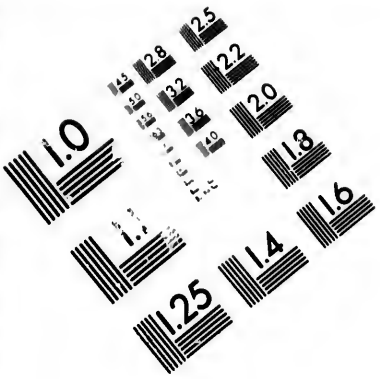


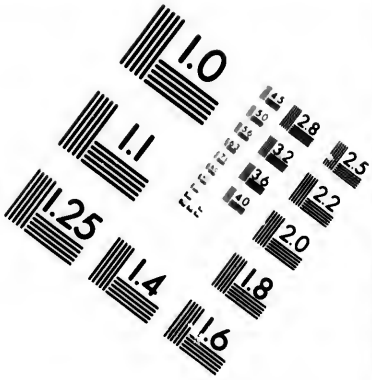
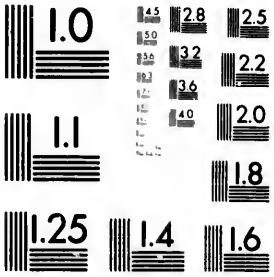
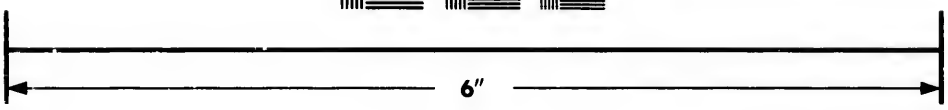
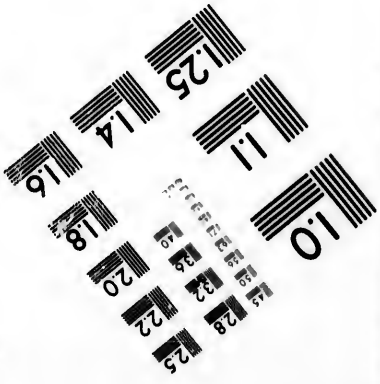


IMAGE EVALUATION TEST TARGET (MT-3)







Photographic Sciences Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

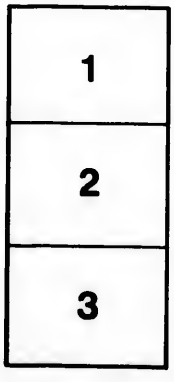
L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

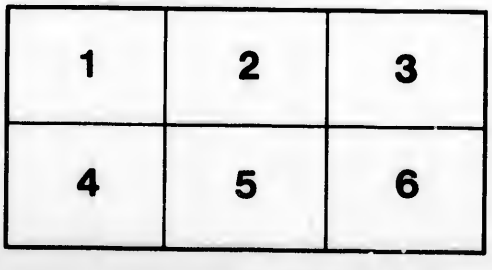
- [x] Coloured covers/ Couverture de couleur
- [ ] Covers damaged/ Couverture endommagée
- [ ] Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- [ ] Cover title missing/ Le titre de couverture manque
- [ ] Coloured maps/ Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- [ ] Bound with other material/ Relié avec d'autres documents
- [ ] Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distortion le long de la marge intérieure
- [ ] Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- [ ] Additional comments:/ Commentaires supplémentaires:

- [ ] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [ ] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [x] Pages detached/ Pages détachées
- [x] Showthrough/ Transparence
- [ ] Quality of print varies/ Qualité inégale de l'impression
- [ ] Includes supplementary material/ Comprend du matériel supplémentaire
- [ ] Only edition available/ Seule édition disponible
- [ ] Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/ Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

