ATLANTIC OCEAN TELEGRAPHY.

CHAPTER XLIV.

The Atlantic Telegraph Company organized—Principles of Philosophy presumed by the Company—The Expedition for laying the Cable in 1857—The first Expedition of 1858—The Second Expedition of 1858—Working of the Telegraph Cable—Cause of the Failure of the Cable to operate.

ORGANIZATION OF THE ATLANTIC TELEGRAPH COMPANY.

To whom the world is indebted for the suggestion of an Atlantic Telegraph is not a question of any material consequence. Those who devised the ways, the means, and the elements of art, in the consummation of the enterprise, are the ones to whom honor is due.

The character of this work renders it impossible for me to mention the names of the brave and dauntless men who planned and executed the submersion of the different Atlantic cables of 1857 and 1858, having in view the connection of the eastern with the western hemispheres—Ireland in the Old World with Newfoundland in the New.

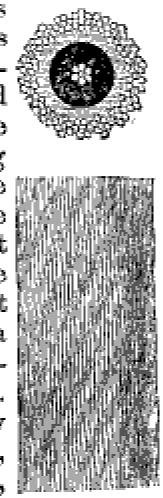
While I have no faith that a telegraphic cable, laid in the ocean two thousand miles, can be made available for practical telegraphic purposes, with the present known sciences, it is but fair to say that there are those of high scientific attainments, who have the fullest confidence in the ultimate realization of the most complete success. The reasons impelling me to disbelieve in the practicability of the enterprise are strictly scientific, and those reasons will be considered elsewhere in this work, in explanation of voltaic currents and their transmission over conductors through air, and on subterranean and submarine lines.

The Atlantic Telegraph Company was registered under the Limited Liability Act of 1856, on the 31st of October of that year.

On the 5th of December, in the same year, the whole of the shares had been fully subscribed for, and in a few days afterward the entire deposit of £200 per share had been paid up.

On the 9th of December, 1856, the Board of Directors was appointed by the shareholders. The first business before the company thus organized, was the selection of a cable, and after much careful investigation the one adopted was as represented by fig. 1.

Fig. 1.



This cable was composed of 7 small copper wires twisted together, forming a cord. Around this copper cord, was placed the gutta percha insulation, carefully manufactured. Next was placed the tarred hempen covering, and around the core thus made was placed the iron armor, consisting of 18 cords of small wire as seen in fig. 1. There can be no doubt but what the organization of the cable was as perfect as could be devised. It might have been improved by making it a little more buoyant, but even that is not a settled fact. It was a great mechanical work, and conceived by a master thought. On the 31st of December the contracts for 2,500 miles of the cable were concluded, the whole to be ready by the first week in July 1857. The manufacturers of the immense cable, were Messrs. Newall & Co., and Messrs. Glass, Elliott & Co., London.

PRINCIPLES OF PHILOSOPHY PRESUMED BY THE COMPANY.

The promoters of the Atlantic Telegraph, as a preliminary, satisfied themselves that the following philosophical points were true, viz.:

1st. That telegraphic signals could be transmitted without difficulty through the required distance;

2d. That a large conducting wire was not required for the purpose; and

3d. That the communication through the conductor could be effected at a thoroughly satisfactory speed.

Subsequent investigation induced the company to officially announce the following as established facts in philosophy:

1st. That gutta percha covered submarine wires do not transmit as simple insulated conductors, but that they have to be charged as Leyden jars before they can transmit at all.

2d That consequently such wires transmit with a velocity that is in no way accordant to the movement of the electrical current in an unembarrassed way along the simple conductors;

3d. That magneto-electric currents travel more quickly along such wires than simple voltaic currents;

4th. That magneto-electric currents travel more quickly when in high energy than when in low, although voltaic currents of large intensity do not travel more quickly than voltaic currents of small intensity;

5th. That the velocity of the transmission of signals along insulated submerged wires can be enormously increased, from the rate indeed of one in two seconds to the rate of eight in a single second, by making each alternate signal with a current of different quality, positive following negative, and negative following positive;

6th. That the diminution of the velocity of the transmission of a magneto-electric current, in induction-embarrassed coated wires, is not in the inverse ratio of the squares of the distance traversed, but much more nearly in the ratio of simple arithmetical progression;

7th. That several distinct waves of electricity may be travelling along different parts of a long wire simultaneously, and within certain limits, without interference;

8th. That large coated wires used beneath the water or earth are worse conductors, so far as velocity of transmission is concerned, than small ones, and therefore are not so well suited as small ones for the purpose of submarine transmission of telegraphic signals; and

9th. That by the use of comparatively small coated wires, and of electro-magnetic induction coils for the exciting agents, telegraphic signals can be transmitted through two thousand miles with a speed amply sufficient for all commercial and economical purposes.

On the night of the 9th of October, 1856, some experiments were instituted which were regarded of great importance. "Ten gutta-percha insulated wires, each measuring more than 200 miles, were connected, so that one continuous circuit of above 2,000 miles was formed. There were coils of five wires, introduced for experimental purposes at the joints of the wires, further increasing the circuit virtually to the amount of 2,300 miles. The magneto-electric induction coils of Mr. Whitehouse were used to excite the wires, and the current was made to operate by means of the receiving apparatus, upon one of Professor Morse's ordinary recording instruments. Signals were distinctly and satisfactorily telegraphed through the two thousand miles of wire, at the rate of 210, 241, and upon one occasion, 270 per minute."

The friends of the enterprise supposed that like results would be accomplished on the ocean cable, and that, as a commercial fact, twenty words could be transmitted through the cable per minute. Under the belief that these things would be realized by the telegraph, capital was raised, and the company with rapid strides proceeded to the completion of the enterprise.

THE FIRST EXPEDITION FOR LAYING THE CABLE.

The British government detailed the ship Cyclops, and the United States government detailed the Arctic, to take the soundings of the ocean on the proposed route. And to lay the cable, the British government detailed the ships Agamemnon and Leopard, and the United States, the Niagara and Susquehanna.

The cable was completed in due time, and placed on board of the respective vessels; and on the 5th of August, 1857, at Valentia Bay, Ireland, the end of the cable was taken on shore from the Niagara. After some few incidental delays, the fleet sailed from Valentia on the 7th of August. All the cable had been put on board of the Niagara and the Agamemnon. The other vessels served as tenders. The cable was being laid with success, until the morning of the 11th of August, when it broke, and was lost in the sea. There had been submerged 380 miles. To enable the reader to understand the particulars of this expedition, I insert the following from the report of Sir Charles T. Bright, the distinguished engineer of the company:

"Early in the month of April, 1857, H. M. S. Agamemnon was placed at my disposal as your engineer; and the fittings necessary to adapt her to the reception of the cable having been carried out with the utmost rapidity, she was moored at her station at Greenwich to take in the eastern half of the cable.

