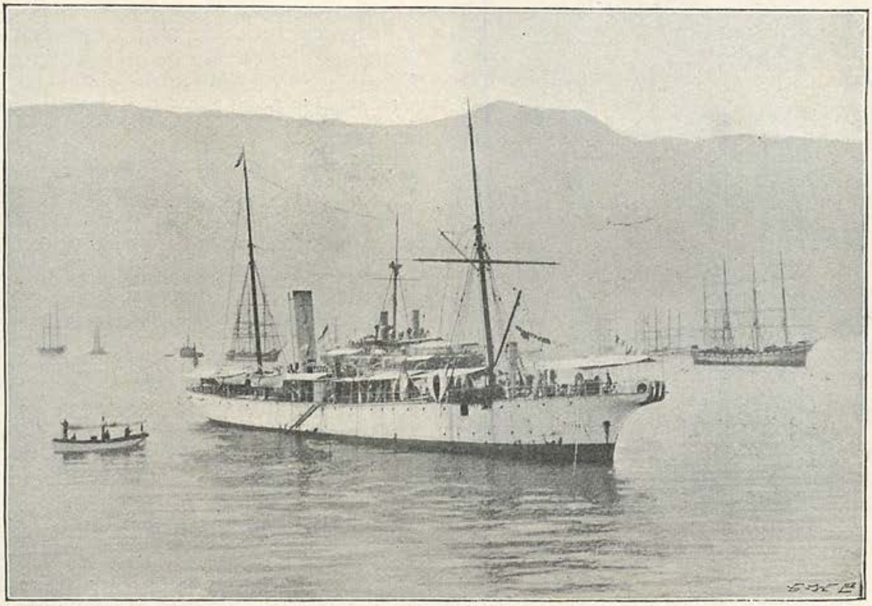
Submarine Cable Laying.

By Archer Philip Crouch, C.E.

From photographs, by permission of the Indiarubber, Guttapercha, and Telegraph Works, Silvertown, E.

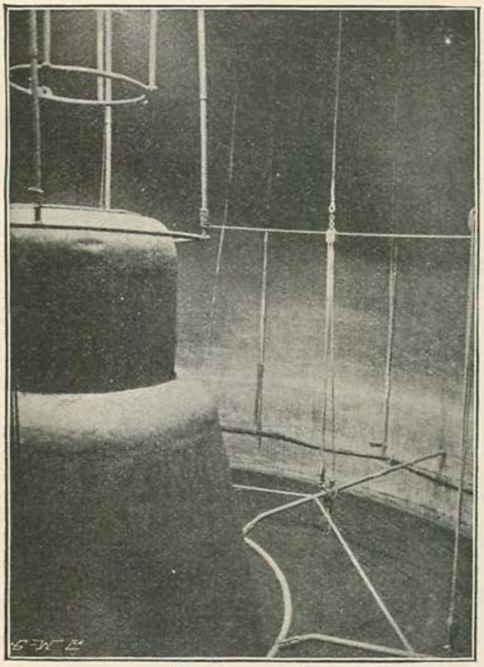


From a] THE CABLE STEAMSHIP "RILEY." [*Photo.*

THIRTY-SIX years have passed away since Sir Charles Bright laid the first Atlantic cable, and the younger generation know nothing of the immense enthusiasm which the great project evoked among all classes at that period. Owing to errors of construction this cable did not last long; but when, seven years later, the second attempt was made, all the former excitement was revived. Special correspondents accompanied the expedition, and the progress of the work, as reported daily through the cable, was followed with the keenest interest. On its successful completion the problem of deep-sea communication seemed definitely solved, and subsequent cables attracted little attention. But the work of submarine telegraphy went steadily on, and at the present time there are ten Atlantic cables, with two more in course of construction; while thirty-six telegraph ships are employed in laying new lines or repairing the 130,000 miles of cable already at the bottom of the sea.

Before a cable is laid it has, of course, to be made, and all the cables now in existence have, with a few insignificant exceptions, come from three large cable factories on the banks of the Thames. Till within the last four or five years England was the only country which manufactured submarine cables, but now France and Italy have appeared as competitors in the industry. The amount they make, however, is at present inconsiderable.