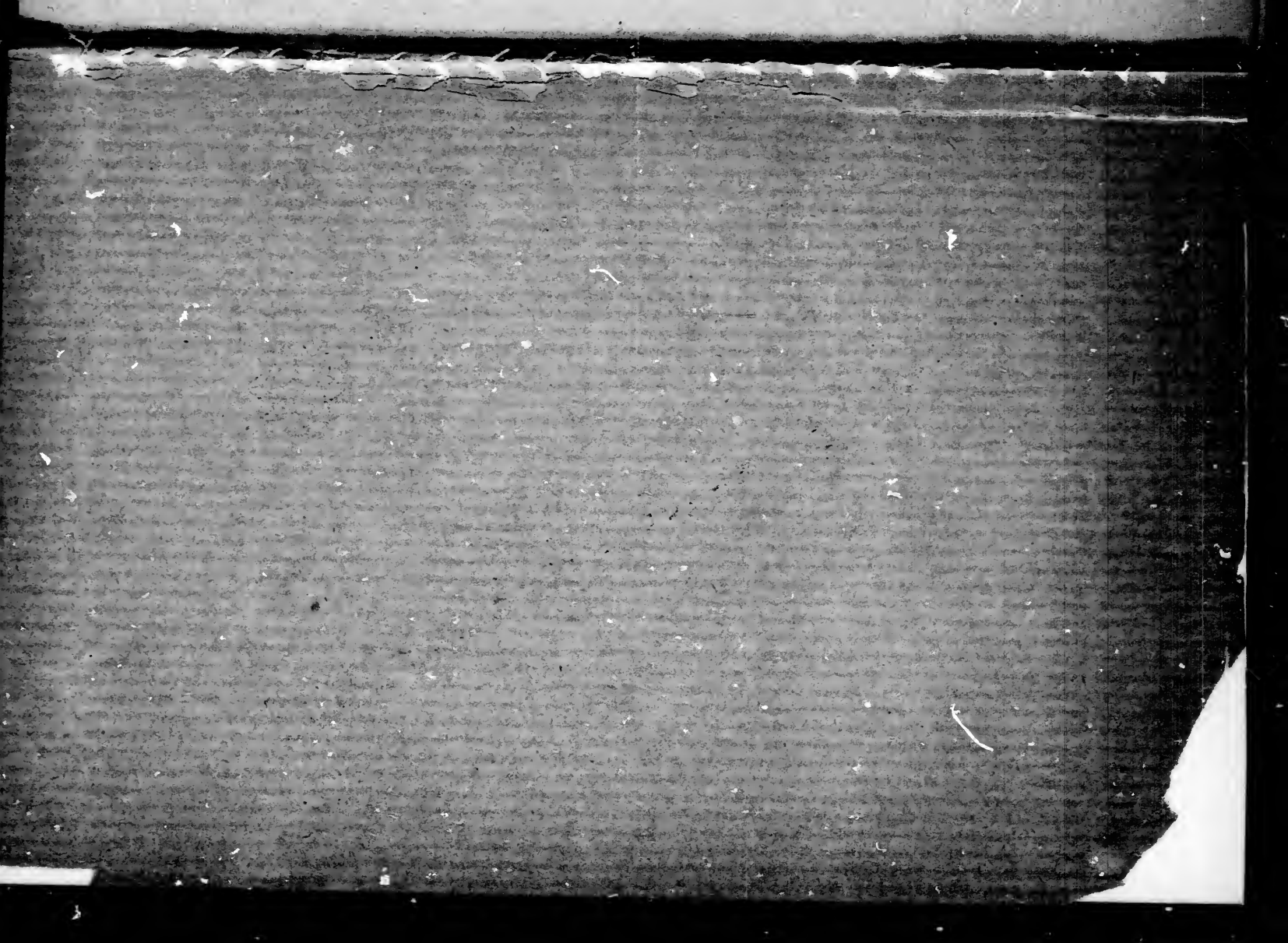
10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
					✓						





Re PACIFIC CABLE

MB 1894



THE PACIFIC CABLE.

The scheme of connecting Canada and Australia by a line of steamers and by a submarine telegraph cable was prominently brought forward at the Colonial Conference of 1887.

