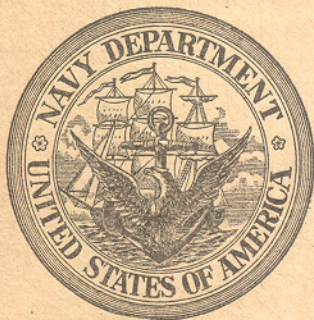


*For Official Use Only* O. N. I. Publication No. 32

# GERMAN SUBMARINES

IN  
Question and Answer

NAVY DEPARTMENT  
OFFICE OF NAVAL INTELLIGENCE  
JUNE, 1918



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1918

# GERMAN SUBMARINES

IN

QUESTION AND ANSWER

NAVY DEPARTMENT,  
OFFICE OF NAVAL INTELLIGENCE,  
*Washington, May 25, 1918.*

This pamphlet is only intended to give a general idea of the characteristics and tactics of German submarines. It is a reprint of a pamphlet published by the British Intelligence Department and is for the exclusive use of commissioned officers of the United States Navy. It is not to be shown to other persons.

ROGER WELLES,  
*Captain, U. S. Navy,*  
*Director of Naval Intelligence.*

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APRIL, 1918

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NAVAL STAFF  
INTELLIGENCE DEPARTMENT

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## GERMAN SUBMARINES IN QUESTION AND ANSWER.

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### 1. What are the principal types of German submarines?

- (a) Cruiser submarines, including converted mercantile (*Deutschland*) class;
- (b) "U" type, including large mine layers;
- (c) "U. B." type;
- (d) "U. C." type.

### 2. What are their general characteristics?

(a) Cruiser submarines are expected to be large double-hull submarines of some 3,000 tons, capable of staying out several months at a time; maximum speed on surface about 16 knots, submerged 9 knots. Up to the present (April, 1918) none of this type is at sea.

The converted mercantile or *Deutschland* type are double-hull submarines of 1,700 tons surface displacement, capable of remaining at sea for 3 to 5 months. They are only the same length as the ordinary "U" boats, but have considerably more beam. Their speed is low—maximum on surface 11½ knots; submerged 8 knots.



(b) "U" boats constitute the principal type. They are 210-225 feet long, 20-22 feet in breadth, and, in surface trim, draw  $11\frac{1}{2}$  to 12 feet. Maximum speed on surface  $14\frac{1}{2}$  to 17 knots; submerged 8 to 10 knots.

### 3. What are the "U" mine layers?

They are a special class of "U" boats, of which there were originally 10, viz, U 71 to U 80, carrying 36 mines and, in addition, 2 torpedoes. They have not been very successful, and only 5 of them now remain. They have only a single hull and are slow boats, cruising generally at about 6 knots, and only capable of 10 knots on the surface and 7 knots submerged.

### 4. What are "U. B." boats?

There are 3 classes, viz, small coastals, larger coastals, and small ocean-going. The latter, which are the most recent and most numerous class, are double-hull boats about 165 feet in length, and are supposed to be able to dive with great rapidity. Maximum speed on surface 13 knots, submerged 8 knots.

The coastal classes are single-hull boats, of lower speed and inferior armament.

### 5. What are "U. C." boats?

They are mine layers about 162 feet long, carrying 18 mines in 6 vertical tubes forward

(3 mines in each tube). Maximum speed 12 knots on surface, 7 knots submerged. They are double-hull boats, but the conning tower is a vulnerable point, as there are no means of shutting it off from the inner hull. There are also 2 survivors of an earlier class of 15 small "U. C." boats, carrying 12 mines only.

### 6. What is the appearance of the various types?

Photographs of various types of German submarines will be found in O. N. I. publication No. 1. These enable the various types to be distinguished.

### 7. What is the characteristic appearance of a cruiser submarine?

No details are available of the cruiser type proper, as none of these vessels is yet at sea.

The *Deutschlands* (converted mercantile type) are distinguished by their high freeboard and very large guns (5.9 inches), one before and one abaft the conning tower.

### 8. What is the characteristic appearance of a "U" boat?

Long flush deck rising toward the bows, straight stem, conning tower midway between bow and stern, usually with steps at different levels. Two conspicuous guns mounted well clear of conning tower, one before and one

abaft it. Some of the later boats have a net cutter at the bow.

"U" mine layers are shorter, have a rounded bow and carry one gun only, which is abaft the conning tower.

9. What is the characteristic appearance of a "U. B." boat?

One gun only mounted close before the conning tower. Deck sloping down aft to the stern, where it is awash. A net cutter is mounted at the bow. Later "U. B.'s" have a ship bow with slight overhang, and a very high conning tower rising vertically from the deck on the fore side. Earlier "U. B.'s" have a rounded bow and are much shorter.

10. What is the characteristic appearance of a "U. C." boat?

Raised forecastle, with gun in the dip between this and conning tower. Net cutter at the bow. Stern awash.

11. What color are German submarines painted, and do they carry a recognition mark?

A dull dirty gray color is usually adopted for the hull. In the Atlantic and North Sea the deck is painted black; in the Mediterranean it is sometimes painted dark blue.

All submarines operating from the German Bight carry a recognition mark, which they

show only on sighting their own aircraft. It consists of a white ring, about 12 inches broad and about 4 feet in diameter, fitted on the deck forward. Boats of the Flanders and Mediterranean flotillas do not carry this mark.

12. What armament do the various types carry?

Converted mercantiles (*Deutschlands*) carry two 5.9-inch guns, one forward and one aft (some of them have also two 22-pounders en échelon amidships), 6 torpedo tubes (4 bow, 2 broadside), and about 30 torpedoes.

"U" boats mostly carry one 4.1-inch forward and one 22-pounder aft, but a few boats carry two 4.1-inch, a few others one 4.1-inch (forward) or two 22-pounders. They have 4-6 torpedo tubes, 2 or 4 in the bow and 2 in the stern, and they usually carry 8-12 torpedoes.

"U" mine layers carry one 4.1-inch abaft the conning tower, 2 deck torpedo tubes (1 bow and 1 stern), 2 torpedoes, and 36 mines.

"U. B." boats carry one 4.1-inch or one 22-pounder forward; earlier classes 2 tubes (bow) and 2-6 torpedoes; later class 5 tubes (4 bow, 1 stern), and 10 torpedoes.

"U. C." boats carry one 22-pounder forward, 3 tubes, viz, 2 bow (deck) and 1 stern, 4-6 torpedoes, 18 mines.

13. What is the extreme radius of action of submarines, and how long do they actually remain out?

Converted mercantile (*Deutschland*) class, 17,000 miles at 6 knots; "U" boats, 5,000 to 10,000 miles at 10 knots; later "U. B." and "U. C." boats, about 6,000 miles at 8 knots.

Converted mercantile class remain out about 3 to 4 months; "U" boats from 20 to 30 days, say 25 days; "U" mine layers generally less; later "U. B." boats from 14 to 24 days; "U. B." coastal class from 7 to 14 days; "U. C." boats operating in the North Sea and Atlantic, from 10 to 20 days, and in the Channel, working from Flanders, about 10 to 12 days. They can, however, remain longer at sea, one holding the record for this type with 55 days.

14. What are their cruising speeds?

The continuous cruising speed of a "U" boat, a later "U. B.," or "U. C." on passage may be taken as 8 to 9 knots, or about 200 miles a day; "U" mine layers about 6 knots; *Deutschland* class are slower and go about 5 to 6 knots.

15. How long can a submarine run submerged?

At her maximum speed, only for a short time, from 1 to 2 hours, but at slow speed

for long periods, up to 48 hours. In case of emergency a submarine could run submerged say at 8 knots for 2 hours, 5 knots for 12 hours, 4 knots for 24 hours, or 2 knots for 48 hours.

On service, however, she would avoid running her batteries right down, and would come to the surface to recharge them before the expiration of these periods.

Charging is done by the Diesel engines, which can be used to drive the electric motors as dynamos while the submarine is proceeding on the surface.

Submarines on service rarely remain submerged more than about 12 hours, and that only in very bad weather or when resting or persistently chased.

16. How far can a submarine go submerged?

As a rule the limit may be taken as 75 miles, though some German submarines could go for over 100 miles in case of absolute necessity.

17. At what depths do submarines usually proceed when submerged?

When carrying out an attack they proceed at about periscope draft; that is, at the depth at which the fully extended periscope just reaches to the surface. This depth is about 45 feet for "U" boats, 38 to 39 feet for "U. B."

and "U. C." types, reckoned to the bottom of the keel.

When cruising submerged, submarines usually proceed at depths between 66 and 81 feet, except in very heavy weather, when they go to over 100 feet, or when expecting attack with bombs or depth charges, when they dive to about 150 feet, if the depth of water permits.

**18. What is the maximum depth to which submarines can dive?**

All modern German submarines are tested for a depth of 197 feet, but for short periods they can go deeper. Cases are known of boats having dived to 250 to 300 feet without injury. For lying on the bottom they do not ordinarily choose localities in which the depth exceeds 164 feet.

**19. How long does a submarine take to dive?**

In an efficient boat, proceeding with both Diesel engines, periscope draft (see 17) can be reached in  $1\frac{1}{2}$  minutes from the order being given to dive. If the boat is proceeding with one Diesel engine and one electric motor running for propulsion (as is frequently done in patrolled areas), the time taken will be even less. If the submarine is going deeper, the further dive will be at the rate of about a foot a second.

**20. What are the principal areas of activity in home waters and the Atlantic?**

The principal areas of activity (April, 1918) are the North Sea, Channel, Irish Sea, and approaches to Channel and Irish Sea.

In the North Sea, operations are carried out by "U. B." and "U. C." boats only.

In the Channel, there are usually several "U. B." and "U. C." boats of the Flanders flotilla, which sometimes go as far as the Bay of Biscay and Irish Sea, and, at the western end, possibly one or two "U" boats. The areas of activity vary, but the eastern portion is used rather for passage, and the central and west for actual operations.

As regards the other areas, in good weather the favorite hunting grounds for "U" boats are the two approaches to the Irish Sea and the western approach to the Channel. In the winter months 1917-18 there was considerable submarine activity in the Irish Sea. This activity may be repeated at any time, but more particularly in bad weather. "U. B." and "U. C." boats also operate in these areas.

