THE SUBMARINE CABLE PLOUGH

by

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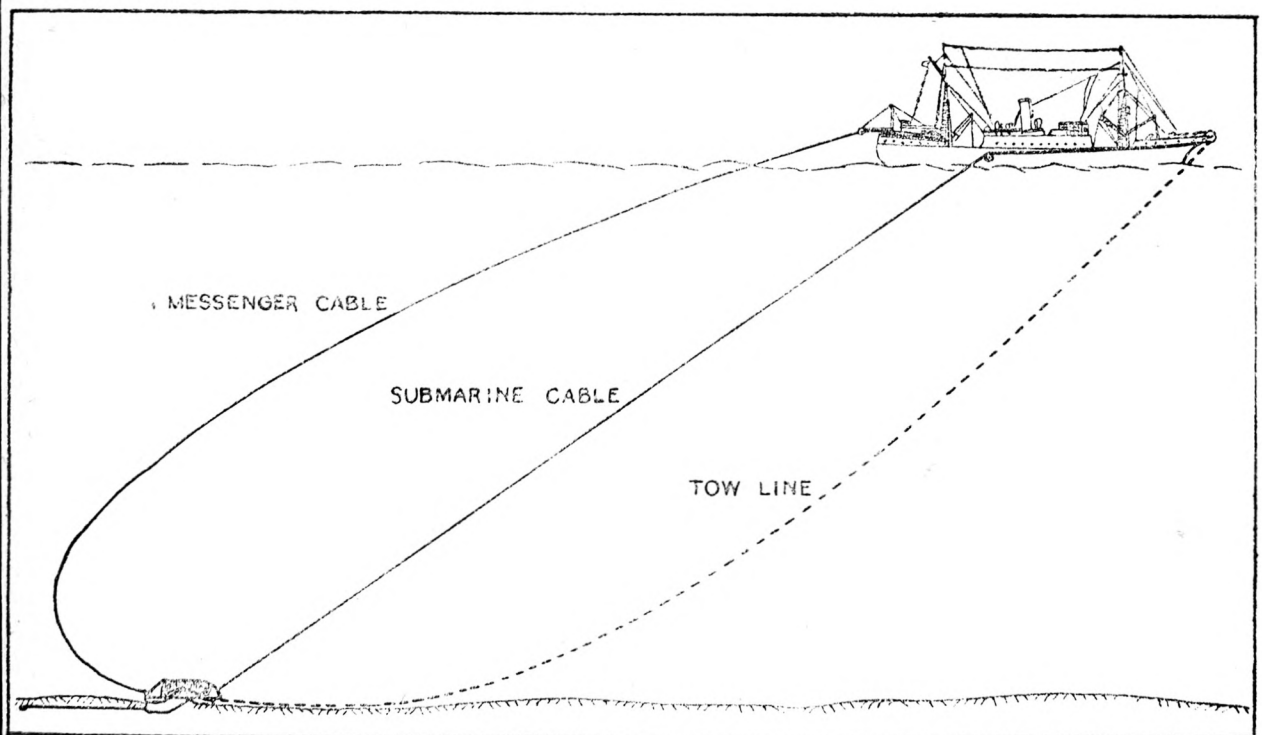
CABLE SHIP « COLONIA ».

Hydrography and the operations connected with submarine cable work were always intimate. The surveying of the course prior to the laying of the cable, the nature of the sea bottom throughout the cable route, and the contours, configuration and other characteristics of the ocean bed are all allied to the hydrographic surveyor's research. From the 100-fathom line to the deeps which extend to twenty times that dimension the oceanographic features are prominent — the ooze which covers the deeps, remind us that nature has provided an ideal cushion for the cables to lie where they can be grappled and repaired.



Cable Ship and Submarine Plow Under Way

This globigerina ooze is found anywhere deeper than the 100-fathom line, covers 29,2 per cent of the ocean bed which averages 2000 fathoms in depth.

Since the laying of the first submarine cable the telegraph companies have spent large sums on repairing the damage caused by fishing trawlers. The first submarine cable between Dover and Calais laid in the year 1850, was interrupted only a few hours after laying by a fisherman who had raised it to the surface with his trawl and cut out a length of it in the belief that he had discovered a new kind of seaweed.

The writer of this article when navigating officer of the cable ship "Cambria" was employed repairing the Borkum-Fayal cable in the North Sea in 1910 broken and twisted, from contact with the modern trawl of a fishing vessel.