On the 14th of May, the U. S. frigate Niagara arrived in the Thames; but, on calculating the space available for our requirements, it was found that considerable alterations would be necessary to suit her interior to our purpose. These were put in hand at Portsmouth, and she finally proceeded to Birkenhead, to receive her portion of the cable.

In the Agamemnon, by clearing her hold of the tanks and magazines, the available space allowed of the cable being made into one great coil, forty-eight feet in diameter and twelve feet high. In the Niagara, it had to be disposed in five coils, three in the hold, orlop-deck and berth-deck forward, and two on the berth and main decks aft.

The machinery for regulating the egress of the cable from the paying-out vessels was constructed with regard to the great depths of water to be passed over, the constant strain, and the number of days during which the operation must be unceasingly in progress.

The cable was passed over and under a series of sheaves, having the bearings of their axles fixed to a framework, composed of cast-iron girders bolted down to the ships' beams.

The sheaves were geared to each other, and to a pinion fixed to a central shaft, revolving at a rate three times faster than that of the sheaves; two friction drums upon this shaft regulated the speed of paying-out, and the grooves of the sheaves (which were fixed to their axles outside the framework and bearings) were fitted to the semi-circumference of the cable, so as to grasp it firmly, without any pressure by which it could be injured.

I need not here enter into the arrangements for splicing, buoying, guard-ropes, staff, lights, and other minor details of the expedition, nor into the causes which led to your resolution, that the laying of the cable should commence from Ireland, instead of from the centre, as was at first contemplated. On the 29th of July, the two ships, with the whole of the cable on board, met at Queenstown. On the 3d of August, after uniting the two lengths, to test the conductivity of the entire line, and taking in coals and sundry stores, we started for Valentia, in company with H. M. S. Leopard and the U. S. frigate Susquehanna, two powerful paddle-wheel steamers, appointed to render assistance in case of need.

At Valentia, we were met by H. M. S. Cyclops, and on the 5th, the end of the cable was landed at Ballycarbery strand from the Niagara, which lay in the bay about two miles distant.

An accident to the heavy shore end cable shortly after weighing anchor on the 6th, deferred our final departure until the 7th of August.

For three days everything proceeded as satisfactorily as could be wished; the paying-out machinery worked perfectly in shallow, as well as in the deepest water, and in rapid transition from one to the other; while the excellent adaptation of the cable in weight and proportions to the purpose was most forcibly demonstrated by the day's work previous to the mishap, during which one hundred and eighteen miles of the cable were laid, for one hundred and eleven miles run by the ship.

The details of the voyage from the 7th until the morning of the 11th, are fully set forth in the following extract from a report made by me to the board shortly afterward:

By noon, on the 8th, we had paid out forty miles of cable, including the heavy shore end, our exact position at this time being in lat. 51° 59′ 36″ N., long. 11° 19′ 15″ W., and the depth of water, according to the soundings taken by the Cyclops, whose course we nearly followed, ninety fathoms.

Up to four P. M. on that day, the egress of the cable had been sufficiently retarded by the power necessary to keep the machinery in motion, at a rate a little faster than the speed of the ship; but as the water deepened, it was necessary to place some further restraint upon it by applying pressure to the friction drums, in connection with the paying-out sheaves; and this was gradually and cautiously increased from time to time, as the speed of the cable compared with that of the vessel, and the depth of the soundings, showed to be requisite.

By midnight, eighty-five miles had been safely laid, the depth of water being then a little more than 200 fathoms.

At eight o'clock in the morning of the 9th, we had finished the deck coil in the after part of the ship, having paid out 120 miles; the change to the coil between decks forward was safely made.

By noon, we had laid 136 miles of cable, the Niagara having reach lat. 52° 11′ 40″ N., long. 13° 1′ 20″ W., and the depth of water having increased to 410 fathoms.

In the evening the speed of the vessel was raised to five knots per hour; I had previously kept down the rate at from three to four knots for the small cable, and two for the heavy end next the shore, wishing to get the men and machinery well at work prior to attaining the speed which I had anticipated making.

By midnight 189 miles of cable had been laid. At four o'clock in the morning of the 10th, the depth of water began to increase rapidly, from 550 fathoms to 1750, in a distance of eight miles. Up to this time, seven cwt. strain sufficed to keep the rate of the cable near enough to that of the ship; but, as the water deepened, the proportionate speed of the cable advanced, and it was necessary to augment the pressure by degrees, until, in the depth of 1,700 fathoms, the indicator showed a strain of fifteen cwt., while the cable and ship were running five and a half and five knots respectively. At noon, on the 10th, we had paid out 255 miles of cable, the vessel having made 214 miles from shore, being then in lat. 52° 27′ 50″ N., long. 16° 00′ 15″ W. At this time we experienced an increased swell, followed late in the day by a strong breeze.

From this period, having reached 2,000 fathoms water, it was necessary to increase the strain to a ton, by which the rate of the cable was maintained in due proportion to that of the ship.

At six in the evening some difficulty arose through the cable getting out of the sheaves of the paying-out machine, owing to the tar and pitch hardening in the grooves, and a splice, of large dimensions, passing over them. This was rectified by fixing additional guards, and softening the tar with oil.

It was necessary to bring up the ship, holding the cable by stoppers, until it was again properly disposed around the pulleys. Some importance is due to this event, as showing that it is possible to lay to in deep water without continuing to pay out the cable—a point upon which doubts have frequently been expressed. Shortly after this, the speed of the cable gained considerably upon that of the ship, and up to nine o'clock, while the rate of the latter was about three knots by the log, the cable was running out from five and a half to five and three quarter knots per hour. The strain was then raised to twenty-five cwt., but the wind and sea increasing, and a current at the same time carrying the cable at an angle from the direct line of the ship's course, it was not found sufficient to check the cable, which was at midnight making two and a half knots above the speed of the ship, and sometimes imperilling the safe uncoiling in the hold.

The retarding force was, therefore, increased at two o'clock to an amount equivalent to thirty cwt., and then again, in consequence of the speed continuing to be more than it would have been prudent to permit, of thirty-five cwt.