Mine laying submarines usually lay their mines in the vicinity of the coast or of sea marks, and, having done so, generally proceed to operate, like the other boats, with torpedoes and gunfire, against commerce.



Converted mercantile submarines (*Deutschland* type) have hitherto worked entirely outside home waters, mainly off the west coast of Spain, westward of Gibraltar, and off the Azores, Canaries, and Cape Verde Islands; also off the west coast of Africa.

21. By what routes do submarines leave and return to the North Sea?

Submarines proceed either northabout round the Shetlands or through Fair Isle Channel, or else via the Straits of Dover. The larger boats have recently (April, 1918) preferred to proceed northabout.

22. Can you give a rough idea of the number of submarines operating simultaneously?

The number varies greatly; a rough average is 3 converted mercantiles, 10 to 12 "U" boats (in the Atlantic, etc.), 5 "U. B." and 2 "U. C." boats in the North Sea, and about 6 "U. B." and 2 "U. C." boats in the Channel and Atlantic.

23. Going northabout, do submarines use the Minches?

They occasionally pass through the Minches, but usually go west of the Hebrides.

24. Do submarines pass Fair Isle at any particular time of tide?

Apparently not, but there seems to be a tendency to pass in the afternoon or at night.

25. Do submarines pass Dover at any particular time of tide?

It is believed that they prefer high water slack at night, but they have also been found lately (March, 1918) trying to pass through quickly on the surface in the mist at early dawn.

26. What are the tactics of a submarine attacking a merchant ship or convoy?

The submarine will first try to reach a position ahead of her objective. After that her tactics will vary according to circumstances.

27. Do submarines work together or in any formation?

Submarines work singly and independently, though they may occasionally cooperate for a time in a particular area.

28. At what range do submarines fire their torpedoes?

When attacking single ships, German submarines endeavor if possible to close to a range of 300 yards to fire a torpedo. When attacking a convoy, they fire at ranges between 500 and 1,000 yards.

**29. What do submarines do after attack?**

They turn away in the direction of their target's stern, endeavor if possible to observe the result of the shot, and fire another if necessary; then they usually dive to about 150 feet and proceed at this depth for some 15 minutes, or longer if pursuit continues.

**30. What is a submarine's turning circle submerged?**

About 430 yards for "U" boats and 220 yards for "U. B." and "U. C." types.

**31. What distance will a submarine go in one minute submerged?**

At 7 knots the distance run would be 233 yards. (One knot = 33 yards per minute.)

**32. How much of a periscope is shown in attack and how often; and at what distance can a periscope be seen?**

This varies greatly with conditions of wind and sea and light. In an attack by a submarine on March 21, 1918, off Dungeness, on a convoy under escort, the periscope was seen about 1,000 yards off, 58° on the port bow of convoy, was showing 12 inches above water, making a slight feather, and was in sight for 7 seconds. A periscope can not be seen at distances much exceeding 2,000 yards, even with good glasses.

**33. Have submarines more than one periscope?**

Yes; all modern submarines have two, and a good many have three periscopes, but only one of these is used at a time, and only one, as a rule, is fitted for use against aircraft.

**34. Do submarines attack at night?**

Submarines now attack at night almost as frequently as by day. During February, 1918, in home waters 50 attacks were made by day and 43 by night. Of the 43 attacks, 25 were in moonlight. The majority of total attacks were made toward nightfall, between 5 and 6 p. m.

**35. Are night attacks made on the surface?**

Yes, almost always, except in bright moonlight.

**36. What are the weather limits for submarine work?**

The worst conditions for submarine operations are given by a calm sea, and if, in addition, there is a long swell running, it becomes almost impossible for a submarine to attack unseen.

At the other extreme, if the state of the sea is more than about 6, a submarine will become unmanageable when near the surface. If it is possible for her to make the final approach on a course at right angles to the direction of the sea, she may attack successfully in worse weather; but, unless she is thus favorably

situated, she will probably give up any attempt to operate near the surface and will dive deep until the weather moderates.

**37. Is navigation difficult in a submarine?**

It requires unremitting care, owing to frequent alterations in course and speed necessary to avoid patrols, etc., and to the varying currents at different depths. In general, however, the navigation of German submarines has been very good.

**38. When and how do mine laying submarines lay their mines?**

The mines are usually laid at night, and either at high or low water. In moderate depths, high water is generally preferred, as giving greater depth for diving. Whilst laying their mines, these submarines can proceed either on the surface or submerged, according to circumstances, as the mines are released from inside the boat.

The mines may be laid at close intervals, i. e., about 50 yards, and in groups, or they may be laid singly at very wide intervals, e. g., 800 yards.

Cases are known of submarines having followed up mine sweepers and laid their mines in the channel which had just been swept.

**39. In what soundings are the mines laid?**

In the Atlantic and North Sea, mines are usually laid in places where the depth lies

between 7 and 80 fathoms. In the Mediterranean, however, they have been laid in depths up to 150 fathoms.

**40. What colors are the mines painted?**

In home waters the mines are painted black; in the Mediterranean they are painted green or blue. Those laid in home waters can easily be distinguished from British mines, which are always painted an olive-green color slashed brown.

**41. Do submarines often lie on the bottom?**

This depends upon circumstances and the ideas of individual captains. They may lie on the bottom in bad weather, if it is not rocky and there is no danger of damage from bumping. They may also do so when pursued with hydrophones (*see* 44) or when resting, but some captains prefer to keep under way, going dead slow, at a safe depth.

**42. Are their resting places known?**

Some information on this subject is contained in C. B. 01228 (O. X. O.), Navigational Instructions for Submarines, and C. B. 01218 (O. X. O.), Submarine Charts.

In general, any place with a sandy or gravel bottom and a depth of less than about 27 fathoms may be used.

43. Can submarines remain stopped when submerged, without lying on the bottom?

A very well trimmed boat may do so for about 5 minutes at a time by juggling with her periscope. For longer periods it is only possible in a few localities where layers of different density occur in the water, e. g., in the Baltic, Cattegat, and Sea of Marmora, where occasionally a boat may lie submerged almost indefinitely<sup>1</sup> with all machinery stopped, resting on a layer of salt water.

44. What are the tactics of submarines when hunted with hydrophones?

If the submarine is in deep water, at no great distance from which there are soundings of 20-30 fathoms, she will usually make for this position, in order to lie on the bottom, unless it is rocky or there is danger of damage from bumping. Lying on the bottom is the only means by which she can stop all machinery and render herself entirely inaudible to her pursuers; but, if forced to keep under way, she will proceed dead slow (2 to 3 knots) and reduce all sounds to a minimum.

<sup>1</sup> Two German submarines, sent at outbreak of war to watch the southern exits from the Sound and Great Belt, succeeded in thus lying submerged, with their motors stopped most of the time, for about 23 hours out of the 24, on 7 consecutive days.

45. Are submarines fitted with hydrophones?

Yes, and they use them extensively when hunted themselves. They need not stop in order to listen, but they get much better results by doing so.

46. Is it necessary for submarines to get their masts up in order to take in wireless messages?

No. The two jumping wires, which run from end to end of the boat, passing over the conning tower and forming a protection against nets, hawsers, and mines, are fitted as an auxiliary aerial; and the submarine is consequently able to intercept signals directly she comes to the surface.

47. Do submarines carry a searchlight?

Yes, a good many of them carry a small portable searchlight, which can be mounted on the bridge and is intended mainly for signaling purposes.

48. Are submarines armored?

None of those at present at sea (April, 1918) have any armor, either on the conning tower or elsewhere, but it is possible that the new cruiser submarines now completing may have something in the nature of armor protection on top of the hull.



49. What is the effect on a submarine of the explosion of depth charges or bombs in her vicinity?

Completely authenticated instances of the following are on record:

(a) So serious a leak is caused that the boat immediately sinks.

(b) A leak is caused, say by a hatch being buckled, which can not be kept under with the pumps and forces the boat to come to the surface.

(c) A leak is caused in the external tanks, which may result in so large a loss of oil fuel as to necessitate the return of the boat to her base.

(d) The periscope bases are shaken or damaged, which may also necessitate the boat's return.

(e) The hydroplanes may be forced hard up or hard down, or rendered difficult to work, causing the boat to come to the surface or dive to a dangerous depth.

(f) If the explosion takes place immediately above or below the submarine, the same effect may be produced as in (e) by the actual force of the explosion.

(g) The boat may merely be shaken, cut outs fused, and the electric light consequently extinguished; in such instances the boat, as a rule, will not come to the surface, but the moral effect is considerable.

50. Is oil, seen on the surface, any proof of a submarine having been destroyed?

Not unless it is accompanied by air bubbles or continues for a considerable time. German submarines are fitted with an arrangement for ejecting oil fuel and use this to mislead or delay their pursuers.

Oil rising to the surface may sometimes indicate a submarine lying on the bottom with her external tanks leaking.



ILLUSTRATIONS  
OF  
SUBMARINES, TORPEDOES  
AND MINES

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FOR INFORMATION OF SEAFARING MEN

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REPORT ALL DISCOVERED

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OFFICE OF NAVAL INTELLIGENCE

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JUNE, 1918



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
1918



## WARNING!

The accompanying illustrations show high-explosive mines, such as are being used by the Germans and other belligerent powers.

These mines when first put in place are so anchored that they are held at a certain distance below the surface of the water. It is intended that they shall remain invisible and be exploded when struck by any vessel that may come in contact with them. They are called submerged contact mines.

Such mines may be removed by various methods of dragging or sweeping, such as by sinking a long cable, each end of which is attached to a tug, and thus dragging a suspected locality. This should only be done by persons who have had experience in work of this nature.

If, due to stormy weather or for any other reason, a mine becomes detached from its anchor, as is often the case, it comes to the surface, and for an indefinite time may be carried about by various currents, and continues to be a danger to navigation, because of being as destructive afloat as submerged. Likewise, floating mines are often cast upon the beach and should be carefully avoided.

Under any conditions whatever a mine floating, stranded, or anchored, should be approached only with the greatest caution. If possible the mine should be destroyed by rifle or gun fire.

