTER CAN BE LOADED AT ANY SEASON OR TIDE THROUGHOUT THE YEAR. ESSENTIAL FACILITIES: POWER OPERATED DERRICK-5 TON CAP. FRESH WATER & ELECTRICITY.
CHANNEL RANGE MARKER
TNT MAGAZINE. ONE BUILDING FOR EACH 100,000 LBS. OF POWDER.