

RESTRICTED

PARAVANE HANDBOOK

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PARAVANE HANDBOOK

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SECTION I. GENERAL INFORMATION

1. The department has directed that paravane gear be considered a permanent military feature on naval vessels, including auxiliaries having a mean draft of more than 12 feet, and that the entire gear is to be retained on board all vessels to which fitted, kept in good condition, and used for exercise. The full allowance of paravanes should be carried in convenient location for ready use.

Permanent
military feature.

2. This gear will not be installed on destroyers, gunboats, tugs, patrol boats, or mine sweepers, even though the mean draft be more than 12 feet, except when the Bureau so directs in individual cases.

Vessels
not fitted.

3. The paravane is a special type of water kite designed to prevent ships from striking a moored mine, and consists of a streamlined body with plane, rudder, and cutter head. Two paravanes are towed, one on each side of the ship, by means of specially constructed wire towropes attached to a fitting which bears on, or is supported at, the forefoot of the vessel and can be raised to the weather deck for rigging the towropes.

4. The construction of the paravane is such that when towed through the water, it moves out from the ship's side in a lateral direction, at its set depth, and deflects mines moored in the path of the vessel by means of the towrope. The mine-mooring, when thus deflected, slips along the towrope until it reaches the paravane, when it is severed by a cutter secured to the paravane. As soon as the mine-mooring is cut, the buoyancy of the mine brings it to the surface, where it can be destroyed by gunfire.

5. The paravanes and their towropes, therefore, form a protecting wedge whose apex is the point of tow. The area of water swept by this wedge is dependent on (a) speed of the ship, (b)

length of towropes, and (c) type of paravane. As paravanes may run 70 feet or more from the ship's side, adequate clearance must be maintained when passing other ships which are streaming paravanes or when passing buoys or other obstructions. The difficulty of protecting a ship from moored mines naturally increases with the beam of the vessel to be protected, since the greater the beam, the farther out must the mine be thrown to clear the vessel with safety.

6. The conditions met when the ship is steaming on a straight course differ materially from those to be dealt with when the ship is turning. In the first case, if the mine can be just deflected from the path of the ship, its moorings cut, and the mine brought to the surface, the safety of the vessel will be assured. But if a long ship is turning, a mine may be missed by the bow protector and yet hit the ship's stern. It is, therefore, important when using paravanes to avoid sharp turns if possible.

7. The depth at which the paravane is set to run depends on the type of vessel, its draft, and the depth of water in which the vessel is operating. In practice this depth is about 5 to 15 feet below the keel as hereinafter described.

8. The protection afforded a vessel is dependent on its speed. If it is too low, the outward thrust on the paravane may be insufficient to hold the mine clear of the vessel's sides until the mooring is cut. There is then danger of the mine swinging in and exploding against the side of the ship. Speed should not, therefore, be reduced below one-half of the maximum designed speed of the plane used on the paravane.

(a) It has been found in service that paravanes may easily be damaged unless skillfully and carefully handled. The success obtained with this gear depends largely on the skill with which the paravanes are launched and recovered and the care taken to maintain the paravanes and handling gear in an efficient condition.

9. It is, therefore, necessary that paravanes be used for drill and that the instructions in this book be carefully followed.

10. Experience has shown that best results can be obtained when handling paravanes by keeping an even, constant tension in the towrope when launching and the same in the inhaul when recovering. Slack in the towropes, which may cause high instantaneous stresses in the gear, may be avoided by careful handling of the easing out lines. (See par. 77.)

11. The Norfolk Navy Yard has been designated as the Paravane Depot and, as such, checks and adjusts new paravanes prior to issue. Spare paravanes and gear will also be carried in stock at the other principal navy yards for necessary replacements.

SECTION II. DESCRIPTION OF PARAVANES

12. The paravane is composed of two main parts—the body and the tail. The body carries the towing frame and oscillator; and the tail, the horizontal and vertical fins and the rudder.

13. The body is composed of three separate sections; namely, the head, the body cylinder, and body cone. The head is of

pressed mild steel, hemispherical, and is welded to the body cylinder. A body ring is fitted on the inside of the joint to insure watertightness and rigidity. The body cylinder and body cone are mild steel plates rolled to shape and welded together to insure watertightness. A body ring is fitted within the paravane at the joint of the body cylinder and body cone. At the after end of the body cone there is also fitted a body ring.

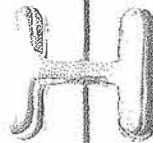
14. The towing frame assembly comprises the cutter, plane, towing frame, and fender. On types B, C, and M the cutter is constructed of two steel forgings, riveted together, which carry the two cutter blades in parallel grooves. On the type D the cutter frame is a single forging or casting of alloy steel to which the cutter blades are bolted.

15. The tail consists of a nonwatertight steel housing more or less conical in shape. It carries the horizontal and vertical fins, a rudder being fitted in the latter. The tail being nonwatertight, water pressure is admitted to the after side of the hydrostatic valve. Motion is transmitted from the oscillator to the rudder by means of the transmission rod and bracket arm. The tail is secured to the body by a number of studs and nuts, the flange of the oscillator rear support ring forming an intermediate jointing ring between the body and tail. A watertight joint is insured by fitting a rubber jointing ring between the oscillator rear support ring and the body ring. The rudder is supported in two bearings, one on the vertical fin and one on the tail casting. The transmission rod is connected at one end to the rudder bracket and at the other end to the oscillator rod, thus transmitting the motion of the oscillator to the rudder.

16. The depth of the paravane is controlled by the rudder, which is actuated by the hydrostatic valve. This valve comprises a rubber diaphragm which is held between the tail casting and the body and connected at its center to the valve rod. (See pl. III.) The valve rod is held in its extreme aft position by the compression of the hydrostatic valve spring. When the paravane dives, the increased water pressure on the afterside of the valve overcomes the compression of the spring, thus moving the transmission rod and altering the rudder. The spring is proportioned so that the full travel of the rudder, plus or minus 10°, is obtained by the change in water pressure corresponding to plus and minus 7½ feet of depth. One-inch compression of the hydrostatic valve spring is equivalent to 20-foot change of depth. The rudder moves in the "up" direction when the water pressure is in excess of the initial compression of the spring, and vice versa.

17. The depth-controlling mechanism comprises two distinct portions—the hydrostatic valve and the mercury oscillator. The hydrostatic valve controls the position of the paravane; the oscillator controls its action. (See pls. VI and VII.)

18. The hydrostatic valve causes the paravane to follow a more or less sinusoidal path through the water. At high speeds this motion becomes excessive, and a dampening device is required which will return the paravane to its correct attitude as soon as it is inclined to leave its set depth.



Depth of
paravane.

Effect of
speed.

Paravane
base.

Body.

Towing
frame.

Paravane

Depth-con-
trolling mech.

Hydrosta-
tic valve.

19. The oscillator, illustrated in plate VI, is composed of a triple valve, comprising two mercury valves and a hydrostatic valve, and the compression spring. The triple valve consists of a steel tube, 62-1, connecting two mercury valve cylinders. Inside this tube and working in bearings fitted at either end of it is a valve rod, 62-3. On the ends of this rod are secured the forward mercury valve, 64-1, called No. 1 valve, and the after mercury valve, 64-2, called No. 2.

20. The mercury oscillator tends to maintain the paravane horizontally when running at its set depth. Should the paravane become inclined, a head of mercury is produced in the oscillator tube proportional to the sine of the angle of the inclination. This head produces compression, which acts on the whole area of the mercury valve, exerting a force which tends to cause the valve, valve rod, and rudder to move in such a direction as to restore the paravane to the horizontal. The oscillator, in fact, anticipates the action of the hydrostatic valve, thus preventing sudden changes in depth.

21. The combined action of the three forces; namely, mercury head, water pressure, and spring compression, gives the following results (see pls. VI and VII):

(a) When the paravane is above its set depth and its head inclined upward, the head of mercury is acting in conjunction with the compression of the hydrostatic valve spring, thus giving a considerable "down" rudder.

(b) When the paravane is above its set depth with its head inclined downward, the head of mercury acts in opposition to the compression of the hydrostatic valve spring and, if the inclination downward is sufficient, will overcome the compression of the spring and give "up" rudder.

(c) There is, therefore, a degree of inclination of the paravane when above its set depth, at which the head of mercury is just sufficient to balance the compression of spring and so give amidship rudder. This angle of inclination is the angle at which the paravane goes down to its set depth.

(d) Similarly, when the paravane is below its set depth and its head inclined downward, the head of mercury is acting in conjunction with the water pressure on the hydrostatic valve spring, thus giving a considerable "up" rudder.

(e) When the paravane is below its set depth with its head inclined upward, the head of mercury is acting in opposition to the water pressure on the hydrostatic valve and, if the inclination upward is sufficient, will overcome the water pressure on hydrostatic valve and give "down" rudder.

(f) Again, there will be a certain inclination when the paravane is below its set depth at which the mercury head is just sufficient to balance the compression on the spring and so produce amidship rudder. This angle of inclination is the angle at which the paravane rises to its set depth.

22. Four types of paravanes are in use, the type supplied depending upon the speed and type of the vessel to which it is fitted. (See par. 23-28 incl. for details.)

(a) Type M, shown on C. & R. type plan No. 93964, is used for merchant ships and naval vessels having speeds not exceeding 16 knots. (See pl. II.)

(b) Type B, shown on C. & R. type plan No. 93965, and type C shown on C. & R. type plan No. 93963, are used for larger or faster vessels whose speed does not exceed 20 knots. (See pl. III.)

(c) Type D (see pl. IV and V) is a development of the previous types, being generally of stronger construction and designed to secure maximum protection through a wide speed range by the use of interchangeable planes. Maximum speeds for which the various planes are designed are 16, 18, 22, and 31 knots. Vessels having a maximum speed in excess of 22 knots will be supplied with the 16-, 22-, and 31-knot planes; those having a maximum speed of 22 knots or less will be supplied with the 16- and 22-knot planes. The 16-knot plane is intended primarily for vessels operating at reduced speeds. The 18-knot plane is usually used on merchant vessels, and at the present time is not being procured.

Type D will eventually supersede both types B and C. At the present time types B and C are being replaced on vessels making speeds of 20 knots and greater.

23. The type M paravane (pl. II) differs from types B and C in only one essential feature, the depth controlling mechanism. Because the type M paravane is designed for use on relatively slow-speed ships, the hydrostatic valve alone proves sufficient for depth maintenance, no mercury oscillator being necessary. The horizontal fin (vertical when streaming) carries on its lower surface a weight similar to that carried on the lower end of the plane fitted to the body of the paravane. The size of the plane on the type M was originally 7 feet by 20 inches and the angle of incidence 6°; the diameter of the body is 21 inches and the length of the entire paravane is 11 feet 8¼ inches. The type M, Mod. I paravane is identical with the type M except that the plane length has been increased to 8 feet and the angle of incidence to 10°.

24. The construction of types B and C paravanes is essentially the same, but there are certain differences in their dimensions. (pl. III.) Of these the most important is in the area of the planes, which are designed to afford approximately the same outboard thrust to both types at the speeds at which they are designed to run. The C type has a smaller body than the B type, its body being 18½ inches in diameter against 21 inches diameter for the B type.

25. The plane is secured to the body at an angle of incidence of 10° in the B and C types. The dimensions of the planes are as follows:

Type B, 7 feet by 20 inches.

Type C, 6 feet 3 inches by 18 inches.

The B and C paravanes are fitted with a weight on the inboard end of the plane (cutter up, nose toward bow) and a similarly shaped float on the outboard end. The weight and float are interchangeable in case it is required to run a starboard paravane on the port side, or vice versa.

Type D
paravane.

26. Detailed instructions for interchanging are given in paragraph 98 below and plate XIX.

27. The type D paravane is basically the same as types B and C, but embodies several changes in details of construction and design. In addition to the strengthening of the body to withstand a depth of 50 fathoms without crushing, the towing frame has been stiffened and designed to carry the one-piece cutter frame in either of two positions and to take any one of four different planes to suit the maximum speed of the ship. The camber of the planes has been increased and the weights and displacers placed entirely on the upper (or inner) side to increase the suction effect. The design of the tail assembly has been improved generally and grease gun fittings provided for pressure lubrication.

28. The cutter head is constructed of a single steel forging to which the cutter blades are attached to the side which will be up in operation. Dummy blades on the opposite side permit the cutter to be used with either port or starboard paravanes. Also two roller cutters are connected to the paravane by means of a span bar, fitted with universal joints to prevent the paravane upsetting in case a mine mooring should jam in the cutters. (See pl. IV.) The body is 18½ inches in diameter and 12 feet 10 inches long over-all. The 16-knot plane is 75 by 28 inches and is set at a 10° angle of incidence; the 18-knot plane is 66 by 18½ inches, set at a 10° angle of incidence; the 22-knot plane is 57 by 18½ inches, set at a 10° angle of incidence; and the 31-knot plane is 50 by 14½ inches, set at a 7° angle of incidence. The cutter head must be in the forward position when the 31-knot plane is mounted. (See pls. IV and V.)

Cutters.

29. In general, paravanes fitted with serrated blade cutters will protect a vessel at all speeds of more than half the maximum designed speed plus 2 knots. Paravanes fitted with roller cutters will protect a vessel at all speeds above half the maximum designed speed of the paravane. After proper mounting and adjustment, the cutters require no resetting, can take two parts of a mine mooring in rapid succession, and will sever a half-inch wire rope with a pull of about 700 pounds. (See par. 97.) The blades should be removed and changed when the paravane is hoisted aboard if they show any signs of wear.

30. Most paravanes have negative buoyancy and will sink if the vessel is stopped with the paravanes out. Wherever possible paravanes should be brought in to the vessel's side before slowing to 6 knots. All paravanes will assume their set depth at speeds of 6 knots or more. (See par. 98.)

Pressure limit
paravanes.

31. Except for the type D, they are designed to withstand an external pressure of 60 pounds per square inch. If a vessel fitted with type B, C, or M paravanes is stopped with the paravanes out, they will probably be crushed by water pressure. Type D paravanes are designed to withstand a water pressure of 130 pounds per square inch.

Horsepower
absorbed.

32. The following table gives the shaft horsepower absorbed at different speeds for the various types of paravanes when using the normal (56 yards) length of rope:

Speed	Horsepower absorbed			
	16-knot plane	18-knot plane	22-knot plane	31-knot plane
Types M and B paravanes:				
16 knots.....				450
18 knots.....				620
20 knots.....				870
22 knots.....				1,170
Type C paravane:				
18 knots.....				640
20 knots.....				850
22 knots.....				1,100
24 knots.....				1,420
26 knots.....				1,780
28 knots.....				2,230
Type D paravane:				
12 knots.....	490	330	280	200
14 knots.....	750	530	420	300
16 knots.....	1,100	790	625	440
18 knots.....		1,100	920	620
20 knots.....			1,225	860
22 knots.....			1,710	1,150
24 knots.....				1,520
26 knots.....				1,920
28 knots.....				2,420
31 knots.....				3,250

SECTION III. DESCRIPTION OF SHIP INSTALLATIONS

33. Paravane handling gear should be installed in general accordance with such of the following general type plans as may be applicable to the particular ship:

Bn. Ships Nos. 188666, 188667, 188668, 180218, 180219, 180220, 180221, 429391, 466286, 475443, 417292, 542351, 617879, 617880, 617881, 632218, and 632610.

