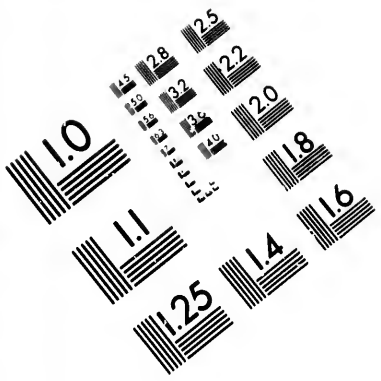

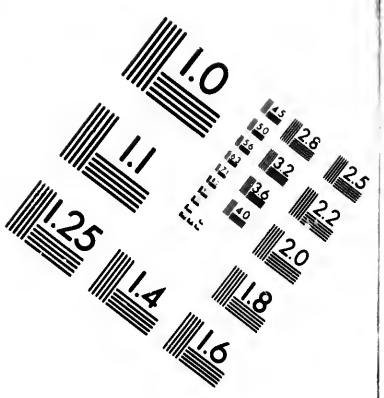

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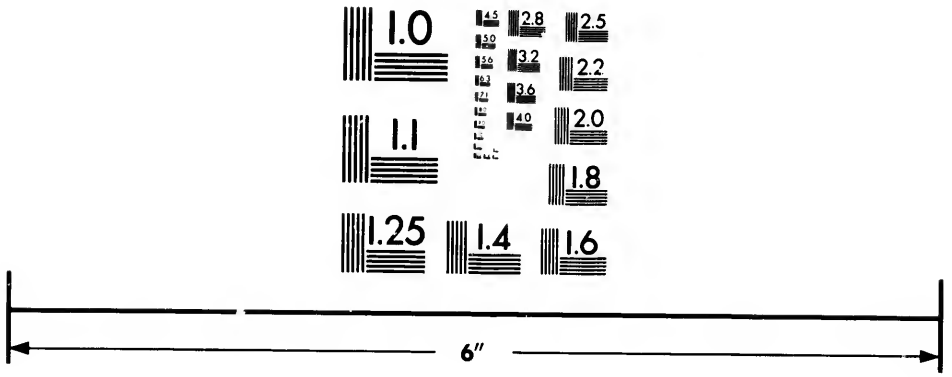

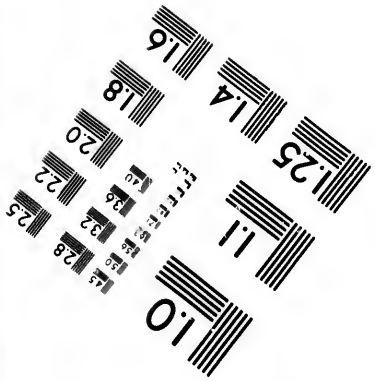

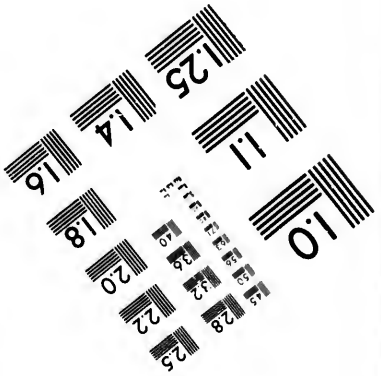

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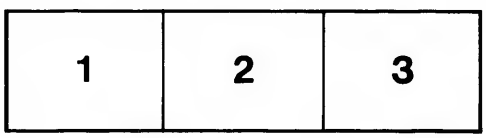

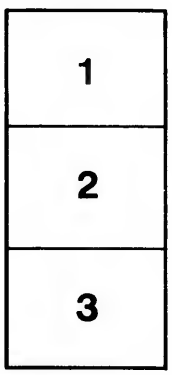

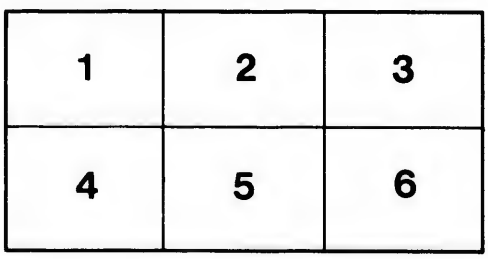

PRIVATE.

REPORT

OF

MR. CYRUS W. FIELD

TO THE

PRESIDENT AND DIRECTORS

LONDON, MARCH 8th, 1866.

LONDON:
PRINTED BY WILLIAM BROWN & CO., 40 & 41, OLD BROAD STREET, E.C.

1866.

INDEX TO DOCUMENTS WITH MR. FIELD'S REPORT.

[Private.]

For the information of the Shareholders of the New York, Newfoundland and London Telegraph Company.

London, *March 8th*, 1866.

To the President and Directors of The New York, Newfoundland and London Telegraph Company,

New York.

Gentlemen,

I sailed from New York in the "Scotia" on the 13th of December, arrived at Liverpool the afternoon of the 24th, and in London late the same evening. Early the next (Christmas) morning, I learnt with much surprise that the Attorney-General of England had, on the previous Friday, given an opinion that the Atlantic Telegraph Company were not authorized by their Acts of Parliament to issue new 12 per cent. First Preference Shares, and as the time had passed for applying to Parliament this session for a private bill making such issue legal, the Directors of the Atlantic Telegraph Company decided that they must return all the money that had been received as subscriptions to this Stock.

Meetings of the Directors of the Telegraph Construction and Maintenance Company and of the Atlantic Telegraph Company were called for Wednesday, the 27th December, to discuss what should be done in this emergency. There was a full meeting of the Directors of the first-named Company, and they manifested great desire to aid the Atlantic Telegraph Company in every way in their power.

Another meeting of both boards was called for Friday, the 29th December, on which day they met and fully discussed the subject. As I have written you from time to time respecting the various negotiations

that have been going on since that date, I will not repeat what I have before stated, but give you the result, which is that a new Company has been formed, called "The Anglo-American Telegraph Company, Limited" and the annexed prospectus (marked A.) will explain the manner in which by means of this Company it is now proposed to carry out the enterprise of telegraphic communication between Ireland and Newfoundland during the present season.

You will observe by this Prospectus that it is estimated that one telegraph cable between Ireland and Newfoundland will yield a gross revenue of £510,000 per annum. The Atlantic Telegraph Company's portion would be divided as follows, viz.:—

After paying on £600,000 Atlantic Telegraph Company's Preference Shares 8 per cent.	£48,000
And on £600,000 Ordinary Shares 4 per cent.	24,000
	£72,000

there will be a further sum to divide amongst the Shareholders of the Atlantic Telegraph Company of £156,500, which would pay another dividend on the full amount of the Preference and Ordinary Stock of 12 per cent., equal to £144,000, leaving a surplus of £12,500 to be carried to New Account. From one cable this would make the total annual dividend on the Atlantic Telegraph Company's Preference Shares 20 per cent, and on the Ordinary Shares 16 per cent.

Annexed you have estimates (marked B and C) of the revenue to be derived by the Atlantic Telegraph Company and the Anglo-American Telegraph Company from the working of one and two cables between Ireland and Newfoundland, and the manner in which it will be distributed.

I believe that the entire stock, £600,000, of the Anglo-American Telegraph Company will be raised within a very short time.

Annexed you have list (marked D) of subscriptions that were obtained privately previous to the issue of the Prospectus.

The Contractors are so confident that the whole capital will be obtained that they are going on full speed with the manufacture of the cable.

Annexed you have an able address (marked E) delivered by Professor William Thomson, LL.D. (who accompanied the expedition with the "Great Eastern" last year), before the Royal Society of Edinburgh, on the forces concerned in the laying and lifting of deep-sea cables; a certifi-

cate of what has been proved by the Atlantic Telegraph Expeditions of 1858 and 1865 (marked F); a letter from C. F. Varley, Esq., about the tariff for messages through the Atlantic cable (marked G); Mr. Willoughby Smith's new system of testing a submarine cable electrically during its submersion (marked H), and several other documents not mentioned in this report, to which I would invite your careful attention.

Captain Frank Bolton has been for many years arranging a code for expediting the transmission of messages through long submarine cables, and the copy of his letter which I send you with this (marked I), will explain to you that he can increase the speed to a very great extent.

On the 7th ultimo I signed on behalf of the New York, Newfoundland and London Telegraph Company, the heads of an agreement with Mr. Richard Atwood Glass on behalf of the Anglo-American Telegraph Company, as per copy annexed. (marked J.)

This agreement I duly forwarded to you for your approval, with a request that you would send me by first mail, a Power of Attorney to execute the detailed contract.

I am apprehensive that this agreement may not at first sight meet with your full approval, but you will please remember that the last extension that the New York, Newfoundland and London Telegraph Company gave the Atlantic Telegraph Company for the completion of the line from Ireland to Newfoundland does not expire until the 1st day of March, 1868, so that the Newfoundland Company could not lay a cable between Ireland and Newfoundland this year or the next, unless the Atlantic Company consented to cancel their agreement. Under all the circumstances, I put it for your consideration, whether it was not better to contribute £25,000 per annum from the receipts for through business to secure the laying of the Atlantic cable this year, than to let this great enterprise remain in abeyance until 1868?

You are aware that by the agreement between the Atlantic Telegraph Company and the New York, Newfoundland and London Telegraph Company, made on the 17th of February, 1858, the revenue for messages through the Atlantic cable or cables, and passing over the lines of the New York, Newfoundland and London Telegraph Company is to be divided, two-thirds to the Atlantic Telegraph Company and one-third to the New York, Newfoundland and London Telegraph Company, that is for every three pounds earned for through business, two belong to the Atlantic and

one to the Newfoundland Company, so that the revenue for through business on the lines of the last named Company would be equal to half that of the Atlantic Telegraph Company, consequently if the gross income from one cable be £540,000 per annum, the same messages passing over the New York, Newfoundland and London Telegraph Company's lines will yield to that Company £270,000 per annum. From this sum, however, must be deducted £25,000 per annum, which I have agreed to contribute from our revenue to that of the Anglo-American Telegraph Company, to secure telegraphic communication between Europe and America this season, thus leaving us a net income of £245,000 per annum for through business.

With two cables across the Atlantic, the revenue for through business of the New York, Newfoundland and London Telegraph Company would amount on the same basis, to £540,000 per annum, less £25,000 contribution to the Anglo-American Company, leaving net £515,000 per annum.

£245,000 per annum, the net revenue estimated to be derived by our Company from the through business of one cable, is upwards of 40 per cent. per annum on our entire capital of $3,000,000. £515,000, the anticipated revenue from two cables, is more than 85 per cent. on the entire capital. What our revenue will be with additional cables I leave you to estimate.