By this the rate of the cable was brought to a little short of five knots, at which it continued steadily until 3.45, when it parted; the length paid out at that time being 380 statute miles.

I had up to this time attended personally to the regulation of the brakes; but finding that all was going on well, and it being necessary that I should be temporarily away from the machine, to ascertain the rate of the ship, and to see how the cable was coming out of the hold, and also to visit the electrician's room, the machine was for the moment left in charge of a mechanic, who had been engaged from the first in its construction and fitting, and was acquainted with its operation. I was proceeding toward the fore part of the ship, when I heard the machine stop. I immediately called out to ease the brake, and reverse the engine of the ship; but when I reached the spot the cable was broken.

On examining the machine, which was otherwise in perfect order, I found that the brakes had not been released, and to this, or to the hand-wheel of the brake being turned the wrong way, may be attributed the stoppage, and the consequent fracture of the cable; when the rate of the wheels grew slower, as the ship dropped her stern in the swell, the brake should have been eased. This had been done regularly before, whenever an unusually sudden descent of the ship temporarily withdrew the pressure from the cable in the sea.

After the accident, the commanders of the vessels proceeded to Davenport at my request, the dockyard at Keyham affording many facilities for unshipping the cable.

At a subsequent discussion, the prudence of making a second attempt in October was considered, but the difficulty of obtaining sufficient additional line, and the uncertainty of the weather so late in the year, were cogent reasons against the adoption of such a course. It was, therefore, decided to store the cable until next summer, and (having been granted the use of a vacant space of ground by the government) four large roofed tanks were constructed to receive it.

The cable, which is in good condition, was discharged from the Niagara first, and has subsequently been unshipped from the Agamemnon. It has been passed through a mixture of tar, pitch, linseed oil, and bees-wax, in such consistency and quantity as effectually to guard against rust.

The buoys, chains, hawsers, and other stores and tools, are safely warehoused in the adjacent building.

Immediately upon the return of the expedition, steps were taken to recover such part of the cable laid from Valentia as could be raised so soon as the equinoctial gales might be over.

The Monarch, a steamer employed upon the submarine lines laid between Orfordness and the Hague, and fitted with the necessary appliances for picking up cables, was at first understood to be at our service for this work; but some delay to our plans for recovery arose from the fact, that at the time she was expected to be available, she was dispatched by the company to whom she belongs upon another duty, and it thus became necessary for us to procure and equip another vessel.

In the middle of October, I proceeded to Valentia with the Leipzig, a paddle-wheel steamer of a sufficient capacity; after some hindrance by the gales which prevailed at that time, fiftythree miles of the small cable and four miles of the heavy cable were got up; the remainder of the shore-end was underrun, and is buoyed ready for splicing next year.

The sea and swell on that coast at this season are so unsuited to the work that the attempt to regain the remainder must be deferred for some weeks; but if the contract which has been accepted by you is successfully carried out, it will be more satisfactory as regards risk of outlay, than for us to renew the operation.

The recovered cable, which is in good order and fit for use again, has been delivered into store at Keyham.

Referring to the proposal to order a further length of three hundred miles of cable, in addition to the four hundred miles now in course of construction by Messrs. Glasse, Elliott & Co., I would observe that while I anticipate that the appliances suggested by experience will enable us to lay the cable this year with much less slack than is expected, I quite agree with the recommendation of your scientific committee that more allowance should be made for contingencies, in laying a line of such extraordinary length.

It is doubtless a circumstance much to be lamented in the past history of our undertaking, that the time within which it was intended to be completed did not permit of experimental rehearsals of various plans of cable-laying in deep water, respecting which there had been no previous successful experience.

"The result has been that experiment and practice have been mixed together in one operation; and hence, although all concerned actively in the undertaking are now fully alive to the means which will, in all human probability, secure success on the next occasion, yet great expense has been incurred without an adequate return, which might have been avoided had the needful time for experiment been available."

The following is extracted from the report of Wildman Whitehouse, electrician of the Atlantic Telegraph Company:

"Placed, at very short notice, in the responsible post which he now holds, your electrician was called upon to examine into one of the latest and most difficult electrical problems of the day, involving considerations at once of the highest philosophical interest and of the utmost social and national importance. He was, moreover, pledged to achieve a practical success therein in the brief space of a few months; nor while engaged in this research could he for a moment be released from the equally important duty of personally superintending the manufacture, and testing the perfection and integrity of the cable as it grew from day to day at the Gutta-Percha Works at Birkenhead and at Greenwich.

The examination of the former required the prosecution of an extended series of researches, and the construction of new instruments for the purpose of determining with accuracy the available force of the electrical current as tested at different distances, and for the investigation of the peculiar and hitherto practically most embarrassing phenomena of induction in submarine wires.

It was necessary, too, to approach the subject to a certain degree tentatively, and from time to time, as the increased length of cable admitted, to let our early telegraphic instruments grow with its growth and increase in strength or sensibility as the augmented distance required.

These indispensable researches naturally involved a somewhat considerable outlay in my department. They were not however, entered into without most careful consideration, and have been fully justified by the important and practical bearing of the results which they have been the means of bringing to light.

Notwithstanding my endeavors, circumstances conspired to limit the range of these researches, while the fact of the cable having been made at two distant places, rendered any full and satisfactory trial of instruments impossible, till the arrival of both vessels in Queenstown Harbor. That event was looked forward to with the most intense interest, as affording a brief and yet valuable opportunity, which, up to that time, had not been enjoyed by any scientific man, at once of proving the practicability of recording intelligible electric signals through a submarine conductor of the unprecedented length of 2,500 miles, and of trying on the extended scale the appliances for affecting this object, which up to that time had necessarily so far been constructed theoretically, as only to have been actually tried upon less than one half of the entire line intended to be worked by the Company.

On the arrival of the vessels at Queenstown Harbor, the earliest opportunity was seized of connecting the halves of the cable on board the two vessels, by a temporary line extended between ship and ship, in order that I might thus be enabled to test the instruments whose construction was based on the results of previous experiment on shorter lengths. In doing this I had the advantage of the assistance and co-operation of Professor W. Thomson, who is one of our directors.

These trials were made under every possible disadvantage of time, place, and circumstance; the connection between ship and ship was imperfect, was interfered with inadvertently on several occasions, and was entirely destroyed at turn of tide.