34. The ship end of each towrope must be accessible and, therefore, the arrangement must permit the lowering of the point of tow from the deck to the forefoot and vice versa. Four general types of fittings are used to accomplish this:

- (a) Clump and chains.
- (b) Internal pipe and chains.
- (c) The boom device.
- (d) The sliding shoe.

35. The clump and chain arrangement provides separate towing connections from two chains leading from the forecable down to and through two holes in a skeg or stem extension on the forefoot. The towropes are attached to a connection in the chains and hauled down to the proper towing position. This arrangement is used principally on the older battleships. (See pl. IX.)

36. The internal pipe and chain device consists of one or two chains leading through pipe or pipes from the weather deck down through the ship's bow to the forefoot. A downhaul chain is reeved down through the pipe or pipes and led up on the outside of the ship through a chock or roller fairlead on the forward end of the weather deck where it is secured by means of a stopper. A swivel tow connection is provided in the chain for towing the paravanes. The towing points are hoisted and

lowered by means of an endless whip arrangement operated by an independent drive or by messenger lines led to the windlass capstans. (See pl. XIV and Bureau plan No. 632610.)

Hinged boom.

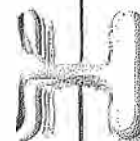
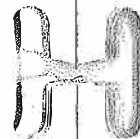
37. The boom device consists of a boom secured to the side of the vessel near the bow and so hinged that the head of the boom may be lowered to a point just forward of, and at the level of, the forefoot. This arrangement has, in past years, been used quite extensively on slow-speed merchant ships, especially on vessels having the materform type of bow. An A-frame arrangement, hinged to both sides of the ship, is also being used on this type of vessel where the lines of the bow will not permit the use of the sliding shoe.

Sliding shoe.

38. The sliding shoe arrangement has been the most generally used device since World War No. 1. The shoe was originally designed to be lowered over a cathead on the bow and to slide down the stem by gravity to the towing position on the forefoot. Experience has proved, however, that on many ships the shoe can not be lowered to its proper position at speeds greater than 7 or 8 knots due to the force of the water on the shoe and uphaul chain. To overcome these difficulties and to provide a positive downhaul for the shoe, a modification of the sliding shoe device has been adopted for vessels requiring it. The modification is obtained by cutting a hole about 7 inches in diameter in the stem at the forefoot, about which is built a well-rounded bolster. The shoe may be positively handled by means of an uphaul and downhaul chain operated from the capstan heads by messenger lines or by the use of a chain known as an endless whip. By attaching one end of the chain to an eye welded on the bottom of the shoe, reeving the chain through the hole in the forefoot, bringing it up on deck over a suitable fairlead and leading it aft around a pedestal sheave, then forward over a cathead sheave or chock, and attaching the other end to the topside of the shoe, the endless whip is formed. By heaving on the portion of the chain attached to the bottom of the shoe, called the downhaul, the shoe may be lowered, and by heaving on the portion attached to the top side of the shoe, called the uphaul, the shoe may be raised. The pedestal sheave around which the endless chain is led on deck provides a fairlead clear of deck obstructions and with sufficient travel to handle the towing points between the weather deck and the vessel's forefoot. The endless chain is operated by an independent drive or by messenger lines led to the windlass capstan heads. By these arrangements the downhaul chain, being stopped on deck when shoe is down, prevents the shoe from working up in heavy seas, and the uphaul chain, being stopped on deck, acts also as a preventer, eliminating the use of an uphaul rope and the separate chain preventer previously used.

Sliding shoe device.

39. In the sliding shoe type of fitting (pl. XI) the paravanes are towed from a forged-steel or cast-steel shoe. The shoe is held against the stem by $\frac{5}{8}$ -inch flexible steel wire ropes, one at either side of the ship, called the backhauls. It is held at its right depth by means of stops on the uphaul and downhaul chains which act also as preventers.



40. The shoe is more or less U-shaped, designed to fit the stem of the particular vessel on which it is to be used. It is provided with a lug, one 1-inch close link, swivel, and one 1-inch long link on the top side at center, to which the uphaul chain is shackled and a lug on the under port side of the shoe to which the downhaul chain is shackled. It is also provided with the necessary eyes and shackles for securing the backhauls and towropes. (See type plan Bureau No. 617881.)

41. On new vessels the stem is designed to provide for lowering the shoe to within a few inches of the keel; on other vessels a fabricated stem extension is fitted to give the necessary strength for towing the paravanes and at the same time give a minimum resistance to motion of the ship through the water. It is riveted or welded to the stem of the vessel and extends down to the bottom of the keel. A fin should also be fitted above the stem extension where necessary to provide a guide for the shoe and clearance between the legs of the shoe and the bow plating. (See Bureau plan No. 475443.)

42. Two portable booms or cranes arranged for quickly striking down when in way of gunfire are used for launching and fishing paravanes, one on either side of the ship. (See Bureau type plan No. 617879.) The booms should be of sufficient length to provide a clear overhang of the vessel's side of at least 10 feet on new installations and an overhang of at least 7 feet 6 inches on others. Although the weight of the gear lifted is only about three-fourths of a ton, the booms should be capable of taking a working load of 4 tons in order that they may be used for recovering paravanes while the ship is under way. In designing paravane booms and cranes the stresses in the various parts should be determined on the basis of a 4-ton working load and the following approximate angles of the inhaul rope:

(a) Outward angle of 20° with the center line of ship; downward angle of 35° with the horizontal.

(b) Inward angle of 15° with the center line of ship; downward angle of 75° with the horizontal. The factor of safety in a wooden boom should be about 8, and in a steel boom about 5, based on the above and the ultimate strength of the materials.

The position of booms is determined on each ship by the necessity for tricing up the towrope in bights along the gunwale as required to facilitate launching the paravane and should be far enough aft to take up most of the slack in the paravane towrope. (See pl. XVII.) Unless this is done, paravanes are liable to part the towrope when launched. Too much slack will also permit the paravane to tow from the inhaul line on recovery. Position of crane and length of towrope should be coordinated to facilitate launching and recovery. The procedure to be followed in striking down the crane or boom is to stream the paravanes in the usual manner keeping the bitter end of the inhaul on the capstan head. Swing the boom forward until the inhaul line can be reached from the deck, hold the inhaul on the capstan until the carpenter stopper used for launching is transferred to the outboard end of the relieving pendant which is

The sho

Stem ex

Parava
booms.

secured to a deck pad just forward of the boom. Attach the carpenter stopper to the inhaul and pay out on the inhaul until the carpenter stopper takes the strain. Strike down the boom to clear gunfire or train.

43. The booms or cranes should be subjected to a static proof test load of double the working load. Tests on new ship installations should be made, if practicable, with the angles given above. It has been found from experiments that maximum stresses may be expected, when fishing paravanes, shortly after the recovery is started and just before the paravane breaks the surface. These stresses, however, will vary in different installations and the use of an inhaul bridle has decreased them considerably.

44. On vessels fitted with preventer stays, the forward boom guys should be used only for swinging the paravane boom when handling the paravanes on deck, being careful to take the entire stress when recovering paravanes on the preventer stays.

45. Special care should be taken that 15-inch snatchblocks with shackle, rig No. 25, be used at the head and heel of paravane booms. The snatchblock at the head of the boom should be of the swivel and upset shackle type. The snatchblock at the heel of the boom should be of the swivel type with regular shackle. It will be noted that these blocks are of a special type suitable for handling paravanes and will not become disengaged when the rope is slack. Snatchblocks fitted with hooks, even if moused, are not considered safe for use in these locations.

46. The inhaul ropes cannot be used for the test load specified in paragraph (43) above without exceeding their safe working load: $\frac{3}{4}$ -inch diameter high-grade plow steel wire rope of 6 by 37 construction should, therefore, be temporarily substituted for such tests.

47. Past experience indicates that the $\frac{5}{8}$ -inch inhaul line is adequate for retrieving paravanes if properly handled from cranes or booms in suitable locations.

48. The length of the inhaul between the paravane and boom head or deck fitting through which the inhaul is secured should be about as shown in the following tabulation:

Half-breadth of vessel at paravane boom, in feet	Length of paravane inhaul rope, in fathoms
20	29.7
25	28.5
30	27.4
35	26.3
40	25.2
45	24.0
50	22.8

49. This length is important as it affects the spread of the paravane materially and should be clearly marked on the paravane-handling general arrangement plan for each vessel.

50. Details of an inhaul bridle, designed to facilitate recovery of type D paravanes, is shown on Bureau's general type plan

No. 617881. This device, attached to the cutter frame and top side of the towing frame, tilts the paravane when the inhaul line is tightened, causing the paravane to plane on the surface after which it swings in to the vessel's side. (See pl. XIII.) It has the disadvantages, through increased off-center drag, of causing the paravane to run above its set depth and of decreasing the spread. The depth setting of paravanes fitted with an inhaul bridle should be increased 10 feet to compensate for this drag. A similar bridle can be rigged on types M, B, and C paravanes by providing a hole in the proper side of the towing frame and increasing length of bridle legs to suit position of the gravity band hook.

51. A special tripping hook is provided for controlling the paravane during launching. Two lines, both 6 by 37 high-grade plow steel, are attached to the tripping hook, one a $\frac{5}{8}$ -inch diameter easing-out line and one a $\frac{3}{8}$ -inch tripping line, both of which must be long enough to reach the paravane towrope in its normal running position. (See pl. XVI.)

52. The position of the easing-out chock is important and should be arranged, when fitting a ship's equipment, to be a definite distance from the towpoint, measured along the vessel's centerline. This distance is 104 feet minus 1.6 times the height of the chock above the water line. This figure applies to the 56-yard towrope. If the 70-yard towrope is used, the distance will be 42 feet greater.

53. A sheave or pedestal cathead, of suitable size for the chain used, is fitted at the head of the stern to take the uphaul and is so placed as to provide a suitable lead to the capstan.

54. The backhauls are $\frac{5}{8}$ -inch flexible steel wire ropes and are connected by means of a section of $\frac{3}{4}$ -inch close link chafing chain to the after eyes on the shoe, and led aft through appropriate chocks to securing tackle on deck. This tackle should be located aft of the chock in all cases where practicable. A section of $\frac{3}{4}$ -inch close-link chain should be fitted in the backhauls to absorb vibration and take chafe in way of the chocks. These chains also serve as markers to show that the shoe is in position and that the backhauls are properly secured. The backhaul lines are not required in the clump and chain and in the pipe and chain devices where the chains take the towing strain.

55. It is understood that devices to prevent mine mooring cables from being cut, as well as obstructions to foul the paravane, may be found on some types of mines. These obstructions if jammed in the cutters may cause the mine to be dragged and endanger a vessel when retrieving the paravanes.

In such case the paravane and snagged mine should be set adrift as follows:

(a) On vessels fitted with a sliding shoe.—Hoist shoe to the deck level and release the pelican hook which tows the paravane.

(b) On vessels fitted with an internal pipe and chain.—Disconnect shackles in endless chain and trip pelican hook on deck which releases the chains.

Inhauls.

Inhaul bridle.

Easing-out lines.

Easing-out chock.

Pedestal cathead.

Backhauls.

(c) On vessels fitted with pelican hook in towrope operated by pendant on deck.—Take strain on pendant from capstan until locking pin in pelican hook is sheared which releases the towrope.

SECTION IV. TOWROPE

Three-strand towrope.

56. The towrope in general use up to the present time consists of a specially designed three-strand wire rope about eleven-sixteenths inch in diameter. Each of the three strands contains 37 galvanized steel wires 0.049-inch diameter, having a breaking strength of 210,000 pounds per square inch. This type of construction has been found to withstand, better than any other similar wire tested, the severe vibration set up by the paravane when running at full speed.

Insulated towrope.

57. As a countermeasure against the antenna type mine, a rubber-covered paravane towrope is being issued along with the type described above. This towrope consists of a 6 by 19 wire rope eleven-sixteenths inch in diameter, impregnated and covered with abrasion-resisting rubber, to give an over-all diameter of approximately 1 inch. In view of the greater difficulty encountered in handling insulated towropes without damage and their lesser effectiveness against moored contact mines as compared with the three-strand towrope, the use of rubber-covered towropes should be restricted to those areas in which antenna mines can reasonably be expected to be found. Due to the limited quantity of these ropes available and the amount of critical material involved, their use in drills should be limited to the minimum required to familiarize the crew with their use.

58. On the initial issue of type D paravanes, the towropes will be furnished with roller cutters mounted. On replacement issues of towrope, unless otherwise requested, the outboard end will be seized only, necessitating the ships pouring a zinc socket fitting to secure the roller cutter to the towrope. Vessels without facilities for pouring these zinc sockets may, where necessary, request that towropes be furnished with roller cutter mounted. In this latter case, it will be necessary for the ship to requisition a roller cutter and span bar, in excess, with each replacement towrope required. The used roller cutter and span bar will be turned into store immediately upon receipt of the new towropes with mounted roller cutter and span bar.

59. The length of the towrope which can be used for streaming paravanes is limited, due to the fact that the rope follows a catenary-like curve in the water. The optimum condition for bow protection is a short towrope with a large angle between the curve of the towrope and the fore and aft line of the ship, while protection of the stern requires a towrope long enough to sweep the area through which the vessel passes. An angle of 30° between the towrope and fore and aft line of the vessel is usually considered the minimum which will afford adequate protection to the bow.

60. A towrope 56 yards long will form an angle of approximately this size when towed within the speed range for which the paravane is designed. With this length of towrope and when towed at maximum designed speed, types M, B, and C paravanes will

tow approximately 110 feet from the centerline of the ship. Type D will tow approximately 93 feet from the centerline of the ship with the 31-knot plane, 115 feet with the 22-knot plane, and 130 feet with the 16-knot plane. With paravanes performing satisfactorily at the above speeds, tensions in the towrope will be approximately 7 tons, except in type D paravane with the 31-knot plane, in which case the tension will be approximately 8 tons.

61. For all ships over 300 feet in length the towrope has a length of 56 to 70 yards. For shorter vessels the lengths usually adopted are: Under 200 feet, 40 yards; 200 to 249 feet, 45 yards; 250 to 299 feet, 50 yards.

62. The 56-yard towrope does not provide full protection to the stern of larger vessels when turning. This limitation must be borne in mind when operating in mined areas. While the 56-yard length is usually considered standard, certain conditions, such as location of armament or increased protection to the vessel's quarters, make it necessary to increase the length to as much as 70 yards, which is now considered the maximum allowable towrope length.

63. No definite figure can be given for the life of a towrope, because it will vary under different service conditions. In general, it will be least with the shortest lengths or with the highest tensions. As a rough guide, a towrope can be expected to last about 100 hours at 20 knots, 150 hours at 15 knots, and 400 hours at 10 knots. Fatigue failure of individual wires usually develops gradually along the bight of the rope, but may occur very rapidly at any particular point at which the rope comes in contact with anything of a rigid nature.