Part of the scheme has since been realized and the line of steamers is practically established; but with the Pacific cable less progress has been made, although the Colonial Governments interested have left no stone unturned to promote the laying of this connecting link between the eastern and western extremities of the British Empire.

At the conference in 1887 there was no diversity of opinion as to the high importance of the project, but the experts, who were invited by the Imperial Government to place their great knowledge of submarine telegraphy at the service of the conference, threw doubts on the practicability of such a cable.

Their adverse opinion was based mainly on the want of a proper survey of the route, and on the extraordinary depth of water which they believed to exist in the Pacific Ocean.

To these technical difficulties a financial objection has lately been added by a letter addressed by Sir John Pender to the Marquis of Ripon in which he conclusively showed that the existing connections were amply sufficient for all purposes, and that the proposed Pacific cable would involve the investors in an annual loss of £120,000 in which a sum of £72,000 representing 4% on the capital outlay is however included.

This letter was written as a sort of protest against the resolution passed by the Postal Conference at Wellington (N.Z.) that a Pacific cable should be subsidized by the various Colonial Governments interested, the United Kingdom being asked to join in the guarantee.

Although Sir John Pender's position, as chairman of the existing company, detracts from the weight his words would carry if he were not

so directly interested to prevent the establishment of a rival route, yet his vast experience in submarine telegraphy was duly acknowledged in the comments which his letter provoked.

With regard to the technical difficulties raised in 1887, it may not be out of place to consider that the necessity for a close survey of a cable route arises principally from the requirements of the engineer laying the cable who has to know at every moment the exact depth of water into which the cable passes.

The brake-power with which the cable is held back and by which the percentage of slack is regulated, has to be adjusted according to the depth of water in order to ensure an even distribution of the slack along the whole route of the cable. Such a distribution prevents accidents, economises cable and facilitates repairs, hence the usual practice is to lay cables only on routes where very frequent soundings have been taken; and in 1887 the experts consulted by the Imperial Government were not satisfied that the Pacific Ocean was sufficiently well explored for this purpose.

During the last seven years the work of survey has steadily progressed, and at present it may be asserted that the route proposed at the Wellington Conference passes nowhere through water more than 3,500 fms. deep.

On the Admiralty chart, No. 780, corrected to November 1892, the route from North Cape (N.Z.) to Suva (Fiji Islands) shows 2,594 fms. as the greatest depth.

Between Suva and Samoa no very great depth is met with, and from Suva, or Apia, to the Phœnix Islands, the greatest depth is 3,312 fms.

The same chart shows 3,020 fms. as a maximum on part of the route from the Phœnix Islands to Honolulu; this route is continued on Admiralty chart No. 782, corrected to June, 1890, where a depth of 3,448 fms. is shown.

A continuation of the soundings can be seen on the same chart, or better on Admiralty chart No. 787, which is corrected to March, 1894, and gives 3,252 fms. as the greatest depth between Honolulu and San Francisco. These routes do not coincide exactly with the Wellington route, but they, together with a number of other soundings shown on the charts, bear out the general features of the bed of the Pacific Ocean, shown by Mr. John James Wild, member of the civilian

scientific staff of H.M.S. "Challenger," in his essay on the depth, temperature, and currents of the ocean, entitled "Thalassa." This work appeared in London (Marcus Ward & Co.) in 1877.

If the adjustment of the brake-power depended entirely on the knowledge acquired by soundings taken previously on the selected route of the cable, grave doubts might still exist whether the laying of the Pacific cable could be proceeded with without further information being obtained by carefully taking soundings over the exact route. Fortunately means have been devised to indicate to the brakesman continuously the percentage of slack with which the cable is payed out, and thus it is possible to lay a cable over a route of which only the general features are known.