The power of the instruments was found to be ample for the whole length of 2,500 miles; the signals received were even stronger than necessary, but the time required to elapse between signal and signal in order to avoid the blending of electric waves in the wire was considerable.

An extemporaneous arrangement by Professor Thomson and myself enabled us to transmit actual despatches in spite of these difficulties.

"Our experiments at Queenstown, therefore, successful though they were as furnishing a proof of the adequacy of the instruments to work through the whole distance, yet rendered it sufficiently evident that much time and attention might judiciously be bestowed upon these, as well as on the details and peculiar arrangements required for signaling through so vast and untried a distance, in order to attain a thoroughly certain and commercially satisfactory rate of communication.

On the sailing of the expedition we commenced our communication with the ship by the use of the lowest battery power sufficient to effect our object, in order to facilitate the detection of a fault or accident to the cable by those on board at the earliest possible moment after its occurrence.

An arrangement has been made by which, on the next occasion, on commencement from mid-ocean, either of the ships shall be able, at any and every instant during the voyage, to ascertain that all is right in her electrical connection with the sister ship, though it is not deemed desirable to endanger the safety of the Company's complete and special telegraphic apparatus by an attempt to keep up, by its use during the voyage, a constant interchange of messages from ship to ship.

Proceeding in the path which the light of experiment has opened up to us in relation to the differential values of conducting media, we have, in the additional length of cable now in process of manufacture, adopted the recent suggestion of Professor W. Thomson, and have instituted a series of tests for the conductivity of copper wire. Every hank of wire to be used for our conductor is tested, and all whose conducting power falls below a certain standard is rejected.

"We have thus secured a conductor of the highest value, ranging in conductivity from twenty-eight to thirty per cent. above the average standard of unselected copper wire.

It is but due to the Gutta-Percha Company to state, that, in their anxiety to advance the interests of submarine telegraphy to the utmost, they have afforded us every possible facility in this laborious and important, but somewhat tedious and obstructive operation.

The arrival of the vessels at Plymouth, and the unshipment of the whole of our cable, to be stored there during the winter, afford the opportunity which I have so long deemed necessary, of submitting the working powers of our instruments to the most rigid tests through the whole circuit, under every conceivable condition. I have, therefore, with the sanction of the directors, removed thither the workshop, retaining a few of our most skilled hands for repairs and alterations of instruments, and the construction of any new ones deemed desirable. With these I have also removed our superintendent, and the whole staff of manipulators or instrument clerks, proposing to give them, during the winter, constant occupation in the transmission of actual dispatches through the whole length of the cable, thus rehearsing what will be the routine of their duties when our line is in operation.

The facilities afforded by the government authorities at the dockyard at Keyham have enabled me to fit up a complete telegraphic station here, in one of the buildings devoted to our use, in which the superintendent and staff of clerks are now constantly engaged in transmitting dispatches.

I have been able to examine most critically into the question of the highest speed of transmission attainable, carefully eliminating all mere instrumental or manipulative error from the results.

In doing this we have made use of an arrangement by which the accurate correspondence or otherwise of the transmitted with the received signal shall be most readily ascertained. The electric signals, *on their entrance into the cable*, are made to pass through an instrument, by means of which they record themselves upon the same slip of paper and side by side with those of the receiving instrument at the other or distant end of the line. We are thus enabled to scrutinize most closely the behavior and transit of every signal. If a dot or dash be lost, it is instantly detected; and if even the slightest discrepancy occur in the length of the relative marks, it cannot fail in this way to be at once made evident.

The power of our apparatus, as already made, is seen to be ample for the purpose; the speed with which it can be worked so as to insure accuracy in the transmission of a dispatch is found, however, to depend so greatly upon the steadiness and mechanical truthfulness of the manipulating clerk, that I have been induced to devise an addition to the transmitting part of our apparatus which shall render manipulative error almost impossible.

This apparatus, though as yet merely in an experimental form, has enabled me, without the use of additional electrical power, to obtain a very considerable increase in our speed, not only without any sacrifice, but with an absolute gain in the accuracy of transmissions.

By this means, and by the adoption of such an amount of abbreviation or code signals as we find it safe to use, we are now transmitting through the entire length of our cable dispatches at the rate of four words in a minute.

I cannot refrain from an expression of the real gratification which the attainment of this step has afforded me,—the more so as I feel justified thereby in anticipating still further progress and higher results;—nor need I point out the direct and positive bearing of this question upon the commercial success of the company."

THE FIRST EXPEDITION OF 1858.

Early in June the vessels proceeded to the deep sea in the vicinity of the Bay of Biscay, on an experimental expedition to test the machinery for the laying and drawing in of the cable. Three days were thus employed, and the results were pronounced as satisfactory.

On the tenth of June the telegraph squadron sailed from Plymouth for mid-ocean, where it had been determined by the company to commence the submerging of the cable, instead of the Irish coast, as had been adopted in 1857. The point in mid-ocean where the vessels expected to meet and unite the cable was lat. 52° 02′, long. 33° 18′.

Each vessel had 1,500 miles of cable on board. It was intended that the Niagara should proceed from the point of junction to the Newfoundland coast, and the Agamemnon was to proceed to the coast of Ireland.

On the 26th of June the splice was made and the respective vessels proceeded on their mission. The vessels had proceeded but a short distance when the cable, becoming entangled in the machinery, broke. Some six miles of cable were lost in the sea. The break was immediately discovered on board the Agamemnon. Both vessels returned and a new splice was forthwith made. The ships again proceeded to lay the cable. On Sunday, the 27th, the continuity of the current was found to be broken when some 42 miles of the cable had been paid out. The cause of the interruption of the electric current was never discovered. The vessels again returned to the rendezvous, and on the 28th another splice was made, and soon thereafter they were under way. The paying out continued with complete satisfaction until 142 miles of the cable had been submerged, when it broke near the stern of the Agamemnon. Up to this time there had been lost in the three efforts 190 miles.

The vessels, failing to meet again in mid-ocean, returned to Queenstown for further arrangements to be adopted in the premises.

THE SECOND EXPEDITION OF 1858.

The company having determined to make another attempt to lay the cable in 1858, the vessels again proceeded to mid-ocean, where they united the ends on the 29th of July, 1858.

The paying out was continued successfully until 7 45 P. M., when the signals ceased; fortunately, however, communication was again restored some two hours thereafter. Like interruptions occurred several times during the voyage, and no satisfactory explanations in regard to them have transpired.