64. The rope should be examined carefully after each run for signs of failure. Whether or not a rope should be replaced depends on the condition of the rope and severity of service, bearing in mind that failure of the towrope will probably result in loss of the paravane. At present, there are no means known of determining the condition of the insulated towrope after extensive use. It is probable that the ends of broken wires can be felt through the insulation or will make the surface uneven.

65. The towrope is connected at one end to the appropriate fitting on the ship by means of a closed socket shackled to 1-inch close-link towing chain and the other end is connected to paravane by means of the special sleeve and shackle shown on plate XII.

66. Due to the excessive vibration set up in the towropes when towing paravanes, the connection for the paravane end of the towrope is constructed to include a rubber buffer. On Types M, B, and C paravanes, the connection is made in the form of a special towing sleeve, the inboard end of which is chamfered to prevent a mine mooring being fouled on the towing connection. (See pl. XII.) On the Type D paravane, the rubber buffer is enclosed in the cutter frame, outboard of the roller cutters. (Pl. IV.)

67. Great care should be taken in connecting the towing sleeve to the paravane to insure that the chamfered surface lies in its correct position facing the nose of the paravane (see pl. VIII)

Length of towrope.

Life of towrope.

Towrope connection.

Lubrication
of towrope.

as otherwise the mine moorings, on reaching the sleeve, will catch in the sharp point of the sleeve and fail to enter the cutter.

68. The external surface and bearing and faying surfaces of the special towing sleeve should be kept well greased at all times to prevent corrosion and insure free movement in operation. Care should be taken to prevent grease coming in contact with any rubber part. After use the towrope should be thoroughly swabbed with wire rope lubricant after which the excess may be wiped off to facilitate handling.

Towrope
stowage.

69. Towing ropes, both bare and insulated, should be stowed under cover wherever practicable to prevent loss of lubricant from the bare rope and deterioration of insulation on the insulated rope. The latter should be kept in a dark, dry place, preferably an airtight container.

SECTION V. HANDLING PARAVANES ON VESSELS FITTED WITH SLIDING SHOE DEVICE

Launching.

70. To launch paravanes proceed as follows:

(1) Connect the chain on the inboard end of each towrope to the after eye on the sliding shoe by means of the shackle provided. Lead towrope aft through easing-out hook and make the bight fast by means of a hemp stopper, leaving enough slack in the rope forward so that the sliding shoe may be lowered into the towing position without strain. Lead the towrope on aft, stopping it by means of three dry turns of light hemp about as indicated on plate XVII. Just enough slack should be left in the towrope aft of the after hemp stopper to allow the paravane to fall freely into the water before breaking the stopper. Connect the other end of each towrope to the cutter head on the paravanes, taking care on types M, B, and C paravanes that the chamfer on the towing sleeve faces toward the nose of the paravane (see pls. VIII and XII), as otherwise the mine moorings, on reaching the sleeve, will catch in the sharp point of the sleeve and fail to enter the cutter; also note that the starboard paravane is on the starboard side and the port paravane is on the port side of the ship. (See pl. XIX.)

On type D paravanes, take care that the roller cutters and span bars are attached with the cutter beneath the towrope and that all nuts on the span bar are located on the under and after sides. If mounted with cutters above the towrope, there is danger of damaging the towrope in retrieving the paravane.

71. With shoe rigged as described in paragraphs 38 and 70 raise the shoe from its stowage chocks by heaving in on the uphaul line. Disconnect the safety pendant from the downhaul line and attach the backhauls. Remove the stop from and slack off on the uphaul. Remove the stop from the downhaul and heave in on it paying off in the inhaul if separate capstans are used. Lower the shoe to a point just above the water, at the same time tending the backhauls to keep just taut enough to prevent shoe from leaving stem.

72. On the type D paravane, fitted with bridle, shackle the inhaul rope with safety link to the bridle and pass both legs

of the bridle through the launching hook on the paravane (see pl. XIII). On types M, B, C, and D, not fitted with bridle, pass the inhaul rope through the lifting hook and secure it to the eye at the back of the cutter head by means of the safety link provided. (See pl. XV.)

73. Reeve six-thread manila tail rope through the lightening holes in the paravane tail casting or around tail tubing for controlling the paravane when launching.

74. Hoist paravane outboard, and lower to within about 10 feet of the water. (See pls. X and XVII.) Secure inhaul rope by means of carpenter stopper on deck. Remove inhaul rope from winch or capstan head and wind it on a reel or flake it carefully on deck so that it will have a free run when the stopper is released. Secure end to prevent loss overboard.

75. On vessels having the endless chain arrangement take 5 feet of slack out of the endless chain and remove downhaul chain stopper as described on Bureau type plan No. 617879.

76. Slow speed of ship to 15 to 20 knots. The shoe can now be lowered to the towing position, keeping enough strain on the backhauls to prevent the shoe leaving the stem. When the shoe is in the towing position, which will be shown by suitable marks on the chain, heave in on the backhaul ropes with the tackle provided until well taut and the chafing chain is centered in the chock, then make fast.

77. Slow ship to a speed suitable for launching paravanes of the type used. No difficulty should be experienced with a trained crew in launching types M, B, and C, and the type D paravane, fitted with the 22-knot plane, at 12 knots, the type D fitted with the 16-knot plane at 10 knots, and the type D fitted with the 31-knot plane at 15 knots. In case of military necessity justifying possible damage to the gear, types M, B, and C, and the type D paravane with 22-knot plane, may be launched at 15 knots; the type D with 16-knot plane, at 12 knots, and the type D with 31-knot plane, at speeds up to 20 knots. Paravanes have been launched successfully at these speeds. Sufficient turns of the easing-out line must be taken around bitts or other deck fitting to control the speed at which the easing-out line goes out. By means of the tailing line tilt the nose of the paravane slightly outward holding it in approximately horizontal position. Trip carpenter stopper, **TAKING CARE THAT ALL ON DECK STAND CLEAR**, letting the paravane drop into the water, the inhaul rope running out freely from the deck. As the paravane submerges, the inhaul rope is washed out of the launching hook. (It is very important that the inhaul rope be slacked off freely the instant that the paravane reaches the water in order to avoid dangerous stresses in the rope.) When the paravane is submerged, it will promptly break the hemp stoppers and pull directly from the easing-out hook unless it broaches (in which case it must be immediately recovered). Slack off gradually on the easing-out line until the hook is well under the water and the paravane is running out smoothly when it should be tripped. The paravane then tows from the bow of the vessel in full operation. Ease

Lowering
sliding sh

out on the inhaul so that it trails off from the paravane in an easy bight and secure with carpenter stopper. (See par. 48.) Resume speed.

Picking up.

78. To pick up paravanes (pl. XVIII): Reduce speed of ship to that desired for recovering. With the use of a bridle, paravanes can be recovered at speeds given above for launching provided a constant uniform strain is maintained on the inhaul. Hoist on inhaul rope until paravane is at the head of the boom clear of the water. Swing paravane inboard into the chocks. The speed of the ship may be increased to normal when the paravane has been brought clear of the water. Experiments have shown that great care and skill in handling the inhauls are necessary if sudden stresses of high order are to be avoided in these ropes. The magnitude of such stresses will ordinarily increase with the speed of the ship. Very high stresses, endangering the gear, will be found at speeds above 15 knots if the hauling-in operation is not performed uniformly. It is important to avoid sudden surges in the inhauls.

The inhaul bridle tends to upset the paravane causing it to slip to, and plane on, the water's surface. Proportions of the bridle and speed at which the inhaul bridle is hauled in should be such that the paravane will slip to and stay on the surface. Should the paravane be tilted too much by the inhaul bridle, it will surface rapidly and head into the side of the ship faster than the inhaul line can be taken in. To remedy such cases the length of the bridle legs may be varied by the addition of shackles as found necessary keeping in mind that any additional fitting on the paravane increases its resistance and decreases its span.

79. When the paravane has been taken aboard, ease the strain off the backhauls and lift the shoe to its stowage position.

SECTION VI. HANDLING OF PARAVANES ON VESSELS FITTED WITH CLUMP AND CHAIN DEVICE AND ALSO PIPE AND CHAIN DEVICE

80. Before launching paravanes, connect the chain on the inboard end of the towropes to the tow connection on the bow chains by means of the fittings provided.

81. Thereafter, proceed to rig paravane gear and launch and recover the paravanes in the same manner as described in section V for sliding shoe device except for the backhauls which are not required in this rig. The towing points should be hauled down at the same point in this procedure as the sliding shoe.

SECTION VII. HANDLING PARAVANES ON VESSELS FITTED WITH BOOM DEVICE

82. The boom device consists of a boom secured to the side of the vessel near the bow as described in par. 37 and shown on Bureau type plan No. 632218.

83. In appearance the boom in the working position is an inverted derrick with the base attached to a trunnion mounted on the ship's starboard side. It is fitted with a topping lift and

control guy for raising and lowering it into position and a backhaul on the port side for holding it rigid against the stem when in the towing position. A clip on the boom fits around the stem in this position and prevents any swaying movement.

84. The head of the boom is raised to the deck with the topping lift and control guys provided for shackling the towropes to the towing band fitted on the end of the boom. The boom is then lowered to the towing position and the backhaul secured to hold the boom rigid in the towing position.

85. The paravanes can now be launched as described under the sliding shoe device.

SECTION VIII. DISASSEMBLY AND ASSEMBLY

86. To disassemble types B and C, the following operations are involved:

Disassembling
types B and C.

(a) To remove the cutter bracket and blades: Remove the four nuts that secure the cutter bracket to the towing frame, after which the cutter bracket is free and can be removed. Remove the four screws, insert the drift provided into the slot at the after end of the jaw and tap the drift with a hammer until the cutter blades move and can be withdrawn.

To remove the
cutter bracket
and blades.

(b) Before removing the tail, note carefully the rudder angle so that the same adjustment may be obtained when reassembling. To remove the tail: Remove the split pin and the transmission-rod jaw pin. Throw the transmission rod clear of the oscillator connecting rod. Take the weight of the tail by a sling passed beneath it. Remove all the joint nuts. The tail is now free and can be removed.

To remove
the tail.

(c) Having removed the tail, to remove the oscillator insert a screw driver between the oscillator rear support ring and body ring and pry gently until the oscillator moves. Withdraw the complete oscillator through the aft end of the body.

To remove the
oscillator.

87. (d) To strip down the oscillator:

(1) Take all compression off the spring by removing the nuts and the compression spring bridge and remove the spring.

(2) Before removing the diaphragms, run off the mercury by removing the air vent plug and the refilling cap. To disassemble the forward mercury diaphragm, remove the nuts, washers, bolts, and keep ring for No. 1 valve. Remove the split pin and the castle nut. Remove No. 1 valve. The diaphragm is now free. To disassemble the after mercury diaphragm and the hydrostatic valve diaphragm, open out the copper locking washer. Remove nut and washer. Remove the hydrostatic valve washer. Remove nuts and washers and keep ring for hydrostatic valve. Remove stop peg. The hydrostatic valve diaphragm is now free and can be removed. Remove the two valves which are pressed together to form one solid piece. Remove nuts and washers, and oscillator rear support ring. Remove the after mercury diaphragm.

To strip the
oscillator.

(3) To remove the oscillator connecting rod, unscrew the forward connecting rod washer. Withdraw the rod.

NOTE.—The after connecting-rod washer is welded to the rod.

To remove the rudder.

Disassembling type M.

(c) To remove the rudder, remove the three nuts and bolts securing the bracket arm.

88. To disassemble the type M paravane, the tail casting may be removed without changing the rudder setting by passing a sling beneath the tail and removing the joint nuts. The complete tail and hydrostatic valve assembly can then be withdrawn and the tail casting separated from the hydrostatic valve by removing the eight 1/2-inch countersunk head screws. If further dismantling is required, the rudder angle for the desired depth cutting should be accurately determined before separating the tail casting and hydrostatic valve. Upon reassembling, the rudder angle should be corrected, if necessary, to correspond with the original setting.

89. To disassemble the type D paravane the following operations are involved:

Disassembling type D.

(a) To remove the cutter bracket slack off the turnbuckle of the wire fender assembly and remove the bolt connecting the wire fender to the cutter frame. Remove the two bolts securing the cutter frame to the towing frame. The cutter blades are secured to one side of the cutter frame by two countersunk head screws and one countersunk head bolt for each blade, a dummy blade being mounted on the opposite (lower) side. Each blade is held in its proper position by two dowel pins.

(b) To remove a plane loosen and separate the turnbuckle in the wire fender and remove the two bolts and two set screws attaching the plane shoes to the towing frame. In exchanging the 16-knot and 22-knot planes for the 31-knot plane the position of the cutter head must be changed.

(c) The general procedure for removing the tail, oscillator, and rudder and for dismantling the oscillator of type D paravane is the same as for types B and C.

Reassembly.

90. To reassemble paravanes, reverse the sequence of the operations given above for disassembling.

SECTION IX. STOWAGE AND CARE OF PARAVANES

Stowage of Paravane.

91. Vessels are supplied with four paravanes—two working and two spares. The two working paravanes should be stowed in an accessible location near the paravane cranes, if practicable, abreast the barbette, superstructure, or skid beams in order not to obstruct the deck space. Portable racks should also be provided for stowing the paravanes in the launching position. The tails of the two working paravanes should be protected by canvas covers, or the tail assemblies, including the hydrostatic valve or oscillator, should be removed and stowed below the weather deck in convenient location for necessary care and overhaul. A blank flange should be used to replace the tail in order to prevent deterioration of the inside of the paravanes. The cutter heads should also be removed and stowed below the weather deck or be kept well flushed with grease to prevent deterioration of the cutter blades. Spare paravanes should be stowed below the weather deck in all cases where practicable.

92. The exterior of the paravane shell, the exterior of the oscillator, and those parts which were originally painted should occasionally be scraped and repainted as necessary.

Painting paravan

93. To maintain paravanes in operating condition the following examinations and tests should be made every 6 months:

Periodic examin

(a) Remove the drain screw and see if any leakage of mercury or water has taken place. If there is any leakage, the cause must be found and the defect remedied.

(b) The paravane should be tested under air pressure to 20 pounds per square inch, and the pressure retained for 20 minutes. This is done by screwing an adapter into the drain screw hole and applying the air pressure.

(c) The tail and oscillator should be removed and examined carefully for any signs of friction or leakage either of mercury or water. The oscillator should be turned through an angle, and any leakage of mercury past the diaphragms will become apparent by the mercury escaping through the escape vent in the oscillator rear support ring. Any dirt, rust, or foreign bodies should be removed from the outside of the oscillator casing, studs, nuts, etc. All nuts should be tightened as requisite. The compression necessary for the running depth should be verified on the hydrostatic valve spring.

(d) Reassemble the paravane and verify that the transmission rod jaw is in the same position on the rod as it was before the paravane was parted. Apply an air-pressure test of 20 pounds per square inch, and retain this pressure for 20 minutes. Verify that the rudder is moving freely and evenly throughout its travel. This is done by raising and lowering the tail of the paravane with the compression for the running depth on the hydrostatic valve spring and measuring the rudder travel or by deflecting the rudder through its full throw by means of a wrench or split bar.