A submarine cable consists of three portions: the conductor, or central copper wire, through which the electric current passes; the insulator, or gutta-percha covering, designed to prevent the escape of electricity; and the sheathing, or outer steel wires, added to give the cable sufficient strength to be proof against the strain of laying and picking up. The conductor, which usually consists of six fine copper wires stranded round a central one, has three coverings of gutta-percha alternated with a sticky compound, to make them adhere perfectly together. The smallest air-hole or pin-prick causes a fault in the cable, which the current rapidly develops till signalling becomes impossible. Gutta-percha is not an absolute insulator of electricity, but its conductivity is so small, that it may be said to stand in the same relation to copper as the rate of a body moving through 1ft. in 6,700 years is to the velocity of light.



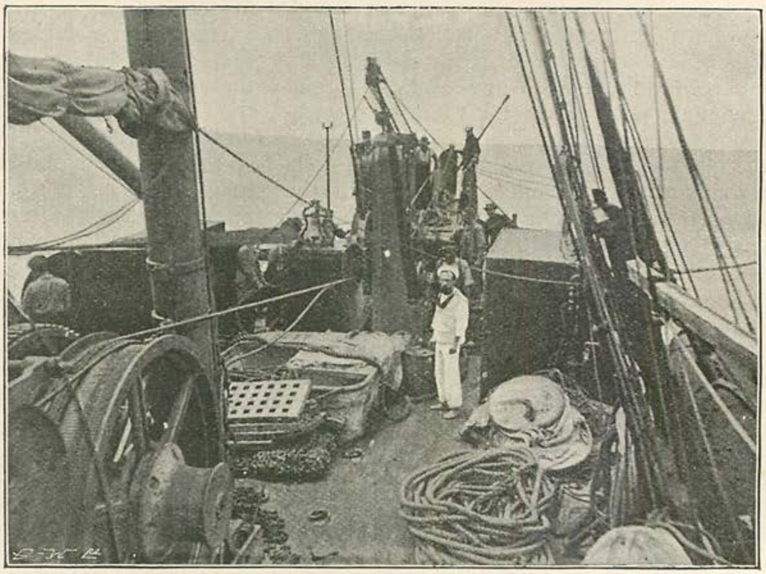
CABLE TANK OF SS. "SILVERTOWN," WITH CENTRAL CONE AND "CRINOLINE," TO PREVENT CABLE GETTING FOULED IN PAYING OUT.
From a] [*Photo.*

As the completed cable leaves the machine, it is coiled into large tanks and covered with water to preserve it in good condition till the ship is ready to receive it. The tanks are built near to the water's edge, so that the loading of the ship, which lies in the river, may be carried on as conveniently as possible. The loading itself is an interesting process to watch. The cable is hauled out of the tanks by a temporary engine on the deck of the ship, and is supported in the space between ship and shore by passing over running blocks suspended from scaffolding, which is erected in two or three empty barges, moored fore and aft. On reaching the deck, the cable is let down into one of the tanks with which all telegraph ships are provided. Here a number of men are stationed to coil it in regular turns round a central cone. One of them receives it as it descends, and running round brings it within reach of the others, who place it close against the preceding turn. In the case of large tanks and a heavy type of cable, this man's work is very hard, and he has to be relieved at frequent intervals. With a light type of cable the rate of coiling is sometimes as high as six knots an hour.

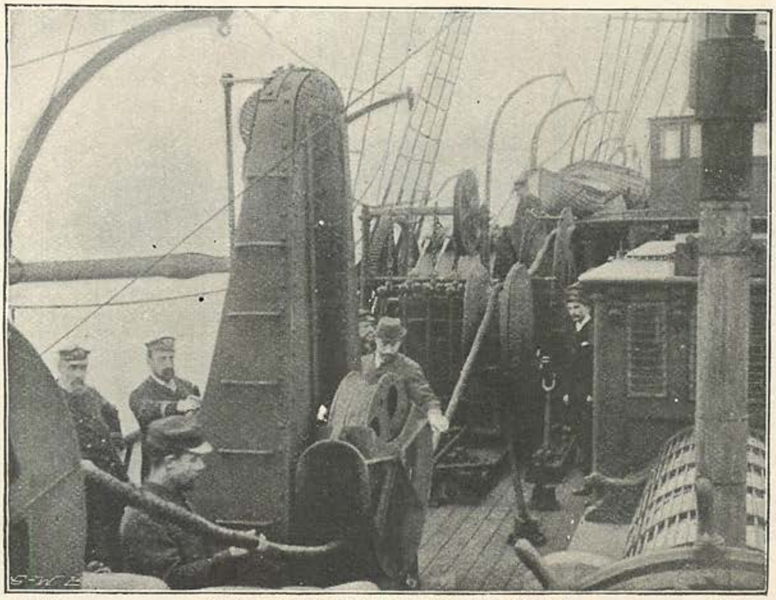
The size of the tanks in a telegraph ship is an important point in cable-laying, for the larger they are, the wider is the margin of safety with regard to the speed of paying out.

