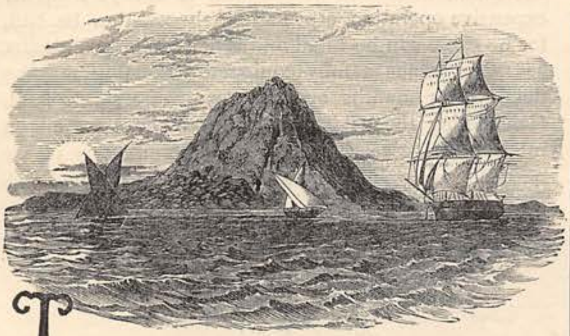
THE CABLE TO THE CAPE.



THE recent disaster that befell our arms at Isandula, in Zululand, has called imperatively for a means of telegraphic communication with our colonies at the Cape of Good Hope; and, after a few weeks of necessary delay, the work has been commenced, and a steamer despatched from the Thames with the first section of a submarine cable designed to connect Natal, and the South African inland telegraph lines, with the existing cables running from England to India.

The question of a telegraph to the Cape has been before the public for some years now, but the settlement of it has hitherto been, from one cause and another, deferred. The expense of such an undertaking is considerable, and the colonies could not of themselves provide the requisite funds. Neither did the Imperial Government see sufficient advantages in the scheme to justify their taking a share in the work. On the other hand, the revenue to be expected from all the messages which would be likely to pass over the cable was not enough to tempt a private company to lay a cable or erect a land-line to the Cape, unless assisted by large subsidies from the colonies or the home Government. Consequently, although Australia and New Zealand, Canada, India, and Demerara, were all supplied with telegraph lines linking them to the mother-country and the rest of the civilised world, the great cluster of South African dependencies was left isolated, with only the mail steamers and other vessels to fetch and carry news at more or less uncertain intervals. The Zulu war, however, brought matters to a head. The Government see that the expense of a cable might quickly be saved by the boon of swift intelligence which it would confer; and ere the end of next autumn, should no unforeseen accident intervene, the long-mooted Cape cable will be an accomplished fact.

Two distinct modes of telegraphic communication with the Cape have been debated of late, and brought before the notice of Sir Michael Hicks-Beach, the Colonial Secretary. One advocated the erection of an overland line through the interior of the African continent, the other a submarine cable laid, as might be selected, along the east or west coast. The overland line scheme was developed, if not originated, by Mr. James Sivewright, the Superintendent of Telegraphs for Cape Colony. At present the Egyptian telegraph lines extend to Khartoum, in Nubia, at the junction of the Blue and White Niles, and in a comparatively short time they will reach as far as Gondokoro, on the White Nile, some 200 miles below its rise in the Albert Nyanza, lat. 4° 54′ N. The colonial lines now run as far north as Pretoria, the capital of the Transvaal territory. From this place the distance to Gondokoro, as the crow flies, is 2,000 miles; but a direct route through the centre of the continent by way of the great lakes is wisely discarded by Mr. Sivewright. His plan is to connect Pretoria to Gondokoro by a single-line wire 2,500 miles long, extending in three great divisions from Pretoria to Tete, a trading town at the head of the navigable Zambesi, from Tete to Zanzibar on the east coast, and from Zanzibar to Gondokoro. The first division would take in the capitals of several friendly native chiefs, and would pass through well-known territory. The second would take in the mission-town called Livingstonia, on Lake Nyassa, and would then follow the route traversed by Livingstone in his earlier journeys to near Cape Delgado, and thence to Zanzibar, over country which Dr. Kirk describes as both safe and easy. The next section would be the most difficult of all, since it would have to pass through an unexplored region peopled by unfriendly savages. Mr. Stanley and other travellers have pronounced strongly against the feasibility of this part of the undertaking. The country above Zanzibar is infested by the *tetse* fly, which would kill the transport bullocks, and necessitate the use of coolies or camels. The forests are a dense and reeking jungle, infected with the seeds of fever, and both money and life would have to be recklessly lavished ere the work could be carried out. With Pretoria, Tete, Zanzibar, and Gondokoro as bases of operation the range of transport would, however, not exceed 400 miles in any direction, whereas in constructing the Australian overland line everything required had sometimes to be carried in wagons over 1,200 miles of desert.