94. As the rubber diaphragms in depth controlling mechanism are subject to deterioration which in time makes them unsafe for use, paravanes on board ship should be fitted with new diaphragms when the rubber is found to have become hardened or which cracks when slightly stretched by hand.

Deterioration depth mechanism.

95. When lubricating the various working parts, great care must be taken that no oil or grease is deposited on any of the rubber diaphragms.

SECTION X. INSPECTION AND ADJUSTMENT BEFORE USE

96. Before use, if time permits, apply air pressure at 20 pounds per square inch to test for watertightness. Set the necessary compression on the hydrostatic valve spring for the desired running depth as described below. See that the rudder is working freely and evenly due to the oscillator. See that the towing shackle works freely on the cutter head. Inspect the cutter blades for broken teeth and coat the blades thoroughly with heavy mineral grease.

Inspection and adjustment before use.

97. Before streaming type D paravanes, ascertain that the roller cutters are set, by means of the eccentric pin through each

roller, to the minimum clearance which will permit free movement of the cutters, ordinarily not greater than 0.002 inch. Cutting edges must be kept coated with heavy grease to prevent dulling by corrosion. *Gloves should always be worn when handling roller cutters.* Roller cutters should be kept boxed as long as possible to prevent injury to personnel and damage to the cutters.

98. *Depth setting.*—In general, the paravanes should be set to run at 10 to 15 feet below the deepest draft of the vessel. In the case of light-draft vessels, however, it is desirable to set the paravanes even deeper so as to avoid the chance of the cutter coming into contact with the mine itself before cutting the mooring. The following rules are laid down for general guidance, the draft referred to being the maximum loaded draft of the vessel:

(1) Ships drawing 25 feet or over are to have their paravanes set for 10 to 15 feet below their draft.

(2) Ships drawing less than 25 feet are to have their paravanes set for 30 to 35 feet, provided that they have 9 fathoms or more of water on the whole of their route where the paravanes will be in use.

(3) In cases where paravanes have to be used in less than 9 fathoms they are to be set to run at 15 feet less than the shallowest portion of the water, but—

(4) No ship, in any circumstances, is to have paravanes set for less than 5 feet below the draft of the ship.

To set for depth.

99. To set for depth:

(a) Remove the tail as described in paragraph 85 (b).

(b) Screw up the hydrostatic valve spring until the pointer is opposite the desired depth (if inhaul bridle is used, see par. 50).

(c) Replace the tail, taking care to make a tight joint.

Changing paravane from port to starboard and vice versa.

100. To change a port paravane into a starboard paravane, or vice versa (see pl. XIX).

(a) Exchange the plane weight with the plane float.

(b) In the case of the M type also change the tail weight to the opposite side of the fin.

(c) Change top rudder bracket to the other side of rudder. The rudder bracket should be installed on the starboard side of the rudder when the paravane is fitted for operation on the starboard side of the ship, and on the port side when the paravane is to be used on the port side of the ship.

(d) Swing the transmission rod to the other side to connect with rudder bracket.

SECTION XI. ISSUE AND REPLACEMENT OF PARAVANES AND PARAVANE EQUIPMENT

101. Paravanes and paravane equipment for vessels under construction and for replacements on vessels in commission will be obtained in accordance with current instructions of the Bureau of Ships.

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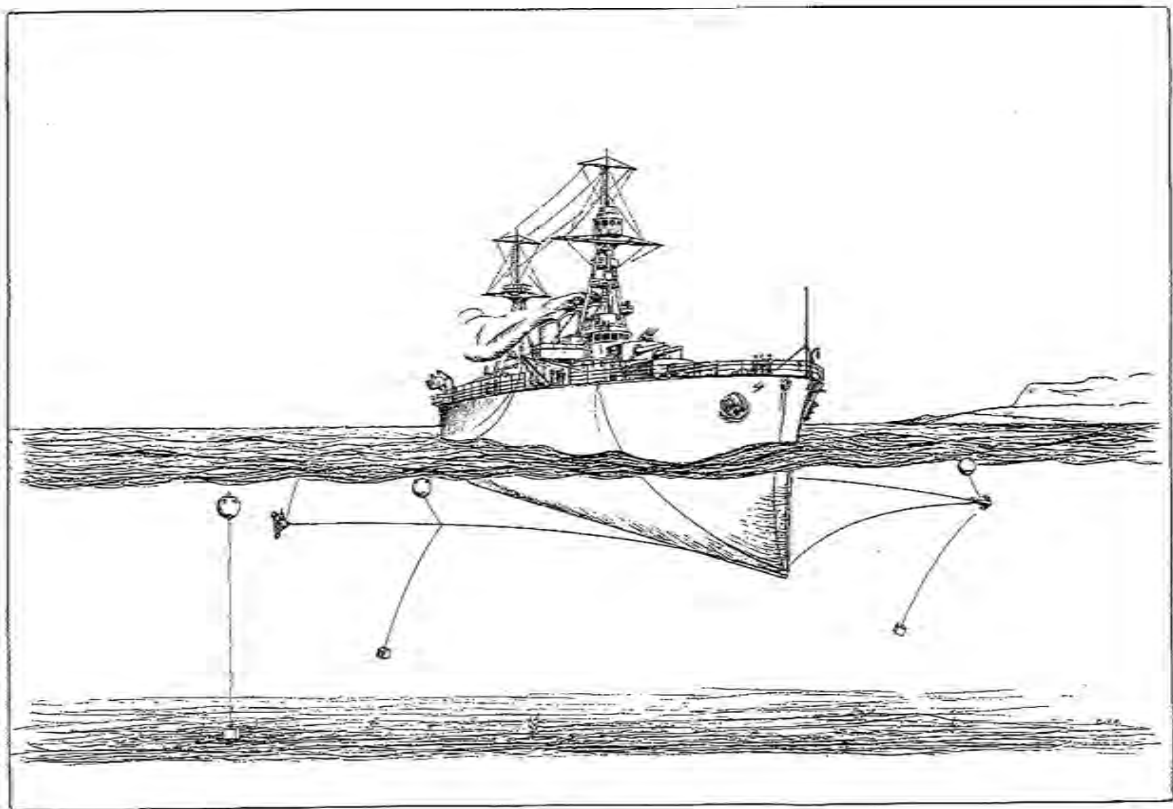
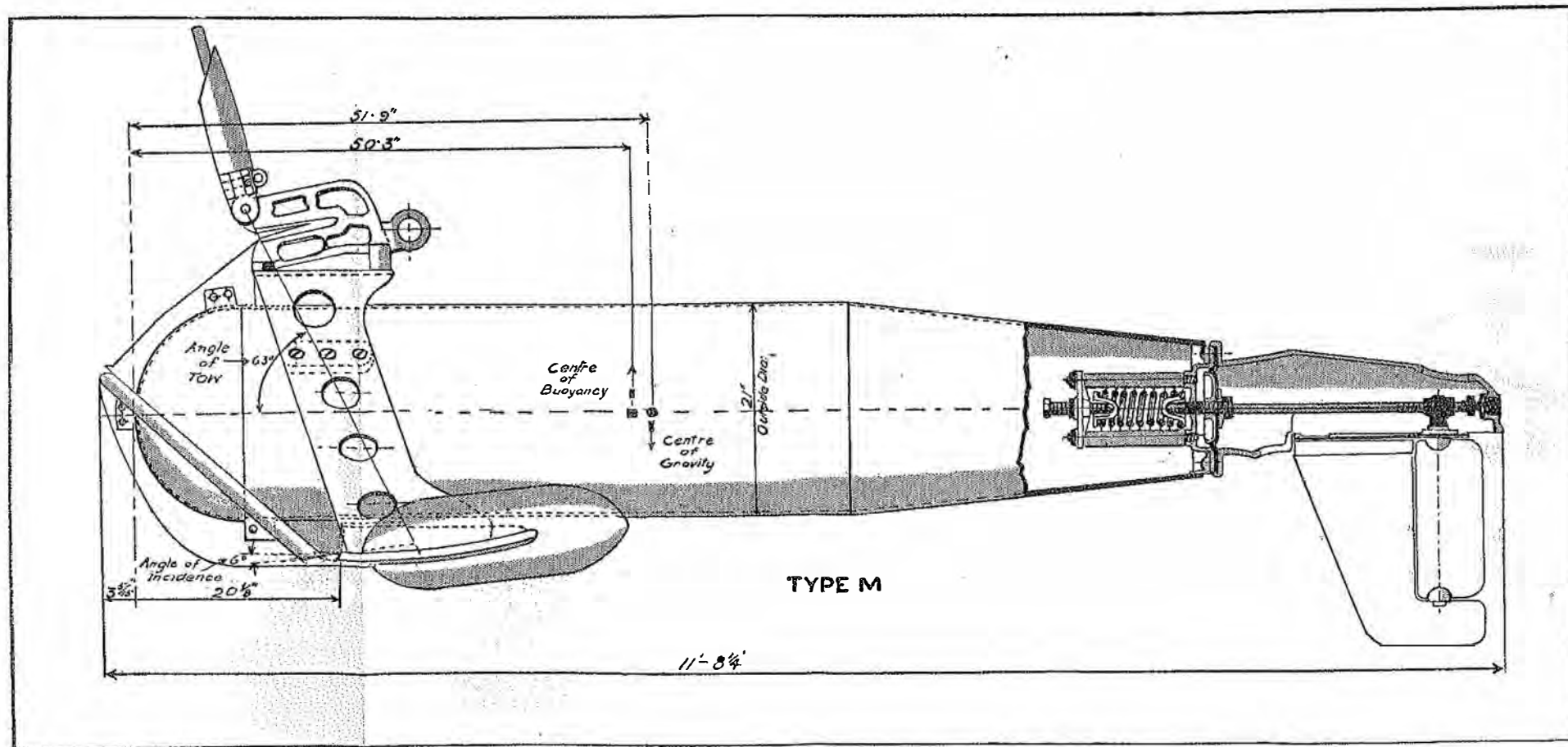
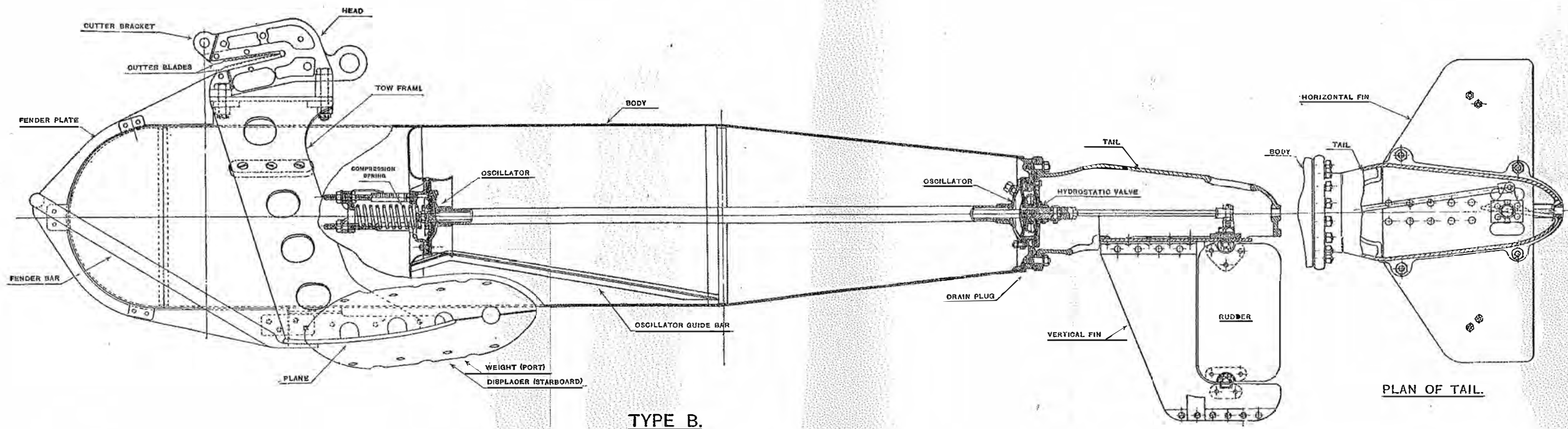
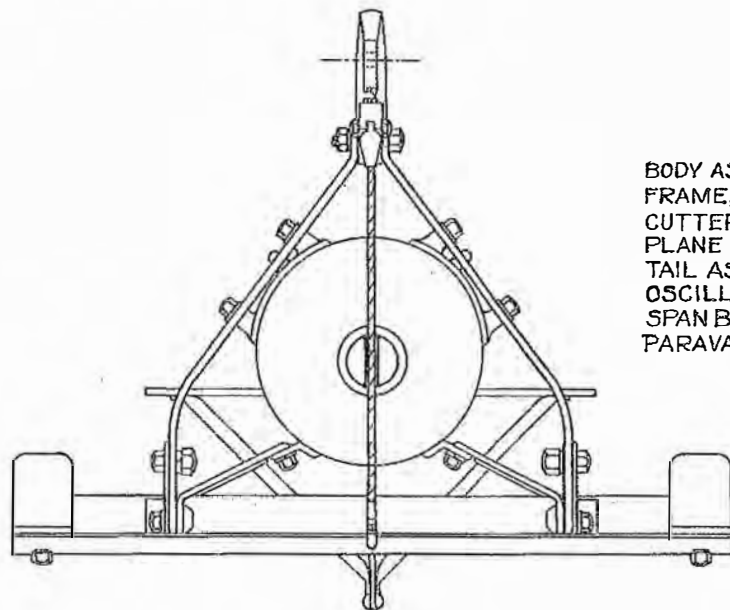


PLATE I.





GENERAL ARRANGEMENT OF PARAVANE.