The *Silvertown*, belonging to the Silvertown Telegraph Works Company, is the largest ship in the cable fleet. Her three tanks are 30ft. in depth and average 50ft. in diameter. Their cubical contents are one-third greater than those of the late *Great Eastern*. The size of the tanks gives the vessel a large beam, and the bridge is 55ft. broad, which is one foot in excess of London Bridge. Her draught when fully loaded is 31ft., the greatest draught of any ship afloat.

Previously to laying a cable, it is necessary to take careful soundings over the intended route. This is done either by the vessel which brings out the cable or by some other telegraph ship beforehand. Sounding plays a very important part in submarine telegraphy, for sudden variations of depth, if unexpected and not allowed for, often prove fatal to a cable. The sounding apparatus is usually



From a] PAYING OUT CABLE FROM THE BOWS—SS. "BUCCANEER." [*Photo.*

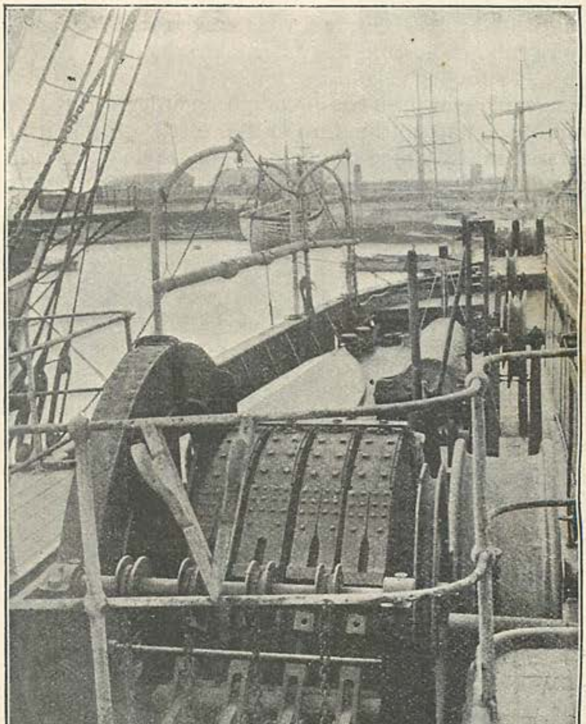


From a] PAYING-OUT MACHINERY ON THE SS. "DACIA." *[Photo.*

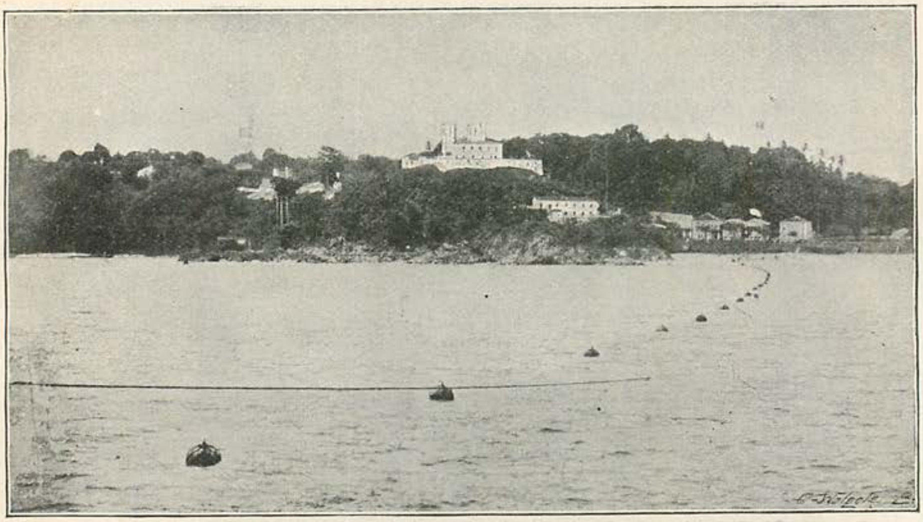
suitable place for landing the cable. As this must be well clear of the area in which ships are accustomed to anchor, it is often three or four miles from the town, and is connected with it by means of a land line or a bay cable. When the spot has been chosen the carpenters are sent ashore to erect the cable hut which has been brought out on the ship. The vessel is then anchored as near as possible to the hut, and preparations are made to land the shore end. The method followed by the