It is very desirable that the kind of mine be determined by those who may discover it before they destroy it or leave the vicinity; that is, whether it is of English, French, or

German make. It is for this purpose, as well as to caution all seafaring people, that this pamphlet is being distributed.

If, under very favorable conditions of weather, it is possible to approach a floating mine in an effort to identify it, the greatest care must be exercised not to do so when any other floating object is likely to touch it, and not to permit any part of your own vessel to come in contact with it. A floating mine is generally harmless unless it touches some other object.

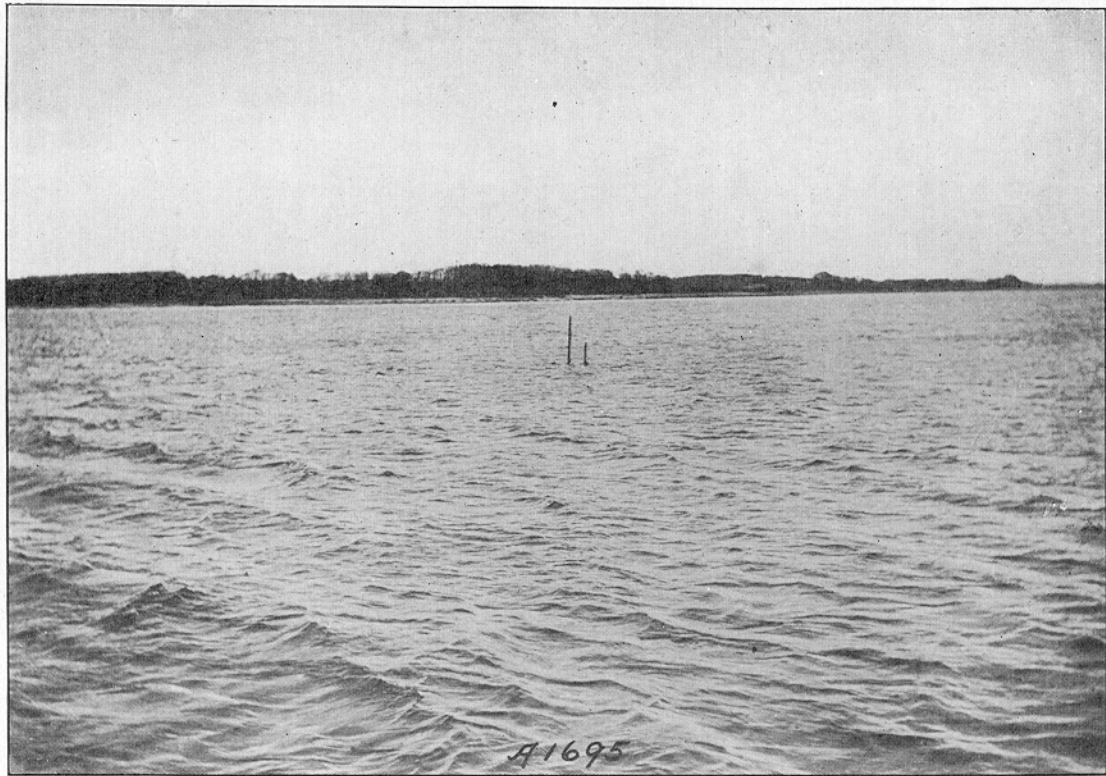
If an attempt is to be made to destroy a mine by gunfire, those who have not had actual experience in such work should not open fire at a shorter range than 200 yards.

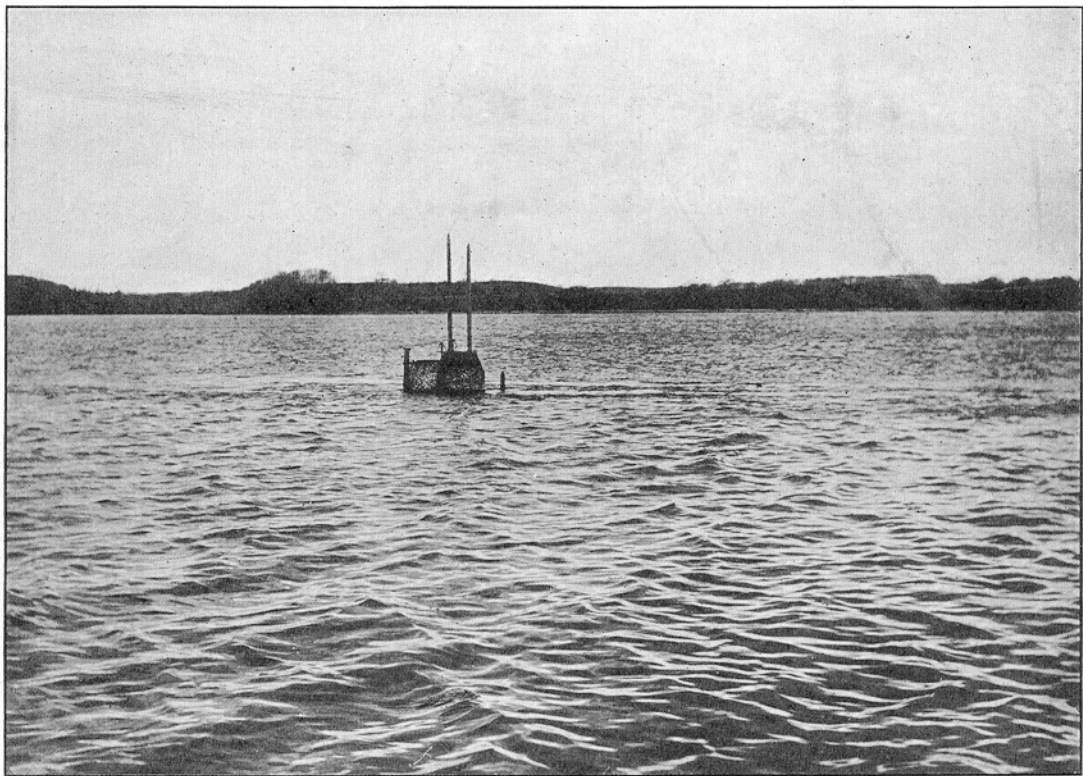
Whether or not an attempt be made to destroy a mine, the fact of its discovery and a report of all circumstances in the matter should be made to the Hydrographic Office, the collector of any port, any officer of the Navy or the Army, or to any other Government officer at the earliest possible moment.

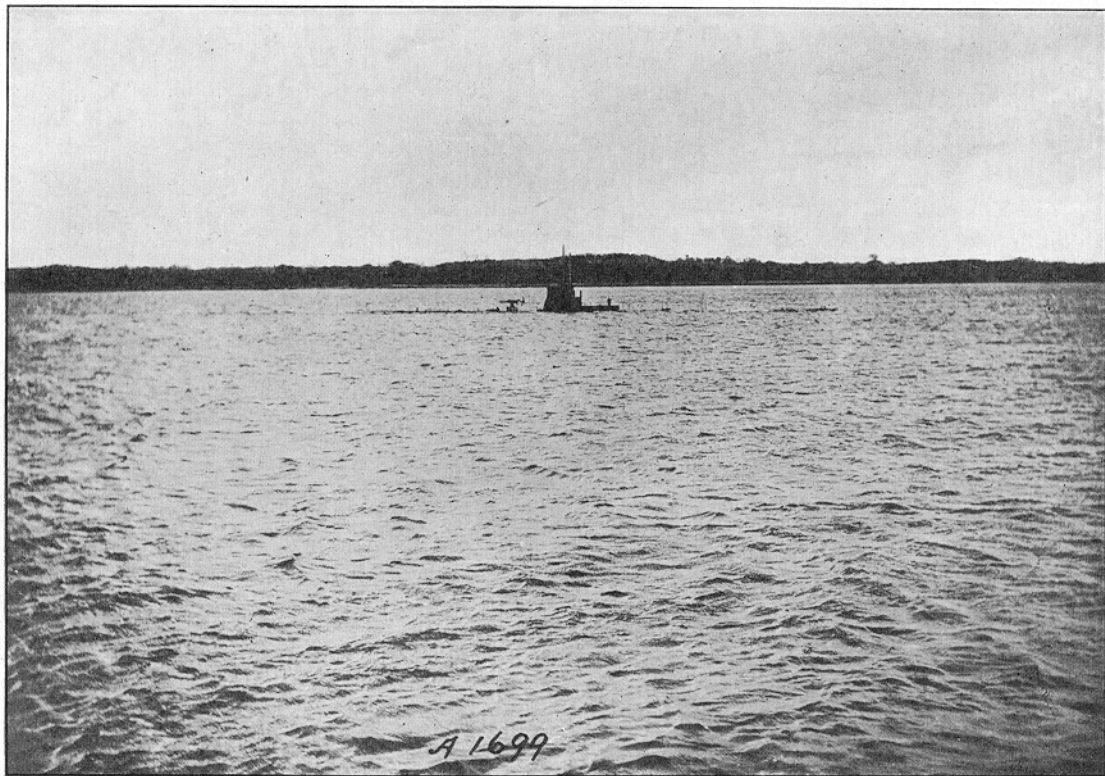
Report the presence of any floating object that may resemble a metal ball or cylinder in order that proper investigation may be made.