This contrivance has been used with perfect success in the laying of six Atlantic cables, so that there is no doubt as to its performance realizing its theoretical advantages. The depth of water met with in the Atlantic reaches 3,000 fms. in several places where the cables have been laid, so that there is no doubt about the possibility of laying cable in 3,500 fms., or even more.

To be sure it will be necessary to select a type of cable which combines great strength with light weight, but there is no difficulty in this either, as it has been possible to construct cables for the Atlantic which will carry 7,000 fms. of their own length before they break.

It may, therefore, be taken for granted that any technical obstacles which were apprehended in 1887 have now been overcome, and that the cable can be laid as soon as the financial question has been settled.

In order to ascertain clearly what the probable financial position of the cable would be, a complete scheme has been worked out for a route consisting of the sections :—

1. Ahaipara Bay (N.Z.) to Suva (Fiji Islands).

2. Suva (Fiji) to Canton, or Mary (Phœnix Islands).

3. Canton (Phœnix) to Necker Island.

4. Necker Island to Vancouver, B.C., of which the details are appended.

As capital, the sum of £2,000,000 has been assumed to cover the cost of the cable, of two repairing steamers, of about 1,800 tons each, of buildings, instruments, and to furnish a working capital of about £50,000.

The working expenses are divided into :—

a. General management	£ 5,000
b. Staff and office expenses at stations....	24,000
c Repair and maintenance of cables	90,000
Total annual outlay—	£119,000

a. The first item explains itself.

b. Of the second item, the details will be found in the appendix.

c. The cost of the repair and of the maintenance of the cable is the most difficult to estimate and the expenditure is naturally divided into a fixed and a variable part.

The fixed expenses consist first, in maintaining the two steamers in efficient working order; this is amply covered by the allowance of £100 per month per steamer, and secondly, in the wages of crew, victualing and other running expenses, these are certain not to exceed £20 per day per steamer.

It is not likely that each steamer will have to go to sea, on the average, more than two months every year, or that more than 200 miles of cable will be used up during that time.

Still these maximum figures are used in the estimate and bring up the total annual cost of the actual repairs and of the maintenance of the steamers to £90,000 or to over £12 per naut. mile of cable laid. That this is a safe estimate may be gathered from the fact that it is usual to calculate £6 per naut. mile to cover this expenditure, and that one at least of the Atlantic companies is able to keep its 6,000 miles of cable in efficient working order for about £4 per naut. mile.

The most important factor in determining the cost of repairs is without doubt the quality of the cable laid, and no greater mistake can be committed than to cut down capital expenditure in an undertaking of the importance and of the magnitude as the Pacific cable undoubtedly is.

It should also be noticed that Sir John Pender in his letter to the Marquis of Ripon estimates the repairing expenses at £35,000 or at the low figure £4 15s. per nautical mile per annum. This figure he may, however, have taken from previous estimates of expenditure published by the advocates of the scheme as they give the same figures.

The real uncertainty of the financial prospects of the Pacific cable is, howe ver, encountered when the probable income is estimated.

In respect to this point, Sir John Pender's opinion is manifestly unfair as he allows not more than one half of the existing traffic to pass over the new cables at extravagantly low rates; although it is quite likely that this would be all the traffic obtainable during the first year.

Mr. Sandford Fleming, the indefatigable promoter of the Pacific cable, appears to have taken the fairest view of the question, when he estimates that the expenses will exceed the earnings during the first few years, but that a cheap tariff and expeditious working will soon attract the public and convert the cable into a profitable investment.

From Sir John Pender's letter it appears that the Australian traffic of the existing company is worth £209,628 nett for 1,306,716 words, or 3s. 2½d. per word. If the Pacific cable earned half this amount during the first year, it would pay, in all probability, the working expenses of that year with an ample margin, as it is not likely that any heavy repairs would become necessary during that time.