placed at the stern of the vessel, and its principal feature is a drum about 2ft. in diameter, on which is coiled some 4,000 fathoms of fine pianoforte wire. By means of this wire the sounder is lowered to, and recovered from, the bottom. In order to accelerate the speed of sinking, a heavy weight, in the form of an oval shot of 20lb. to 60lb., is added ; and, by an ingenious piece of mechanism in the sounder, becomes detached on touching the ground, so that the strain on the wire during recovery is considerably lessened. On account of the friction augmenting with the increasing length of wire in the water, the sounder sinks slower and slower the farther it goes. Still, the average rate for descent is over 100 fathoms a minute, and for recovery somewhat less. A complete sounding in 2,000 fathoms, or nearly 2⅓ statute miles, has been known to occupy barely 38min. from the time when the sounder plunged into the water to the time of its reappearance at the surface.

When the cable is all on board, and the final tests have been taken, the ship leaves for her destination. Arrived here, the first care of the engineer-in-chief is to select a



From a] PAYING-OUT MACHINERY ON THE SS. "SILVERTOWN." *[Photo.*

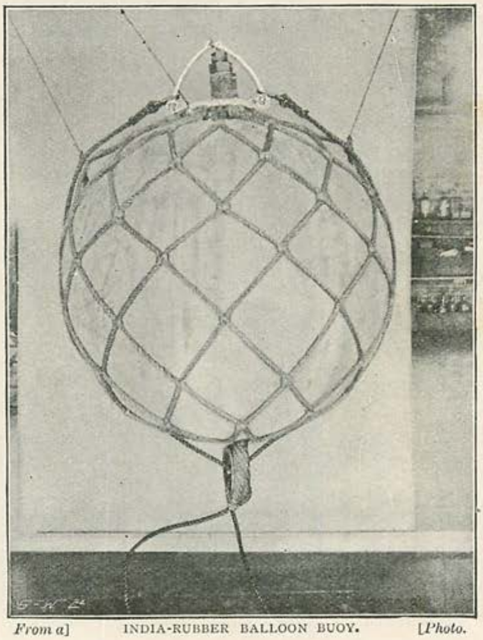


LANDING CABLE AT BAHIA, BRAZIL. SHOWING HAULING LINE AND BALLOON BUOYS SUPPORTING CABLE.
From a Photo.

"Silvertown" Company is to attach two "spider sheaves," or large V-shaped wheels, to sand anchors securely buried on the beach and about sixty yards apart. A strong line is then run from the ship round these two wheels and back again. One end is secured to the end of the cable, and the other end is hauled on to by the heaving-in machinery on board. The cable end itself has already been brought out of the tank to the stern of the vessel. On its way it takes three turns round the paying-out drum, and thence passes under the dynamometer, a machine for measuring the strain on the cable during laying.

When all is ready the word is given to heave-in on the line, and the cable starts on its journey to the shore. In order to prevent it sinking to the bottom on its way, large india-rubber balloon buoys, nearly a yard in diameter, are attached at intervals of 30ft. to 60ft., and support it 2ft. or 3ft. below the surface. Meanwhile a trench has been opened up from the shore to the hut, to receive the cable and shelter it from the injurious effects of exposure to the sun. On reaching the shore it is laid along this trench and the end inserted through the flooring into the hut, where it is connected to the speaking instruments, and establishes communication with the ship.