The local business of the New York, Newfoundland and London Telegraph Company and the discounts agreed to be paid by Telegraph Companies in America to that Company, will in my opinion, keep the lines in perfect working order and pay all expenses of operating the same, so that the revenue from through business will be entirely net profit.

The capital of the New York, Newfoundland and London Telegraph Company is $3,000,000, of which there has been issued $2,750,000 besides £50,000 sterling 5 per cent bonds due in 1874.

I am negotiating in England for the manufacture of a new submarine cable, to be laid down as early in the ensuing spring as the weather will permit, between Cape Ray Cove, Newfoundland, and Ashpee Bay, Cape Breton, and also for the repairs of the existing cable, so as to have two cables in good working order across the Gulf of St. Lawrence. I am also negotiating for the manufacture of a new cable to be laid between Prince Edward Island and New Brunswick, and for the thorough repair of the

present cable, so as also to have a double line across the Straits of Northumberland. As soon as the Atlantic cable is in working order I strongly advise another cable to be laid from Placentia, Newfoundland, to Sydney, Cape Breton, and the erection of an additional wire upon our present poles, and also that new land lines be constructed from Heart's Content to Placentia, and from Sydney to Port Hood; this being completed, there would be three cables across the Gulf of St. Lawrence, and three independent telegraph lines all the way from the terminus of the Atlantic cable at Heart's Content, to the end of the Newfoundland Company's lines. I hope that no message to or from the Atlantic cable will ever be delayed one hour on the lines of the New York, Newfoundland and London Telegraph Company. You will observe by the annexed extracts from letters of Mr. A. M. Mackay (marked K), our Superintendent, that he has no doubt the present cable across the Gulf of St. Lawrence can be repaired.

The New York, Newfoundland and London Telegraph Company hold the exclusive right for 50 years, from 1854, of landing submarine cables on the shores of Labrador, Newfoundland, and Prince Edward Island, and for 25 years on the coast of the State of Maine, the right to build lines in Canada, and an exclusive connection with the American Telegraph Company owning or leasing all the lines in Nova Scotia and most of those in New Brunswick. These exclusive privileges, extending over more than 2,000 miles of sea coast, must ultimately prove of great value to our Company, for I believe that within a few years there will be many submarine cables working between Ireland and Newfoundland, and that they will all have as much business as they can do. I am sure, that when you consider for a moment the hundreds of millions of persons in Europe, Asia and Africa who will be brought into communication with America by the Atlantic cable, you will agree with me that it is almost impossible to estimate the future value of our property. The intercourse between the eastern and western hemispheres is increasing in an enormous ratio. It is less than thirty years since the first regular steam-packet crossed the Atlantic, and now there is an average of nearly two steamers daily each way (Sundays excepted), as will be seen from the annexed statement. (marked L.)

Professor M. C. Vincent, of the Royal Geological Society, London, visited Newfoundland last year at the request of some gentlemen in this city, and I have obtained a copy of his report to them on our lead mine at La Manche, and annexed you have the same. (marked M.)

I declined an offer made to me a few days since in London for the purchase of the La Manche lead mine.

Copper, lead, coal, iron and many other minerals have been discovered in various parts of Newfoundland, and I would strongly advise that we locate this summer the balance of the 100 square miles of land granted to us by the Government of Newfoundland, and if this is done judiciously, these grants will prove of great value to us.

At the Annual Meeting of the Shareholders of the Atlantic Telegraph Company held this day, the Agreement between that Company and the Anglo-American Telegraph Company Limited was unanimously approved.

It is my intention to return to New York as soon as I have received from you the Power of Attorney to execute the agreement between the Anglo-American Company and the New York, Newfoundland and London Telegraph Company, and that the capital is secured for the new Atlantic cable.

It is a source of great pleasure to me to assure you that there is little doubt of the successful laying of the new telegraph cable between Ireland and Newfoundland this summer, and that there is great probability of the raising and completion of the one about two-thirds laid last year, and that the accomplishment of this work will give not only a large profit to the Shareholders of the Anglo-American Telegraph Company, but also substantial returns to the original and preference Shareholders of the Atlantic Telegraph Company. It will increase the prosperity of the Telegraph Construction and Maintenance Company, which has come forward so liberally to aid this great enterprise, establish the success of the steam ship "Great Eastern," the proprietors of which have dealt so generously with this Company, and last, but not least, it will ensure that you and the other Shareholders in the New York, Newfoundland and London Telegraph Company will receive some compensation for the labour, anxiety and time that you have devoted, and for the capital which you have invested during the last twelve years, in order to connect by telegraph our own land with the great country from which we are descended.

With respect,

I remain, GENTLEMEN,

Very truly your friend,

CYRUS W. FIELD.

(A.)

MESSRS. J. S. MORGAN & Co.

Are prepared to receive Subscriptions for Shares in the

ANGLO-AMERICAN

TELEGRAPH COMPANY LIMITED.

Incorporated under the "Companies' Act, 1862," which limits the liability of each Shareholder to the amount of the Shares subscribed by him.

CAPITAL £600,000 in 60,000 SHARES of £10 EACH.

Deposit on Application	£1
Deposit on Allotment	£3
16th April	£3
1st June	£3
	£10

Under arrangements with the Atlantic Telegraph Company, this Company will be entitled to receive **£125,000** *per annum out of the earnings from the working of the Atlantic Telegraph Company's Lines, and they will also be entitled to receive* **£25,000** *per annum from the New York, Newfoundland and London Telegraph Company, out of the earnings of that Company for through Messages.*

The agreements between the Companies provide for other contingent advantages which are after stated.

Directors.

GEORGE PEABODY, Esq., 22, Old Broad Street.
EDWARD CROPPER, Esq., Swaylands, Penshurst.
CAPTAIN A. T. HAMILTON, 12, Bolton Row, Piccadilly.
RICHARD ATWOOD GLASS, Esq., Ashurst, Dorking.
DANIEL GOOCH, Esq., M.P., Clewer Park, Windsor.
HENRY BEWLEY, Esq., Willow Park, Dublin.
FRANCIS A. BEVAN, Esq., 54, Lombard Street.
J. R. M'CLEAN, Esq., C.E., 23, Great George Street, Westminster.
CHARLES E. STEWART, Esq., 102, Lancaster Gate, Hyde Park, W.

Bankers.

Messrs. BARCLAY, BEVAN, TRITTON, TWELLS & Co. 54, Lombard Street, E.C.

Secretary *(pro tem).*—J. C. DEANE, Esq.

THIS COMPANY has been established for the purpose of executing in the course of the present year the great enterprise of laying a Submarine Cable between Ireland and Newfoundland, so as to connect telegraphically the Old

World and the New, and to raise the cable partially laid last year, in order to complete a second line to America.

The circumstances attending the recent attempts to carry out this work have greatly increased the confidence of all those who have been engaged in it, and they are convinced that this renewed effort will be attended with success.

The whole length of 1,212 nautical miles of Cable laid from the Great Eastern in July last continues perfect, according to the daily reports of the electricians in charge at Valentia, and the observations taken by Capt. James Anderson, of the Great Eastern, and Staff Commander Henry A. Moriarty, R.N., have determined the position of the broken end with the utmost accuracy. Mr. Canning and the other engineers engaged in the late expedition are confident that with the machinery and tackle now being prepared, they will be able to raise the cable and complete the line to Newfoundland.

The 1,070 nautical miles of cable, which has remained on board the Great Eastern since August last, is certified to be in as perfect condition as when it was shipped.

The Atlantic Telegraph Company had arranged for providing the funds necessary for resuming the work by an issue of new 12 per cent. First Preference Shares; but having been recently advised that such issue is not authorised by their Acts of Parliament, the proposal has been withdrawn and all the subscriptions are being returned.

It has therefore been decided that, for the purpose of aiding in the completion of this important undertaking, an entirely distinct Company shall be formed, and this Company is accordingly formed with valuable privileges, hereinafter specified, secured to them by Agreements with the Atlantic Telegraph Company, and the New York, Newfoundland and London Telegraph Company.

A copy of the Memorandum of Association, which has been registered in accordance with the Companies' Act, 1862, is annexed.

The effect of the agreement entered into between the Atlantic Telegraph Company and this Company is that the latter undertake the construction for the former Company of 1,660 nautical miles of new cable to be added to that now on board the Great Eastern, and for its submersion, from that vessel, between Ireland and Newfoundland during the ensuing summer, and for the adoption of suitable measures for raising and completing the broken cable of last year.

This Company also engage to work both cables, or either as the case may be, as the Agents and on behalf of the Atlantic Telegraph Company during the continuance of the agreement, and the agreement further provides that in consideration of the engagements so contracted by this Company,

there shall be an annual payment by the Atlantic Telegraph Company to this Company out of the earnings from the working of the cables of £125,000, the arrangements being that the receipts in each year from all the Atlantic Telegraph Company's Lines are, after paying expenses of repairs, management, working, and direction, and interest (not exceeding £5,000 per annum) on the debentures of the Atlantic Telegraph Company, to be appropriated thus:—

First. In paying to this Company £125,000 per annum.

Second. In paying £72,000 per annum (representing Eight per Cent. on the Atlantic Company's existing Preference Stock and Four per Cent. on their Ordinary Stock) to the Atlantic Telegraph Company, and

Third. The entire balance of each year's receipts is to be divided between this Company and the Atlantic Telegraph Company in equal shares; but no deficiency in respect of the above annual payments in any one year is to be carried forward to another year.

The right is reserved to the Atlantic Telegraph Company of terminating the Agreement on or before the 1st January, 1869 (on giving three months' notice to that effect), by payment to this Company of the sum of £1,200,000, being double the amount of its capital. If, however, the Atlantic Telegraph Company exercise this option, the Anglo-American Company will have the right to take payment of the £1,200,000, one-half in cash and one-half in Ordinary Atlantic Telegraph Shares at par, instead of the whole amount in cash.

In the event of the Atlantic Telegraph Company exercising their right of redemption by payment of the above-named sum of £1,200,000, this Company will be forthwith dissolved and the funds distributed amongst the Shareholders.

The New York, Newfoundland and London Telegraph Company, with a view of securing the completion of telegraphic communication between Ireland and Newfoundland during the present year, have by their Deputy Chairman now in London agreed to contribute £25,000 per annum to this Company out of their share of the receipts, for through messages between Ireland and America, and passing over their lines. This subsidy will terminate upon the payment by the Atlantic Telegraph Company of the £1,200,000 above mentioned, or upon both cables ceasing after 31st December, 1866, to be in working order for twelve successive months. The agreement has been forwarded to New York for formal ratification there.