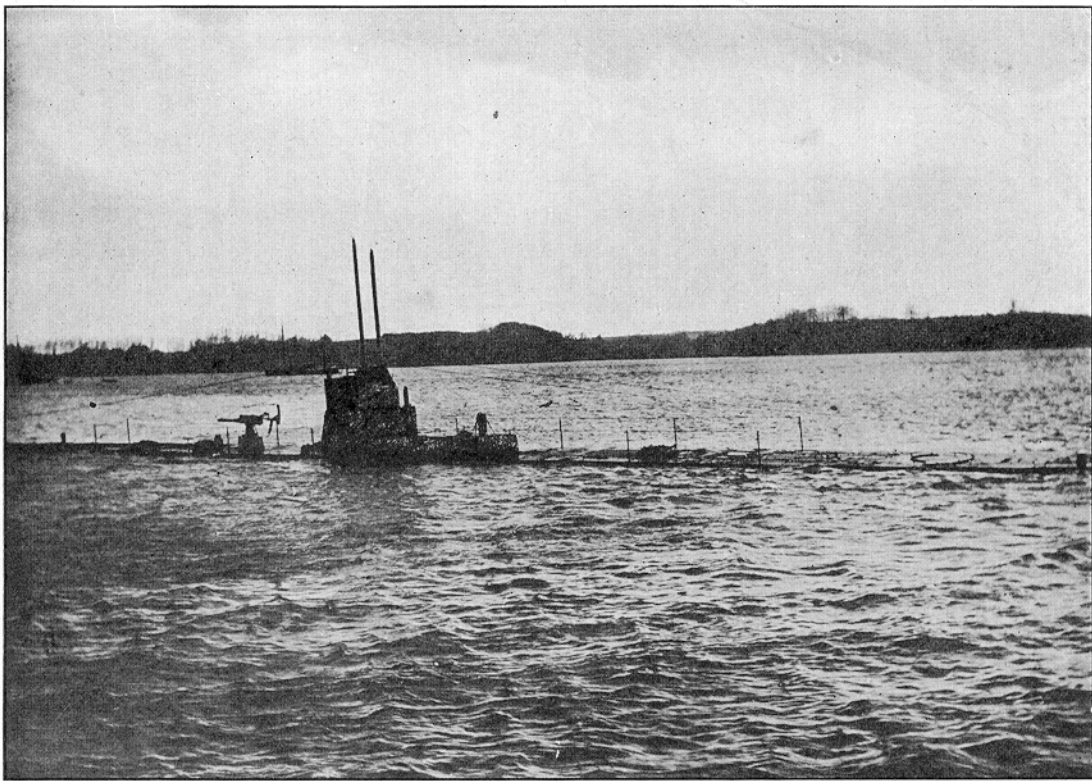
If all people along the coast or at sea keep always on the lookout and bear in mind these instructions, a great loss of life and property may be avoided and service of the greatest importance to the Government will be rendered.



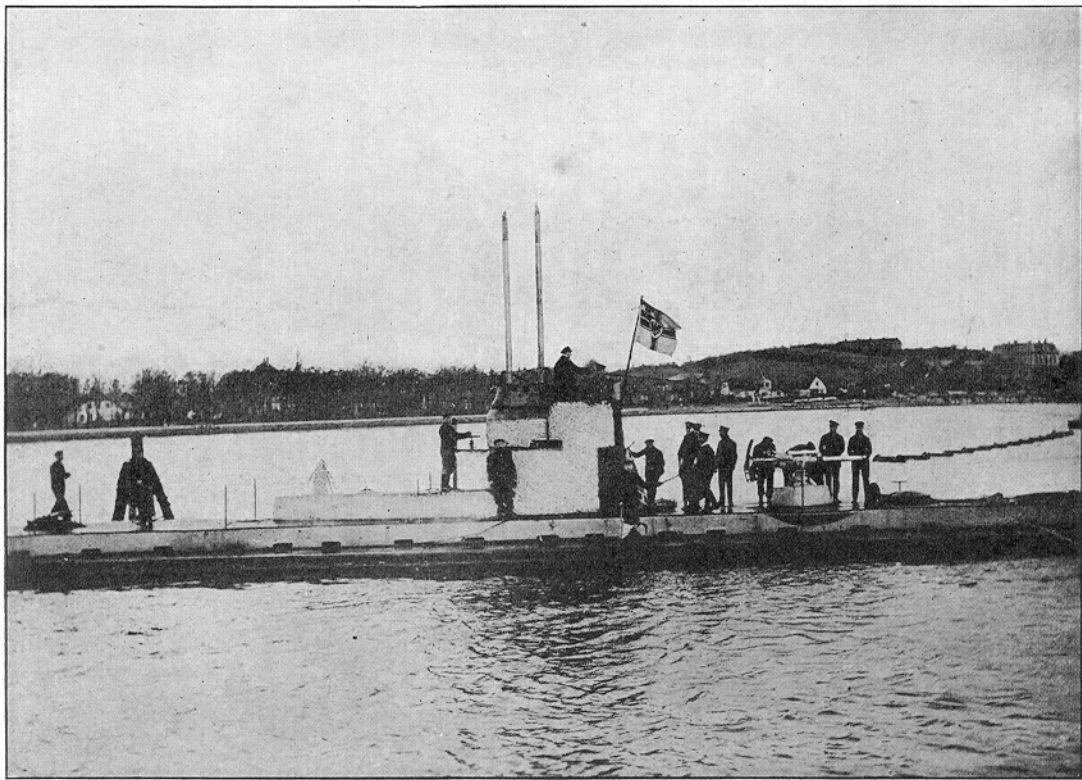












VIEW OF A SUBMARINE AT FIVE STAGES OF EMERGENCE.

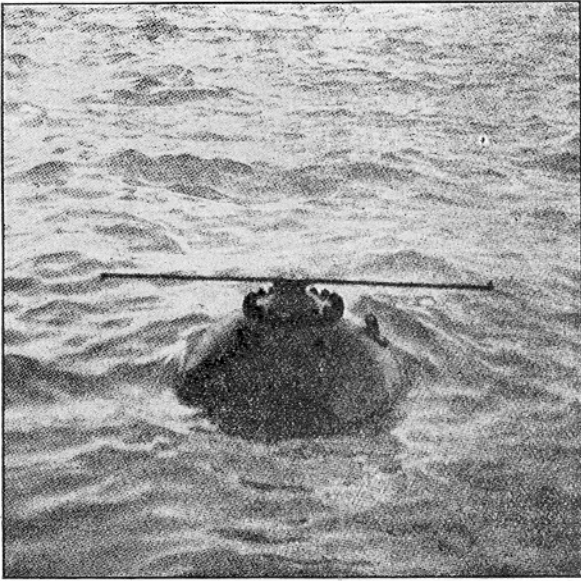
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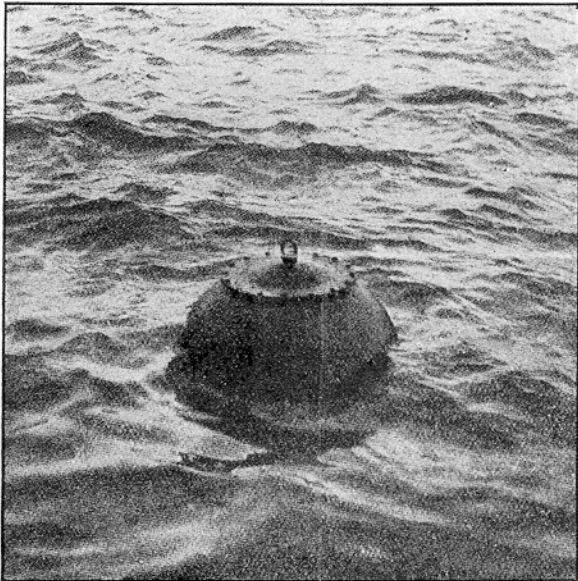
Types of Mines,  
British and German.

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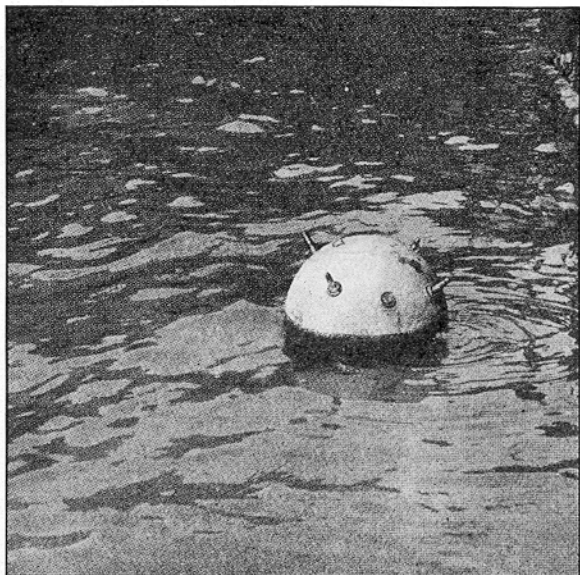
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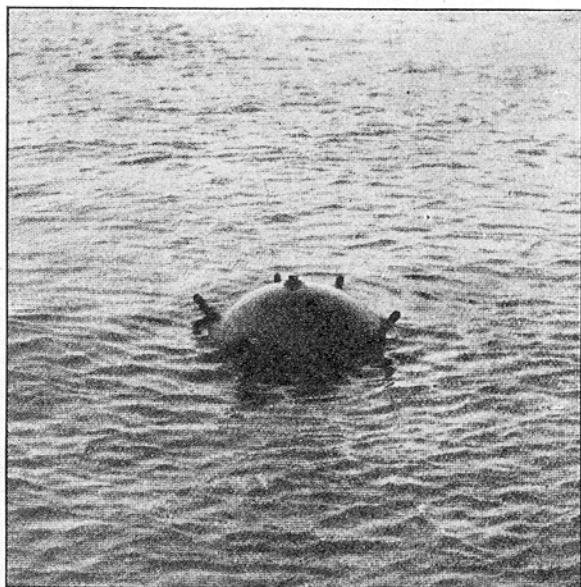
NOTE THE DANGEROUS BAR ON TOP OF MINE.



IN THIS TYPE THE DANGEROUS BAR IS AT THE BOTTOM OF THE MINE.