The cable is now released from the buoys, and when the cable hands have returned to the ship, the anchor is weighed, and "paying out" commences. The rate, at first slow, is considerably accelerated on reaching the lighter type of cable, and the *Silvertown* can lay at the rate of nine knots and sometimes even ten knots, the size of her tanks making the operation free from danger. The first shore end is usually buoyed some ten to twenty miles from shore, and then the vessel steams on to land the shore end at the second of the two places which are to be put in telegraphic communication. If the cable is a long one, such as an Atlantic cable, it will take at least ten or twelve days. Relays of watches give unremitting attention to every detail of the work.

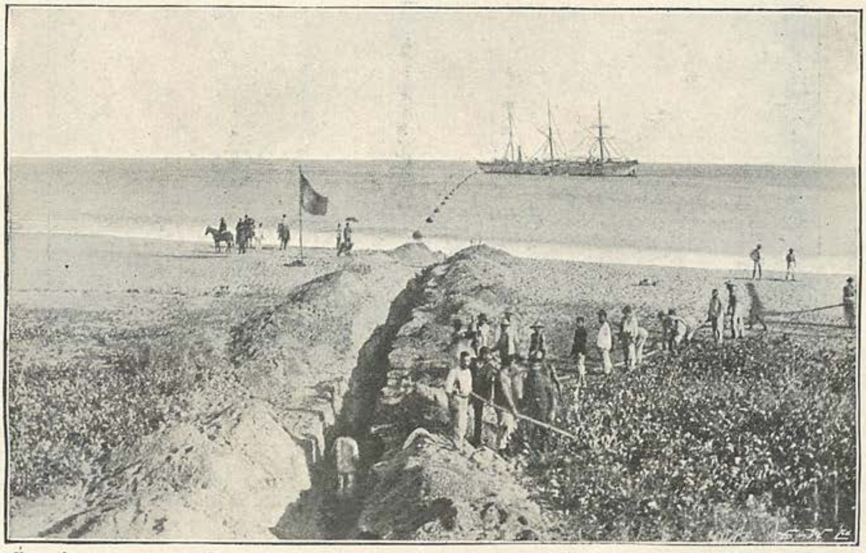


From a] INDIA-RUBBER BALLOON BUOY. *[Photo.*

The engineer-in-chief decides the amount of *slack* cable—that is, cable in excess of the distance travelled—which the depth and the character of the sea bottom necessitate.

The rate of paying out is regulated by varying the amount of the weights on the paying-out drum. A man is stationed at a hand-wheel in front of the dynamometer to watch the strain it registers, and to increase or decrease the pressure of the brakes, according as this strain is too little or too great. In the tank from which the cable is being paid out, half-a-dozen men are employed removing the thin laths of wood between the flakes, and keeping watch on the cable, as it rises from its bed like an interminable snake, and ascends wriggling and twisting to the eye-hole at the top of the tank. The foreman stands above, close to an electric bell-push communicating with the engine-room, ready to ring " stop her " directly anything goes wrong. The enormous strain thrown upon a cable by a foul in the tanks may be better understood when it is known that, if paying out in 2,900 fathoms at only 6½ knots an hour, from the stern of the ship to the spot where the cable touches the ground there is a length of no less than twenty-seven statute miles, a particular point of cable taking over three hours to reach the bottom.

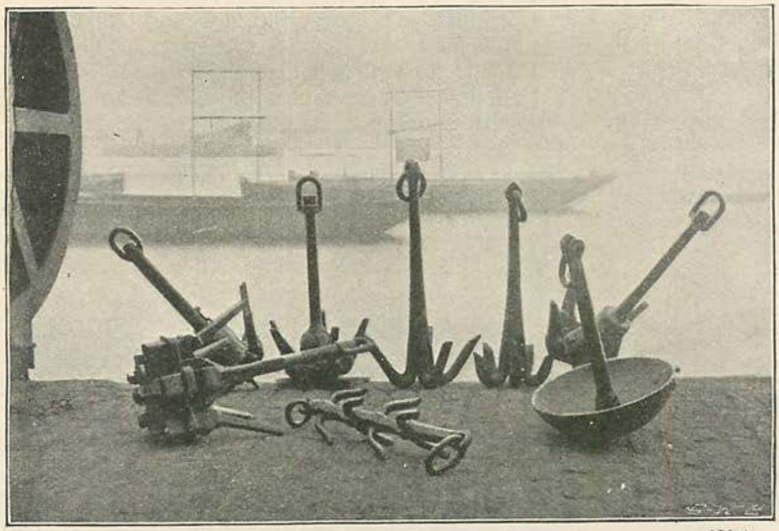
But perhaps the most interesting work is to be seen in the testing-room. Here the electrician sits at his post in front of an array of testing instruments, with their bright brass terminals and glossy ebonite bases, and watches the small round spot of light, thrown by the mirror of the galvanometer, as it quivers on the darkened scale. Every five minutes, almost to the second, this small spot gives a sudden leap, proving that the electrician left ashore in the hut has sent his signal up to time, and that the continuity of the inner wire remains unbroken. Should the spot suddenly vanish from the scale and not return, the electrician knows that a fault has developed, the engineer-in-chief is at once informed, and the ship is stopped. The cable is then picked up with a grapnel, several kinds of which are shown in the next illustration. When the fault comes on board, it is cut out, the two ends spliced, and paying out resumed.