There are, however, too many factors left uncertain when the probable traffic of the Pacific cable is compared with the existing traffic over another route and under totally different circumstances. Sir John Pender has, for instance, quite ignored that at present the intercourse between America and Australasia does not give rise to frequent telegrams, but when the interests served by the cables are taken into careful consideration, and the great possibilities of commerce between America and Australasia are appreciated at their proper value, small doubt can exist about the Pacific cable earning as much money per naut. mile of its lengths as the average of the existing submarine cables.

As long ago as the 2nd April, 1887, the Pall Mall Gazette published an article on submarine cables by Mr. Henniker Heaton from which the following interesting figures are taken :—

At that time 26 submarine cable companies were in existence, possessing 100,000 naut. miles of cable, laid with an expenditure of £35,000,000 capital. These cables earned (including subsidies) £3,173, 692 per annum, enabling the companies to pay from 1 to 14¾% dividends. In addition the reserve and sinking fund of all the companies amounted to £3,400,000.

From Mr. Heaton's figures it follows that the capital outlay per

nautical mile of submarine cable is, on the average, £350 and the annual revenue is £31 15s. per naut. mile.

According to Mr. Heaton, the capital outlay of the Eastern Telegraph Co. was £299 per naut. mile, and their income, at that time, £35 per naut. mile per annum.

The Eastern Extension Co. had to lay out £265 per naut. mile, and was earning £39 10s. per naut. mile per annum.

If the capital outlay for the Pacific cable be taken to be £2,000,000 and its length from Ahaipara Bay (N. Z.) to Vancouver (B. C.) as 7,340 naut. miles, the cost per naut. mile will be about £273. On the other hand, earning £30 per mile, the annual income from the cable would amount to just over £220,000.

This figure will naturally not be reached during the first two or three years, but it is even under the average of the earnings of all submarine cables seven years ago, and since that time telegraphic correspondence has continued to increase rapidly. One of the Atlantic companies, for instance, earned on the average during the last three years more than £50 per mile.

If the share of the Pacific cable is 2s. per word, it only wants 2,200,000 words per annum to realise this income, and the cable communication, which can be established for £2,000,000, would be capable of transmitting 15 words per minute on the Recorder. This corresponds to over 7,000,000 words per annum, but the speed of sending messages through the cable can practically be doubled by introducing duplex working when the traffic requires it.

It is, therefore, not extravagant to assume that [illegible] regular working there will be a surplus of £101,000 per annum.

This would be utilized for paying 3 per cent. on the capital outlay and placing the rest to the credit of a sinking fund.

As the cost of repairs includes replacing on the average 200 miles of cable per year, the whole of the cable will be renewed in about 37 years.

If the cable is manufactured with the best materials and with proper care, it may be assumed that it can only be destroyed by local influences or by extraordinary occurrences, for it is proved beyond doubt that a cable free from electrical faults will not deteriorate.

A very striking example of the durability of cables was the finding of some parts of the original gutta percha covered conductor, laid without any further protection between Dover and Calais. Although this wire had been in the sea for over 35 years when it was picked up by the s.s. "Monarch" (the General Post Office telegraph steamer) it looked like new, and no deterioration could be detected.

Generally speaking all those submarine cable companies have succeeded who have laid their cables on a strictly commercial basis, by expending their capital for nothing but legitimate purposes; it is, therefore, to be anticipated that the example can be followed in establishing telegraphic communication between Canada and Australia and that the Pacific cable will prove to be a good investment in spite of adverse opinions.

The time required for completing the work provided that the two repairing steamers are assisting in carrying the same out would be about three years, if no serious accidents delay the undertaking.

For an additional outlay of £30,000 a second large cable steamer could be employed and the time of completing the cable shortened to two years after commencing the manufacture.

ALEXANDER SIEMENS.

OTTAWA, 9th, July, 1894.

APPENDIX.

BUILDINGS AND INSTRUMENTS.