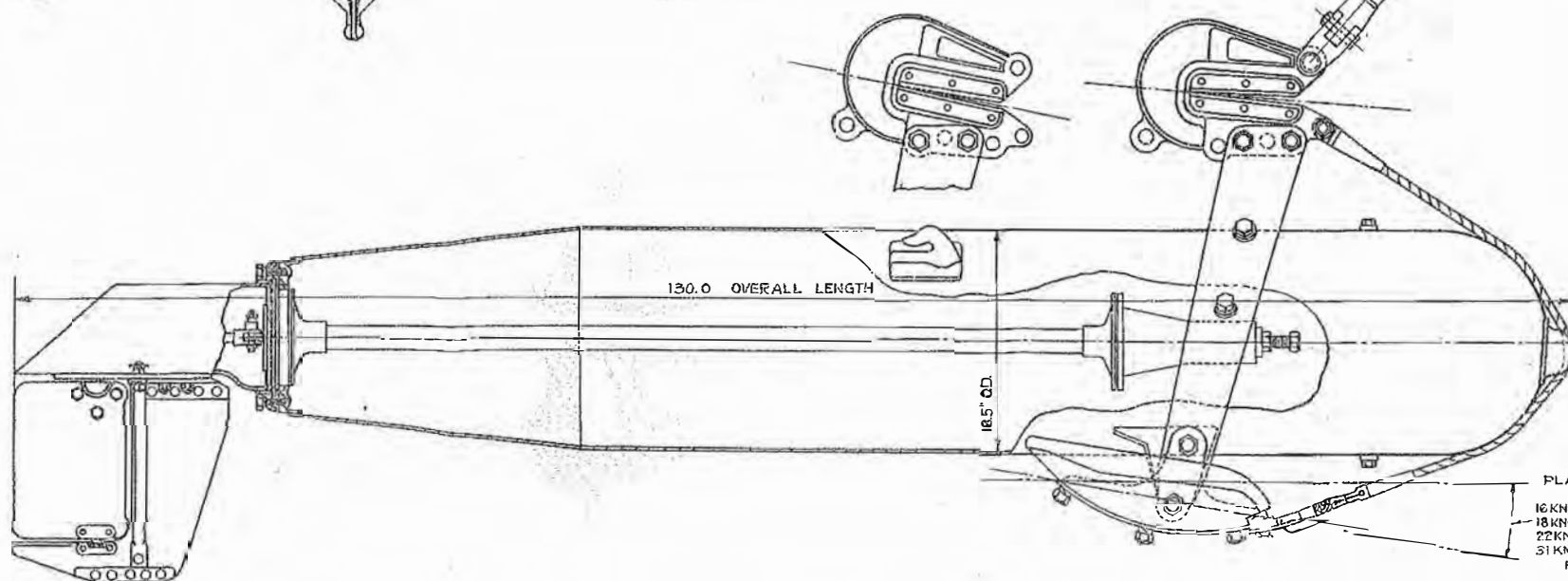


REFERENCE PLANS
 BODY ASSEMBLY AND DETAILS
 FRAME, TOWING- ASSEMBLY AND DETAILS
 CUTTER ASSEMBLY AND DETAILS
 PLANE ASSEMBLY AND DETAILS
 TAIL ASSEMBLY AND DETAILS
 OSCILLATOR ASSEMBLY AND DETAILS
 SPAN BAR AND ROLLER CUTTERS ASSEMBLY AND DETAILS
 PARAVANE ASSEMBLY TYPE D

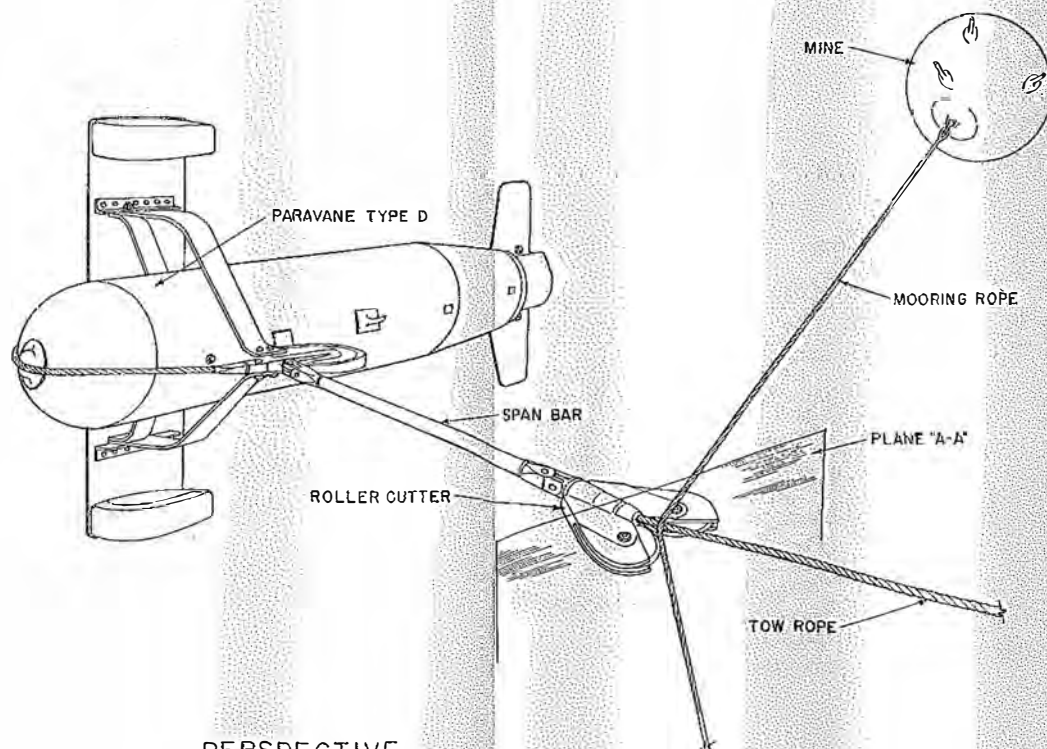
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 422 042
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 422 037

FOR 31 KNOT PLANE, THE CUTTER IS
 ASSEMBLED WITH THE AFT HOLE IN THE CUTTER-
 FRAME MATING WITH THE AFT HOLE IN THE
 TOWING-FRAME, AS SHOWN IN PART ASSEMBLY.

FOR 22, 18, AND 16 KNOT PLANES, THE CUTTER
 IS ASSEMBLED AS SHOWN IN FULL ASSEMBLY
 DRAWING WITH FORWARD HOLE IN THE CUTTER-
 FRAME MATING WITH THE FORWARD HOLE
 IN THE TOWING-FRAME.

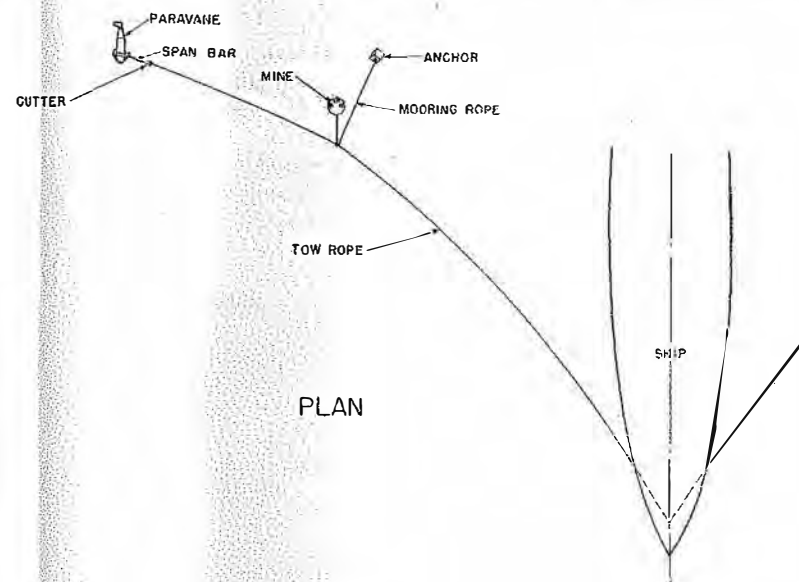


GENERAL ARRANGEMENT OF TYPE D PARAVANE

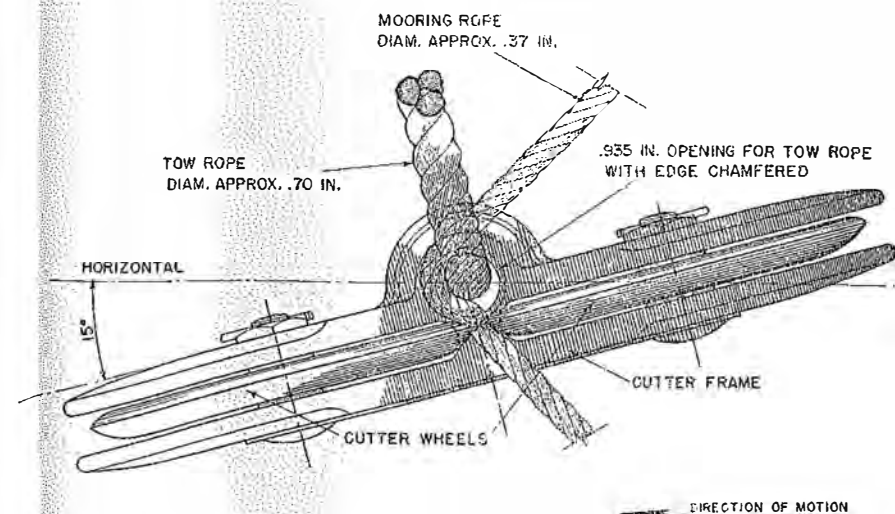


PERSPECTIVE

TYPE D PARAVANE
SPAN BAR AND ROLLER CUTTER



PLAN



ELEVATION AT PLANE "A-A"
NORMAL TO SPAN BAR
WITH MOORING ROPE PASSING THRU CUTTER

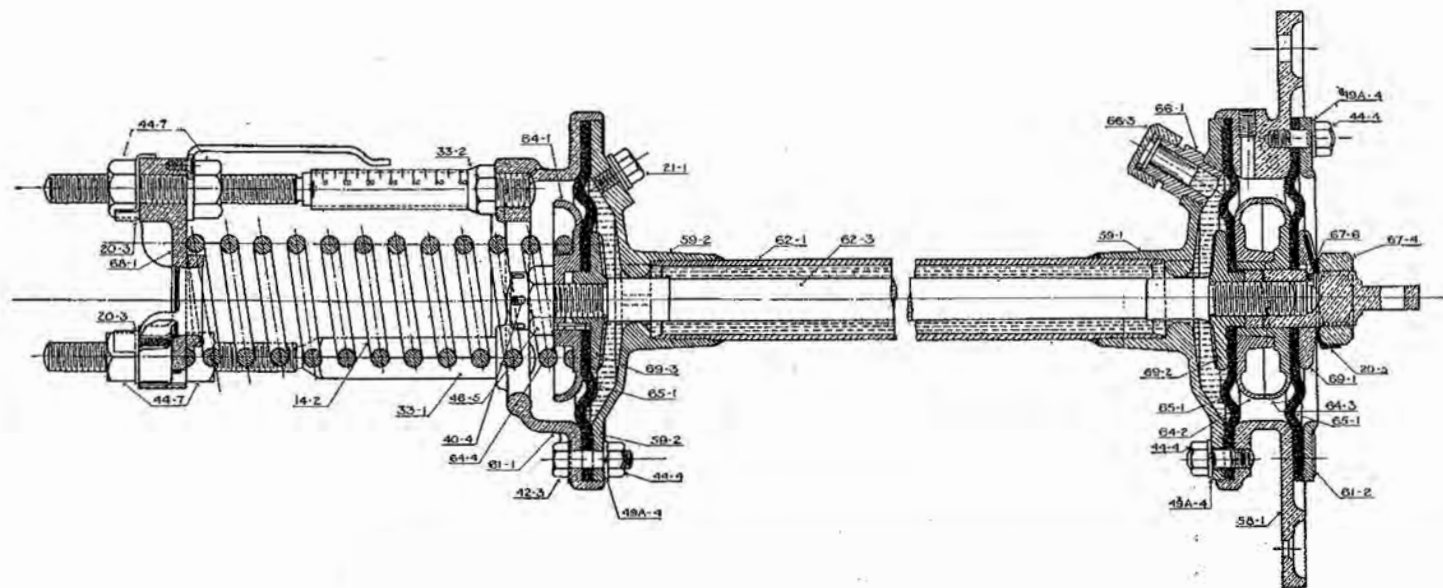


PLATE VI.—General arrangement of oscillator. Types B and C.

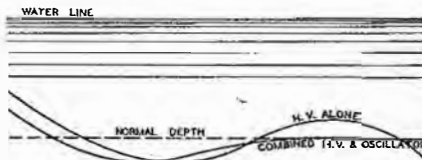
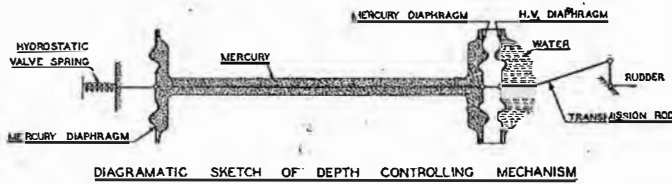


PLATE VII.

ARRANGEMENT SHOWING
METHOD OF FITTING
TOWING SLEEVE
(NOTE POSITION OF CHAMFER)

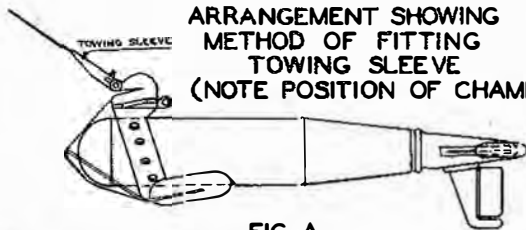


FIG A

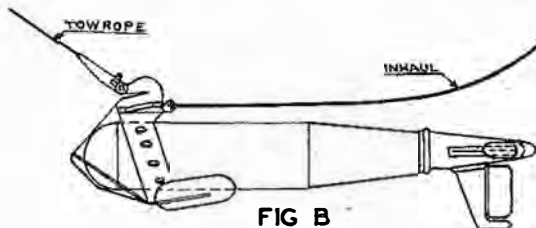
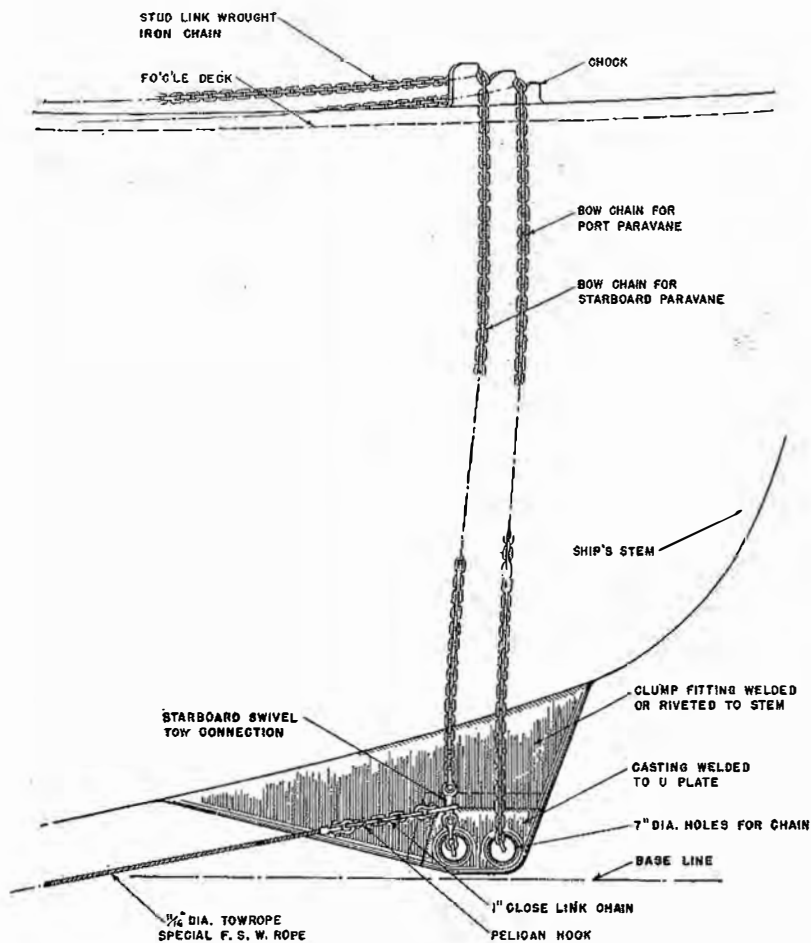


FIG B

SKETCH SHOWING INHAUL
TRAILING OFF PARAVANE WHEN TOWING

PLATE VIII.