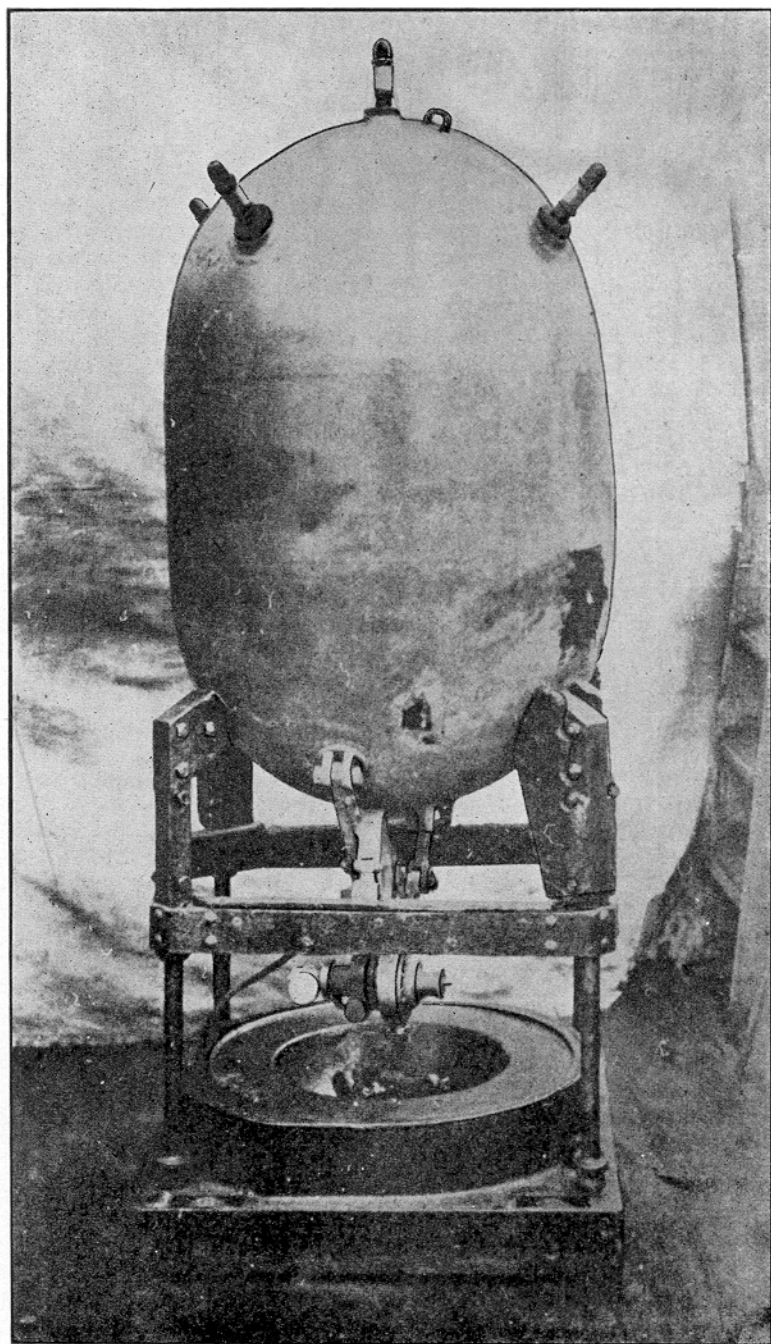


NOTE THE DANGEROUS HORNS ON TOP OF MINE.

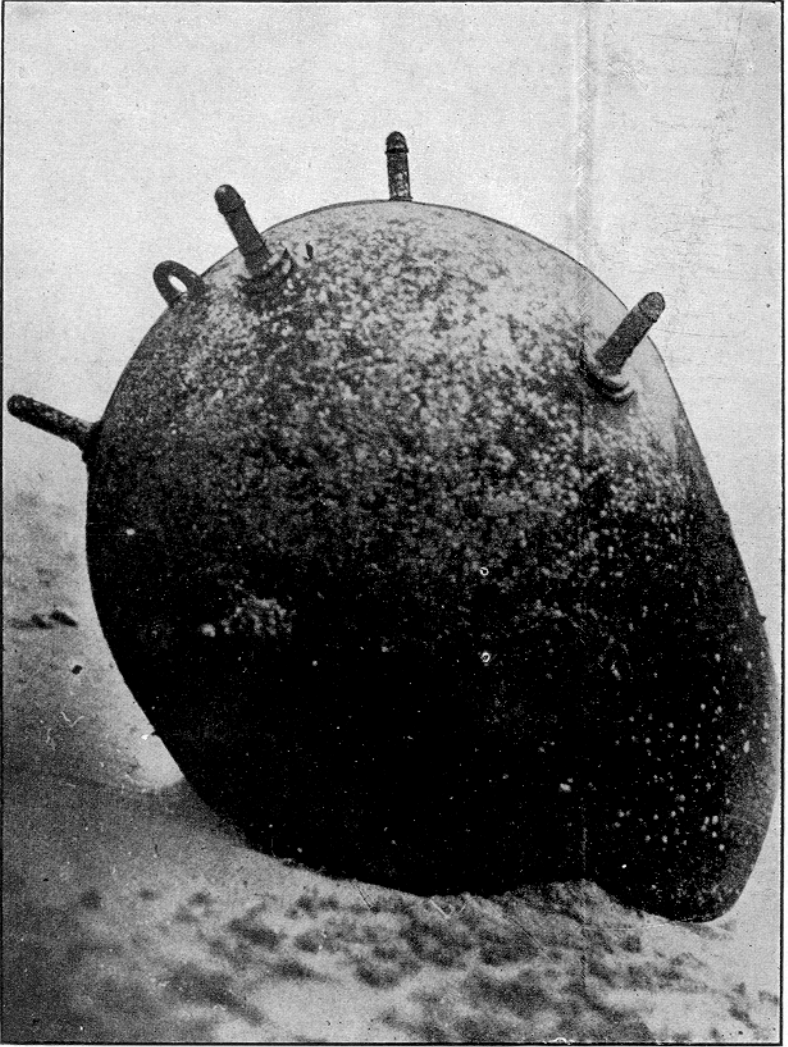


NOTE THE DANGEROUS HORNS ON TOP OF MINE.



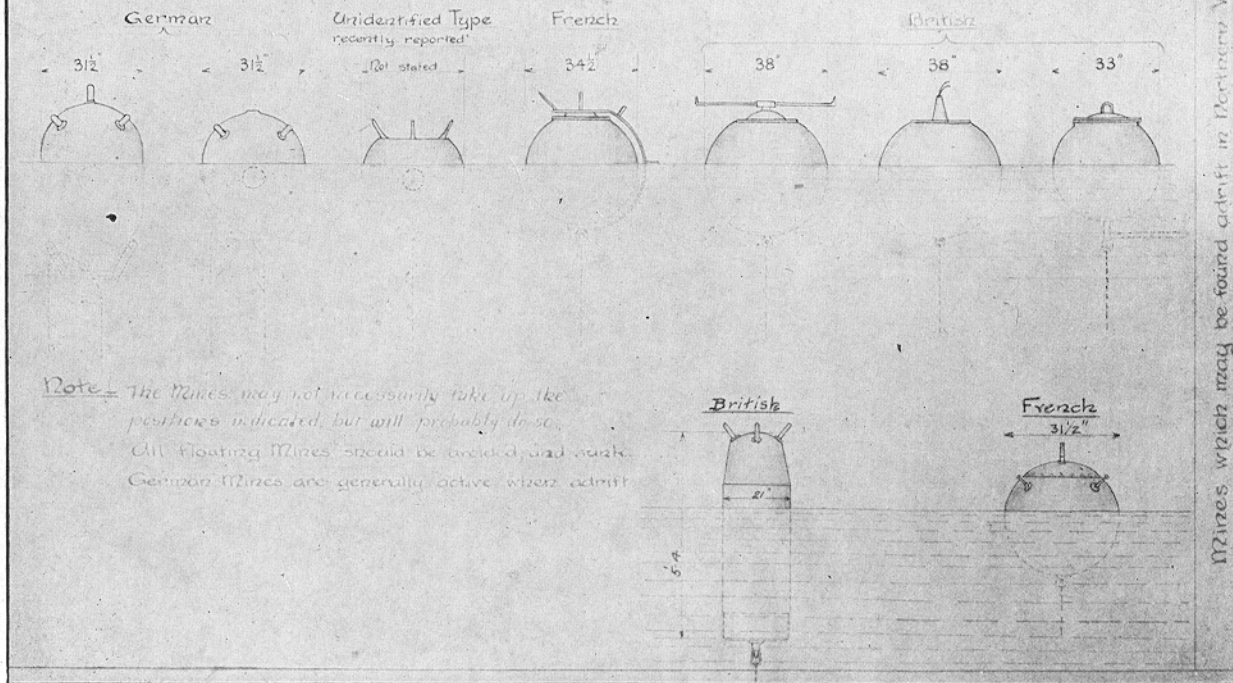


GERMAN MINE WITH SINKER.



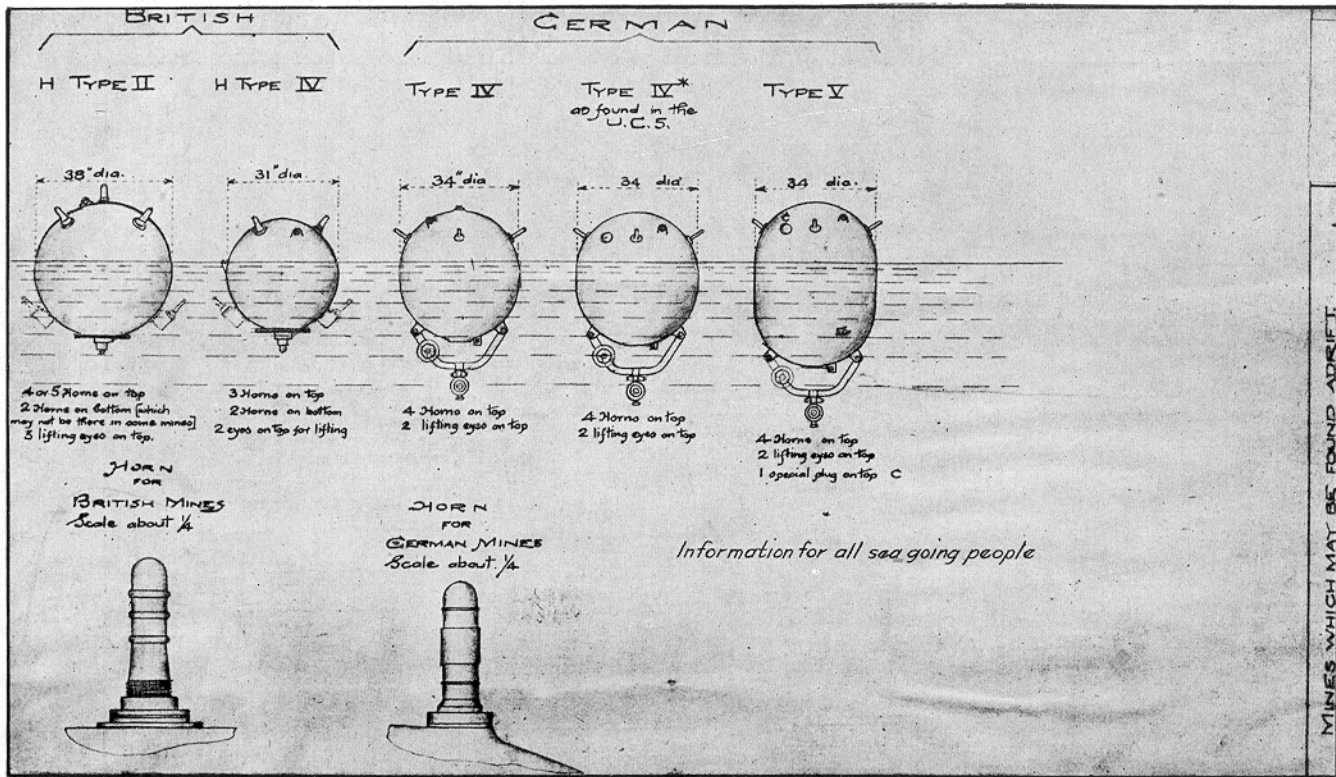
A GERMAN MINE WASHED ASHORE.