The chief advantages of a land-line over a cable are that it is less expensive to construct at first, and although it requires to be repaired oftener, it is more cheaply maintained on the whole, since a flaw in it can so readily be got at as compared with a cable lying on the sea-bottom. A land-line in Africa would also open up the country in a way which a cable touching only at a few points on the coast could not do; and, besides, should the traffic grow too much for a single wire, another wire can easily be erected on the same posts, without much additional expense, at a future time. Land-lines are subject to many mishaps, but it is doubtful if they experience more of these than cables, although they seem to be more openly exposed to them. Wild elephants, with a keen eye for jungle novelties and a lordly jealousy of interloping things, have been known to uproot with their trunks a line of telegraph-posts for miles; crows and monkeys sometimes lodge offal and rubbish on the wires; hurricanes level them with the ground; trees fall across and break them down; lightning splinters the posts and shatters the porcelain insulating cups; savages steal the wire for arrow-heads or ornaments; the riotous vegetation encroaches on the line and clings about the wires. But all these ills can be overcome with patience, attention, and a moderate amount of money. On the other hand, a submarine cable represents a vast sum of money hazardously flung into the sea, and exposed throughout its attenuated length to some attack of beast, or chemistry, or force of rock and wave, which may render the whole useless until the particular harm is mended. The African coast is beset with coral reefs and shoals, whose jagged edges can file the slender rope in twain as it is swayed about by tides or storm-waves; voracious fishes may crush it in their powerful jaws; the insidious teredo-worm, which nature has endowed with a pair of sharp cutting forceps and a ruinous relish for gutta-percha, may prey upon its very core; and even the salt water itself will slowly and silently dissolve the iron wires which sheath it, until it is left too weak and unprotected to resist injury or bear to be lifted to the surface for repair.

In addition to these external causes of "faults," there are inherent defects in a cable which only show themselves in course of time so as to interfere with the communication. The recovery of the damaged cable and extraction of the fault is always a highly expensive operation, especially if the weather be bad, for no cable can be lifted and repaired except in quiet seas, and hence a fully equipped steamship may be detained for months over the repair of a single fault. Considering the wild and unknown character of the interior of Africa, however, and the urgency of the need for telegraphic communication with the Cape, we cannot but think that the Government have done right in preferring a cable to a land-line. It is always advisable to have an alternative route, however, in case of interruption, and Mr. Sivewright's scheme has much to recommend it for this purpose; so that before the century is ended it is not unlikely that an overland wire will stretch all the way through Central Africa, from Alexandria to Cape Town.

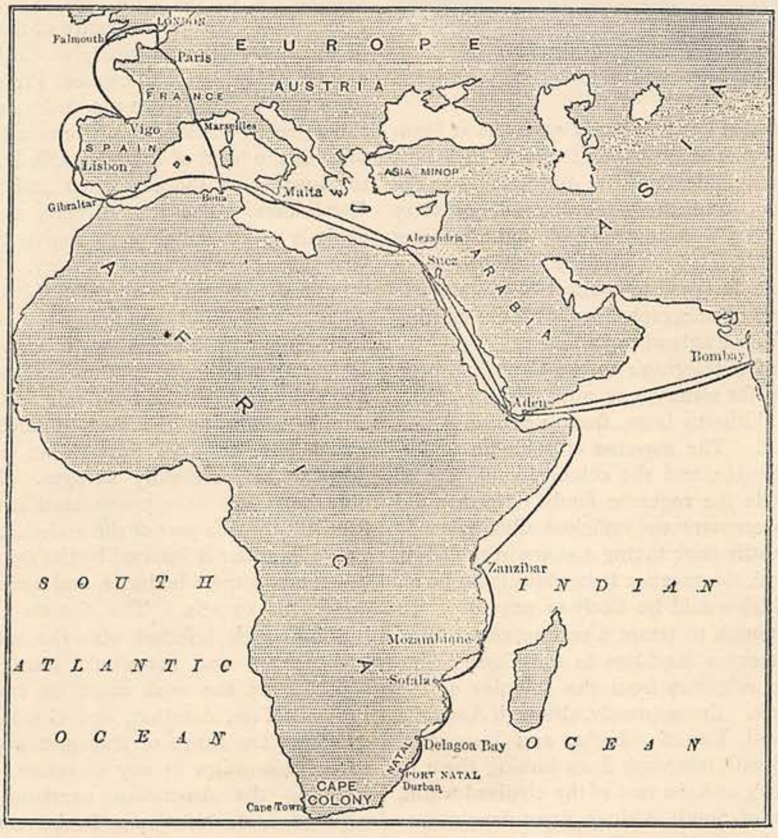


CHART SHOWING THE COURSE OF THE NEW CABLE TO THE CAPE.