CLUMP FITTING ARRANGEMENT

PLATE IX.

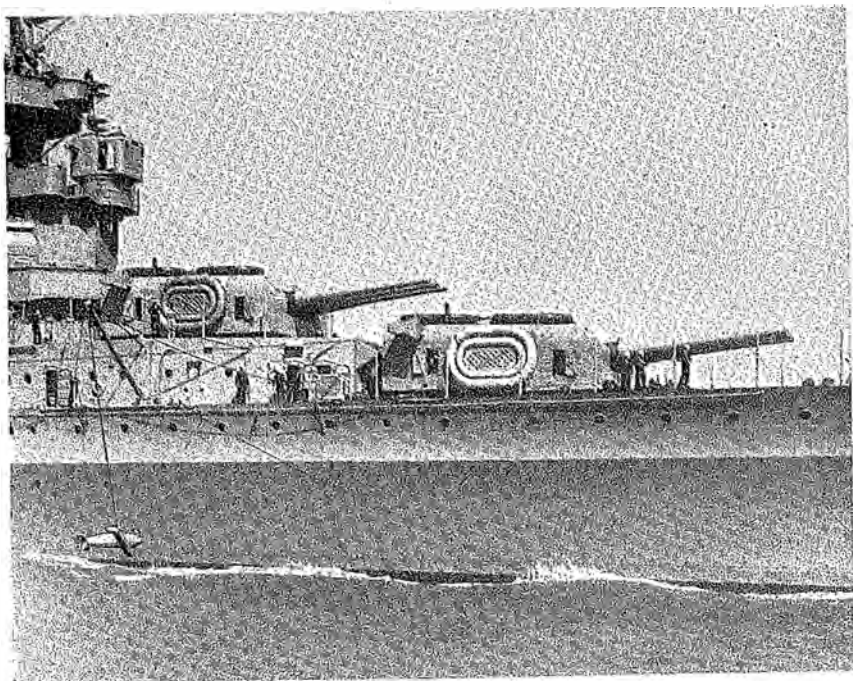
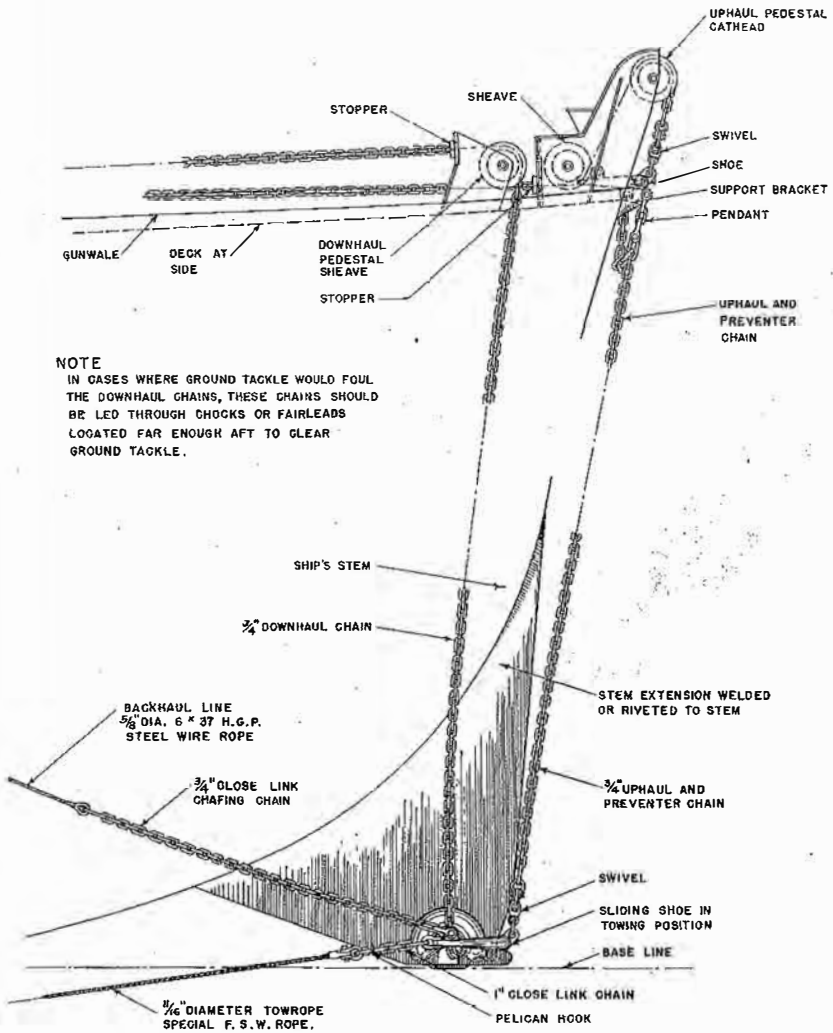


PLATE X.



SLIDING SHOE ARRANGEMENT

PLATE XI.

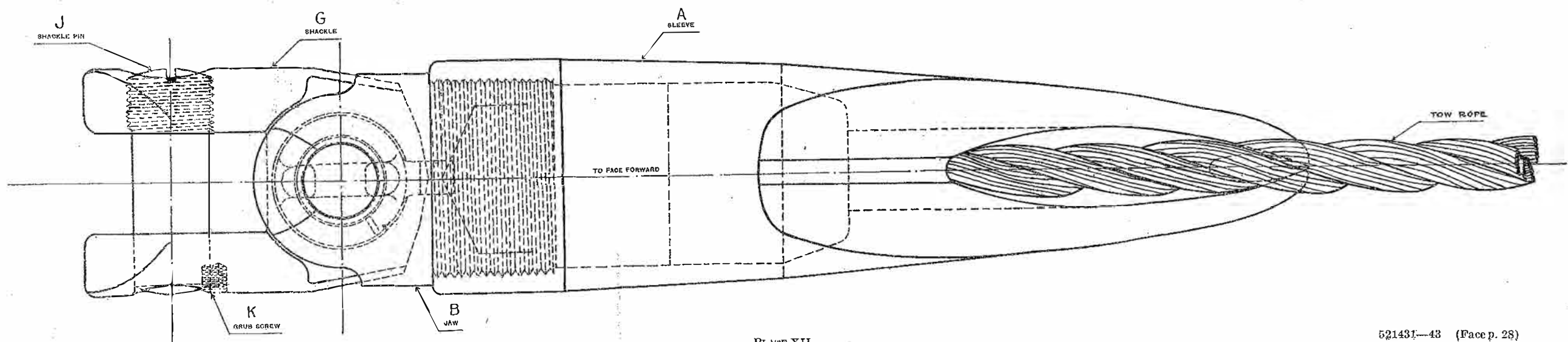
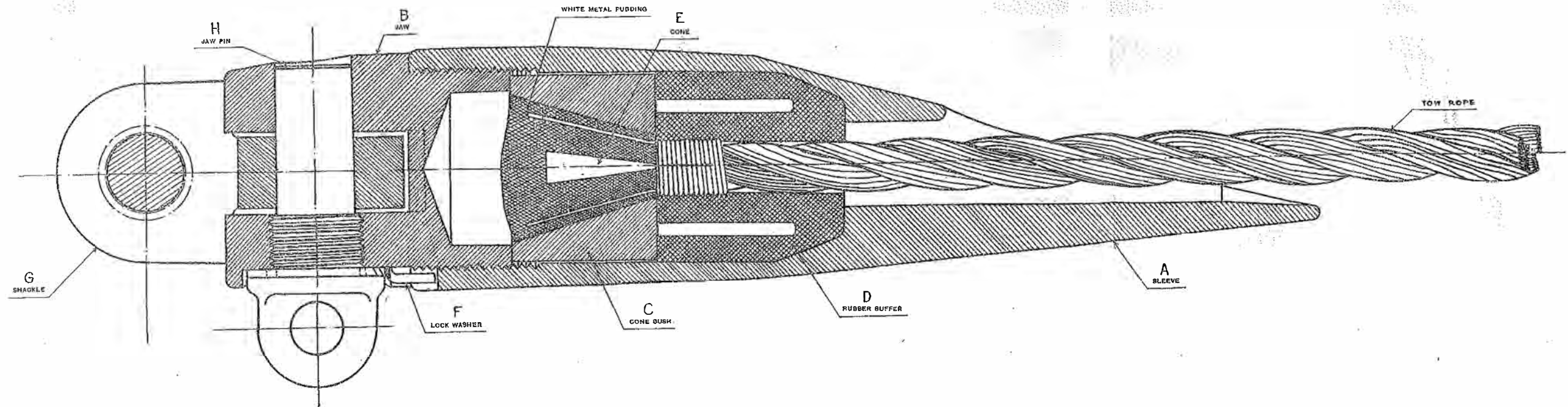
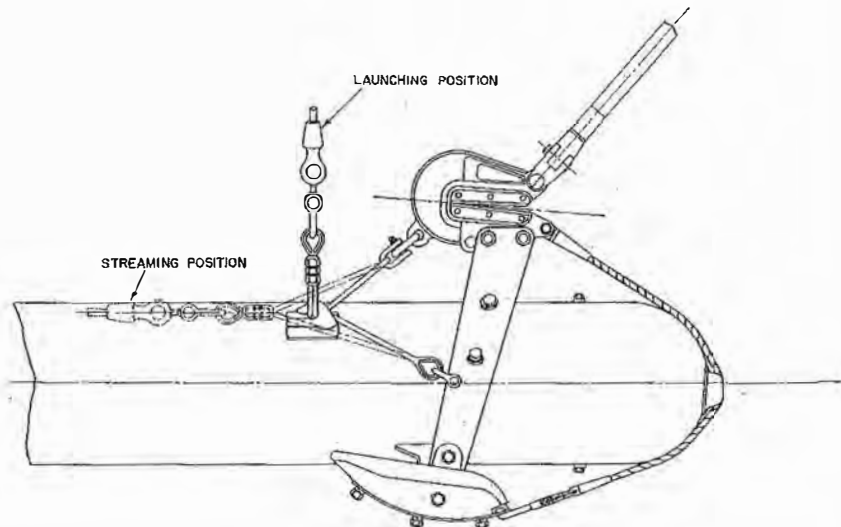
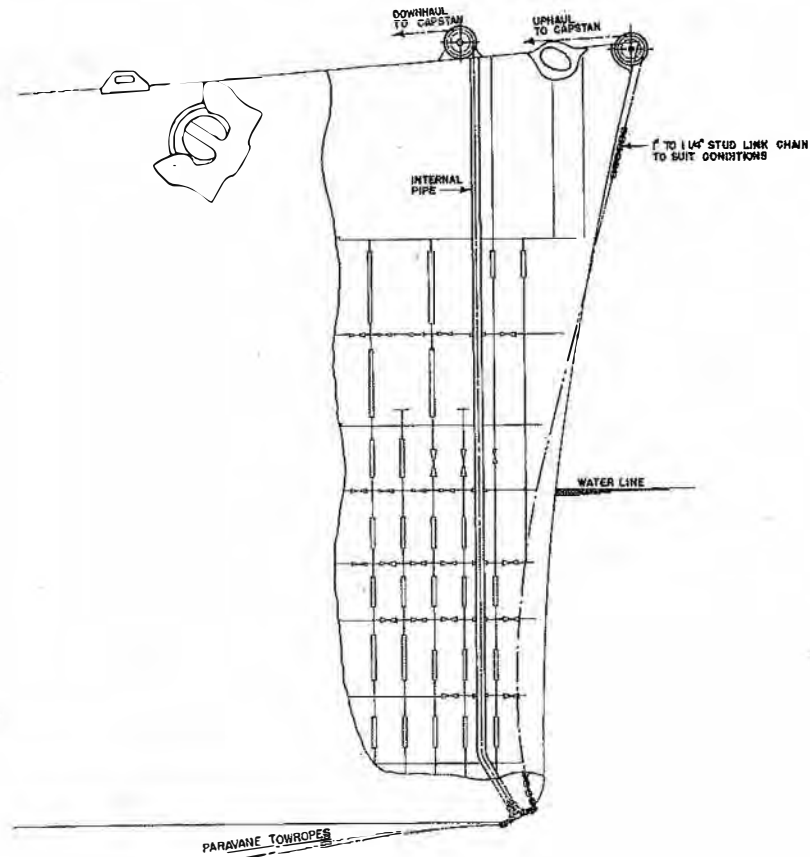


PLATE XII.



INHAUL BRIDLE ARRANGEMENT

PLATE XIII.



INTERNAL PIPE AND CHAINS
PLATE XIV.

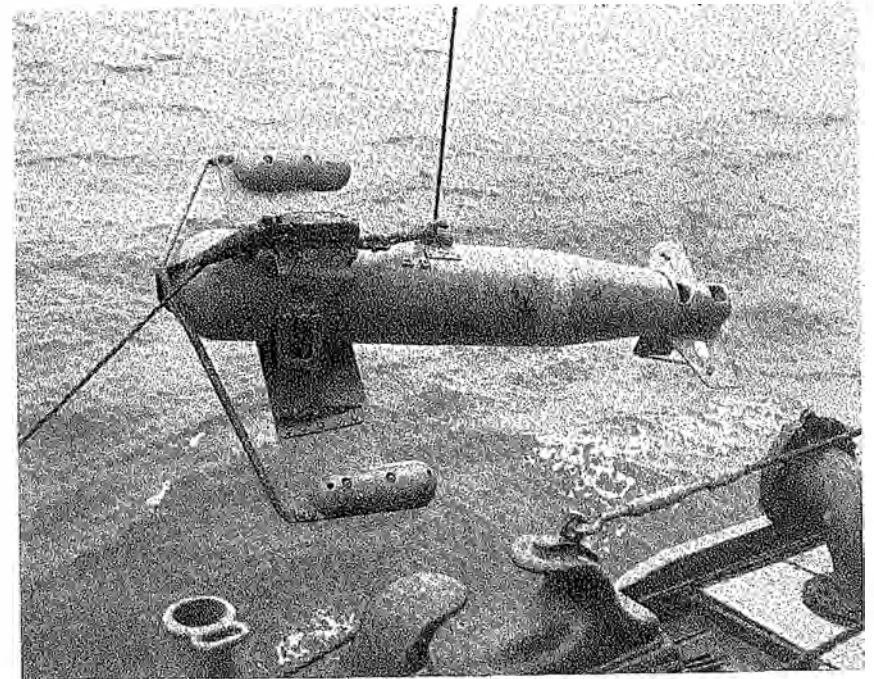
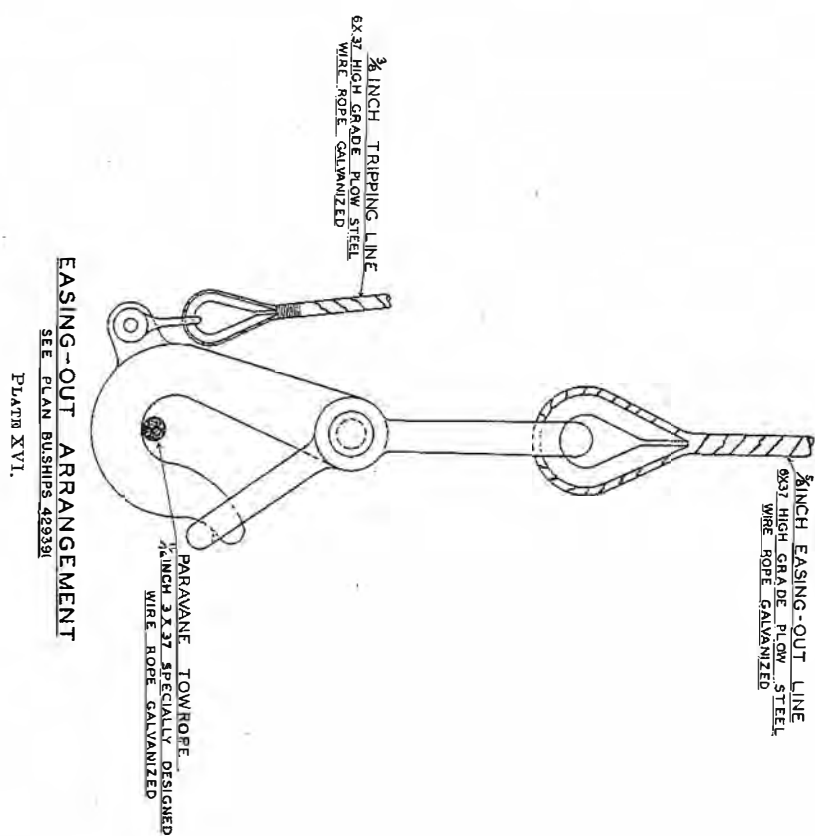


PLATE XV.



