LAYING A CABLE.

IT was not much of a cable, after all, and its laying was no great performance, although forty years ago it might have been considered a marvel.

Science, in its so-called practical aspects, is now advancing in parallel lines; and these are so numerous, and some of them so far-reaching, that most men are unable to follow along more than one or two. This fact has suggested the idea that there may be something of interest to many in a description of this cable, and of the operation of putting it in the water.

It does not connect us with any foreign country; it does not complete the girdle round the earth: it is modestly content to serve as the link which joins the intelligence of the rest of the world with that of the interesting and important islands, Martha's Vineyard and Nantucket, where formerly the influence of the whale prevailed over all else, but now, alas! tributary to the state of Massachusetts, from which comes good government, and to the Standard oil company, from which comes petroleum, that arch enemy of the whale trade. But exclusiveness, even when aided by insulation, must give way to the progress of events. A glance at the map will show the nature of the forces operating in this case. Vineyard Sound is the great highway of the coasting trade. Thousands of vessels of all kinds pass through it every year. The harbors of Vineyard Haven (correctly named), Tarpaulin Cove, Lambert's Cove, etc., afford shelter for hundreds during rough weather. Wrecks are, unfortunately, not infrequent; and a visitor from the outside world is likely to see in the simple but perfectly neat and thrifty-looking home of the fisherman-farmer a carved and upholstered chair, or something of the kind, which is referred to with no little pride as a relic from the wreck of some passenger-steamer which went ashore with the loss of many lives and much property upon the coast near by.

The principal and sufficient reason for asking for a special appropriation from congress to secure telegraph communication with the mainland, was that stations of the U.S. signal service might be established on the islands, and particularly that danger-signals might then be displayed from the more prominent points for the guidance of the numerous sailing-craft constantly passing through the sound. Some years of effort were rewarded with success at the last session, an appropriation of forty thousand dollars having been made for the purpose of laying the necessary cable, amounting in all to less than thirty miles, and for erecting the land-lines, display-stations, etc. The work has been done, therefore, under the direction of the chief signal-officer.

The cable was made in London, and shipped to New York in the hold of a steamer, coiled in two large tanks especially built in the steamer for that purpose. It fortunately happens that the gutta-percha insulation, used almost exclusively for submarine cables, is improved and preserved by being kept damp, cracking and deteriorating when dry. For this reason it is necessary to keep the cable in tanks during its passage, so that it may be kept covered with water. The conducting part of the cable consists of seven copper wires, each about .028 inch in diameter, six being twisted about the seventh as a centre. The resistance of this conductor was not to exceed thirteen ohms per nautical mile, and it fell considerably short of that upon being measured. This copper core was covered with three or four layers of gutta-percha, until the diameter of what might be called the cable proper was a little more than a quarter of an inch. Such a cable would scarcely last while it was being put down, and it is therefore necessary to put an 'armor' upon it, so that it may be able to endure the destructive agencies to which it is likely to be subjected. The gutta-percha-copper core is wound with two or three layers of heavy jute twine, and this, again, with twelve number five galvanized iron wires laid on spirally. The result is apparently a strong iron rope about an inch and a quarter in diameter.