On the 5th of August, at 1 45 A. M., the Niagara anchored in Trinity Bay, Newfoundland. The distance run by the Niagara was 882 miles, and the amount of cable paid out was 1,016 miles. At 5 15 A. M. the end of the cable was landed on shore.

On the 5th of August, at 6 A. M., the Agamemnon anchored opposite Valentia, having laid 1,020 miles of cable. At 3 o'clock P. M. the end was carried on shore.

WORKING OF THE ATLANTIC TELEGRAPH CABLE.

In regard to the working of the cable, but little has been made public. The batteries employed to work it consisted in the first instance of induction coils known as Ruhmkorff's, but in a modified form, excited by a Smee battery. Subsequently the ordinary Daniell battery was adopted. The instrument used at the Newfoundland end was a delicate electrometer, and at the Valentia end Professor Thomson's reflecting electrometer.

To what extent communication has been transmitted over the cable the public has not been informed. I have, however, learned from reliable sources that the maximum speed of intelligible and unintelligible signals transmitted and received over it were at the rate of one wave for each three and one third seconds. It was announced that a message from the Queen of Great Britain was received over the cable for the President of the United States, on the 16th of August, eleven days after the cable had been landed on the Newfoundland and Irish coasts. On the evening of the 16th a paragraph containing about one third of the message was presented to the President and the public as the whole dispatch, but on the 17th the remainder was published, with the following explanation:

St. Johns, N. F., *August* 17.

Mr. De Sauty, the electrician-in-chief at Trinity Bay, says that he is unable to give any information for publication as to the working of the cable, but that the time necessary for the transmission of the President's Message depends on its length and the condition of the line and instruments at the time—perhaps, under favorable circumstances, an hour and a half.

The reception of Queen's Message was commenced early yesterday morning, and not finished until this morning, but it was stopped for several hours to allow of repairs to the cable. The fragment of the message transmitted yesterday was handed to the Newfoundland line as the genuine entire message, and was supposed to be such until this morning.

Another publication estimated that the time required for the transmission of the message was about 20 hours. It contained about 100 words.

In regard to this subject, the following extracts of a letter was published in the London Morning Post of August 18th:

To the Editor of the Morning Post:

Sir: I have the pleasure to inform you that the line from Valentia to Newfoundland is now working satisfactorily both ways. The following message was dispatched yesterday evening from the Directors in England to the Directors in America:

"Europe and America are united by telegraph. Glory to God in the highest, and on earth peace, good will toward men."

This message, including the addresses of senders and receivers, occupied 35 minutes in transmission, and consisted of 31 words. Immediately afterward a message from her majesty the Queen to his excellency the President of the United States, consisting of 99 words, was received by Newfoundland in 67 minutes. Both messages were repeated back to Valentia to test their accuracy, and were found to be taken with great exactness. Of course, unless permission was given, the contents of her majesty's dispatch cannot be made public.

It will thus be seen that the line is now capable of being worked with perfect accuracy, and the company will now proceed, as rapidly as is consistent with the establishment of a proper system, to make the necessary arrangements for opening the communication to the public; in doing which, however, some delay must necessarily occur.

Yours truly, GEORGE SAWARD,
Secretary and Manager.

Chief Office, 22 *Old Broad-street*,
LONDON, *August* 17.

The signals over the cable continued to grow feebler until the 1st of September, when nothing intelligible could be received. Since that time all efforts to operate it have failed. The failure of the cable to operate successfully, as had been announced by the company, fell upon the world with surprise and profound regret.

The successful laying of the cable across the ocean had been hailed by the roar from thousands of guns, by the shouts of joy throughout the land, by the chiming of bells in the sacred spires, and songs of praise were heard on hill and in dale. It was but natural that the failure of the cable to work successfully, after it had been stretched from hemisphere to hemisphere, should produce in the minds of men more than an ordinary astonishment.

CAUSE OF THE FAILURE OF THE CABLE TO OPERATE.

As soon as the company in London ascertained that the cable had failed to communicate intelligible signals, energetic efforts were made to ascertain the cause, having in view the remedying of the difficulty. To that end, Mr. C. F. Varley, the very able electrician of the International Telegraph, was dispatched to Valentia, and subsequently, was Mr. W. T. Henley, a distinguished electrician, of London. Through the kindness of the energetic secretary of the company, Mr. Saward, I am enabled to present the reports of those gentlemen to the reader. They contain scientific information very valuable to submarine telegraphers.

Report on the State of the Atlantic Telegraph Cable.

LONDON, *Saturday, Sept.* 18.

I arrived at Valentia on the evening of the 5th inst., when I found that no words had for many days been received through the cable from Newfoundland.

On the 6th, 7th, 8th, 9th and 10th, I tested the cable at intervals in four different ways to ascertain its condition. The following are the results:

1. There is a fault of great magnitude at a distance of between 245 and 300 statute miles from Valentia, but the local-

ity cannot be more accurately ascertained until a portion of the cable, 20 or 30 miles in length, has been tested against my standard of resistance, and until the log has been consulted to ascertain the amount of slack paid out. I would suggest that the piece of cable at Greenwich be carefully measured and tested against my standard, in order to obtain the most correct estimate of the distance of the fault. Assuming, however, that it is 270 miles, and allowing 22 per cent. for slack, it is possible that the chief defect is in shallow water—410 fathoms.

2. The copper wire at the faulty place above alluded to does not touch the iron covering of the cable, as is proved by its forming a voltaic element, which gives rise to a continuous positive current from the copper wire varying very little in tension.

3. The insulation of the wire between Valentia and the fault, is perfect, or at least contains no defect of sufficient importance to be perceptible, or to materially influence the working were the cable otherwise perfect.

4. The copper wire is continuous, and consequently the cable has not parted. Faint signals, or reversals, are still received from Newfoundland, but the power used will shortly eat away the exposed copper wire in the faulty place by electrolytic decomposition.

The actual resistance of the fault appears to be at least equal to ten miles of the cable, but is most probably greater.

Taking it at its lowest resistance, viz., ten miles, and assuming that Newfoundland is only using 180 cells of Daniell's battery, the strongest current received thence during my stay was only a 24th part of the force that it should be were there but this one fault. When it is, however, borne in mind that on the other side they are probably using more power, and also that the defect first alluded to probably offers more resistance than that assumed, viz., ten miles, it is evident that there is another and more distant fault, the approximate locality of which I could not pretend to estimate at this end without being able to speak to Newfoundland.