LAUNCHING

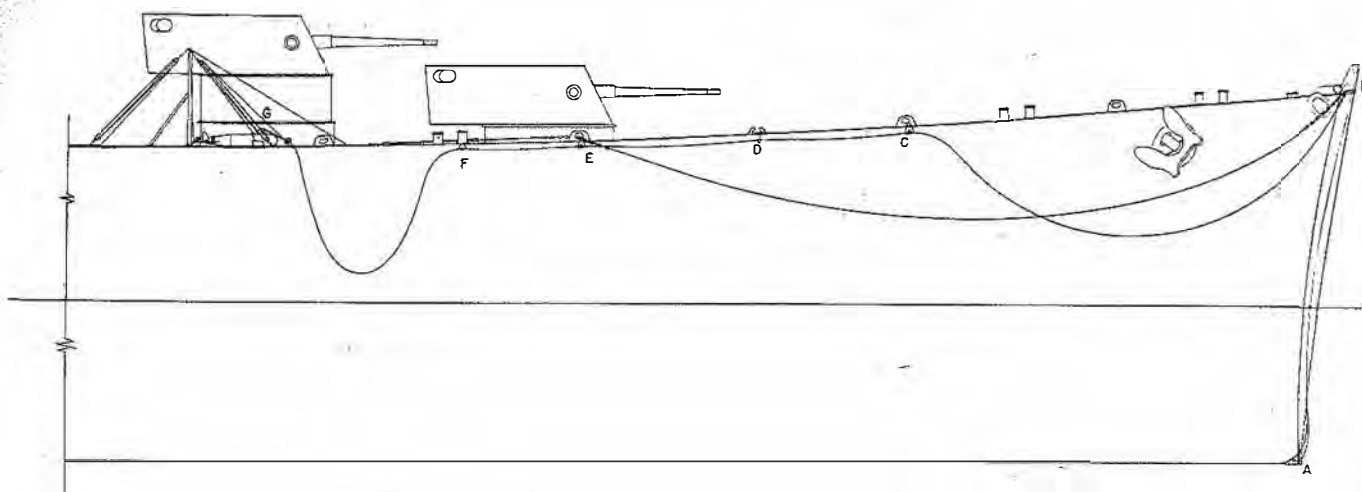
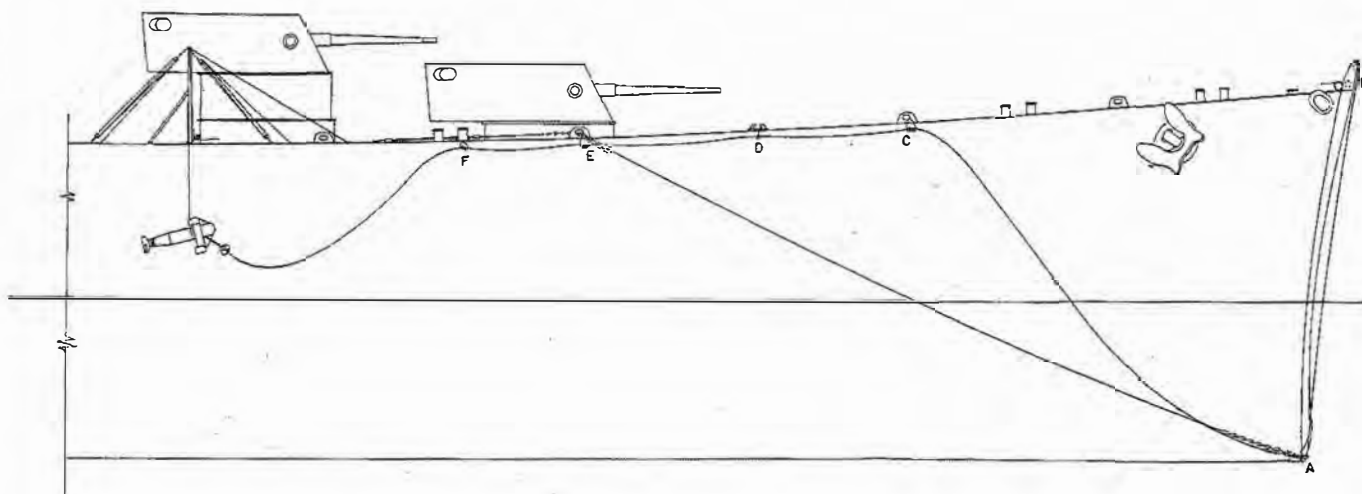


PLATE XVII.
(6 parts)

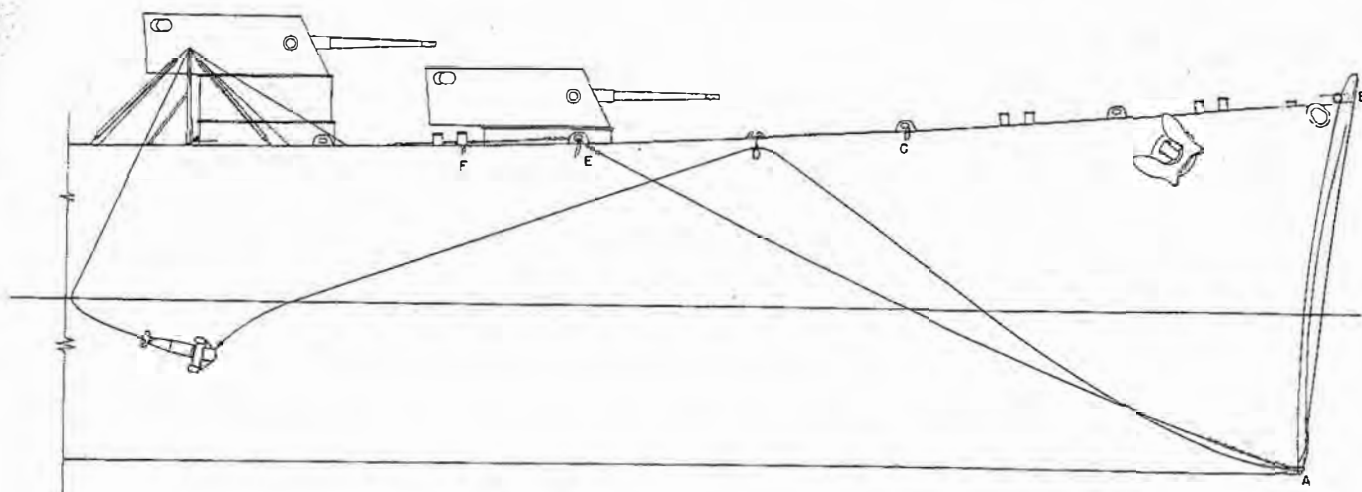
1. Attach towropes and backhauls to shoe in cathead at "B." Lead backhauls aft through appropriate chocks to securing tackle on deck. Secure towrope with rope stopper at "C." Lead towrope aft through easing-out hook "D," attaching hemp stoppers "E" and "F." Connect roller cutters to span bar on paravane. Attach uphaul bridle to paravane, running the two legs under the hook on lifting band at "G." Paravane is now ready for lowering.



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PLATE XVII—Continued.
(6 parts)

2. Take 5 feet of slack out of endless whip, release deck stoppers, and haul shoe to its towing position. Make fast deck stoppers and backhauls. Pick up paravane with crane and lower to about 10 feet above water. Secure inhaul to carpenter stopper on deck. Remove inhaul from capstan head and wind on reel or flake on deck.



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PLATE XVII—Continued.
(6 parts)

3. Drop paravane into water by releasing carpenter stopper on deck and simultaneously releasing rope stopper at "C." Inhaul bridle will be washed out of lifting hook after paravane enters the water. As strain is put on towrope it will break the hemp stoppers "E" and "F" and paravane will tow from easing-out hook "D."

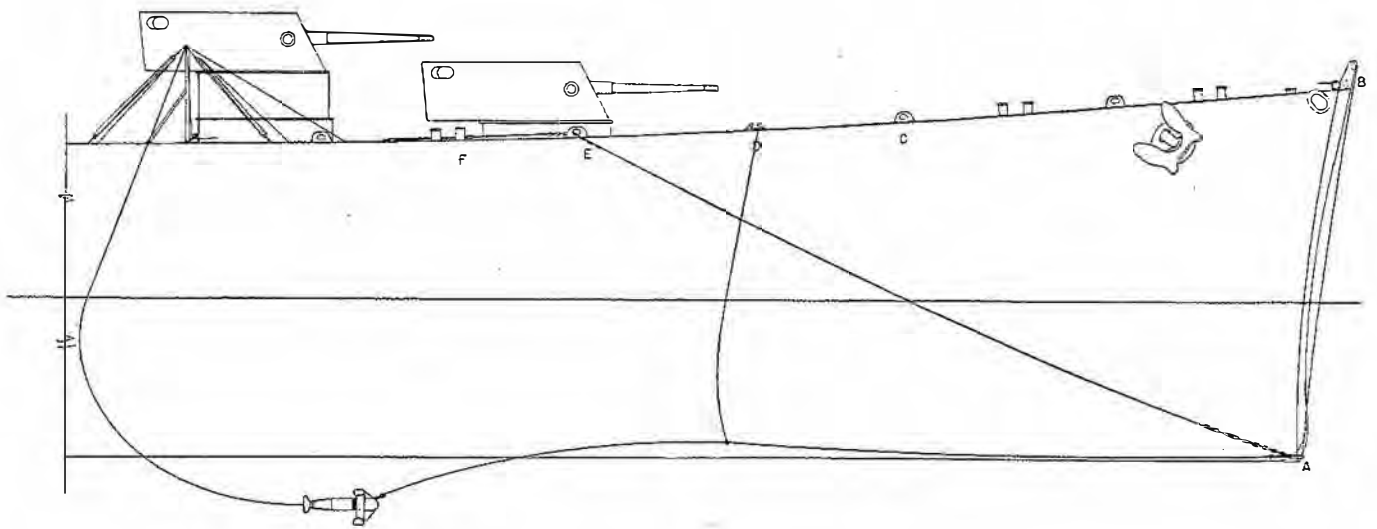


PLATE XVII—Continued.
(6 parts)

4. As the paravane begins to move out from the ship, slack off evenly on the easing-out line. Do not trip until the easing-out line is well under water. (See p. 15 of handbook.)

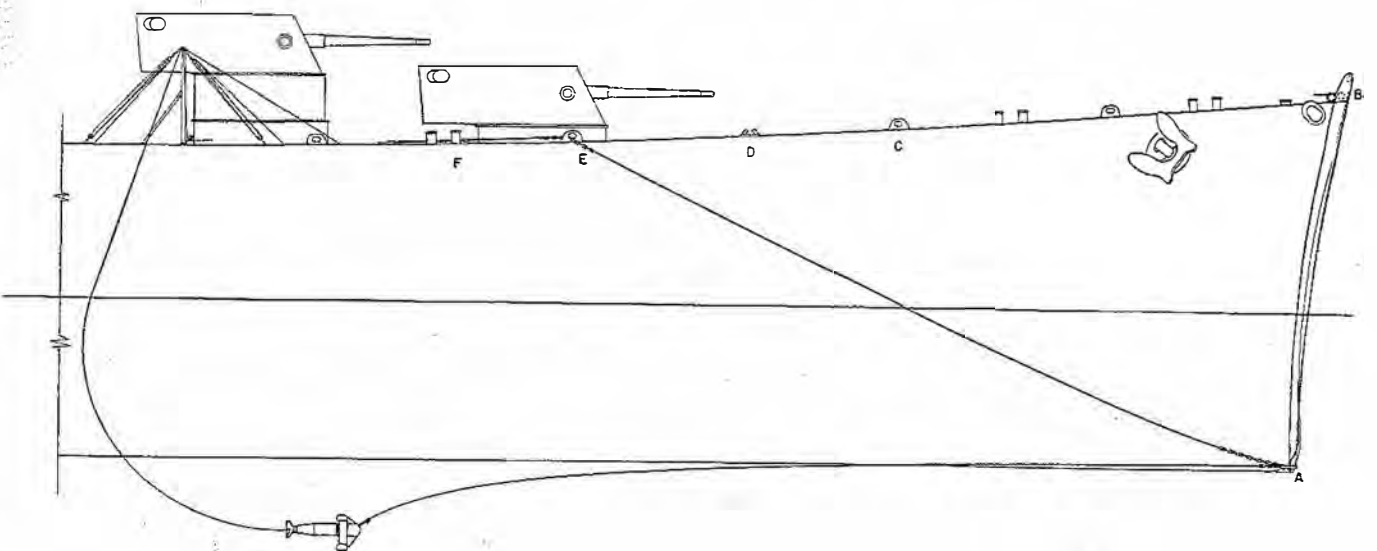
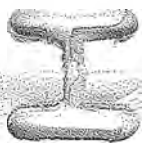


PLATE XVII—Continued.
(6 parts)