In certain other areas, particularly off the Irish Coast, the risk of interruption to cables from the operations of fishing vessels is considerable. These trawlers use a large net with a spread of about 80 feet kept open by two "otter" boards towed obliquely by the trawler — so as to exert lateral forces in opposite directions. The boards measure about 12 ft. in length, 5 ft. in width and are 4 to 5 inches thick.

Recently the writer was privileged to inspect the submarine cable plough for entrenching cables 2 feet below the ocean bed on the cable ship "Lord Kelvin" which visited London under the command of Captain Bloomer who has been the pioneer spirit in this new feature of cable protection.

Preparatory to entrenching a section of cable the proposed route is surveyed to ascertain the nature of the bottom. Rocks and other obstructions must be avoided. Two special devices are used — (1) a special sounding tube which is driven into the sea bed by the force of a weight to which it is attached — and recovered with a sample of the sub-surface deposit, (2) a clinometer, consisting of a sledge-like contrivance having a flat surface for sliding over the bottom. This clinometer carries a recording pendulum electrically connected so as to delineate the undulations of the sea bed. The manoeuvres associated with laying an entrenched cable require much skill and experience.

They consist of:

(a) hoisting the plough from its position on deck, lowering it over the side by a special winch,
(b) connecting up the messenger cable, and
(c) paying out the cable rope through the plough bell-mouth and trunk way.

As the illustration shews, when the plough is on the sea bed, the cable to be ploughed-in leads to mid-ship sheave on the ship's side and forward over the bow sheaves with which every cable vessel is fitted. The tow chain being led through the bows also ensures that the submarine cable and towing chain are in the same direction for strain when in action.

The lowering rope which is used to place the plough on the sea bottom is automatically released when the sea bottom receives the weight of the plough.

It is essential in manoeuvring the ship that suitable tensions are maintained on the four lines. Tow chain, submarine cable rope, messenger line, and lowering rope.

The cable rope is a length of rope used as a pilot for the cable to be inserted, it has a mushroom anchor attached to one end, which is payed out first, and the cable to be laid is spliced to the other end.

When in action a speed of three knots is deemed sufficient and the course is set, the cable being paid out over one bow sheave and the tow chain over another. The tow chain is led to the windlass below deck where it is held of payed out as required by depth of water and stresses encountered. After the ploughing of the cable has been completed the plough is hauled up by the tow chain and taken on board the ship.. The total weight of the tow chain, together with plough is 20 tons.

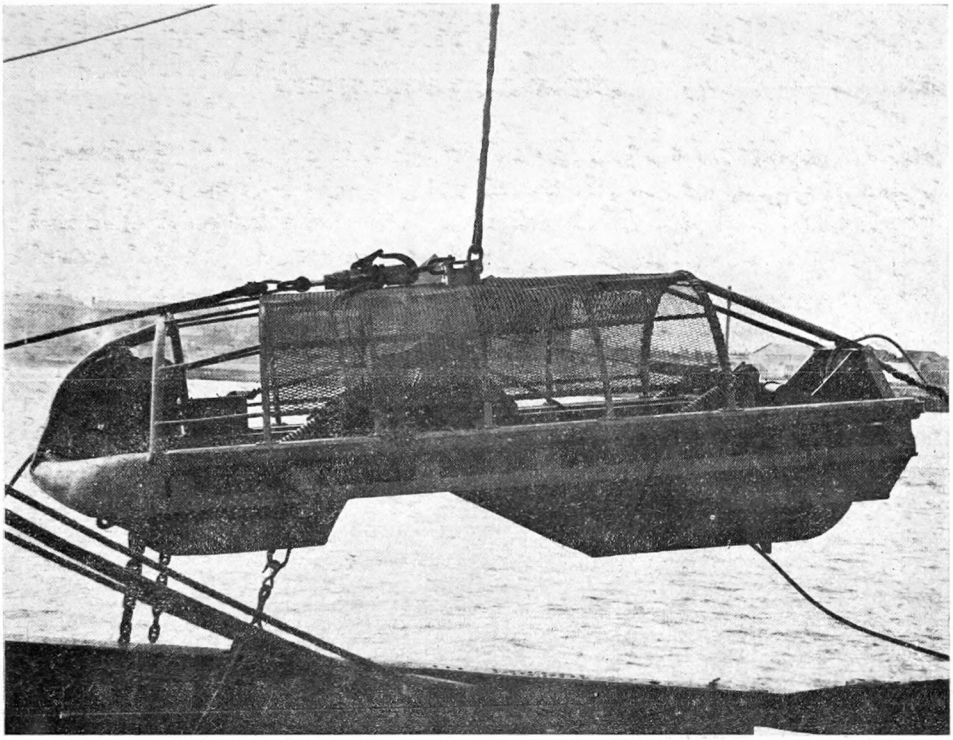
The technical devices to ensure success have been developed by Captain Bloomer and the techniciens of the Cable Company. They are as follows:

(1) Dynamometer — a strain indicating instrument common to cable laying.
(2) Penetration gauge.
(3) Cable feeler.
(4) Recording pendulum.

All four of these devices connect by means of the messenger cable to electrical recording instruments in the chart house where the various functions of the plough are recorded on moving tapes (shewing the progress in graphic form).

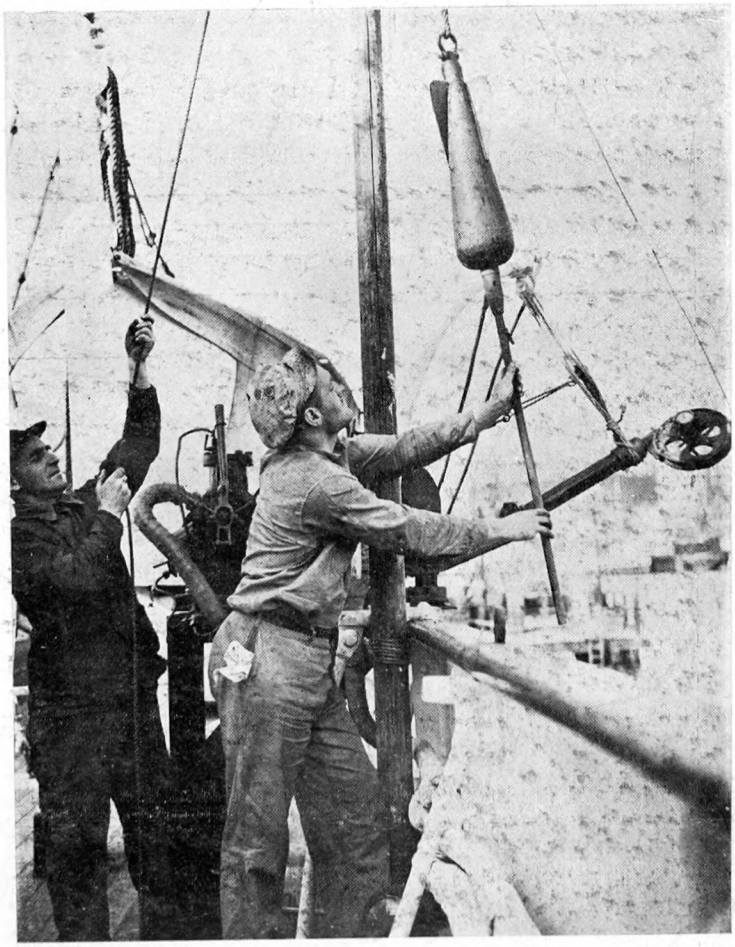
A "Hughes" recording super-sonic echo sounder gives a simultaneous sounding graph as required.

Upon completion of the ploughing operation a special test is applied by a Depthometer to ascertain the depth to which the cable is buried. The Depthometer is a sledge which is towed along the ocean bottom at right angles to the line of the buried cable, having its electrical coil connections carried to the ship through conductors in the towing cable, the ship making a U turn after each crossing of the cable. Use is made of the fact that ocean cables have a protective layer of steel or iron armour wires around the outside, and that these wires are magnetised, chiefly by the earth's magnetic field. The coils in the sledge, which is towed across the cable, intercept the magnetic field of the steel or iron armour wires, thereby generating a small voltage which is transmitted to the ship where it is amplified and finally recorded on a moving strip of paper. The strength of the signal depends on the speed at which the sledge crosses the cable, doubling the speed will double the signal. The strength of such signal also depends upon the distance between the sledge and cable at the moment of crossing and is inversely proportional to the square of this distance. That is, if the distance is doubled the signal drops to one-fourth or if the distance is trebled the signal drops to one sixth. Knowing from a calibration the value of the signal at various distances between the sledge