From authentic *data* shown to me at Valentia, I am of opinion that there was a fault on board the Agamemnon, before the cable was submerged, at a distance of about five hundred and sixty miles from one end, and six hundred and forty from the other.

The following are the *data* in question, but on what occasion they were obtained, I am unable to state. They were, however, probably taken when the ships were at Queenstown:

Testing of Coils on board the Agamemnon, consisting of about twelve hundred statute miles of Cable.

1. When the upper end was disconnected, the current entering the cable from a battery, was.................................. 8.5 parts.
2. When upper end was put to earth, current entering the cable was..................... 10.5 parts.
3. Current going out of upper end of cable to the earth................................ .5 parts.
4. When the lower end was disconnected, the current entering the cable was............... 8.5 parts.
5. When lower end to earth.................. 10.5 parts.
6. Current going out of upper end of cable to earth................................ 4.5 parts.

Showing that, if there were a fault, it was nearer to the upper end, but not far from the middle of the coil.

When 200 miles had been removed from one end of the coil, (but from which end I am not at present aware,) leaving 1,000 miles, the amounts were:

1.............	7.5 parts.	4.............	8.5 parts.
2.............	10.25 parts.	5.............	11.5 parts.
3.............	6.5 parts.	6.............	6.5 parts.

Indicating that there was a fault, by rough calculation, at about 560 miles from one end, and 440 from the other.

With the 200 miles of cable amounts were:

1.............	2 parts.	4.............	— parts.
2.............	40 parts.	5.............	40.5 parts.
3.............	39.5 parts.	6.............	39.5 parts.

Test of the entire Cable on board the Agamemnon and Niagara—viz., twenty-five hundred miles.

BATTERY AT AGAMEMNON END.

1. Current entering the cable, the Niagara end being disconnected...................... 45 parts.
2. Niagara end to earth .... $49\frac{3}{4}$ parts.
3. Current flowing out at Niagara end to earth.. $15\frac{1}{2}$ parts.

BATTERY AT NIAGARA END.

4. Current entering cable, Agamemnon end being disconnected........................... $35\frac{3}{8}$ parts
5. Agamemnon end to earth.................. 37 parts.
6. Current flowing out at Agamemnon end to earth................................. 14 parts.

Indicating considerable leakage on board the Agamemnon.

I am also informed that the currents through the cable, even immediately after it was submerged, were so weak that relays were useless, and that not one perfect message was recorded by them, everything that was received being read from the reflections of a galvanometer.

By comparing the above *data* with those of the new cable now making by Messrs. Glasse and Elliott, for the Electric and International Telegraph Company, the amount of current which entered the 1,000 miles of cable when disconnected at one end should not have exceeded 2 or 2.5 parts, instead of 7.5 and 8.5 parts.

The inference by rough calculation, therefore, is that there was a fault offering a resistance equal to 1,000 or 1,200 miles of cable, situated at a distance about 560 miles from one end of the 1,200 mile coil on board the Agamemnon.

This, however, cannot be the fault first alluded to, situate at about 270 miles from Valentia, but may have been the one which caused such alarm when the ships were 500 miles from Ireland, and when the signals ceased altogether and never certainly recovered.

It is not at all improbable that the powerful currents from the large induction coils have impaired the insulation, and that had more moderate power been used, the cable would still have been capable of transmitting messages.

To satisfy myself on this point, I attached to the cable a piece of gutta-percha covered wire, having first made a slight incision in the gutta-percha to let the water reach the wire; the wire was then bent so as to close up the defect. The defective wire was then placed in a jug of sea water, and the latter connected with the "earth." After a few signals had been sent from the induction coils into the cable, and, consequently, into the test wire, the electricity burnt through the incision, rapidly burning a hole nearly one tenth of an inch in diameter.

When the full force of the coils was brought to bear on the test wire by removing them from the cable, and allowing the electricity only one channel—viz., that of the test wire, the discharges, as might be expected, burnt a hole in the gutta-percha under the water, half an inch in length, and the burnt gutta-percha came floating up to the surface.

The foregoing experiments prove that when there are imperfections in the insulating covering, there is very great danger arising from using such intense currents.

The size of the present conducting strand is too small to have worked satisfactorily even had the insulation been sound.

With a strand of larger dimensions less intense currents would be required, and both speed and certainty increased.

It is not, however, altogether impossible that some intelligible signals may yet be received through the cable, as stated in my previous communication.

C. F. Varley,
Electrician of the Electric and International Telegraph Company.

On the 5th of October, 1858, Mr. George Saward, the Secretary of the Company, officially authorized the publication of the following report in the London Times:

To the Chairman and Directors of the Atlantic Telegraph Company:

Valentia, *Sept.* 30, 1858.

Gentlemen: In accordance with your instructions, I have, since my arrival here on the 8th instant, carefully tested the cable at various times, and with different degrees of battery power, and have found its insulation seriously impaired, and the results of the testing led to the conclusion that the injury is at a considerable distance from this (very nearly 300 miles of the cable apparently intervening between this point and the fault).

As I think it right you should know on what grounds and by what modes of operation I and others have arrived at this conclusion, and as you may also like to be informed as to some of the phenomena of electrical science as shown in connection with this cable, I have ventured to go a little into detail, hoping thereby to convey some information that may not be unacceptable.

On connecting one pole of a voltaic battery with the end of the cable with a galvanometer in circuit, and the other battery pole to earth, I find the current meets a resistance to its passage equal to two hundred and ninety miles of the copper conducting wire of the cable, and as the cable is more than two thousand miles long, it is therefore evident that the greater part of the current finds a shorter route to the earth.

By resistance is meant the impeding force that electricity meets with in its passage through conductors of all kinds, metallic or otherwise, and which varies immensely, not only in various metallic and other bodies, but also in the same kind of metal, and this can be accurately measured even in one inch of wire. Taking any given metal, the conductibility of which is uniform, the resistance of the wire will be found to increase as the size decreases, exactly in proportion to the sectional area. A mile of No. 40 copper wire is thus found to resist as much as 175 miles of the conducting wire of the Atlantic cable. It is necessary also that the fine wire should have been previously tested with some of the cable, as wires of the same gauge are frequently found to vary very much in size as well as in conductibility. Knowing the resistance per yard of the fine wire, to obtain that of the cable comprised between the point of operating and the fault (and thus to find its length), the battery and galvanometer are connected with the line and earth in the before-mentioned manner. The degrees of deflection are accurately read on the galvanometer, and this process is repeated several times with batteries of different degrees of strength; the batteries and galvanometer are then disconnected from the cable and earth, and connected with coils of fine wire, the length of which latter is added to or diminished until the readings of the galvanometer exactly coincide in every case with those noted when connected with the cable. The length of the fine wire will then give that of the cable up to the point at which the battery current finds earth, reckoning about one mile of cable for every 10 yards of wire. There are several methods of doing the same thing, but they are all based on the same system of proportionate resistances.