To sum up the financial arrangements, the effect will be as follows:—

The Shareholders in this Company will be entitled to £125,000 a-year out

of the earnings of the Atlantic Telegraph Company's Lines, and £25,000 a-year out of those of the Newfoundland Company for through business, together £150,000 a-year upon a capital of £600,000, making 25 per cent. per annum. But this by no means represents all the advantages which may accrue, as, according to the calculations that have been made, it is confidently believed that even with a single cable and a low tariff the revenue will afford a large additional sum for division. An estimate, drawn up by practical and experienced telegraphists, of the probable returns is annexed.

The Directors have great confidence in recommending this undertaking to the public.

The Telegraph Construction and Maintenance Company will manufacture the new cable and undertake the actual execution of the work contracted for by this Company, as above stated (up to the opening of the Atlantic Telegraph Lines for public business) for a total sum of £600,000; with a bonus to be provided by the Atlantic Telegraph Company under their agreement with this Company of £137,140 in ordinary shares of the Atlantic Telegraph Company, payable by instalments extending over fourteen months, in case the cable of last year is successfully completed and continues in working order during that period.

In the possible contingency of the new Cable not being successfully laid, £500,000 only will be paid to the Telegraph Construction and Maintenance Company, and this Company will in that event be entitled to the value of all the unused and recovered Cable (subject to the payment of certain specified charges thereon), and it is estimated that this arrangement will provide, in case of failure, for a return to the Shareholders of this Company of at least one-third of their paid up capital.

The whole of the deposits on Shares will be returned to the subscribers if two-thirds of the capital of the Company are not subscribed, or if the agreement with the New York, Newfoundland and London Telegraph Company is not ratified by them.

Copies of the Memorandum and Articles of Association can be inspected at the Counting House of Messrs. J. S. Morgan & Co., and contracts at the Offices of Messrs. Bircham & Co., 46, Parliament Street.

Applications for Shares are to be made in the accompanying form, and the deposit of £1 per Share paid to Messrs. J. S. Morgan & Co., 22, Old Broad Street.

Should a less number of Shares be allotted than is applied for, the deposit will, so far as required, be appropriated towards the payment due on allotment. If no allotment is made, the amount deposited will be at once returned without deduction.

6th March, 1866.

ANGLO-AMERICAN TELEGRAPH COMPANY, LIMITED.

The Directors cannot of course bind themselves at present to any tariff for messages. The amount to be charged will be a matter for consideration hereafter. But it may be safely assumed that it will not be less than 5s. per word. Working at 5s. per word, only five words a minute, twenty-four hours per day, and allowing 300 working days for the year, there would be a gross revenue of £1,800 a-day, or £540,000 a year. This is for one cable only.

The highest authorities in Electrical Science give it as their opinion that eight words a minute could easily be obtained through the Atlantic Cable. And there is every reason to anticipate that at a tariff of anything like 5s. a word there would be more messages offered than the Company could transmit.

The undersigned append their names as considering this Estimate of the probable result a reasonable one.

CHARLES T. BRIGHT, M.I.C.E.,
Consulting Engineer to the British and Irish Magnetic Telegraph Company.

LATIMER CLARK, M.I.C.E.,
Consulting Engineer to the Electric and International Telegraph Company.

HENRY C. FORDE, M.I.C.E.

FLEEMING JENKIN, F.R.S.

WILLIAM THOMSON, LL.D., F.R.S.,
Professor of Natural Philosophy in the University of Glasgow.

CROMWELL F. VARLEY, M.I.C.E., F.R.G.S., M.R.I., &c., &c.,
Electrician to the Electric and International Telegraph Company.

The realisation of this Estimate (allowing £25,000 per annum for Working Expenses) would make the income of the Company over £300,000 per annum.

Memorandum of Association

OF THE

ANGLO-AMERICAN TELEGRAPH COMPANY, LIMITED.

1. The Name of the Company is "THE ANGLO-AMERICAN TELEGRAPH COMPANY LIMITED."

2. The registered Office of the Company is to be in England.

3. The objects for which the Company is established are the contracting for construction, laying down, maintenance, and working of submarine and land telegraphs between Great Britain and America, or between any places or points forming or intended to form part or parts of any telegraphic route between those countries or any intermediate places; the recovery and completion of the Atlantic Telegraph Cable partially laid in 1865; the purchase, chartering, and employment of any vessel or vessels for any purpose connected with any of the objects of the Company; the entering into contracts and agreements with any Company, Corporation, or persons with reference to any of the objects of the Company; the applying for and obtaining, or acquiring by purchase or otherwise, of all such concessions, grants, privileges, licenses, letters patent, and other rights, or any interest therein respectively as may be useful or desirable for any such objects; and the doing of all such things as are or may hereafter be incidental or conducive to the attainment of the above objects or any or either of them. But the Company shall not do anything whereby the limitation of the liability of their Shareholders shall be prejudiced.

4. The liability of the Shareholders is limited.

5. The nominal capital of the Company is £600,000, in 60,000 shares of £10 each.

(B.)

ANGLO-AMERICAN TELEGRAPH COMPANY, Limited.

Estimated Revenue based upon the opinion of the highest authorities in Electrical Science. Assuming that the charge for transmission of Messages between the Old and the New World be fixed at 5s. per word, and that the speed of working be limited to only 5 words per minute during 24 hours per day, and allowing 300 working days in the year,

ONE CABLE

Would produce a gross Annual Revenue of £540,000, to be divided as follows:—

1.	Working Expenses (say)	£25,000
2.	Interest at 5 per Cent. on £100,000 Atlantic Telegraph Debentures	5,000
3.	Anglo-American Telegraph Company	125,000
4.	Atlantic Telegraph Company's Preference Shares £600,000, 8 per Cent.	48,000
5.	Atlantic Telegraph Company's Ordinary Shares £600,000 4 per Cent.	24,000
6.	Balance divided { Anglo-American Telegraph Co.	156,500
	{ Atlantic Telegraph Co.	156,500
		£540,000

To the £281,000 above shown as coming to the Anglo-American Telegraph Company from the revenue of the cable, the sum of £25,000 must be added, granted as a subsidy by the New York, Newfoundland and London Telegraph Company, which will make a total income of £306,500, or over 50 per Cent. net upon the capital of the Anglo-American Telegraph Company. After paying 8 per Cent. on the Atlantic Telegraph Company's Preference, and 4 per Cent. on the Ordinary Shares, there is a surplus for the Atlantic Telegraph Company of £156,500, which would pay a further dividend of 12 per Cent. on the full amount of both Stocks of that company, £144,000, and leave a sum to be carried to new account of £12,500. This is a total dividend to the Preference Shareholders of 20 per Cent., and to the Ordinary Shareholders of 16 per Cent. per annum.

(C.)

In the anticipated event of the Telegraph Construction and Maintenance Company succeeding in laying the new cable, in raising the end of the cable partly laid in 1865, *and completing it to Newfoundland, then upon the same basis of calculation as that made for one Cable,*

TWO CABLES

Would produce a gross Annual Revenue of £1,080.000, which would be divided as follows:—

1.	Working Expenses (say)	£30,000
2.	Interest at 5 per Cent. on £100,000 Atlantic Telegraph Debentures	5,000
3.	Anglo-American Telegraph Company.....	125,000
4	Atlantic Telegraph Company Preference Shares, £600,000, 8 per Cent.	48,000
5.	Atlantic Telegraph Company Ordinary Shares £600,000, 4 per Cent.	24,000
6.	Balance divided { Anglo American Telegraph Co. ..	424,000
	{ Atlantic Telegraph Co.	424,000
		£1,080,000

The subsidy of £25,000 from the New York, Newfoundland and London Telegraph Company being added to the £549,000 coming as above to the Anglo-American Telegraph Company from the revenue of the two cables will make the income of the latter £574,000, or over 95 per Cent. net upon the capital of the Anglo-American Telegraph Company. After paying 8 per Cent. on the Atlantic Telegraph Company's Preference, and 4 per Cent. on the Ordinary Shares, there is a surplus for the Atlantic Telegraph Company of £424,000, which would pay a further dividend of 35 per Cent. on both Stocks of that Company, and leave a sum of £4,000 to be carried to New Account, making a total dividend to the Preference Shareholders of 43 per Cent., and to the Ordinary Shareholders of 39 per Cent.

(D.)

Private List of Subscriptions for Anglo-American Telegraph Company's Stock previous to the issue of the Prospectus.

Telegraph Construction and Maintenance Co., Limited	£100,000
Henry Ford Barclay, Esq.	10,000
Henry Bewley, Esq.	10,000
Thomas Brassey, Esq.	10,000
A. H. Campbell, Esq., M.P.	10,000
George Elliot, Esq.	10,000
Cyrus W. Field, Esq.	10,000
Richard Atwood Glass, Esq.	10,000
Daniel Gooch, Esq., M.P.	10,000
John Pender, Esq., M.P.	10,000
John Smith, Esq.	10,000
Thomas Bolton and Sons	5,000
James Horsfall, Esq.	5,000
A Friend of Mr. Daniel Gooch, M.P.	5,000
John and Edwin Wright	5,000
John Wilkes & Sons	2,500
C. M. Lampson, Esq.	2,000
J. Morison, Esq.	2,000
Ebenezer Pike, Esq.	2,000
Edward Cropper, Esq.	1,000
Joseph Robinson, Esq.	1,000
	£230,500

(E.)

PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

Monday, December 18th, 1865.

SIR DAVID BREWSTER, President, in the Chair.

At the request of the Council, Professor WILLIAM THOMSON, LL.D., of Glasgow, delivered the following Address on the Forces concerned in the Laying and Lifting of Deep-sea Cables.

THE forces concerned in the laying and lifting of deep submarine cables attracted much public attention in the years 1857-58.

An experimental trip to the Bay of Biscay in May, 1858, proved the possibility, not only of safely laying such a rope as the old Atlantic cable in very deep water, but of lifting it from the bottom without fracture. The speaker had witnessed the almost incredible feat of lifting up a considerable length of that slight and seemingly fragile thread from a depth of nearly $2\frac{1}{2}$ nautical miles.* The cable had actually brought with it safely to the surface, from the bottom, a splice with a large weighted frame attached to it, to prevent untwisting between the two ships, from which two portions of cable with opposite twists had been laid. The actual laying of the cable a few months later, from mid ocean to Valentia on one side, and Trinity Bay, Newfoundland, on the other, regarded

* Throughout the following statements, the word mile will be used to denote (not that most meaningless of modern measures, the British statute mile) but the nautical mile, or the length of a minute of latitude, in mean latitudes, which in electric cable reckoning is taken as 6,073 feet. For approximate statements, rough estimates, &c., it may be taken as 6,000 feet, or 1,000 fathoms.

merely as a mechanical achievement, took by surprise some of the most celebrated engineers of the day, who had not concealed their opinion, that the Atlantic Telegraph Company had undertaken an impossible problem. As a mechanical achievement it was completely successful; and the electric failure, after several hundred messages (comprising upwards of 4,359 words) had been transmitted between Valentia and Newfoundland, was owing to electric faults existing in the cable before it went to sea. Such faults cannot escape detection, in the course of the manufacture, under the improved electric testing since brought into practice, and the causes which led to the failure of the first Atlantic cable no longer exist as dangers in submarine telegraphic enterprise. But the possibility of damage being done to the insulation of the electric conductor before it leaves the ship (illustrated by the occurrences which led to the temporary loss of the 1865 cable), implies a danger which can only be thoroughly guarded against by being ready at any moment to back the ship and check the egress of the cable, and to hold on for some time, or to haul back some length according to the results of electric testing.