Three different plans for cable communication have been tendered to the Government, namely—a cable along the west coast of Africa, from the Cape of Good Hope, *viâ* Cape Coast Castle and St. Helena, to the island of St. Vincent, where it would join the existing cable from Pernambuco (Brazil) to Madeira, Lisbon, and England; a cable from Port Natal to Cape

Comorin, in India, *viâ* the Seychelles Islands; and lastly, that which has been accepted, the Eastern Telegraph Company's proposal to connect Port Natal to Aden, touching at the chief trading towns along the coast, Delagoa Bay, Sofalá, Mozambique, and Zanzibar. At first sight it would seem that the second of these routes should have been preferred on Imperial grounds, since it links the South African colonies to India, which is already connected to England by two routes, the Indo-European line and the Eastern Telegraph Company's cables. But the Indo-European line has the disadvantage of passing through Persian, Turkish, and Russian territory; and Aden is a point equally connected to India and England.

The new cable will be some 4,000 miles long, and will cost about £1,000,000. There are about 2,000 miles of cable already made, including 1,500 which had been prepared to duplicate the Australian line of the Eastern Extension Telegraph Company. This portion has been shipped in the steamship *Kangaroo*, belonging to the contractors (the Telegraph Construction and Maintenance Company of Greenwich), and is, as we write, on its way to Durban (Port Natal) to be laid to Zanzibar. If all goes well, this half of the work will have been accomplished by the middle of July, and the remainder will probably be completed by October next. The Eastern Company undertake to lay and work the cable as a private enterprise, supported by subsidies from the home and colonial Governments, amounting to £50,000, for a period of twenty years, in order to cover the estimated deficit of revenue.

The Eastern Telegraph Company's lines of communication from England to Aden, as shown on the accompanying sketch-map, consist of a cable from Falmouth to Malta, touching at Vigo in North Spain, Lisbon, and Gibraltar. Another line runs from London to Malta overland—through France to Marseilles, and thence by cable to Bona in Algeria, and from Bona to Malta. From Malta two cables run to Alexandria, thence a land line runs across the desert to Suez, and thence two cables proceed to Aden, on the southern corner of Arabia. Aden is an English fortress city, built in an extinct crater, and guarded by impassable volcanic peaks. It has a large export trade in coffee, gums, and spices. From Aden two cables stretch across the Indian Ocean to Bombay, and from thence lines extend by devious routes to Java and Australasia, to China and Japan. Zanzibar, the first place of call on the southward line of the new cable, is a fertile coral island close to the African coast, with a luxuriant vegetation, and a growing trade in manioc, sugar, cloves, and other tropical produce. Mozambique is the metropolis of the Portuguese possessions, and although all its ancient forts and palaces are falling into decay, it still exports a good deal of ivory from the Zambesi country—coir, coffee, manioc, and gold-dust from Sofalá and Delagoa. Natal is a fine grazing country, and, in addition to hides and tallow, exports sugar, indigo, and coffee; while Cape Colony sends home grain, wool, Cape wine, ostrich feathers, and ivory.

The new cable will quicken trade in these rich but remote countries, and it is eagerly desired by the colonists themselves. It will help also to speed the foot of civilisation into the interior of the country, and further the suppression of the cruel slave-trade. During the last twenty-five years we have seen cables crossing the stormy oceans, lacing the sides of continents, and threading the isles of the Indies together; the extremities of America have already been connected to Europe and Asia; and the new cable will complete the electric system which traverses all the great land-masses of the earth; so that Europe, Asia, Africa, America, throughout their length and breadth, will be united by wire.

J. MUNRO, C.E.

A WEDDING.

THE happy morn has smiling come;
Before God's altar man and wife,
Hand clasped in hand, all silent stand,
One flesh, one life:
Ah me! ah me!
Is it for joy or misery?

The parting words with friends are said,
The slippers and the rice are cast,
And to new life new man and wife
Have gaily passed:
Ah me! ah me!
Is it to joy or misery?

Is it to live as God has willed,
In bonds of love and sympathy?
Is it to share or joy or care
Co-equally?
Is life to be
One grand soul-stirring harmony?