There is next the resistance of the fault itself to be taken into account, for, strange as it may appear to some, faults (in proportion to their magnitude) may be equal in resistance to from one mile to several hundreds of miles of cable, and would give the same indications on a testing instrument. If we knew the exact nature of the injury, and how much of the copper was exposed, we could, with tolerable certainty, tell at what distance it existed; but in the absence of such knowledge we must judge from appearances, making use of any previous experience we may have had in matters of a similar kind. And, firstly, we know if much of the resistance was produced by the fault, it must expose a very small amount of surface, and that on sending positive currents, the wire (by electrolytic action) would be oxydized at the faulty spot, and the galvanometer would show that the fault was partially repaired by the non-conducting power of the oxyde.

On reversing the direction of the current, hydrogen would be evolved, which, by reducing the oxyde and cleaning the wire, brings the fault back to its former state. Should it be of considerable size, and consequently of small resistance, the coat of oxyde would be thin, and quickly reduced by reversing the current, showing that very little alteration was produced by changing its direction.

Precisely this effect is produced by sending currents into the cable, indicating the injury to be of that character. A small fault could not reduce the strength of the signals to the extent we find them, unless the wire was separated near that point, and this (which is quite within the range of probability) would set our calculations at naught. That the cable is not severed we have abundant proof, but that any one can, by the most delicate tests, discover whether the conducting wire is so or not in a cable of this length I utterly deny. Should such be the case, it does not follow that the line must be rendered useless, as I have known underground telegraphs to work for months after the conducting wires had been separated more than a quarter of an inch by the decomposing power of the batteries employed. A slight failure existed in the gutta-percha; this admitted moisture, which, by conveying the electricity to the earth, caused the decomposition of the wire, and then aided the working of the telegraph by conducting a portion of the current from one point of the separated wire to the other. Signals were much reduced in power, as in the present case; still the wire continued to work, and if such can be done for months, it might happen for a longer period.

If, by any means, the conducting wire separates, and the gutta-percha remains sound, all communication ceases, from the absence of moisture to complete the circuit. By our testing, one fact is unquestionably established, and that is, the fault is not beyond 300 miles. I speak of the great fault; others may exist between that and Newfoundland, but if it be a fact, as I have heard, that, on testing at the latter place, very little earth is shown, the probability is that the other part of the cable is good. Having arrived at the fact of the injury not being beyond 300 miles, the difficulty is to know how much within that distance it is to be found, or how much of the resistance is due to the cable, and how much to the fault; and although by accurate testings and examinations a pretty correct knowledge of the facts may be obtained, still it is liable to some uncertainty, and instances have occurred in testing cables where the most experienced have been quite wrong in their conclusions.

I cannot think it possible for the injury to be in the harbor, but should think it advisable to lay down some length of shore end, as the cable near the land must soon be injured by friction on the rocks and shingle. A piece of the same size, laid across the harbor for the Magnetic Company, was entirely worn asunder some days since.

In my opinion the fault or faults existed in the cable before it was submerged, and that they would have been detected and made good had the precaution been observed of having the whole cable tested in water during its manufacture.

Its not showing so bad when first laid is easily to be accounted for, as it takes some time for the water to soak through the coating of pitch and tar. In a cable I am now manufacturing a fault was four days in the water before showing anything.

Had your cable been injured after submersion by resting on the sharp edge of a rock, the inner wire and the outer metallic covering must have come in contact, and that this is not the case we have absolute proof, both from the fact of a battery current being generated by the iron sheathing and the exposed copper, and from signals being received from Newfoundland; for, did the iron touch the copper conductor in the smallest point, not the slightest signal could be observed. Signals were from the first much weaker than they ought to have been from a tolerable insulated line of that length, and were scarcely sufficient to work a very delicate relay, which can be used with a current so feeble that it could only just be detected on the tongue. The currents now received are not more than a tenth of that power, and can only be indicated on Professor Thomson's very ingenious reflecting galvanometer. This is constructed on the principle of the boys' "trick" of receiving the rays of the sun on a piece of looking-glass and reflecting them on the wall, a very small motion of the hand giving a range of many feet to the spot of light. Professor Thomson attaches a small mirror to the magnetic needle of a very delicate galvanometer of his own contrivance; the light of a lamp is thrown on the mirror, and a motion of the needle that would be inappreciable in itself is plainly indicated by the reflected spot of light on a scale. The apparatus could be made much more delicate still, and capable of working with the smallest amount of current, but there is an obstacle in the way of using such a feeble power, and that is the earth current, which shows itself at all times more or less.

If this earth current were at all constant in its quantities or direction, it would be quite easy to compensate for it and render its effects neutral; but it is most erratic in its movements, sometimes throwing the spot of light entirely off the scale, at others changing from positive to negative and back again so rapidly and frequently, and with such regularity that it is difficult to know whether it is Newfoundland or the earth current signaling.

These earth currents in submarine and subterranean lines (like the atmospheric currents, as they are termed in overground wires) are produced by the inductive effect of natural currents of electricity moving parallel with the conducting wires, it being a well-known law of electricity that if a current moves in the vicinity of a wire or other insulated conductor, a current is set up in each wire in a contrary direction, its strength being in proportion to the parallelism of the wire with the natural current.

Any wire laid parallel with the equator, or nearly so, will have also its electrical condition disturbed by every variation in the earth's magnetism. On the first establishment of practical telegraphy, the inconvenience experienced from these currents was as annoying as it was unexpected, but in course of time contrivances were produced capable of modifying or counteracting their effects, so that but little trouble is now felt from their occurrence; although even now occasionally on some lines all communication is stopped for a short time when these terro-magnetic currents are unusually strong. On lines of 100 miles or so they only show themselves at intervals. At other times the line is quite free; but on a line of such enormous length as the Atlantic cable, electric disturbance is sure to take place on some part of it at all times; and if a current is set in motion in any part, the effect is communicated throughout the whole. In another cable (as well as in this had its insulation been more perfect) earth currents would not cause much trouble, as the working currents sent through the line would not lose their strength, as in the present case, and consequently would overpower them.