The forces concerned in these operations, and the mechanical arrangements by which they are applied and directed, constitute one chief part of the present address; the remainder is devoted to explanations as to the problem of lifting the west end of the 1,200 miles of cable laid last summer, from Valentia westwards, and now lying in perfect electric condition (in the very safest place in which a submarine cable can be kept), and ready to do its work, as soon as it is connected with Newfoundland, by the 600 miles required to complete the line.

Forces concerned in the Submergence of a Cable.

In a paper published in the "Engineer" Journal in 1857, the speaker had given the differential equations of the catenary formed by a submarine cable between the ship and the bottom, during the submergence, under the influence of gravity and fluid friction and pressure; and he had pointed out that the curve becomes a straight line in the case of no tension at the bottom. As this is always the case in deep sea cable laying, he made no further reference to the general problem in the present address.

When a cable is laid at uniform speed, on a level bottom, quite straight, but without tension, it forms an inclined straight line, from the point where it enters the water, to the bottom, and each point of it clearly moves uniformly in a straight line towards the position on the bottom that it ultimately occupies.* That is to say, each particle of the cable moves uniformly along the base of an isosceles triangle, of which the two equal sides are the inclined portion of the

* Precisely the movement of a battalion in line changing front.

cable between it and the bottom, and the line along the bottom which this portion of the cable covers when laid. When the cable is paid out from the ship at a rate exceeding that of the ship's progress, the velocity and direction of the motion of any particle of it through the water are to be found by compounding a velocity along the inclined side, equal to this excess, with the velocity already determined, along the base of the isosceles triangle.

The angle between the equal sides of the isosceles triangle, that is to say, the inclination which the cable takes in the water, is determined by the condition, that the transverse component of the cable's weight in water is equal to the transverse component of the resistance of the water to its motion. Its tension where it enters the water is equal to the longitudinal component of the weight (or, which is the same, the whole weight of a length of cable hanging vertically down to the bottom), diminished by the longitudinal component of the fluid resistance. In the laying of the Atlantic cable, when the depth was two miles, the rate of the ship six miles an hour, and the rate of paying out of the cable seven miles an hour, the resistance to the egress of the cable, accurately measured by a dynamometer, was only 14 cwt. But it must have been as much as 28 cwt., or the weight of two miles of the cable hanging vertically down in water, were it not for the frictional resistance of the water against the cable slipping, as it were, down an inclined plane from the ship to the bottom, which therefore must have borne the difference, or 14 cwt. Accurate observations are wanting as to the angle at which the cable entered the water; but from measurements of angles at the stern of the ship, and a dynamical estimate (from the measured strain) of what the curvature must have been between the ship and the water, I find that its inclination in the water, when the ship's speed was nearly $6\frac{1}{2}$ miles per hour, must have been about $6\frac{3}{4}°$, that is to say, the incline was about 1 in $8\frac{1}{2}$. Thus the length of cable, from the ship to the bottom, when the water was two miles deep, must have been about 17 miles.

The whole amount (14 cwt.) of fluid resistance to the motion of this length of cable through it is therefore about ·81 of a cwt. per mile. The longitudinal component velocity of the cable through the water, to which this resistance was due, may be taken, with but very small error, as simply the excess of the speed of paying out above the speed of the ship, or about one mile an hour. Hence, to haul up a piece of the cable vertically through the water, at the rate of one mile an hour, would require less than 1 cwt. for overcoming fluid friction, per mile length of the cable, over and above its weight in water. Thus fluid friction, which for the laying of a cable performs so valuable a part in easing the strain with which it is paid out, offers no serious obstruction, indeed, scarcely any sensible obstruction, to the reverse process of hauling back, if done at only one mile an hour, or any slower speed.

As to the transverse component of the fluid friction, it is to be remarked that,

although not directly assisting to reduce the egress strain, it indirectly contributes to this result; for it is the transverse friction that causes the gentleness of the slope, giving the sufficient length of 17 miles of cable slipping down through the water, on which the longitudinal friction operates, to reduce the egress strain to the very safe limit found in the recent expedition. In estimating its amount, even if the slope were as much as 1 in 5, we should commit only an insignificant error, if we supposed it to be simply equal to the weight of the cable in water, or about 14 cwt. per mile for the 1865 Atlantic cable. The transverse component velocity to which this is due may be estimated with but insignificant error, by taking it as the velocity of a body moving directly to the bottom in the time occupied in laying a length of cable equal to the 17 miles of oblique line from the ship to the bottom. Therefore, it must have been from 2 miles in $17 \div 6\frac{1}{2} = 2{\cdot}61$ hours, or ·8 of a mile per hour. It is not probable that the actual motion of the cable lengthwise through the water can affect this result much. Thus, the *velocity of settling* of a horizontal piece of the cable (or velocity of sinking through the water, with weight just borne by fluid friction) would appear to be about ·8 of a mile per hour. This may be contrasted with longitudinal friction by remembering that, according to the previous result, a longitudinal motion through the water at the rate of one mile per hour is resisted by only 1-17th of the weight of the portion of cable so moving.

These conclusions justify remarkably the choice that was made of materials and dimensions for the 1865 cable. A more compact cable (one for instance with less gutta percha, less or no tow round the iron wires, and somewhat more iron), even if of equal strength and equal weight per mile in water, would have experienced less transverse resistance to motion through the water, and therefore would have run down a much steeper slope to the bottom. Thus, even with the same longitudinal friction per mile, it would have been less resisted on the shorter length; but even on the same length it would have experienced much less longitudinal friction, because of its smaller circumference. Also, it is important to remark that the roughness of the outer tow covering undoubtedly did very much to ease the egress strain, as it must have increased the fluid friction greatly beyond what would have acted on a smooth gutta percha surface, or even on the surface of smooth iron wires, presented by the more common form of submarine cables.

The speaker showed models illustrating the paying-out machines used on the Atlantic expeditions of 1858 and 1865. He stated that nothing could well be imagined more perfect than the action of the machine of 1865 in paying out the 1,200 miles of cable then laid, and that if it were only to be used for *paying out*, no change either in general plan or in detail seemed desirable, except the substitution of a softer material for the "jockey pulleys," by which the cable in entering the machine has the small amount of resistance applied to it which

it requires to keep it from slipping round the main drum. The rate of egress of the cable was kept always under perfect control by a weighted friction brake of Appold's construction (which had proved its good quality in the 1858 Atlantic expedition) applied to a second drum carried on the same shaft with the main drum. When the weights were removed from the brake (which could be done almost instantaneously by means of a simple mechanism), the resistance to the egress of the cable, produced by "jockey pulleys," and the friction at the bearings of the shaft carrying the main drum, &c., was about 2½ cwt.

Procedure to repair the Cable in case of the appearance of an electric fault during the laying.

In the event of a fault being indicated by the electric test at any time during the paying out (as proved by the recent experience), the safe and proper course to be followed in future, if the cable is of the same construction as the present Atlantic cable, is instantly, on order given from an authorised officer in the electric room, to stop and reverse the ship's engines, and to put on the greatest *safe* weight on the paying-out brake. Thus in the course of a very short time the egress of the cable may be stopped, and, if the weather is moderate, the ship may be kept, by proper use of paddles, screw, and rudder, nearly enough in the proper position for hours to allow the cable to hang down almost vertically, with little more strain than the weight of the length of it between the ship and the bottom.

The best electric testing that has been practised, or even planned, cannot show within a mile the position of a fault consisting of a slight loss of insulation, unless both ends of the cable are at hand. Whatever its character may be, unless the electric tests demonstrate its position to be remote from the outgoing part, the only thing that can be done to find whether it is just on board or just overboard, is to cut the cable as near the outgoing part as the mechanical circumstances allow to be safely done. The electric test immediately transferred to the fresh-cut seaward end shows instantly if the electric line is perfect between it and the shore. A few minutes more, and the electric tests applied to the *two ends* of the remainder on board, will, in skilful hands, with a proper plan of working, show very closely the position of the fault, *whatever its character may be*. The engineers will thus immediately be able to make proper arrangements for re-splicing and paying out good cable, and for cutting out the fault from the bad part.

But if the fault is between the land end and the fresh-cut seaward end on board ship, proper simultaneous electric tests on board ship and on shore (not hitherto practised, but easy and sure if properly planned) must be used to discover whether the fault lies so near the ship that the right thing is to haul back

the cable until it is got on board. If it is so, then steam power must be applied to reverse the paying-out machine, and, by careful watching of the dynamometer, and controlling the power accordingly (hauling in slowly, stopping, or veering out a little, but never letting the dynamometer go above 60 or 65 cwt.), the cable (which can bear 7 tons) will not break, and the fault will be got on board more surely, and possibly sooner, than a "sulky" salmon of 30 lbs. can be landed by an expert angler with a line and rod that could not bear 10 lbs. The speaker remarked that he was entitled to make such assertions with confidence now, because the experience of the late expedition had not only verified the estimates of the scientific committee, and of the contractors, as to the strength of the cable, its weight in water (whether deep or shallow), and its mechanical manageability, but it had proved that in moderate weather the "Great Eastern" could, by skilful seamanship, be kept in position and moved in the manner required. She had actually been so for thirty-eight hours, and eighteen hours during the operations involved in the hauling back and cutting out the first and second faults, and re-uniting the cable, and during seven hours of hauling in, in the attempt to repair the third fault.

Should the simultaneous electric testing on board and on shore prove the fault to be 50 or 100 or more miles from the ship, it would depend on the character of the fault, the season of the year, and the means and appliances on board, whether it would be better to complete the line, and afterwards, if necessary, cut out the fault and repair, or to go back at once and cut out the fault before attempting to complete the line. Even the worst of these contingencies would not be fatal to the undertaking with such a cable as the present one. But all experience of cable-laying shows that almost certainly the fault would either be found on board, or but a very short distance overboard, and would be reached and cut out with scarcely any risk, if really prompt measures, as above described, are taken at the instant of the appearance of a fault, to stop as soon as possible with safety the further egress of the cable.