*Information for all sea going people*



MINES WHICH MAY BE FOUND ADRIFT.

NOTE.—The mines may not necessarily take up the positions indicated, but will probably do so. All floating mines should be avoided and sunk. German mines are generally active when adrift.



MINES WHICH MAY BE FOUND ADRIFT.



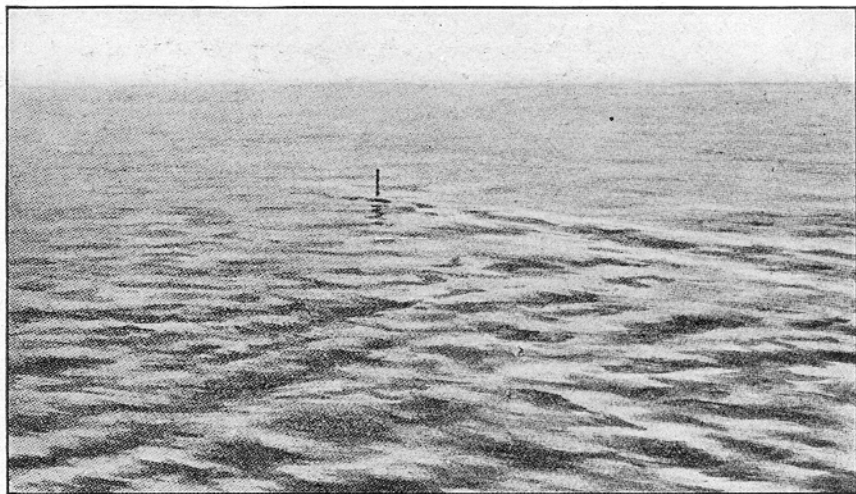
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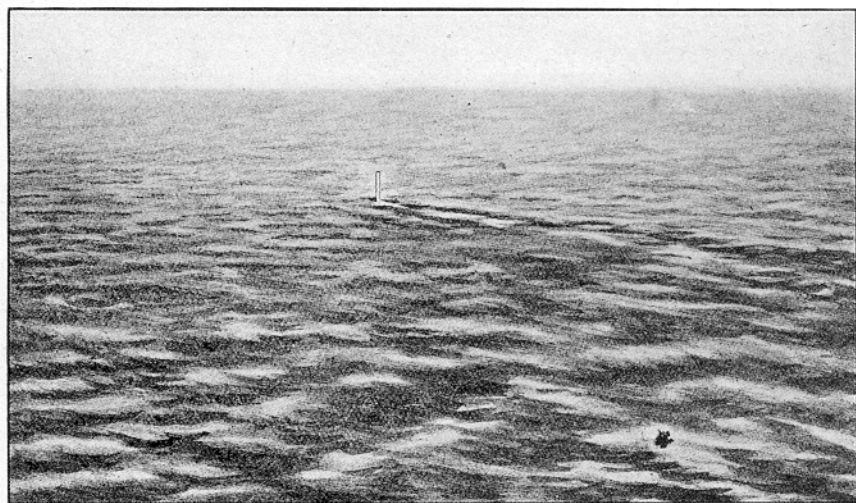
German Submarines.

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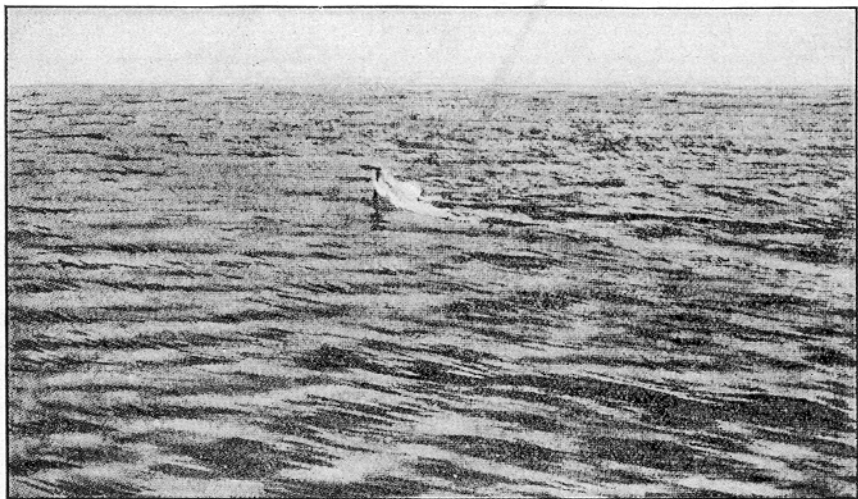
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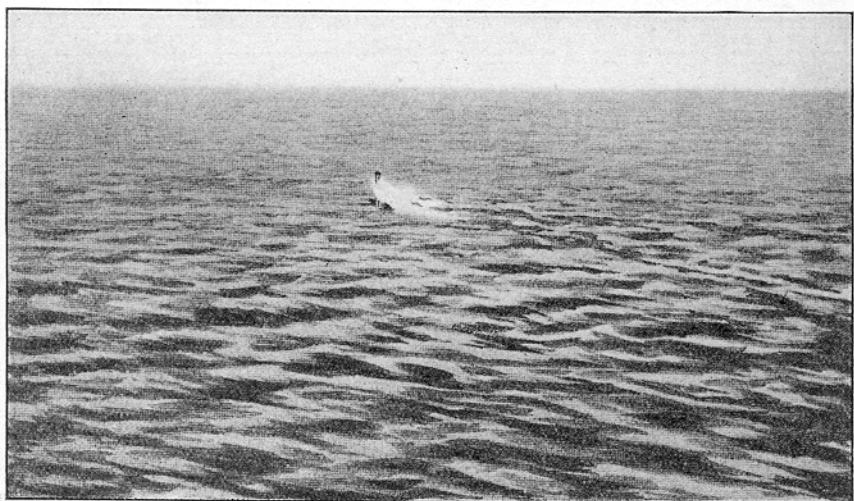
PERISCOPE MOVING SLOWLY THROUGH WATER, THE LIGHT BEING BEHIND IT.



PERISCOPE MOVING SLOWLY THROUGH WATER, THE LIGHT BEING IN FRONT OF IT.



PERISCOPE MOVING AT A SPEED OF ABOUT 5 KNOTS, THE LIGHT BEING  
BEHIND IT.

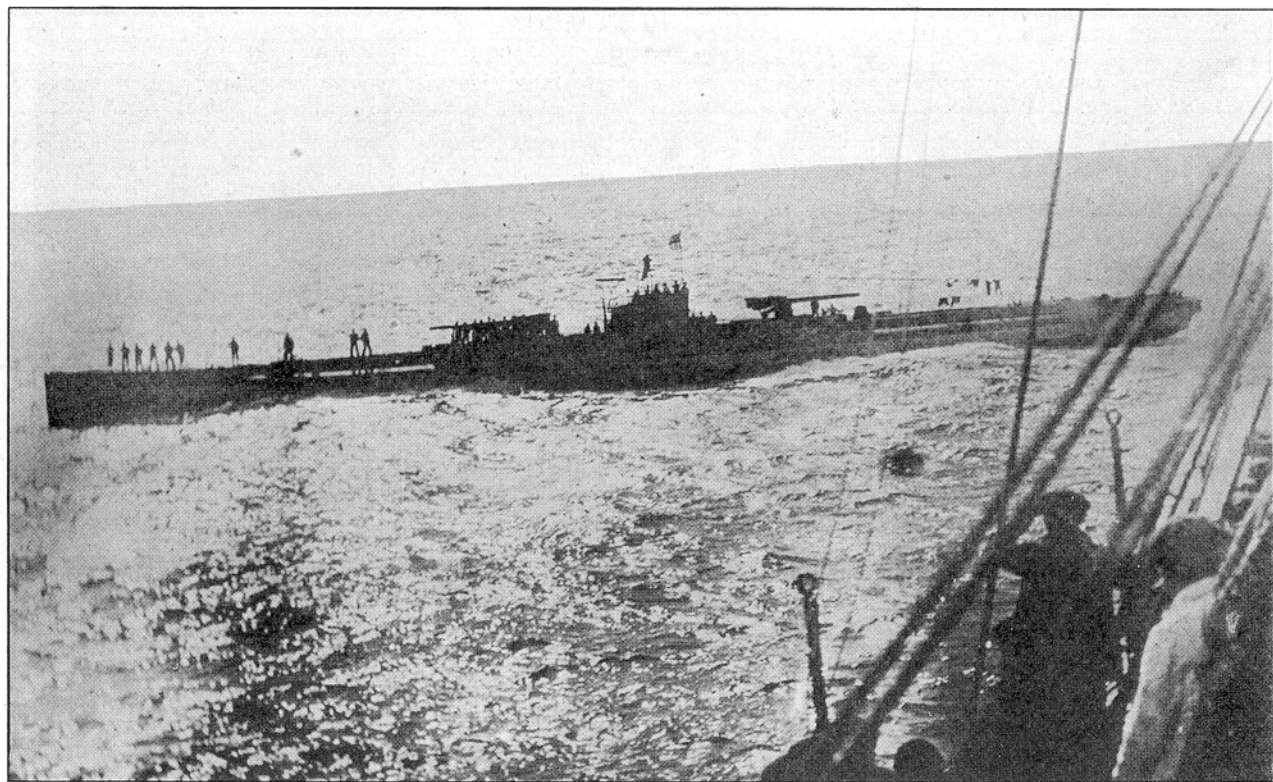


PERISCOPE MOVING AT A SPEED OF ABOUT 5 KNOTS, THE LIGHT BEING IN  
FRONT OF IT.