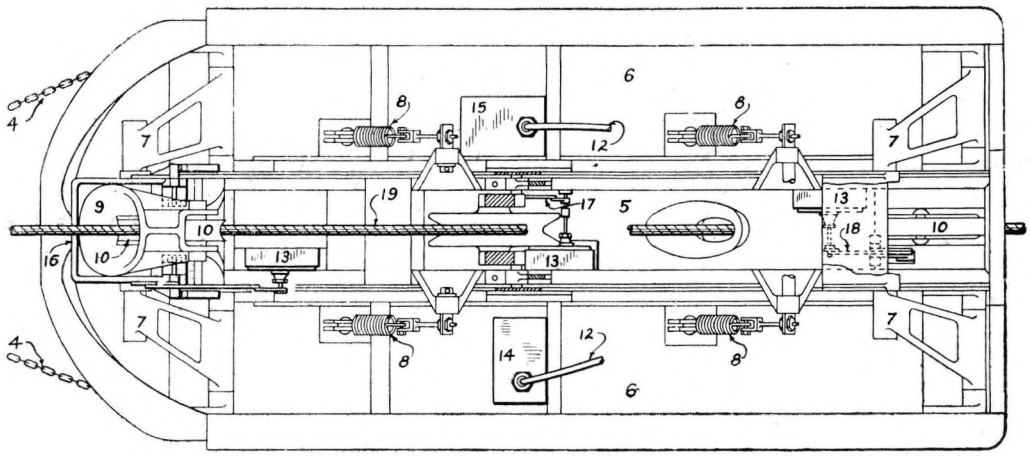
Submarine Cable Plough.

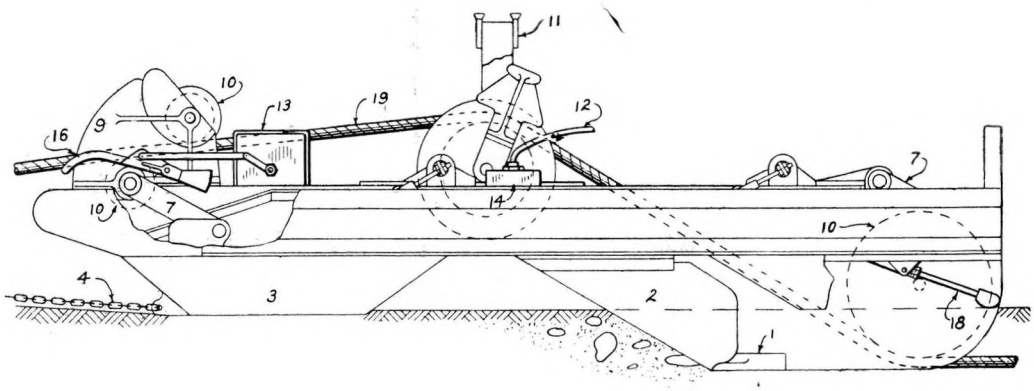
Charrue Spéciale pour creuser un sillon sous-marin.



Special Sounding Tube.

Tube Sondeur spécial.





1 - SHARE
2 - GUARD PLATE
3 - RUNNERS
4 - TOWING CHAIN
5 - LOWER DECK OR PLATFORM
6 - UPPER OR MAIN DECK
7 - ARMS AND HINGE PINS
8 - TENSION SPRINGS
9 - BELLMOUTH
10 - GUIDE SHEAVES
11 - LOWERING ATTACHMENT
12 - ELECTRIC CABLE
13 - RHEOSTAT BOXES
14 - PENDULUM - TRANSVERSE
15 - PENDULUM - LONGITUDINAL
16 - CABLE FEELER OR INCLINATION GAUGE
17 - CABLE DYNAMOMETER
18 - PENETRATION GAUGE
19 - SUBMARINE CABLE PASSING THROUGH PLOW

LENGTH OVERALL - 19'-9" WIDTH - 8'-11" WEIGHT IN AIR - 10½ LONG TONS

C.S. LORD KELVIN.

OCEAN CABLE ENGINEER - WESTERN UNION TELEGRAPH CO

and the buried cable and allowing for the speed, it is possible by this Depthometer to measure the distance buried from the strength of the signal received.

In order to prevent loss of the valuable towing gear, a special type of towing chain is used. This is a one inch nickel steel stud link chain. This chain stands a proof load of 84,000 pounds. To avoid connections it is manufactured in one length of 4,200 feet. The total weight being 43,000 pounds.

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