The most striking part of the Atlantic undertaking proposed for 1866, is that by which the 1,200 miles of excellent cable laid in 1865 is to be utilised by completing the line to Newfoundland.

That a cable lying on the bottom in water two miles deep can be caught by a grapnel and raised several hundred fathoms above the bottom, was amply proved by the nine days' work which followed the breakage of the cable on the 2nd of August last. Three times out of four that the grapnel was let down, it caught the cable on each occasion after a few hours of dragging, and with only 300 or 400 fathoms more of rope than the 2,100 required to reach the bottom by the shortest course. The time when the grapnel did not hook the cable it came up with one of its flukes caught round by its chain; and the grapnel, the short length of chain next it, and about 200 fathoms of the wire rope, were proved

to have been dragged along the bottom, by being found, when brought on board, to have the interstices filled with soft light gray ooze (of which the speaker showed a specimen to the Royal Society). These results are quite in accordance with the dynamical theory indicated above, according to which a length of such rope as the electric cable, hanging down with no weight at its lower end, and held by a ship moving through the water at half a mile an hour, would slope down to the bottom at an angle from the vertical of only 20°; and the much heavier and denser wire-rope that was used for the grappling would go down at the same angle with a considerably more rapid motion of the ship, or at a still steeper slope with the same rate of motion of the ship.

The only remaining question is: How is the cable to be brought to the surface when hooked? The operations of last August failed from the available rope, tackle, and hauling machine not being strong enough for this very unexpected work. On no occasion was the electric cable broken.* With strong enough tackle, and a hauling machine, both strong enough, and under perfect control, the lifting of a submarine cable, as good in mechanical quality as the Atlantic cable of 1865, by a grapnel or grapnels, from the bottom at a depth of two miles, is certainly practicable. If one attempt fails another will succeed; and there is every reason, from dynamics as well as from the 1865 experience, to believe that in any moderate weather the feat is to be accomplished with little delay, and with very few if any failing attempts.

The several plans of proceeding that have been proposed are of two classes—those in which, by three or more ships, it is proposed to bring a point of the cable to the surface without breaking it at all; and those in which it is to be cut or broken, and a point of the cable somewhat eastward from the break is to be brought to the surface.

With reference to either class, it is to be remarked that, by lifting simultaneously by several grapnels so constructed as to hold the cable without slipping along it or cutting it, it is possible to bring a point of the cable to the surface without subjecting it to any strain amounting to the weight of a length of cable equal to the depth of the water. But so many simultaneous grapplings by ships crossing the line of cable at considerable distances from one another would be required, that this possibility is scarcely to be reckoned on practically, without

* The strongest rope available was a quantity of rope of iron wire and hemp spun together, able to bear 11 tons, which was prepared merely as *buoy-rope* (to provide for the contingency of being obliged, by stress of weather or other cause, to cut and leave the cable in deep or shallow water), and was accordingly all in 100 fathom lengths, joined by shackles with swivels. The wire-rope itself never broke, but on two of the three occasions a swivel gave way. On the last occasion about 900 fathoms of Manilla rope had to be used for the upper part, there not being enough of the wire buoy-rope left; and when 700 fathoms of it had been got in, it broke on board beside a shackle, and the remaining 200 fathoms of the Manilla, with 1,540 fathoms of wire-rope and the grapnel, and the electric cable which it had hooked, were all lost for the year 1865.

cutting or breaking the cable at a point westward of the points raised by the grapnels. On the other hand, with but three ships the cable might, no doubt, be brought to the surface at any point along the line, without cutting it, and without subjecting it at any point to *much* more strain than the weight corresponding to the vertical depth, as is easily seen when it is considered that the cable was laid generally with from 10 to 15 per cent. of slack. And if the cable is cut at some point not far westward of the westernmost of the grapnels, there can be no doubt but it could be lifted with great ease by three grapnels hauled up simultaneously by three ships. The catenaries concerned in these operations were illustrated by a chain with 15 per cent. of slack hauled up simultaneously at three points.

The plan which seems to the speaker surest and simplest is to cut the cable at any chosen point, far enough eastward of the present broken end to be clear of entanglement of lost buoy-rope, grapnels, and the loose end of the electric cable itself; and then, or as soon as possible after, to grapple and lift at a point about three miles farther eastward. This could be well and safely done by two ships, one of them with a cutting grapnel, and the other (the "Great Eastern" herself) with a holding grapnel. The latter, on hooking, should haul up cautiously, never going beyond a safe strain, as shown by the dynamometer. The other, when assured that the "Great Eastern" has the cable, should haul up, at first cautiously, but ultimately, when the cable is got well off the bottom by the "Great Eastern," the western ship should move slowly eastwards, and haul up with force enough to cut or break the cable. This leaves three miles of free cable on the western side of the "Great Eastern's" grapnel, which will yield freely eastwards (even if partly lying along the bottom at first), and allow the "Great Eastern" to haul up and work slowly eastwards, so as to keep its grappling rope, and therefore ultimately the portions of electric cable hanging down on the two sides of its grapnel, as nearly vertical as is necessary to make sure work of getting the cable on board. This plan was illustrated by lifting, by aid of two grapnels, a very fragile chain (a common brass chain in short lengths, joined by links of fine cotton thread) from the floor of the Royal Society. It was also pointed out that it can be executed by one ship alone, with only a little delay, but with scarcely any risk of failure. Thus, by first hooking the cable by a holding grapnel, and hauling it up 200 or 300 fathoms from the bottom, it may be left there hanging by the grapnel-rope on a buoy, while the ship proceeds three miles westwards, cuts the cable there, and returns to the buoy. Then it is an easy matter, in any moderate weather, to haul up safely and get the cable on board.

The use of the dynamometer in dredging was explained: and the forces operating on the ship, the conditions of weather, and the means of keeping the ship in proper position during the process of slowly hauling in a cable, even if it

were of strength quite insufficient to act when nearly vertical with any sensible force on the ship, were discussed at some length. The manageability of the "Great Eastern," in skilful hands, had been proved to be very much better than could have been expected, and to be sufficient for the requirements in moderate weather. She has both screw and paddles—an advantage possessed by no other steamer in existence. By driving the screw at full power ahead, and backing the paddles, to prevent the ship from moving ahead, or (should the screw overpower the paddles), by driving the paddles full power astern, and driving at the same time the screw ahead with power enough to prevent the ship from going astern, "steerage way" is *created* by the lash of water from the screw against the rudder; and thus the "Great Eastern" may be effectually steered without going ahead. Thus she is, in calm or moderate weather, almost as manageable as a small tug steamer, with reversing paddles, or as a rowing boat. She can be made still more manageable than she proved to be in 1865, by arranging to disconnect either paddle at any moment; which, the speaker was informed by Mr. Canning, may easily be done. *

The speaker referred to a letter he had received from Mr. Canning, Chief Engineer of the Telegraph Construction and Maintenance Company, informing him that it is intended to use three ships, and to be provided both with cutting and with holding grapnels, and expressing great confidence as to the success of the attempt. *In this confidence the speaker believed every practical man who witnessed the Atlantic operations of* 1865 *shared, as did also, to his knowledge, other engineers who were not present on that expedition, but who were well acquainted with the practice of cable-laying and mending in various seas, especially in the Mediterranean. The more he thought of it himself, both from what he had witnessed on board the "Great Eastern," and from attempts to estimate on dynamical principles the forces concerned, the more confident he felt that the contractors would succeed next summer in utilising the cable partly laid in* 1865, *and completing it into an electrically perfect telegraphic line between Valentia and Newfoundland.*

* It is being done.

(F.)

THE ATLANTIC TELEGRAPH COMPANY.

Certificate signed by persons officially engaged in laying the Atlantic Telegraph Cable from the Great Eastern in 1865.

1. It was proved by the expedition of 1858, that a Submarine Telegraph Cable could be laid between Ireland and Newfoundland, and messages transmitted through the same.

By the expedition of 1865 it has been fully demonstrated :—

2. That the insulation of a cable improves very much after its submersion in the cold deep water of the Atlantic, and that its conducting power is considerably increased thereby.

3. That the steamship Great Eastern, from her size and constant steadiness, and from the control over her afforded by the joint use of paddles and screw, renders it safe to lay an Atlantic Cable in any weather.

4. That in a depth of over two miles four attempts were made to grapple the cable. In three of them the cable was caught by the grapnel, and in the other the grapnel was fouled by the chain attached to it.

5. That the paying-out machinery used on board the Great Eastern worked perfectly, and can be confidently relied on for laying cables across the Atlantic.

6. That with the improved Telegraphic instruments for long submarine lines, a speed of more than eight words per minute can be obtained through such a cable as the present Atlantic between Ireland and Newfoundland, as the amount of slack actually paid out did not exceed 14 per cent., which would have made the total cable laid between Valentia and Heart's Content, less than 1,900 miles.

7. That the present Atlantic Cable, though capable of bearing a strain of 7 tons, did not experience more than 14 cwt. in being paid out into the deepest water of the Atlantic between Ireland and Newfoundland.

8. That there is no difficulty in mooring buoys in the deep water of the Atlantic between Ireland and Newfoundland, and that two buoys even when moored by a piece of the Atlantic Cable itself, which had been previously lifted from the bottom, have ridden out a gale.

9. That more than four nautical miles of the Atlantic Cable have been recovered from a depth of over two miles, and that the insulation of the gutta percha covered wire was in no way whatever impaired by the depth of water or the strains to which it had been subjected by lifting and passing through the hauling-in apparatus.

10. That the cable of 1865, owing to the improvements introduced into the manufacture of the gutta percha core, was more than one hundred times better insulated than cables made in 1858, then considered perfect and still working.

11. That the electrical testing can be conducted at sea with such unerring accuracy as to enable the electricians to discover the existence of a fault immediately after its production or development, and very quickly to ascertain its position in the cable.

12. That with a steam-engine attached to the paying-out machinery, should a fault be discovered on board whilst laying the cable, it is possible that it might be recovered before it had reached the bottom of the Atlantic, and repaired at once.

S. CANNING *(Engineer in Chief, Telegraph Construction and Maintenance Company, Limited.)*

JAMES ANDERSON *(Commander of the Great Eastern).*

HENRY A. MORIARTY, *(Staff Commander, R.N.)*

DANIEL GOOCH, M.P. *(Chairman of "Great Ship Co.").*

HENRY CLIFFORD *(Engineer).*

WILLIAM THOMSON, LL.D., F.R.S. *(Prof. of Natural Philosophy in the University of Glasgow).*

CROMWELL F. VARLEY *(Consulting Electrician Electric and International Telegraph Co.).*

WILLOUGHBY SMITH.

JULES DESPECHER.

(G)

THE TARIFF OF THE ATLANTIC CABLE.