An examination of the cable was made in New York City, before its removal from the tanks referred to, for the purpose of seeing that its insulation was still intact. It was then transferred to a barge lying alongside, from which it was to be laid, and in which it was towed through the sound to Vineyard Haven. Its arrival at this place caused little less than a sensation. The first section of the cable was to be placed across Vineyard Sound; and, although not the longest, it was the section likely to cause the greatest anxiety. In fact, the Western union telegraph company has several times tried to place and maintain a cable from West Chop light on Martha's Vineyard to Nobska Point on the mainland, but their efforts have not been altogether successful. The damage to a cable across the sound arises from two sources. The tidal current is strong, at some points nearly three miles per hour; the seaweed, which is carried back and forth by this current, is caught on any suspended or exposed part of the cable, and twisted around it until huge, solid masses are attached to it, which offer so much surface to the swift current that the cable must give way under the strain. The other source of danger is quite as disastrous, and nearly as uncontrollable. It is in the dragging of ships' anchors across the line of the cable. In this way the cable is caught in the anchor and brought to the surface when the latter is hoisted. A little intelligence combined with good nature would enable the shipmaster to release the cable and drop it uninjured; but more frequently, in his annoyance, he will deliberately cut it in order to escape, although release without injury could be accomplished in less time. In putting in this cable, it was desirable to locate it so that the chances of damage from both of these sources might be reduced to a minimum. To this end the officers in charge of its laying did not need to seek advice from persons familiar with the waters, for it was freely offered by every inhabitant of the islands. The multitude included a few old sea-captains, who seemed to know every foot of the coast, and to understand the nature of the bottom of the sea; and it is believed that their words were words of wisdom. The route selected lay across the sound several miles to the westward of that already referred to. It is undoubtedly freer from probable damage arising out of the anchorage of vessels, but time alone can determine to what extent.

Every thing being in readiness, the barge was towed to the starting-point, which was the northern terminus of the cable on Naushon Island. As there was a good deal of a 'sea' running, it was not possible to approach nearer than twelve hundred or fifteen hundred feet from the shore. The tug was anchored, and the barge was allowed to drift in a few hundred feet farther. A stout rope an inch and a half in diameter was then attached to the end of the cable, eight or ten men were put into a boat, and the other end of the rope was carried ashore. The end of the cable was dropped overboard, and the operation of pulling it to the beach began. This was finally successful, and the shore end was made fast to a stout post which had been erected for the purpose. All hands came on board, anchor was weighed, the barge made fast to the tug, and the journey across the sound was begun. The cable lay in two great coils in the barge, and dropped into the water over the stern. It passed around and over a couple of large reels or drums, where a large pulley-brake was applied to it in order to regulate the tension to which it was subjected. To one of the drums a counter was attached, so that the rate at which it was paying out could at any time be determined. Wind and tide opposed each other, and the rate of sailing did not exceed five or six miles per hour. The opposition of wind and tide was favorable to a straight course, and good pilotage secured a run across which undoubtedly put the cable down in almost exactly a straight line from the point of departure to the southern terminus on Martha's Vineyard. At this end the landing was a little more difficult. A rope was first carried ashore, its length measured as it went out, to determine where to cut the cable that it might reach the beach from the anchorage. On its next trip the little surf-boat carried a small, weather-worn 'A' tent, a rough bench, batteries, galvanometers, resistance coils, and two shivering signal-service men, who were to test the cable as soon as it was landed. A rude testing-station was soon established amid the hillocks of sand, and the instruments were in position when the cable was at last landed, and secured to a portion of the wreck of an unfortunate vessel that had stranded upon the shore many years before. But the high winds were still rising, darkness was coming on, and the captain of the tug, declaring that he had had enough of cables for one day, ordered all hands on board forthwith. It was impossible to leave the instruments in that condition, and the prospects for a night on the beach seemed good, when the hospitality of the owner of the one house within sight brought relief, furnishing a storehouse for the appliances, a well-supplied table for keen appetites, and a wagon-ride at night through the woods to the hotel, seven or eight miles away.

On the following day the termini were again visited, the ends properly secured, and the cable tested. A trench was dug in the sand down to low-water mark, in which the cable was buried. At a point above high tide on the beach a strong post was erected, to which the cable was secured by means of a heavy chain; from which point, still underground, it was carried higher up the sand-hills on which it had been landed, to the foot of an ordinary telegraph-pole. It extended up the side of this, being enclosed in a box until it reached the top, where it entered the cable-box proper, the end being secured to a binding-screw ready for connection later with the land-line. Some of the party had been sent to Naushon Island, carrying with them an ordinary telegraph instrument and key. By previous agreement it was to be connected with the cable at once on the arrival of the party. A few cells of battery and a similar instrument were joined to the end on Martha's Vineyard, and the two expeditions had been timed so accurately that almost instantly responsive ticks proved that intelligence was at work on the other side. Much interest is often felt in the first message transmitted through a cable or telegraph line. Brushing aside the romance of the thing, it is safe to say that in nine cases out of ten the first message is that which traversed the river first on this occasion, being simply, 'Do you get me now?' After some further interchange of compliments, the operator on Naushon was directed to seal up the end of the cable by covering the exposed wire with gutta-percha. This having been done, communication ceased, and the insulation was tested. A number of battery cells were joined 'in series' to the galvanometer, which was a delicate instrument of high resistance, with a reflecting mirror, and to this the end of the cable was attached. The test was practically an endeavor to force the current through the gutta-percha insulation, the amount of the leak being measured by the deflection of the galvanometer needle. It had been demanded of the cable that it should show an insulation resistance of at least two hundred and fifty megohms per mile, and it greatly exceeded this number when tested.