5. The paravane now tows from the shoe in its proper position.

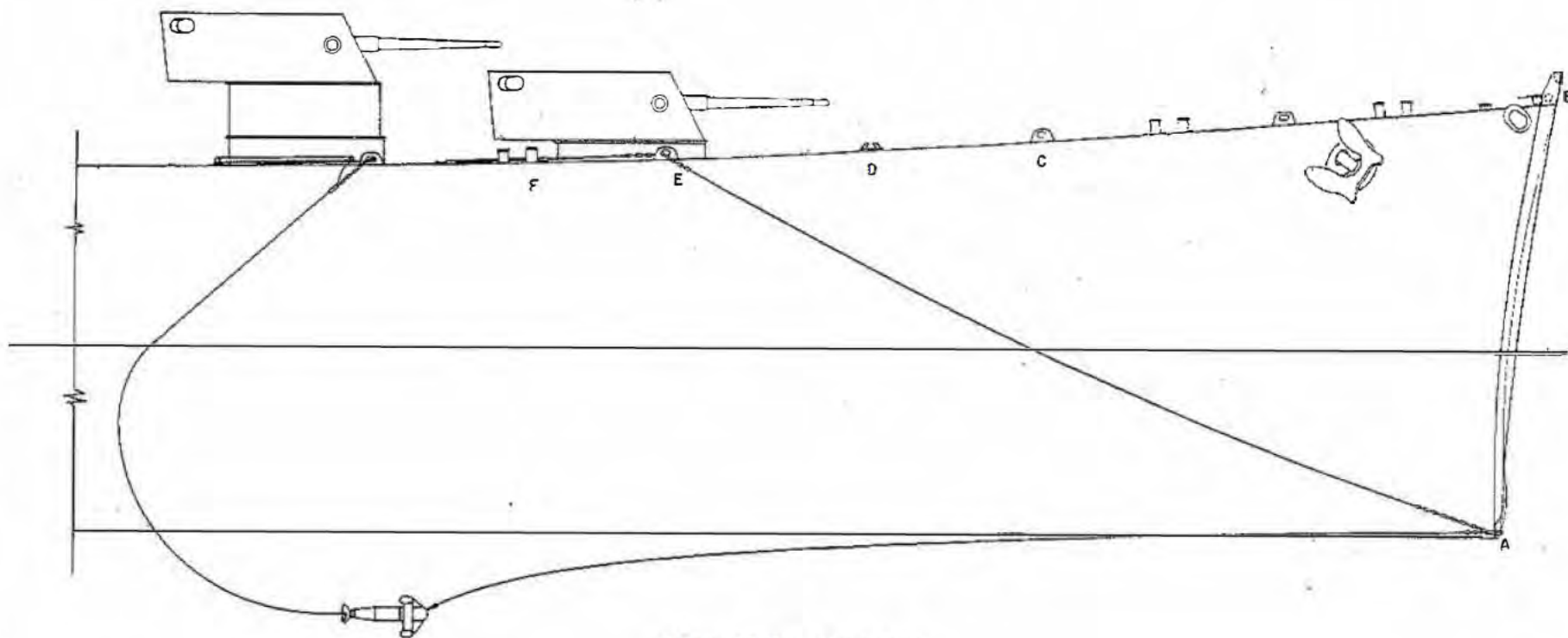


PLATE XVII—Continued.
(6 parts)

6. Crane is struck down while streaming paravanes to clear train and fire of guns.

PICKING UP

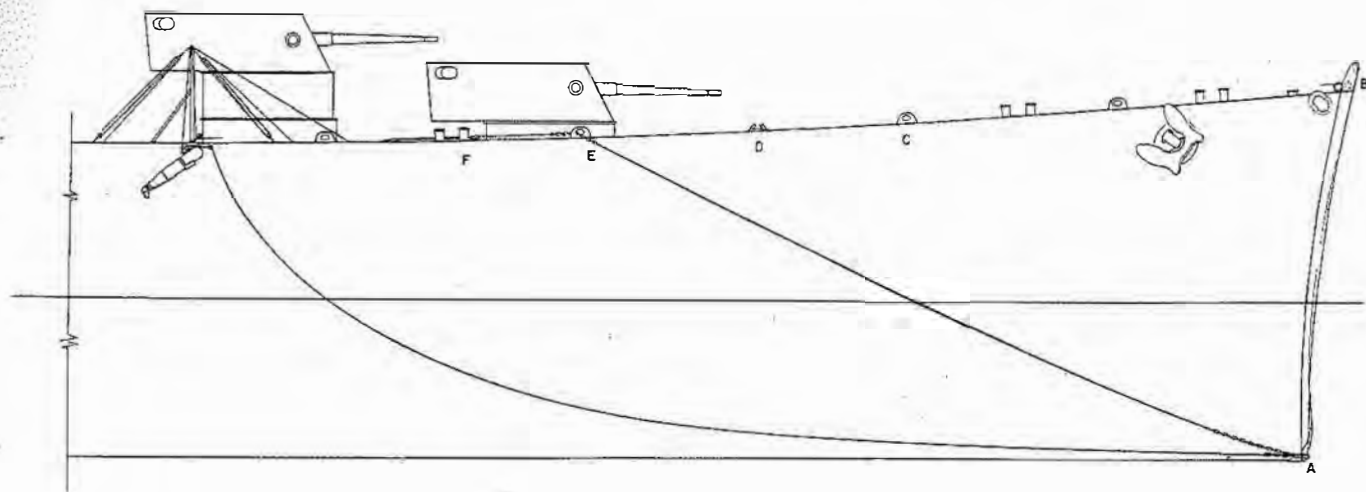


PLATE XVIII.

(3 parts)

1. Heave on the inhaul. This operation should be performed uniformly without sudden surges in the rope. Increase speed as soon as paravane is clear of the water, and immediately hoist the shoe.

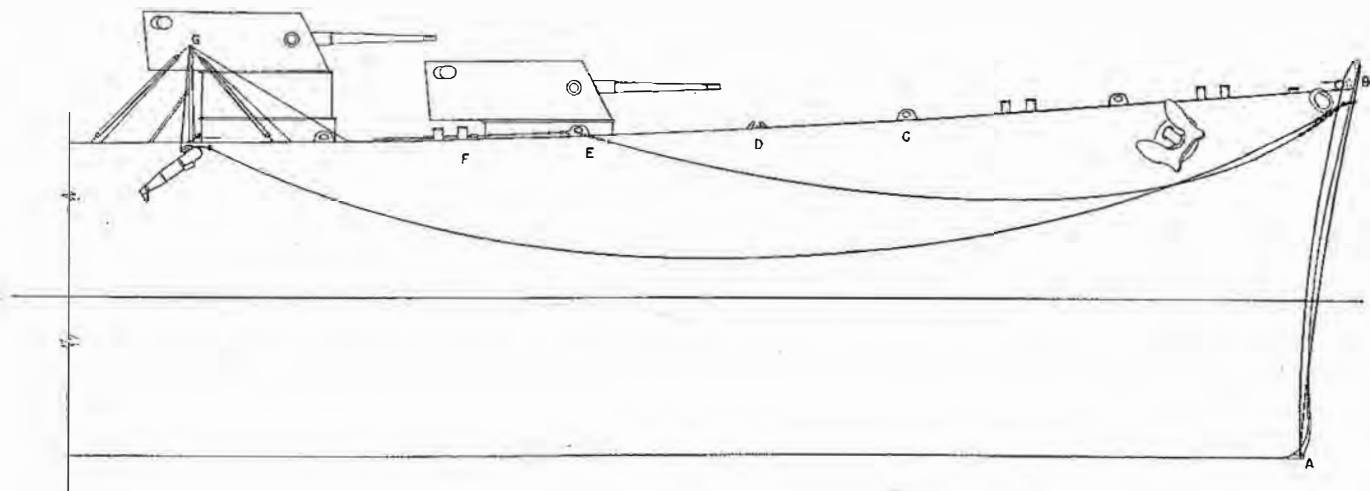


PLATE XVIII—Continued.

(3 parts)

2. The shoe has now been raised. Hoist with pedestal cathead and lower into stowage rack.

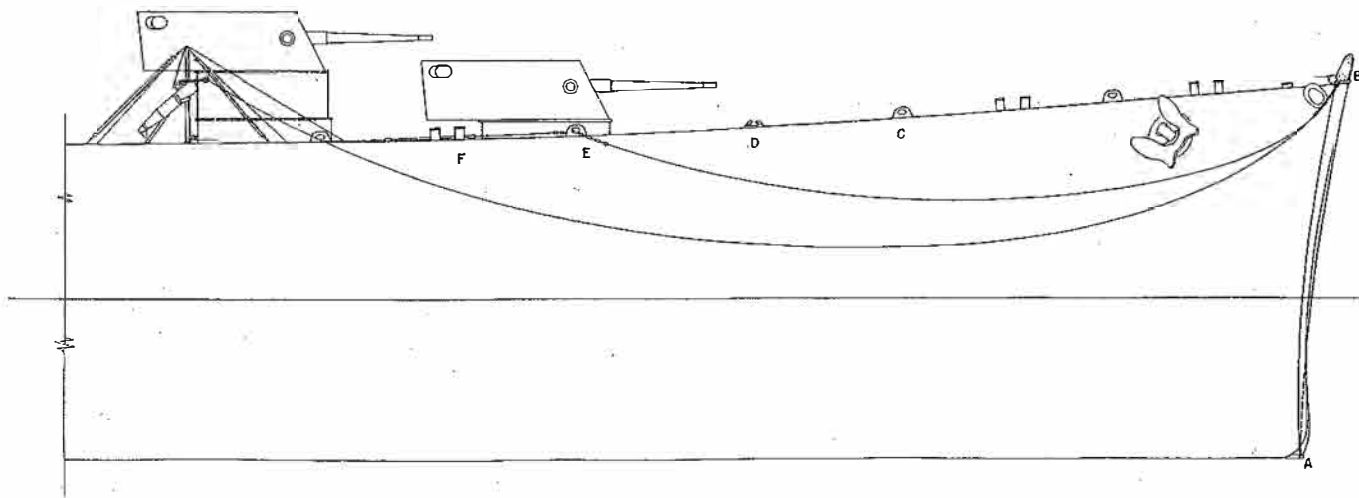
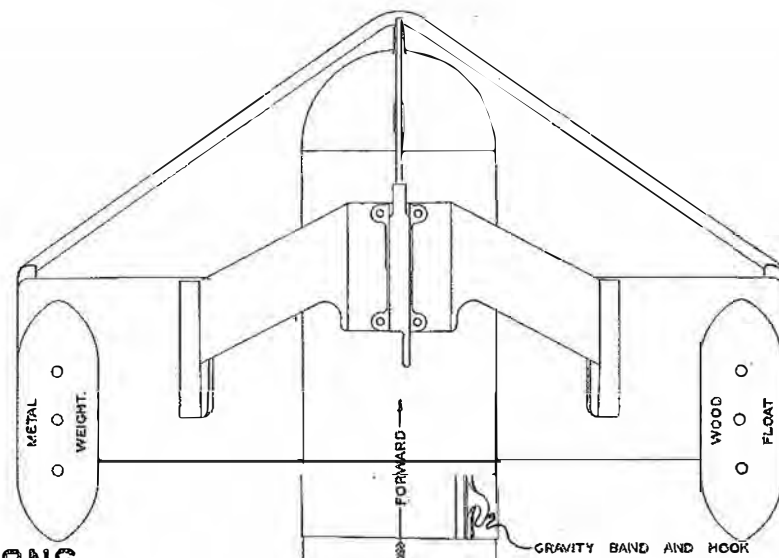
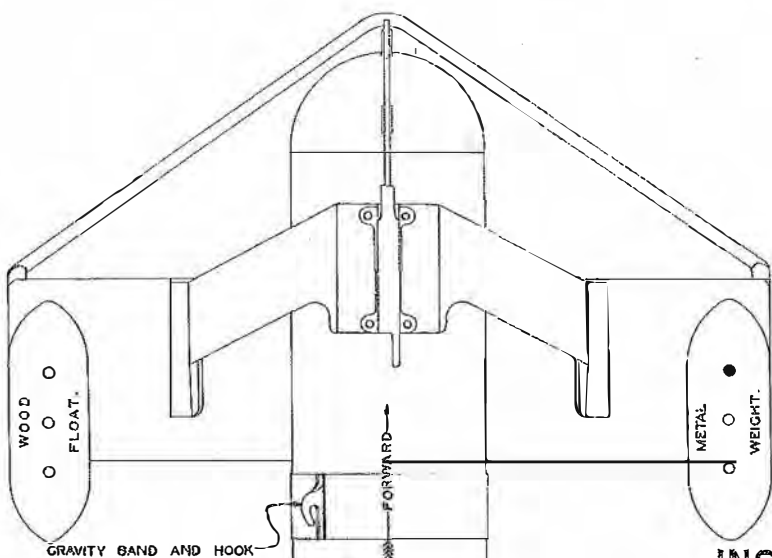


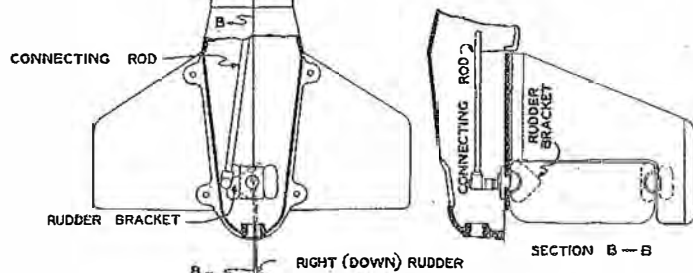
PLATE XVIII—Continued.
(3 parts)

3. Continue to heave on the inhaul until paravane is at the head of the crane. Swing inboard and put in chocks.

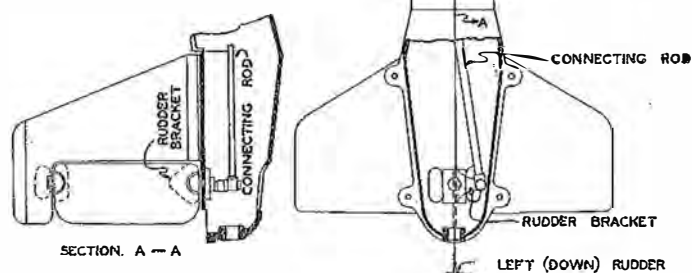


INSTRUCTIONS.

1. TO CHANGE STB'D PARAVANE TO PORT PARAVANE —
 - (A) SHIFT METAL WEIGHT FROM PORT TO STB'D SIDE OF PLANE.
 - (B) SHIFT WOOD FLOAT FROM STB'D TO PORT SIDE OF PLANE.
 - (C) SHIFT RUDDER BRACKET FROM STB'D SIDE OF RUDDER TO PORT SIDE.
 - (D) CHANGE INITIAL SETTING OF RUDDER FROM LEFT TO RIGHT.
 - (E) SHIFT CONNECTING ROD TO SUIT.
 - (F) SHIFT GRAVITY BAND AND HOOK FROM STB'D TO PORT SIDE OF BODY.
2. TO CHANGE PORT PARAVANE TO STB'D PARAVANE —
 - (A) SHIFT METAL WEIGHT FROM STB'D TO PORT SIDE OF PLANE.
 - (B) SHIFT WOOD FLOAT FROM PORT SIDE TO STB'D SIDE OF PLANE.
 - (C) SHIFT RUDDER BRACKET FROM PORT SIDE OF RUDDER TO STB'D SIDE.
 - (D) CHANGE INITIAL SETTING OF RUDDER FROM RIGHT TO LEFT.
 - (E) SHIFT CONNECTING ROD TO SUIT.
 - (F) SHIFT GRAVITY BAND AND HOOK FROM PORT TO STB'D SIDE OF BODY.



PORT PARAVANE



STARBOARD PARAVANE