London, September 1st, 1865.

My Dear Sir,

In the London Press, calculations of the profits of an Atlantic Cable have appeared, these calculations are based upon the idea of charging only 5s. a word.

A telegraph to be of use must be expeditious and accurate. It will, therefore, be necessary to limit the messages to be transmitted through the cable to such an extent that the number received during the twenty-four hours shall not exceed the carrying powers of the cable during that period of time. Should the number of messages received during the twenty-four hours exceed the transmitting powers of the cable the second day would begin with a portion of the messages left over from the first day, and in the course of a short time this daily accumulation would amount to so much that letters by mail would reach their destination sooner than messages by telegraph, as, by law, all messages must be sent in the order in which they were received.

There is only one legitimate way that I can see of limiting the messages that will pour in from every part of Europe, Asia, and Africa, to be transmitted to the whole of the North American Continent, and *vice versa*, and that is, to make the price such that it shall limit the messages sufficiently to keep them within the carrying power of the cable.

From an experience of over eighteen years, dating from the very commencement of the telegraph as a public institution, and from the experience gained by means of the submarine cables connecting Alexandria and Malta with Europe, I feel perfectly convinced that even a sum of 20s. per word will not limit the traffic sufficiently to keep the line between America and Europe free.

When we consider that the submarine line between Alexandria and Malta, which forms the connecting link between but a small part of Egypt and Europe, has a very large amount of business, how is it possible that two wires can do the business between Europe, Asia, and Africa on the one side, and America on the other? The manager of the Malta and Alexandria line recommended that a sum of £2 per word should be charged through the Atlantic Cable to limit the messages to the capacity of the line.

As soon as one line of communication is established between America and Europe it will undoubtedly have to be immediately followed by others to meet the increasing demand which experience shows invariably to follow the opening of telegraphic communication between distant points.

I am, Sir, yours faithfully,

C. F. VARLEY,

The Electrician of the Electric and International Telegraph Company.

Cyrus W. Field, Esq.,
Palace Hotel, Buckingham Gate.

(II)

Mr. Willoughby Smith's *New System of testing a Submarine Cable electrically during its submersion.*

Mr. Willoughby Smith, of the Gutta Percha Works, who was on board the Great Eastern last year, and who saw the difficulties we had to contend with, has since his return devised quite a new system of testing a cable electrically during its submersion. Of the merits of this system there can be no question, as it has been thoroughly tried through the 1,000 knots of Atlantic Cable now on board the ship with perfect success. Professor Thomson and all the gentlemen competent to form an opinion upon the subject, speak of it in the highest terms.

The characteristic advantage of this system over all previous ones is, that the insulation test may be permanently maintained throughout the voyage on shore as well as on board, while tests for continuity may be freely made, and communication between ship and shore constantly kept up without interfering in any way with the insulation test, which is all important.

Should a fault in insulation take place, it is immediately discovered and readily localised; for, by the peculiar working of this system, the electricians on board and on shore are enabled to furnish each other with such data as to render the localisation of the fault comparatively easy.

Another advantage in this system may be mentioned, namely, the simplicity of all its arrangements. There is not throughout the entire voyage any alteration in the connections. Whatever takes place, there cannot be any confusion in the handling of the apparatus. Experience has shown that in the excitement of laying a submarine cable great trouble is caused by having to change the apparatus so frequently for the different tests; but in this new system all these tests are combined in one, and thus this great annoyance is completely obviated.

(1.)

Copy.

Chatham, 14th February, 1866.

DEAR MR. FIELD,

In reply to your enquiry as to how I am getting on with my Telegraph Code, it will doubtless interest you to know that it is now rapidly approaching completion. When I made the trial through the 2300 miles of cable on board the Great Eastern, in July last, I succeeded in gaining 14 minutes out of 32 in the transmission of a message. The code at that time was incomplete.

Now I fully expect to be able to gain (at the lowest average) cent. per cent. over any instruments worked on the existing telegraphic system. Another advantage possessed by this code is its correctness in the rendering of telegrams, added to which is its simplicity.

I have proposed to the Telegraph Construction and Maintenance Company to open negociations for the commercial working of my code, not with the Atlantic Cable alone, but with other existing great lines, especially India; and I am induced to believe that by doubling the working powers of a line the market value of the shares must necessarily be advantageously influenced.

I hope to see you again shortly on the subject, meanwhile believe me,

Yours very truly,

(Signed) FRANK BOLTON.

CYRUS W. FIELD, Esq.,
Palace Hotel,
London.

(J.)

Heads of Agreement *Between* Mr. Richard Atwood Glass *on behalf of a Company about to be formed and called* The Anglo-American Telegraph Company *(or some other name) hereinafter called the New Company, and* Mr. Cyrus West Field *on behalf of the New York Newfoundland and London Telegraph Company hereinafter called the New York Company.*

WHEREAS the New Company being about to enter into a contract with the Atlantic Telegraph Company for the manufacture and submersion in 1866 of a new Atlantic Telegraph Cable between Ireland and Newfoundland and for the endeavour to recover and complete the broken Atlantic Telegraph Cable of One thousand eight hundred and sixty-five have in conjunction with the Atlantic Telegraph Company applied to the New York Company to assist them in that enterprise: AND WHEREAS the New York Company are desirous of encouraging and assisting the proposed undertaking so as to obtain Telegraphic communication between Ireland and Newfoundland during the present year: IT IS THEREFORE AGREED between the New Company and the New York Company as follows that is to say:

Article 1. If the New Company during the year One thousand eight hundred and sixty-six manufacture and endeavour to lay a new Atlantic Telegraph Cable between Ireland and Newfoundland and endeavour to recover and complete the broken Atlantic Telegraph Cable of One thousand eight hundred and sixty-five and succeed in both or either of those endeavours so as to have established in One thousand eight hundred and sixty-six Telegraphic communication between Ireland and Newfoundland by one or both of the said two cables the New York Company will pay to the New Company out of the proportion belonging to the New York Company of the first receipts (after deducting current expenses of repairs maintenance management and staff for working the traffic) for messages passing through the two Atlantic Telegraph Cables above referred to or either of them and also passing over the Telegraph lines of the New York Company or any of

them the annual subsidy of £25,000 with a proportionate part of that sum for any period less than a year up to the determination of this Agreement as hereinafter provided.

Article 2. The subsidy to commence from the date of the opening of the Telegraph cable or cables for public business between Ireland and Newfoundland and to be payable quarterly out of the New York Company's proportion of the receipts of such through messages as aforesaid which are to constitute the only source for payment thereof.

Article 3. If the New York Company's proportion of the aforesaid receipts in any one year in respect of the through messages be insufficient to pay the amount of the subsidy for that year the deficiency shall not be carried forward to another year or constitute any claim against the New York Company or its future earnings.

Article 4. The subsidy shall cease when the Atlantic Telegraph Company pay to the New Company the sum of £1,200,000 of capital pursuant to the contract to be entered into as aforesaid between the Atlantic Telegraph Company and the New Company or if and when the said New Company shall agree with the said Atlantic Company for some new or varied mode of payment or satisfaction of their claim, or, if and when Telegraphic communication between Ireland and Newfoundland by both of the said two cables shall at any time after the 31st December 1866 have ceased for twelve successive months to be in order for public business.

Article 5. A formal contract on the above basis to be entered into between the two companies to be settled in case of difference by Mr. John Horatio Lloyd, or him failing, by some counsel to be named by the Attorney-General of England on behalf of both parties.

Article 6. These heads of Agreement are subject to the ratification of the New York Company which ratification Mr. Field pledges himself to use his best endeavours to obtain within five weeks from the date hereof.

Article 7. The New Company are to obtain the consent of the Atlantic Telegraph Company to this Agreement but this Agreement is not in any way to prejudice or lessen the rights of the New York Company under their Agreements with the Atlantic Telegraph Company.

(Signed) R. A. GLASS,
CYRUS W. FIELD.

Witness—W. Shuter.

Dated 7th February, 1866.

(K.)

Extracts from letters of Mr. A. M. Mackay, Superintendent of the New York, Newfoundland and London Telegraph Company.

St. John's, 29th November, 1865.

"From what I now know I have no hesitation in saying that I can repair our Gulf Cable during the month of May next, probably in the early part, and at no very great expense. I do not say I hope to do so, but confidently and unhesitatingly say I can do it."

St. John's, 14th December, 1865.

"There is no doubt in the least that I can repair the cable early in May."

28th December, 1865.

"There is not the least doubt whatever that the cable can be repaired. A reef lies off Cape North and on that reef, 21 fathoms, the cable is bad.

"On the Newfoundland shore it is as good as the day it was laid."

(L.)

1866.

List of voyages by Steamers crossing the North Atlantic between Europe and America yearly.

Name of Line.	Per Week each way		Number per Annum
Inman	2		208
Cunard	1		104
Montreal	1		104
National	1		104
British and American	1		104
	Every Two Weeks		
Cunard (Extra)	1		52
North German Lloyds	1		52
Hamburg American	1		52
Union and Co.'s	1		52
London and New York	1		52
London and Boston	1		52
Liverpool and Boston	1		52
Liverpool and Baltimore	1		52
Anchor	1		52
Trans-Atlantic (French)	1		52
	Every Four Weeks.		
North American Lloyd	1		26
New York and Havre	1		26
		Total	1,196

N.B.—On several of the above Lines it is intended to increase the number of passages, and new Companies are being formed.

(M.)

GREAT PLACENTIA, NEWFOUNDLAND.
October 16th, 1865.

GENTLEMEN,

In compliance with arrangements perfected with you in London during the early part of last month, I have visited the La Manche Lead Mining Property; and after a thorough examination into the merits, character, and condition of the same, have much pleasure in laying before you the following

REPORT.