A few days later, when wind and weather were favorable, the island of Nantucket was connected in a similar way with Martha's Vineyard, the cable taking a sweep out into the sea to avoid shoals; and finally a short piece, about a mile in length, was made to connect Naushon, by way of the little island Uncatena (always 'Uncle Timmy' at home), with Wood's Holl, and thus was completed the union of these islands with the mainland, which it is hoped may last for many years.

M.

PHYSICS AT JOHNS HOPKINS.

The large and well-appointed laboratories recently erected by the trustees of the Johns Hopkins university for the chemical and biological departments have by contrast made the more evident the needs of the physical department, which has been obliged to occupy temporarily parts of four different buildings. The trustees, recognizing this need, are now erecting a building for a physical laboratory. The new laboratory is to be a handsome building of red brick, trimmed with brown sandstone, and will occupy a fine site about a block from the other university buildings, on the corner of a quiet little street midway between the more important streets, which carry the bulk of the traffic of that region. It will therefore be as free from disturbance from the earth vibrations as could be expected in a city.

The building will be 115 feet long by 70 feet broad, and will have four stories besides the basement. In the centre of the building, and below the basement, are several vaults for instruments requiring to be used at constant temperature, also a fire-proof vault for storage. In these vaults will be placed Professor Rowland's dividing-engine, by which the diffraction gratings are ruled, and the Rogers-Bond comparator, which has recently become the property of the university. In the basement will be rooms for the mechanical workshop, for furnaces, and for piers for instruments requiring great stability. The first floor will include the main lecture-room, which will accommodate 150 persons, and rooms for investigations by advanced students in heat and electricity. The second floor will contain mathematical lecture-rooms, studies for instructors, and a room for the mathematical and physical library of the university.

The elementary laboratory will be on the third floor, which will also have rooms for more advanced work. The fourth floor will contain rooms for special work in light.

There will be a tower on the south-east corner of the building, which will have two rooms above the fourth floor. The upper of these will be provided with telescope and dome, and will be a convenient observatory when great steadiness in the instruments is not required. There will be power in the building for driving the machinery in the workshop and for running the dynamo-machines. A large section of the building is to be made entirely free from iron. The sash-weights will be of lead, and the gas-pipes of brass. Brackets will be attached to the walls, on which galvanometers and cathetometers may be placed. In order to avoid the inconvenience of having piers go up through the lower rooms, and yet to secure steadiness, beams have been introduced into the floors, which reach from one wall to the other between the regular floor-beams, and do not touch the floor at any point. If, now, a table is made to rest on two of these beams, by making holes in the floor over them to admit the legs of the table, it is entirely undisturbed by any one walking over the floor, except by such motion as is transmitted to the walls. There will also be a small vertical shaft in the wall of the tower, running from top to bottom, in which a mercurial manometer may be set up.

The vaults for constant temperature have been built with double walls, so that a current of air may be drawn between them whenever desirable to prevent dampness. It is expected that the laboratory will be ready by October next.

The photographic map of the spectrum, upon which Professor Rowland has expended so much hard work during the past three years, is nearly ready for publication. The map is issued in a series of seven plates, covering the region from wave-length 3100 to 5790. Each plate is three feet long and one foot wide, and contains two strips of the spectrum, except plate No. 2, which contains three. Most of the plates are on a scale three