GERMAN SUBMARINE OF DEUTSCHLAND TYPE PASSING INTO MOONLIGHT.

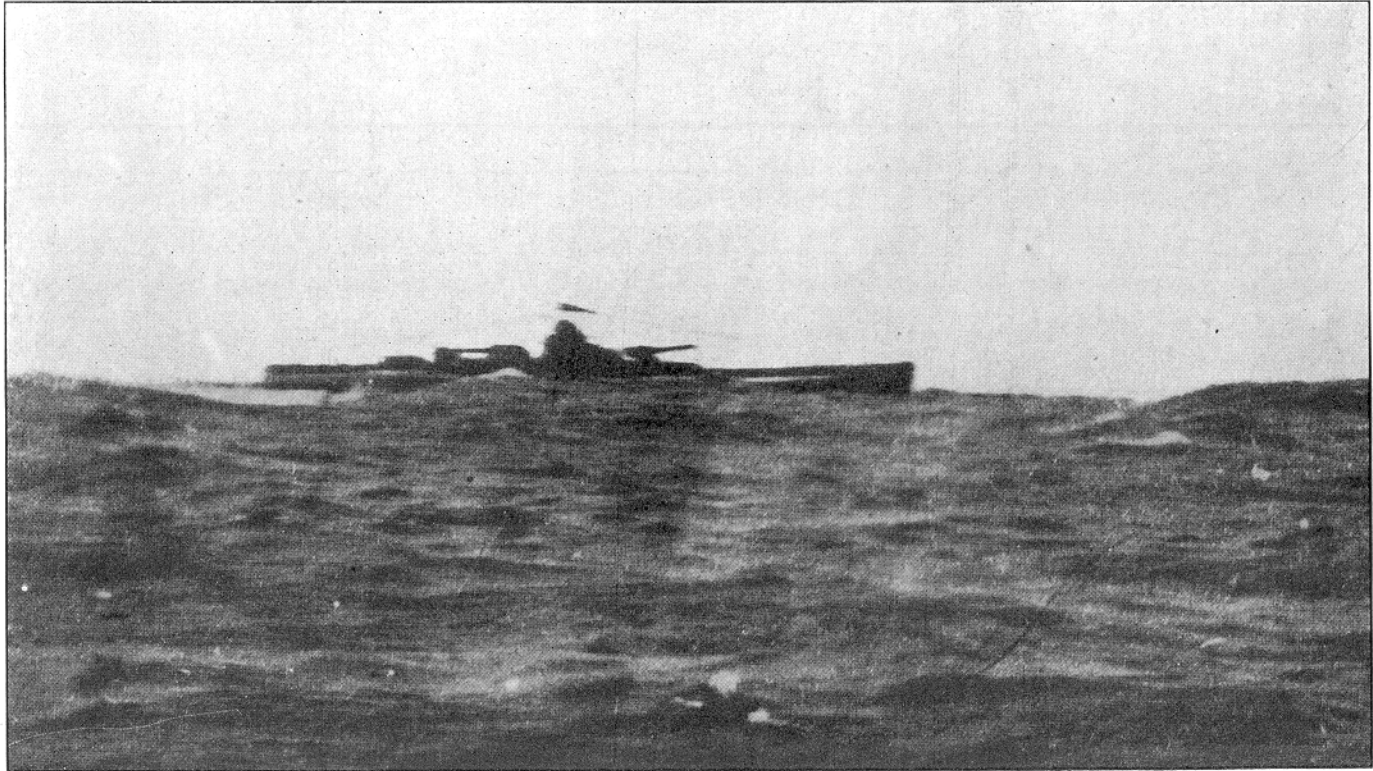
Note resemblance to a tug.



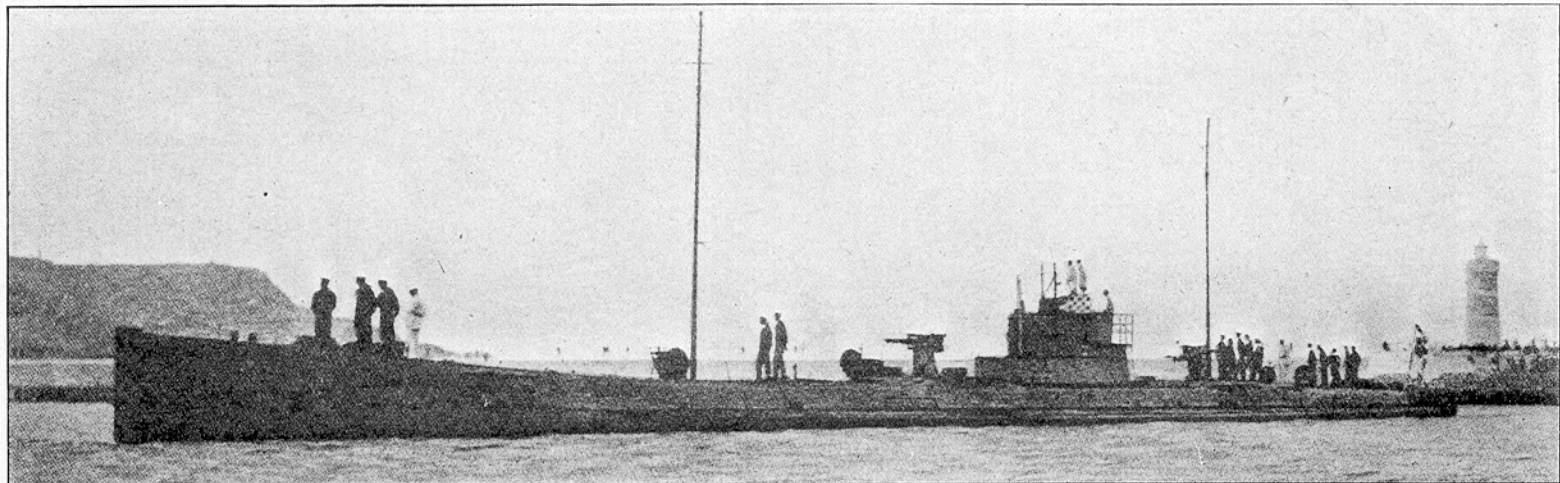
PHOTOGRAPH MADE IN FEBRUARY, 1918, OF A LARGE GERMAN SUBMARINE OVERHAULING AND STOPPING A PASSENGER STEAMER

Note two 6-inch guns. There are also four smaller guns.