This property comprises an area of about eight thousand acres, and extends across the entire isthmus which separates the waters of Trinity Bay on the east, from those of Placentia Bay on the west. It is a nearly rectangular tract about six miles in length by two in breadth, and situated some seventy miles, in a direct line, west of St. John's, the capital. Passing from the eastern extreme, the surface gradually rises towards the centre, till an elevation of four or five hundred feet is attained. The timber, consisting of birch, alder, and various spruces and firs, is not plentiful, but in many places a fine soil prevails, with excellent grass for the rearing of live stock; and as a number of little streams trend through the property, good water is abundant. Trinity Brook, the largest of these streams, flows almost due west, and enters Placentia Bay about half a mile north of the line constituting the southern boundary. In the bed of this stream occurs the deposit of galena which occasioned my visit to this country. I find the lode to be one of great magnitude, and of the most valuable description. It lies almost due east and west—conforming as nearly as possible to the course of the property—and occurs in a schistose formation, the strata of which dip at an angle of about 12° to the north. The walls embracing the lode are of a highly indurated porphyritic character, and cut their way down, with a slight incline to the south, through metamorphic slate to an unknown depth. The outcrop of the vein on the shore (here called the "landwash") is in a precipitous bluff about thirty feet high, and a few steps north of the point where

the stream makes into the Bay. The lead, which is of the finest quality, is imbedded in a soft "gangue" of pink-tinged calcareous spar, and is carried through the centre of the lode in several distinct "ribs," equal in the aggregate to a seam of pure galena, averaging about six inches in thickness. The present partial development of the mine may in truth be said to only extend sufficiently far to exhibit to advantage the real magnitude and superior character of the deposit. The entire workings, by actual measurement, extend over a distance of barely one thousand five hundred feet. An adit-level has been driven from the "landwash" westwardly through a distance of about one thousand three hundred and thirty feet, and five shafts, at an average distance apart of about two hundred and fifty feet, have been sunk to the adit, or water level. One of these, known as the "McConochie" shaft, eight hundred and ten feet from the landwash, has been sunk to a point sixty feet beyond the adit, with the most satisfactory results. I have examined, with unusual interest and a deal of care, every feature of this mine, and do not hesitate to pronounce it one of the most encouraging I have ever seen. Fine surface indications are abundant for more than a mile eastward of the present workings of the vein; the same great deposit, I am fully convinced, extends throughout the entire length of the property. It is no venture to assert, that an instance cannot be found, of a mine bearing marks and affording results similar to this, that has failed to prove a continuous and ever-increasing "true lode" of the highest remunerative value. As regards the beautifully defined character of this mine, there is not, in my opinion, a lode in the galena regions of Southern Missouri, or of England, that will compare with it. The remarkable evenness and semi-polish of the north wall, in places, almost delude one into the belief that it was prepared by human ingenuity. The thickness of the lode in many places is immense—ranging from twelve to eighteen feet—the average being from six to seven feet. To justify my high opinion of this mine, I must inform you that from the present limited workings, over *four million five hundred thousand pounds* of lead ore of the purest and best description have been realised; and that of the five shafts sunk to the water level, only two exceed a depth of one hundred feet. *The sales of ore up to this time amount to over three hundred thousand dollars.*

In operating the mine, immense caverns, or "vughs," containing many tons of pure "prill" ore, entirely divested of the gangue, are hit upon. These were doubtless formed by the decomposition of spar identical with that pervading the main lode; the carbonate of lime passing into a solution, the charge of ore became disengaged, and fell to the bottom of the cavern. Several of these "vughs," of various sizes, have been met with, all con-

taining large quantities of "prill" ore, which in such cases is generally invested with, or imbedded in, a thick liquid consistency of the black oxyd of manganese. In other cases, the prill, though a sulphuret itself, is covered with a heavy coating of the carbonate of lead, and the walls of the cavity are lined with a similar deposit.

I caused a blasting to be made a short distance in advance of the furthest regular workings, and was much pleased with the show of ore revealed. Indeed, all that I have seen in connection with this mine has proved extremely satisfactory. Everything exhibits the determination of legitimate and well-ordered business on the part of the company. There are twenty-six well-arranged and comfortable houses for the accommodation of the miners; the "cribbing" in the shafts is carefully done, and the houses over the same are in superior condition. A tramway is laid in the water-level, and the stream, the course of which is identical with that of the lode, is neatly turned aside and led through a race to the Bay, driving the machinery for dressing the ores as it passes along. Two magazines, and a store house three stories high, and 21 by 44 feet, are also prominent features in the Company's improvements. A substantial dam has been constructed at the outlet of an important pond, a mile inland, by which means a fine reserve of water for driving the machinery and dressing the ores is always available.

As to the workability of this mine, it may be said that few mineral deposits are so free from difficulties. The spar in which the ore occurs is so soft and tender as to strongly remind one of camphor, and indeed much of it is only slightly more persistent. About sixty feet below the surface, and forty feet above the adit, levels in several places have been driven from two or three of the shafts, and some "stoping" has been executed. The same may be said with regard to various sections of the adit-level, in which considerable stoping has been done, and "stulls" erected.

Operations in a portion of the adit-level are at present suspended from the interruption of water breaking in from a large "vugh," in such quantity that the present draining appliance, consisting of one small pump, is not sufficient to successfully combat it. An iron pump, of splendid dimensions and quality, is now obtained and on the ground, but not arranged in working order. If operated by a small engine, I believe this new pump, without the aid of the old one, would be sufficient to keep the mine free from any embarrassing amount of water. I doubt not but this water proceeds from a cavern much greater than any yet discovered on the property, and that when

pumped dry it will be found to contain an immense accumulation of "prill" ore.

This galena already has a reputation superior to, and commands a price higher, than that of any other American mine; and with respect to discharging supplies and the withdrawal of ore, no property could be better situated, as vessels of large tonnage can be moored alongside the pier at the mouth of the adit. Mining operations can be carried on with even greater facility and economy in winter than in summer, as in the former season large numbers of men connected with the fisheries are out of their usual employment and can be hired as miners at from fifteen to twenty dollars per month.

Another important advantage enjoyed by the company is the fact that at least fifty per cent. of the wages of their employés is paid in supplies from their store, there being no village or town within ten or twelve miles of La Manche.

There is a telegraph station upon the property, connected with the line of the New York, Newfoundland and London Telegraph Company. Not far distant is the proposed terminus of the great Atlantic Cable, and when this grand enterprise is once achieved, the mine will be placed in immediate communication with Liverpool and London.

In view of the anxiety which has been felt and expressed during the last year with reference to an almost entire suspension of work on the lead deposits of England and Wales, *the fact that this fine property is within Her Majesty's domain, and with every encouraging circumstance as to location and development, requiring a comparatively small capital to reach large and immediate results*, I feel strongly urged to recommend this remarkable mine to the prompt and earnest attention of yourselves and friends.

I am, gentlemen,

Very truly yours,

M. C. VINCENT.

Extract from letter of Mr. A. M. Mackay, General Superintendent of the New York, Newfoundland and London Telegraph Company, dated St. John's, January 29th, 1866:—"*La Manche looks uncommonly promising.*" * * * "*For the force engaged they are getting out a great deal of lead.*"

NEW YORK, NEWFOUNDLAND AND LONDON TELEGRAPH COMPANY.

(Incorporated April 15th, 1854.)

PETER COOPER, Esq. ..... *President.*
CYRUS W. FIELD, Esq. ..... *Vice-President.*
MOSES TAYLOR, Esq. ..... *Treasurer.*
Professor S. F. B. MORSE ..... *Electrician.*
DAVID DUDLEY FIELD, Esq. ..... *Counsel.*

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MOSES TAYLOR, Esq. .....
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} New York.

SECRETARY.

ROBERT W. LOWBER, Esq.

GENERAL SUPERINTENDENT.

ALEXANDER M. MACKAY, Esq., St. John's, Newfoundland.

THE ATLANTIC TELEGRAPH COMPANY.

(Incorporated by Act of Parliament, 1857.)

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(P.)

TELEGRAPH
CONSTRUCTION AND MAINTENANCE COMPANY,
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Uniting the Business of the Gutta Percha Company with that of Messrs. Glass, Elliot & Company.

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WORKS.

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(Q)

THE

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J. H. YATES, Esq., 26, Castle Street, Liverpool.

(R.)

Extract from Letter of Mr. Cromwell F. Varley to the "Observer," dated March 3rd, 1866.

* * * The best preservative of gutta percha is sea water. Failure of cables already laid prove no deterioration of the gutta percha; it has proceeded from imperfect joints and imperfect manufacture. The Dover and Calais Cable, laid in 1851, is still doing its duty. These latter sources of failure are now entirely overcome, thanks to Samuel Statham, John Chatterton, Willoughby Smith, and those scientific gentlemen who have devised methods as well as apparatus for hunting out minute faults, even when they have been so small that they would not weaken the signals through the Atlantic Cable one-millionth part.

There is no instance of a deep sea cable that was perfect when laid having failed in deep water. The Malta and Alexandria Line is laid in three sections, and the one laid in deep sea from Malta to Tripoli has never cost sixpence for repairs. The injuries have all been, with one exception, between Bengazi and Alexandria, where the cable is laid in shallow water, and where it has had to be repaired each time it has been chafed by the rocks. In the new Atlantic Cable the shore ends will be carried sufficiently far out to reach into deep water, and we have no instance on record of a cable approaching to the weight of this shore end having been injured. The lines once laid perfectly will, in all probability, be permanent.

With the Atlantic Cable, which I have every confidence will be laid this year, and the half cable (now in a perfect state at the bottom of the sea) completed, there will be complete freedom with these lines from the delays and errors experienced in our Indian telegrams. The communication from London to Valentia will be direct at one leap, Valentia to Newfoundland in a second leap, and Newfoundland to New York in one or at most in two leaps. When one cable is successfully laid, it is certain to be quickly followed by others. The Newfoundland Company contemplate constructing two additional wires by different routes, so that there shall be several means of communication throughout the distance, and I for one shall be sadly disappointed if messages from London to New York do not reach their destination long in advance of time.

The lines will be all under the management of joint stock companies, whose interest it will be to secure the highest speed and efficiency, and the countries through which the lines will pass speak our own language, an inestimable advantage as regards accuracy * * *

SUBMARINE TELEGRAPH CABLES now in successful working order, the Insulated Wires for which were manufactured by the Gutta Percha Company, Patentees, Wharf Road, City Road, London. *March*, 1866.