Or is it rather day by day
To waken to their cruel fate?
With icy heart to drift apart,
And learn too late
That life must be
A dull, dead waste of misery?

Nay, God forbid! but let them go
To such sweet life of perfect love,
That hand in hand at length they'll stand
In heaven above,
And so may be
One life through all eternity.

W.

LAYING A SUBMARINE CABLE.

AFTER a lull of five or six years, there is at present a revival of cable-laying in various parts of the world. Every one knows that a ship is now engaged in laying the first section of the Cape Cable from Durban or Port Natal to Zanzibar. It is expected that she will finish this operation before the end of July, and that the remaining section of that important line of telegraphic communication will be completed and opened for traffic ere next New Year's Day. Similarly, the large cable steamer *Faraday* is now at sea laying the shore-end of the new French Atlantic Cable between Brest and the Scilly Islands; after which she will return to the Thames, to take on board the ocean portion, and then proceed to lay it from Scilly to the island of St. Pierre off Nova Scotia, and from there to Cape Cod on the coast of Massachusetts. This scheme, which has been chiefly originated to gratify a pardonable desire on the part of the French people to have a cable of their own, will in all likelihood be realised ere the end of autumn, and the cable opened for public traffic. Besides these larger undertakings, there is to be laid shortly a German-Norwegian Cable across the Baltic, which will divert a considerable portion of the Scandinavian traffic now passing through Denmark.

A submarine cable consists, as is now perhaps well known, of three principal parts: the copper wire or *conductor*, which conveys the electrical current forming the message from one place to another; the coating of gutta-percha or india-rubber surrounding this wire, so as to keep the sea-water out and the electricity in—or, as it is called, the *insulator* of the cable; and lastly, the cover of hemp and iron wires, or *sheathing*, which protects the "core," composed of the insulator and conductor, from injury, and also strengthens it. The gutta-percha coating is applied to the copper wire in layers by drawing the wire repeatedly through vats of the melted gum, until a sufficient thickness is laid on: india-rubber, on the other hand, requires to be masticated, and wound on the wire spirally in ribbons, then vulcanised by steam and sulphur to cement all the turns of ribbon together and make a homogeneous, tough, and durable core. The sheathing is put on by first enveloping the core in a wrapping of soft Indian jute, to form a cushion or bed for the iron wires to bear upon, then winding the core thus served with hemp-covered iron or steel wires of the best quality.

There are three types of sheathing in every cable, according to the parts of the sea-bottom on which it is designed to lie. The shore-ends, being exposed to mishaps from anchors of ships, grinding rocks, swift currents, and the fury of storm-waves, require a very heavy sheathing of iron wires, twisted into strands: the deep-sea or main cable, laid quietly in the serene depths of the ocean, on a bed of soft ooze formed by the continual rain of minute diatomaceous shells, and far removed from any violence, except indeed a sunken ship should chance to settle down upon it, needs but a sheathing strong enough to enable the cable to be pulled to the surface for repairs in case a "fault" should break out in it at any time: while between these two types there comes an intermediate one, smeared with bitumen, but not so heavily armoured as the shore-end, nor so slender as the deep-sea main. The core itself is the same throughout the entire cable, and on it wholly depend the electrical properties of the line. The number of words which can be got through the cable in a minute (a number which ranges from fifty in a short cable of, say, 500 miles, to fourteen in a long cable like that being laid to the Cape) is determined by the dimensions of the core. If the conductor should break within the insulator, no messages can be sent at all, since the signal current will not travel; and, again, should the insulator be punctured so as to admit the sea-water to the wire, all or a portion of the current will escape, and the message be lost in the sea. It is therefore of the utmost importance that each part of the core should be thoroughly sound, and accordingly it is subjected to searching electrical tests during the whole time it is being manufactured, shipped, and laid.

A cable steamer is now-a-days a familiar object, especially to voyagers up or down the Thames, on whose banks nearly all the cables of the world have been manufactured. It is conspicuous among other steamers by having big scarlet buoys lashed amidships, and large iron pulleys projecting from the bow and stern. It is from these pulleys that the cable is paid out into the sea. On being made the latter is stored in iron tanks among salt water until it is ready to be shipped. It is then uncoiled from the tanks in the factory, and coiled into the tanks on board, by means of a steam windlass on the deck, and an arrangement of running pulleys. To keep the separate turns from sticking to each other, the cable during this process is brushed with whiting and water. Shore-end type is deposited at the bottom of the ship-tank, then intermediate, then main, then intermediate again, and lastly shore-end, so that on laying the cable the different types will lie in their proper order on the bottom.