	Morton's Buildings.		Sets of Instruments.	
	B.C.C. No. 2.	No. 795.	Recorder.	Testing.
Vancouver	1	..	2	1
Necker Island	..	4	3	1
Canton Island	..	4	3	1
Suva	1	2	3	1
Ahaipara.....	1	2	3	1
Totals	3	12	14	5

3 Cable Houses B.C.C. No. 2.....	@	£300	£900
3 Sets Fittings for do.....	@	200	600
12 Houses No. 795...	@	1,000	12,000
12 Outfits for same	@	500	6,000
14 Sets Recorders complete.....	@	400	5,600
5 Sets Testing Instruments, with extra spares...	@	240	1,200
Transport and Erection.....			3,700
			£30,000

No land is included, nor the erection of buildings on Necker and Canton, unless in the opinion of our Engineer-in-charge the buildings can be erected by our own staff without delaying operations.

STAFF REQUIRED FOR STATIONS AND OFFICE EXPENSES.

VANCOUVER (B.C.)

	Per annum.	
1 Superintendent	£400	
4 Clerks @ £200	800	
2 Messengers @ 50	100	
4 Boys @ 30	120	
Taxes, Ground Rent, Renewals and Repairs	200	
Stationery, Insurance, Advertising	200	
Sundries Unforseen	200	
		£2,000

NECKER AND CANTON ISLANDS. (EACH.)

1 Superintendent	£600	
8 Clerks @ £500	4,000	
3 Messengers @ 100	300	
Rations £1 per week per head	600	
Sundries Unforseen	500	
	2 × £6,000	
		12,000

SUVA (FIJI) AND AHAIPARA (N.Z.) (EACH).

1 Superintendent	£500	
8 Clerks @ £400	3,200	
3 Messengers @ 80	240	
Rations £1 per week per head	600	
Sundries Unforseen	460	
	2 × £5,000	
		10,000
Total annual cost of Staff and Office Expenses		£24,000

REPAIR AND MAINTENANCE OF CABLES.

TWO REPAIRING STEAMERS

Of about 1,800 tons each, fitted complete .....@ £100,000		£200,000

ANNUAL COST :—

(*a*) *Fixed Expenses.*

Repair of Hull and Machinery ....@ £1,200		£2,400
Wages of Crew, Victualling and other running Expenses—2 × 365 days .....@	20	14,600

(*b*) *Variable Expenses.*

2 Months at Sea. each Steamer—

For Ropes and other Stores, extra pay, &c. @ £125 per day	15,000
100 Naut. Miles Cable, @ £200 per Naut. Mile	20,000
100 " " " @ 350 " "	35,000
Sundries.....	3,000
	£90,000

The Variable Expenses (*b*) are usually estimated at £6 per Naut. Mile, which would, in this case, amount to about £45,000.

One Steamer to be stationed at Vancouver, B.C., and the other Steamer to be stationed at Suva (Fiji Islands).

CAPITAL ACCOUNT.

Capital to be raised under Govt. guarantee @ 3 per cent.	£2,000,000	7,340 naut. miles cable	£1,720,000
		Steamers	200,000
		Buildings, &c.	30,000
		Working capital	50,000
			£2,000,000

Cost per naut. mile ... £273

REVENUE ACCOUNT.

General management	£ 5,000	Earnings	£220,000
Building staff	24,000		
Repairs and renewals	90,000		
To Profit and Loss Account	101,000		
	£220,000		

PROFIT AND LOSS ACCOUNT.

3 per cent. interest on capital	£60,000	From Revenue Account	£101,000
2 per cent. amortisation of capital	40,000		
Carried forward	1,000		
	£101,000		

The earnings are estimated at £30 per naut. mile (the average amount of the earnings of all cables, according to Mr. Henniker Heaton).

If share of Pacific cable is 2s. per word, 2,200,000 words are wanted, while cables are calculated for 15 words per minute or more than 7,000,000 words per annum. This capacity can practically be doubled by introducing duplex working when the traffic requires it.

per minute or more than 7,000,000 words per annum. This capacity can practically be doubled by introducing duplex working when the traffic requires it.