The mere resistance of the cable as regards its length would offer very little impediment to its working. The same length of insulated wire, stretched on dry earth or other non-conductor, could be worked through with a very small power and at a rapid rate. It is only when it becomes surrounded by a conductor, such as damp earth or water, or by the metallic covering of the cable, that the phenomena of induction again come into play, and the more complete the insulation the greater will be the embarrassment from induction.

The effect of this is shown when a battery is connected with the line and earth, or outside of the cable. The inner, or conducting wire, becomes charged or electrified *plus;* the outer coating *minus* (similar to a Leyden jar). When the ends are put to earth the effect goes off, but not instantly, and when the two electrified media are so far removed, as in a line of 2,000 miles, if connected with the earth, a very considerable time is occupied both in charging and discharging, causing much retardation of the current, so that I think four words per minute will be the maximum rate of transmission through any Atlantic cable with the present dot and dash system. If other plans can be worked by which a letter would be indicated by one or two signals, the rate would be increased in proportion.

As I have made use of the terms resistance and retardation, and as they are words having different meanings, I will explain what constitutes the difference. The "resistance" of a wire has the effect of keeping part of an electric current back, or diminishing its quantity, without affecting its velocity, the remainder passing as quickly as it would through a wire of the same length with less than a hundredth part of the resistance. The effect of "retardation," on the contrary, is to diminish both the quantity and velocity of the current. For example, in an overground well-insulated wire, 2,000 miles long, an electric current or impulse would traverse the entire length in one tenth of a second; through the same extent of submarine line, owing to the effect of the charge, the time occupied would be nearly a second and a half.

Respecting the question of injury to the line from the use of powerful currents—if a small hole leading to the wire exists in the gutta-percha covering near either end, there is no doubt that a current of great quantity and intensity, whether produced by battery or coils, would have the effect of enlarging the breach by burning; but this can only take place to a limited extent. Heat can only be developed by an electric current when the latter meets with great resistance; consequently, as soon as that is diminished by a slight enlargement of the hole, all burning ceases. I tried the experiment alternately with the large induction coils, with the battery now here (400 cells of Daniell's) and with my large magneto-electric machine. They were each connected in turns with the line and the earth, and at the same time with a piece of gutta-percha-covered wire, in which the copper was bared to one thirty-second of an inch diameter, and a piece of copper in a basin of sea-water, thus dividing the current between the two routes. The coil current enlarged the fault to one twentieth of an inch in diameter; the batteries to a sixteenth—both very slowly. That from the magneto-electric machine made no change in the fault it was applied to until it was disconnected with the line and earth, and allowed the one road only; when burning took place, as might have been expected. The fault was enlarged very slowly to one tenth of an inch. On repetition with the coils, the fault was increased to one tenth diameter, and with the batteries to one sixth, rapidly with both. No further burning can take place with either current till the wire is brought to the surface of the water, when, owing to the resistance increasing, by the fault being only partly immersed, the burning commences anew and the gutta-percha inflames.

On the arrival of my large magnetic machine, I put it together, and connected it with the cable, and have used it a part of every day since, sending at some times reversals and at others words and sentences. I am unable to tell whether they were received and understood, but hope to find such has been the case on the receipt of intelligence from Newfoundland. Having a machine at one end only, it will, of course, be evident that, even if they received properly, they could not have answered better than before. But we have been encouraged by seeing more reversals and attempts to send words from them lately than before. I will leave the machine here; it will be worked at stated hours each day by the assistants until the days fixed upon in October, when it will be used alternately as arranged with the battery and coils. The clerks at each end will then act according to preconcerted arrangements, which I hope will have the effect of renewing telegraphic correspondence. If that is not accomplished, probably the best thing then would be to raise the cable for about 15 miles out and test. I cannot say I have any hopes of the fault being found within that distance, but as it would not be attended with any trouble or risk I think it worth the trial. If the injury is in the deep soundings, I believe any attempt to raise it would be the means of breaking the cable and losing the end altogether. If the state of the cable should not get worse I am still in hopes of its being rendered workable by transmitting signals slowly, by having delicate receiving apparatus, and by adopting means for neutralizing the earth current. Professor Thomson has partially succeeded in the latter object by throwing into the receiving end of the line feeble currents of different values, from one cell to one twentieth of a cell, in opposition to the earth current.

I am, gentlemen, yours obediently,

W. T. Henley, *Telegraph Engineer.*

46 *John-street-road, Clerkenwell.*

Various trials have been made to work the cable since the report of Mr. Henley was submitted, but without success. The company has exerted itself to make available the great enterprise, but thus far, sadly to be recorded, in vain.

This stupendous enterprise was started and executed with great energy and skill. The account current of the company up to December 1, 1858, exhibited an aggregate expenditure of £379,029. The governments of Great Britain and the United States loaned the vessels employed in 1857 and in 1858, by which the finances of the company were materially benefited. The governments, also, had agreed to pay an annual subsidy upon certain conditions for a term of twenty-five years. The colonial governments in America had also granted certain immunities for the benefit of the undertaking. In a word, the company had lavished upon it every consideration to enable it to effect the most signal triumph. Every effort within human power was directed toward the consummation of success; but, how to make the cable work effectively for commercial purposes, was something beyond the reach of man, and known only to the Supreme Being.

At the present time it has not been determined when another attempt will be made to connect the New and the Old World by telegraph.

In the meantime, other companies are being organized for the submerging of cables on other routes, one of which is proposed to run from England or Portugal to the Azores, and thence to the United States, on which route the longest circuit will be about 1,400 miles; and another project is to run a line *via* the Faroe Isles, Iceland, and Greenland, to Labrador, the longest circuit on which line will be about 500 miles. There can be no doubt but what cables can be laid on any and all the routes projected across the ocean; but to practically work them after they are laid for commercial purposes, is a problem not yet solved. We can, however, indulge the hope that some new discovery may be made in the science of electrics that will enable the world to realize the most complete consummation of the great desideratum, which was, for a time, supposed to have been accomplished on the submerging of the late Atlantic cable between the coasts of Ireland and Newfoundland.

It is a singular coincidence that the first feat of telegraphing was executed by order of King *Agamemnon* to his queen, announcing the fall of Troy, 1084 years before the birth of Christ, and that the last great feat was executed by the ship *Agamemnon* in the landing of the Atlantic cable on the coast of Ireland, 5th of August, 1858.