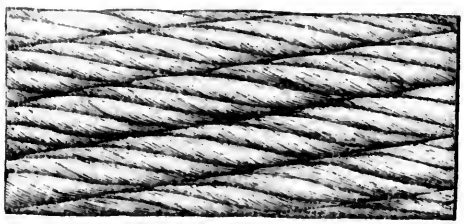
No.	Date when laid.	From	To	No. of Conductors	Length of Cable in Statute Miles.	Length of Insulated Wire in Statute Miles.	Depth of Water in Fathoms.	Length of time the Cables have been working
1	1851	Dover	Calais	4	27	108	..	15 years
2	1853	Denmark, across the Belt		3	18	54	..	13 years
3	1853	Dover	Ostend	6	80½	483	..	13 years
4	1853	Frith of Forth		4	6	24	..	13 years
5	1853	Portpatrick	Donaghadee	6	25	150	..	13 years
6	1853	Across River Tay		4	2	8	..	13 years
7	1854	Portpatrick	Whitehead	6	27	162	..	12 years
8	1854	Sweden	Denmark	3	12	36	11	12 years
9	1854	Italy	Corsica	6	110	660	325	12 years
10	1854	Corsica	Sardinia	6	10	60	20	12 years
11	1855	Egypt		4	10	40	..	11 years
12	1855	Italy	Sicily	3	5	15	27	11 years
13	1856	Straight of Canso	Cape Breton, N.S.	3	1½	4½	..	10 years
14	1857	Norway across	Fiords	1	49	49	300	9 years
15	1857	Across mouths of Danube		1	3	3	..	9 years
16	1857	Ceylon	Mainland of India	1	30	30	..	9 years
17	1858	Italy	Sicily	1	8	8	60	8 years
18	1858	England	Holland	4	140	560	30	8 years
19	1858	Ditto	Hanover	2	280	560	30	8 years
20	1858	Norway across	Fiords	1	16	16	300	8 years
21	1858	South Australia	King's Island	1	140	140	45	8 years
22	1858	Ceylon	India	1	30	30	45	8 years
23	1859	Alexandria		4	2	8	..	7 years
24	1859	England	Denmark	3	368	1104	30	7 years
25	1859	Sweden	Gothland	1	64	64	80	7 years
26	1859	Folkestone	Boulogne	6	24	144	32	7 years
27	1859	Across rivers in India		1	10	10	..	7 years
28	1859	Malta	Sicily	1	60	60	79	7 years
29	1859	England	Isle of Man	1	36	36	30	7 years
30	1859	Suez	Jubal Island	1	220	220	..	7 years
31	1859	Jersey	Piron, France	1	21	21	15	6 years
32	1859	Tasmania	Bass' Straits	1	240	240	..	6 years
33	1860	Denmark	(Great Belt) (14 miles / 14 miles)	6 / 3	28	126	18	6 years
34	1860	Dacca	Pegu	1	116	116	..	6 years
35	1860	Barcelona	Mahon	1	180	180	1400	6 years
36	1860	Minorca	Majorca	2	35	70	250	6 years
37	1860	Iviza	Majorca	2	74	148	500	6 years
38	1860	St. Antonio	Iviza	2	76	152	450	6 years
39	1861	Norway across	Fiords	1	16	16	300	5 years
40	1861	Toulon	Corsica	1	195	195	1550	5 years
41	1861	Holyhead	Howth, Ireland	1	64	64	..	5 years
42	1861	Malta	Alexandria	1	1535	1535	420	5 years
43	1861	Newhaven	Dieppe	4	80	320	..	5 years
44	1862	Pembroke	Wexford	4	63	252	58	4 years
45	1862	Firth of Forth		4	6	24	..	4 years
46	1862	England	Holland	4	130	520	30	3½ years
47	1862	Across River Tay		4	2	8	..	4 years
48	1863	Sardinia	Sicily	1	243	243	1260	3 years
49	1864	Persian Gulf		1	1450	1450	120	2 years
50	1864	Otranto	Avlona	1	60	60	569	1½ years
51	1865	La Calle	Biserte	1	97¼	97¼	..	12 months
52	1865	Sweden	Prussia	3	55	166	..	12 months
53	1865	Biserte	Marsala	1	164¾	164¾	..	12 months
54	1865	Corsica	Tuscany	1	66	66	..	6 months
			TOTAL ..		6811	11080½		

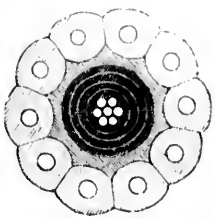
A great many Cables of short lengths, not included in this List, are now at work in various parts of the world; and other Cables, the Wires Insulated by the Gutta Percha Company, have been laid by Messrs. FELTES & GUILLEAUME, of Cologne, during the last eight years, amount to over 1,000 miles, and which are now in working order.

ompany in 1858, and of the Cable manufactured for the same
& Co., and the Gutta Percha Company.)

L MILES.

NEW ATLANTIC CABLE, 1866.





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mile
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CONDUCTOR—Copper strand consisting of 7 wires (6 laid round one), and weighing 300 lbs. per nautical mile, embedded for solidity in Chatterton's Compound. Gauge of single wire ·048 = ordinary 18 gauge. Gauge of strand ·144 = ordinary No. 10 gauge.

INSULATION—Gutta Percha, 4 layers of which are laid on alternately with four thin layers of Chatterton's Compound. The weight of the entire insulation 400 lbs. per nautical mile. Diameter of core ·464, circumference of core 1·392.

EXTERNAL PROTECTION—Ten solid wires of the gauge ·095, (No. 13 gauge) drawn from Webster and Horsfall's Homogeneous Iron, and galvanized, each wire surrounded separately with five strands of white Manilla Yarn, and the whole laid spirally round the core, which latter is padded with Jute yarn, saturated with preservative mixture.

WEIGHT IN AIR—31 cwt. per nautical mile.

WEIGHT IN WATER—14¼ cwt. per nautical mile.

BREAKING STRAIN—8 tons 2 cwt., or equal to eleven times its weight in water per nautical mile; that is to say, the cable will bear its own weight in eleven miles depth of water.

DEEPEST WATER TO BE ENCOUNTERED—2,400 fathoms, or less than 2½ nautical miles.

THE CONTRACT STRAIN is equal to 11 times its weight per nautical mile in water.

LENGTH OF CABLE TO BE SHIPPED TO COMPLETE BOTH LINES—2,730 miles.

Wa[illegible] not less than eight words per minute.

Captain [illegible], LL.D., F.R.S., and Joseph Whitworth, Esq., C.E., F.R.S., who [illegible]ted [illegible]mpany, *unanimously* recommended that Messrs. Glass, Elliot & Co.'s

S[illegible]AN[illegible]*ineer Telegraph Construction and Maintenance Company, Limited.*

London,

DESCRIPTIONS respectively of the Cable submerged between Ireland and Newfoundland by th
Company by the Telegraph Construction and Maintenance Company, Limit

DISTANCE FROM IRELAND TO NEWFOUN

ATLANTIC CABLE, 1858.

CONDUCTOR—A Copper strand, consisting of 7 wires (6 laid round one), and weighing 107 lbs. per nautical mile.

INSULATOR—Gutta Percha laid on in three coverings and weighing 261 lbs. per knot.

EXTERNAL PROTECTION—18 strands of Charcoal Iron wire, each strand composed of 7 wires (6 laid round one), laid spirally round the core, which latter was previously padded with a serving of hemp saturated with a tar mixture. The separate wires were each 22½ gauge, the strand complete was No. 14 gauge.

WEIGHT IN AIR—20 cwt. per nautical mile.

WEIGHT IN WATER—13·4 cwt. per nautical mile.

BREAKING STRAIN—3 tons 5 cwt., or equal to 4·85 times its weight in water per nautical mile; that is to say, the cable would bear its own weight in a little less than 5 miles depth of water.

DEEPEST WATER TO BE ENCOUNTERED, 2,400 fathoms, or less than 2½ nautical miles.

THE CONTRACT STRAIN was equal to 4·85 times its weight per nautical mile in water.

LENGTH OF CABLE SHIPPED—2,174 nautical miles.

ATLANTIC CABL

CONDUCTOR—Copper strand consisting of 7
weighing 300 lbs. per nautical mile, emb
ton's Compound. Gauge of single wire ·04
of strand ·144 = ordinary No. 10 gauge.

INSULATION—Gutta Percha, 4 layers of whi
four thin layers of Chatterton's Compou
insulation 400 lbs. per nautical mile. D
ference of core 1·392.

EXTERNAL PROTECTION—Ten solid wir
gauge) drawn from Webster and Horsfall's
surrounded separately with five strands of
a preservative compound, and the whole
which latter is padded with Jute Yarn,
mixture.

WEIGHT IN AIR—35 cwt. 3 qrs. per nautic

WEIGHT IN WATER—14 cwt. per nautical

BREAKING STRAIN.—7 tons 15 cwt., or e
in water per nautical mile; that is to sa
weight in eleven miles depth of water.

DEEPEST WATER TO BE ENCOUNTERE
2½ nautical miles.

THE CONTRACT STRAIN is equal to 11 t
mile in water.

LENGTH OF CABLE TO BE SHIPPED—

Speed of working through new cable, with the present improved instruments, is certified by

Captain Douglas Galton, R.E., F.R.G.S., F.G.S., F.R.S.; William Fairbairn, Esq., C.E., F.R.S.; Charles Wheatstone,
formed the Scientific Committee, appointed by the Directors of the Atlantic Telegraph Company to examine all Specir
Specimen be adopted, and that their Tender for making and laying the Cable be accepted.

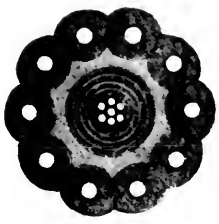
London, 54, *Old Broad Street, E.C., March*, 1866.

(T.)

Newfoundland by the Atlantic Telegraph Company in 1858, and of the Cable manufactured for the same
nce Company, Limited, (late Glass, Elliot & Co., and the Gutta Percha Company.)

AND TO NEWFOUNDLAND, 1670 NAUTICAL MILES.

ATLANTIC CABLE, 1865.



'opper strand consisting of 7 wires (6 laid round one', and
lbs. per nautical mile, embedded for solidity in Chatter-
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OTECTION—Ten solid wires of the gauge ·095, (No. 13
from Webster and Horsfall's Homogeneous Iron, each wire
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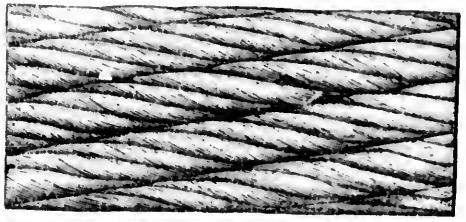
nautical mile; that is to say, the cable will bear its own
ven miles depth of water.

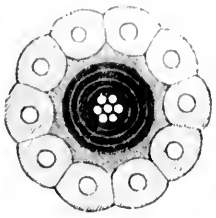
ER TO BE ENCOUNTERED—2,400 fathoms, or less than
iles.

T STRAIN is equal to 11 times its weight per nautical

BLE TO BE SHIPPED—2,300 nautical miles.

NEW ATLANTIC CABLE, 1866.





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INSULATION—Gutta Percha, 4 layers of which are laid on alternately with four thin layers of Chatterton's Compound. The weight of the entire insulation 400 lbs. per nautical mile. Diameter of core ·461, circumference of core 1·392.

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struments, is certified by Messrs. Thomson and Vary ... *be not less than eight words per minute.*

S.; Charles Wheatstone, Esq., F.R.S.; William Thomson, Esq., LL.D., F.R.S., and Joseph Whitworth, Esq., C.E., F.R.S., who
nuy to examine all Specimens and Tenders submitted ... th Company, *unanimously* recommended that Messrs. Glass, Elliot & Co.'s
pted.

S. CANNING *Engineer Telegraph Construction and Maintenance Company, Limited.*