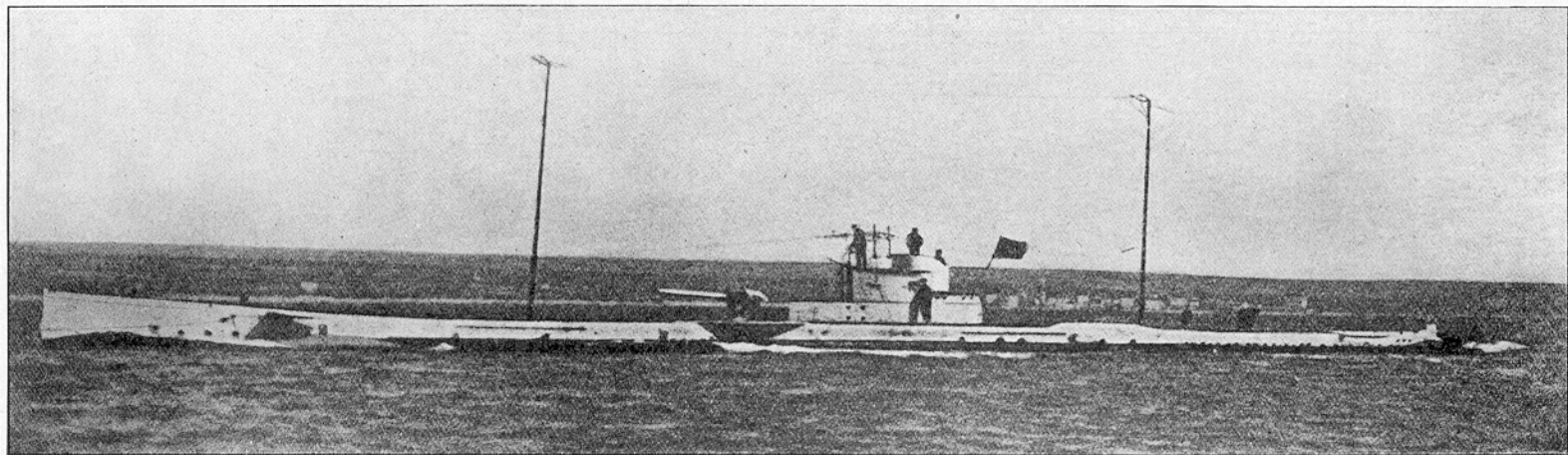




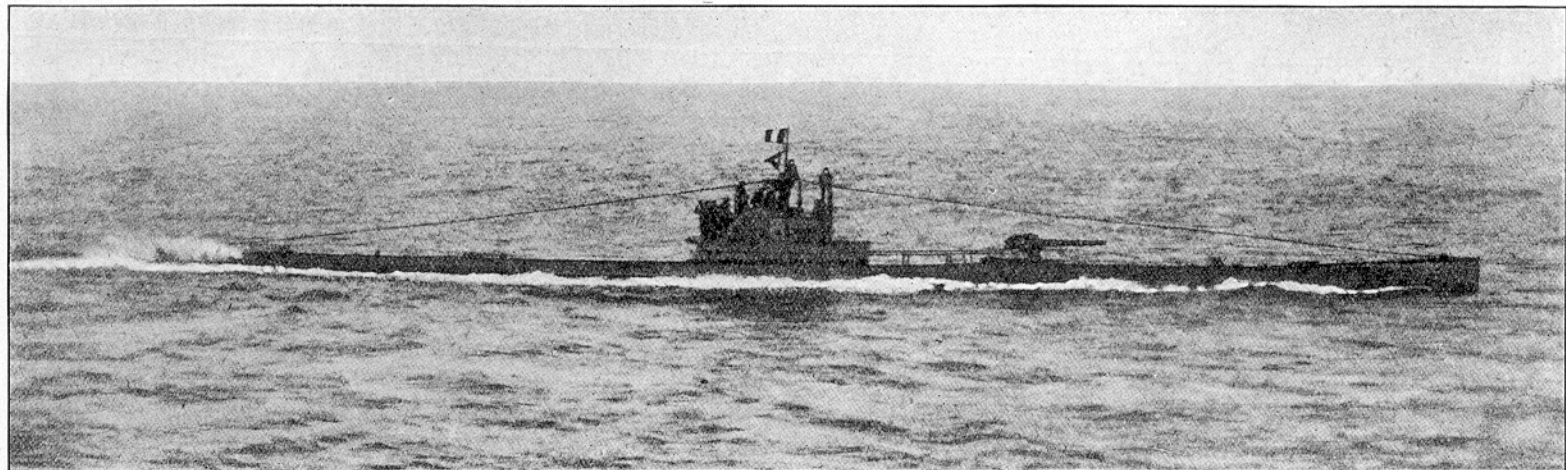
SUBMARINE OPERATING OFF COAST OF NEW JERSEY IN JUNE, 1918.



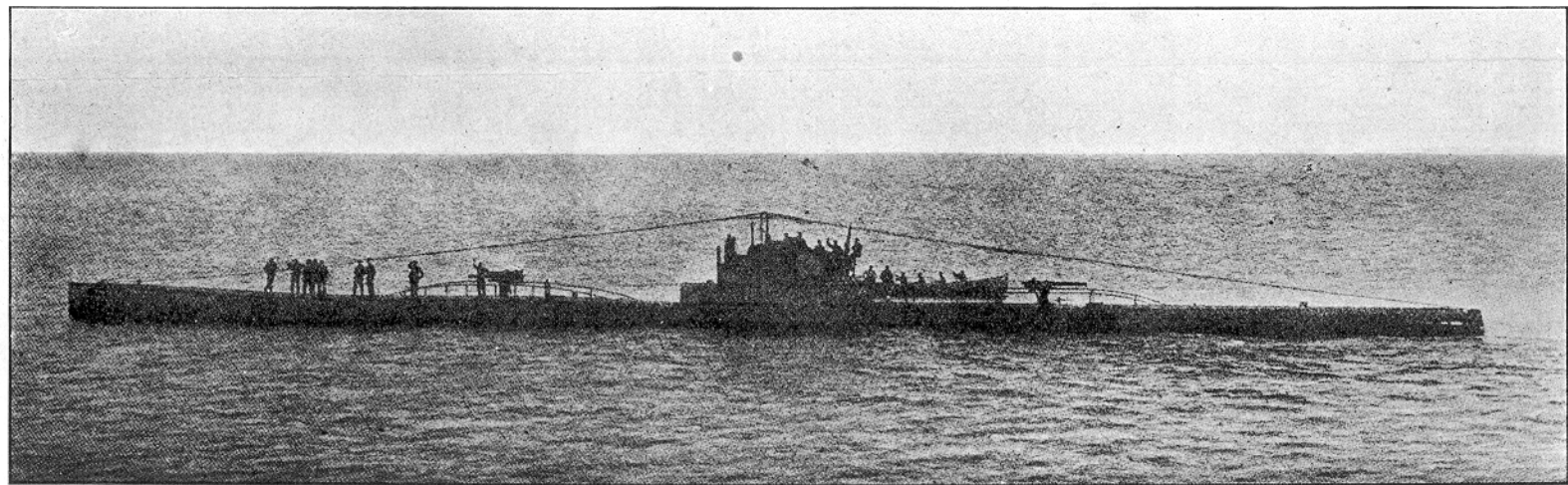
EARLIER GERMAN OCEAN-GOING SUBMARINE WITH TWO 22 PR. GUNS (MASTS UP).



EARLIER OCEAN-GOING GERMAN SUBMARINE WITH ONE 4.1-INCH GUN (MASTS UP).

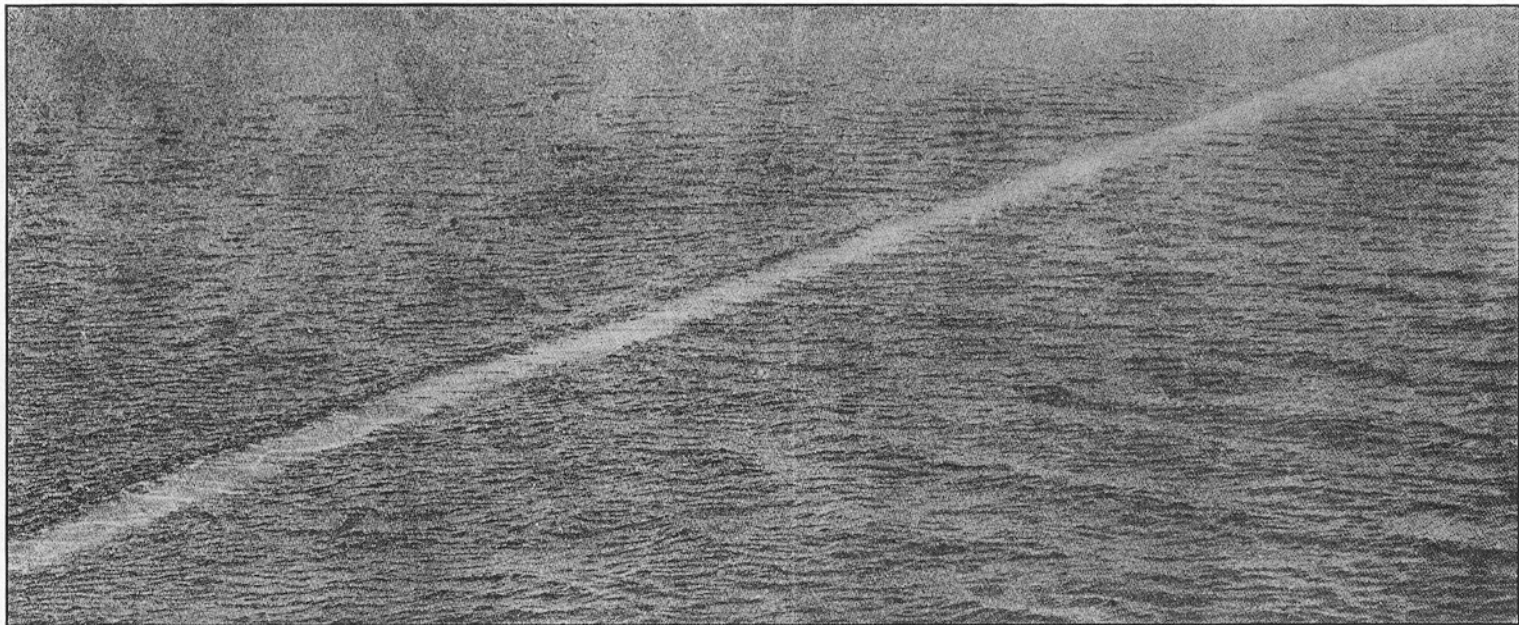


LATER OCEAN-GOING GERMAN SUBMARINE WITH ONE 4.1-INCH GUN (MASTS DOWN).

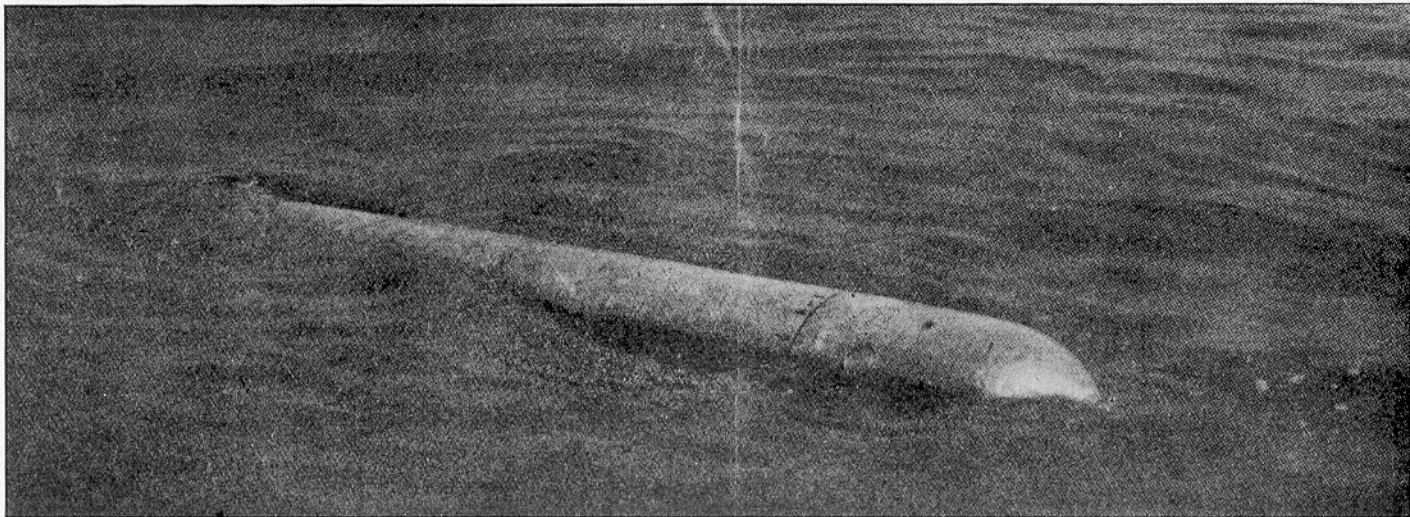


LATER GERMAN OCEAN-GOING SUBMARINE WITH TWO 22 PR. GUNS (MASTS DOWN).





TRACK OF TORPEDO.



TORPEDO FLOATING ON THE SURFACE.