From a] SS. "SILVERTOWN" LANDING SHORE END AT FERNANDO NORONHA. [*Photo.*

At length the ship comes up to the buoy attached to the cable which was the first to be laid, the end is hauled on board and spliced to the cable which the ship has been paying out, and which has been cut and brought round to the bows for the purpose. On the completion of the splice, it is carefully lowered over the bows by a couple of manila ropes, and when it is well clear of the ship the signal is given, two men with sharp axes sever the two ropes, and the cable disappears with a farewell swish beneath the surface.

The interest of a cable expedition is not confined to the work alone. Cable engineers are the greatest travellers of any profession, the Navy, of course, excepted. An officer in the mercantile marine is not, as a rule, acquainted with as many coasts as a submarine telegraph engineer his equal in age. For a ship's officer, after his apprenticeship in sailing vessels, usually enters a line of steamers which call, voyage after voyage, at the same places with unvarying routine; whereas a cable engineer may go to a different part of the world with every trip. At one season of the year he is laying a cable at some small settlement on the West Coast of Africa, consisting of barely half-a-dozen European inhabitants, and so little known that even its position is not properly located on the Admiralty charts. A few months later he is putting in a new shore end at one of the busy Australian ports. Plenty of adventures lie in his path. Sometimes he is on the coast of a South American Republic at the height of a revolution, and encounters all the difficulties and even risks of laying cable from one port in the hands of the Government to another in the hands of its opponents. On one occasion the late King of Dahomey, before his power had been shattered by the French, sent a message to the cable engineer, who had erected a hut on what His Majesty considered to be his territory, that he would come down with his amazons and "sweep the white men into the sea," if it were not removed at once.



From a] VARIOUS KINDS OF GRAPNELS AND A MUSHROOM ANCHOR. *[Photo.*

Less hazardous, but considerably more irksome, are the vexatious local regulations of small Colonial ports. On arriving at a French settlement on the West Coast of Africa, a telegraph ship from Pernambuco was put in quarantine, although she had been twenty-two days at sea, and the climate of the West Coast at that season of the year was far more deadly than Brazil. Leave was, however, granted to land the cable at a certain spot, which was to be roped off and guarded by a cordon of soldiers. There was a heavy surf, through which Europeans never ventured except in native canoes. Although none of these were allowed to approach the ship, the engineer-in-chief determined to land the cable. Those who have not tried to run an ordinary boat, propelled by oars, through West African breakers, can have no idea of the difficulties of the undertaking, but two boats succeeded in getting ashore with the necessary gear, and the cable was landed in the course of the day. On the return journey, however, both boats were capsized and stove in, and as the shore-party could not expect the ship to send any more in such a surf, they returned to the beach wet through, and prepared to spend the night on the sand. The governor relented sufficiently to send down a tent, together with food and change of clothes, which were delivered at the end of a pole, and the Englishmen made themselves fairly comfortable. The following morning the difficulty was surmounted by the crews of two native canoes offering to take them on board and then undergo twenty-four days' quarantine on shore, for which impending loss of liberty they were amply compensated.

This is one of the many fixes in which a cable engineer may at any time find himself, and their occurrence adds a sense of novelty, if not always of undiluted pleasure, to his varied career.