Besides the cable tank or tanks in the hold of the ship, and the bow and stern pulleys for delivering the cable into the sea, there is an intermediate train of machinery rigidly fixed to the upper deck, which is employed in laying the cable. This consists of a *dynamometer*, for indicating the strain in hundredweights on the cable as it is being paid out, so that the engineer can tell at a glance whether the stress is more than it can safely bear; a large and powerful friction drum, whereby the egress of the cable can be retarded, if it is running out too fast and making too much slack; and a number of guiding pulleys, which direct the cable in its route from the tank to the stern pulley. Paying out is almost always done from the stern pulley, as the ship proceeds on her way; but the bow pulley is frequently used in picking up. On coming up from the tank, where several men keep hold of it, and free each coil of it from the rest, the cable, guided by pulleys over which it runs, first passes under the dynamometer, then makes several turns round the big drum of the friction brake, after which it travels to the stern pulley, and thence runs out to sea. A man is always stationed at the stern with an axe, to chop the cable in two, should any obstruction stop the free passage of the cable. For example: instances are known in which several flakes of cable have been torn out of the tank together, and in such a case it is necessary to sever the cable at once, and free the ship. On the other hand, "stoppers," or ties, are also provided at the stern to lash the cable to the ship, and stop its egress, in case it should have parted on board, and the broken end be in danger of escaping to the sea.

The cable is pulled out of the ship by the weight of that portion hanging in the water, between the surface and the bottom. It sinks in a straight line, not a curve, and slants out in the wake of the ship, staining the blue bosom of the sea with pitch and whiting for miles behind. The usual speed of paying out is five miles an hour, but as this goes on day and night without ceasing, the work is soon accomplished. It is generally during the voyage out that so much time is consumed. This is a holiday for all on board; but work begins in earnest as soon as the ship arrives at the place from which the cable is to be laid.

The first thing to be done is to land the shore-end, and connect it to the telegraph office, or cable-hut, as the case may be. Accordingly either a small tug and barges are chartered, to pay out sufficient cable to reach from the ship to the shore, or rafts are extemporised out of life-boats and planking. When the beginning of the cable has been landed in this way, it is laid in a deep trench up the shore to the cable-hut, where it is connected to the land-line which connects the hut to the telegraph office of the nearest town. The ship is thus put in communication with the shore office, and the work of laying can be proceeded with, ship and shore exchanging signals at intervals to make sure that all is going well. Besides these regular signal messages between the shore and the ship, the cable is kept constantly charged with electricity, which is allowed to soak through the insulator, from the wire inside to the sea-water without. If the insulating power of the gutta-percha keeps perfect, this leakage of electricity should not be more than a certain value, indicated by a spot of light on the scale of the galvanometer, or testing instrument, observed in the electrical testing room on board. Night and day this spot of light is constantly watched, and if it remains steady all is well, but if it suddenly flies off the scale, the "slave of the lamp" who keeps up this weary vigil has orders to ring the alarm-bell, and stop the ship, for a "fault" must have broken out in the cable; when this is so, the ship is kept head to wind, the cable is cut on board, and both the portion in the sea and that on board are tested. If the fault is found in the piece still in the ship, only a few hours' delay will be necessary to seek the fault and cut it out; but if the length already laid is defective, the position of the flaw will have to be localised by difficult tests, and the ship will have to return on her course, either to haul the cable on board as she goes, or (after buoying the cut end) to grapple for it on the bottom, perhaps in 2,000 fathoms water, and at a loss of many thousands of pounds.

If no mishaps occur, the cable-steamer steadily pursues her way, along a route carefully marked out for her on the chart, and chosen partly because of its shortness, the depth of water, and general character of the bottom, as revealed by special soundings. Frequent observations of sun and stars are made to calculate the true course of the ship, for it is important in case of future repairs that the true position of the cable on the sea-bed should be known. In this way she reaches her destination, where the end of the cable is landed to the cable-hut, and the work is completed. Congratulatory messages are thereupon exchanged between the two extreme stations; and very soon after, the cable is declared open for the receipt of public messages.

J. MUNRO, C.E.