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COMMONWEALTH OF AUSTRALIA.

PARLIAMENTARY STANDING COMMITTEE ON
PUBLIC WORKS.

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE

PROPOSED ERECTION OF AN ADDITIONAL
TELEPHONE TRUNK LINE BETWEEN
SYDNEY AND MELBOURNE.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

Third Committee.

The Honorable HENRY GREGORY, M.P., Chairman.

Senate.

Senator Hattil Spencer Foll.*
 Senator George Henderson.†
 Senator John Newland, Vice-Chairman.‡
 Senator Edward Needham.§
 Senator William Plain.*

House of Representatives.

Llewelyn Atkinson, Esquire, M.P.
 The Honorable Frederick William Bamford, M.P.
 George Hugh Mackay, Esquire, M.P.
 James Mathews, Esquire, M.P.
 Parker John Moloney, Esquire, M.P.

* Appointed 28th July, 1920. † Resigned 22nd July, 1920. ‡ Reappointed 28th July, 1920.
 § Ceased to be a Member of the Senate, 30th June, 1920.

PROPOSED ERECTION OF AN ADDITIONAL TELEPHONE TRUNK LINE BETWEEN SYDNEY AND MELBOURNE.

REPORT.

The Parliamentary Standing Committee on Public Works, to which the House of Representatives referred for its report thereon the proposal to erect an additional telephone trunk line between Sydney and Melbourne, has the honour to report as follows:—

INTRODUCTORY.

1. Telephone communication between Sydney and Melbourne is at present carried on over a copper wire 600 lbs. to the mile, laid between the two cities. Representations have been made from time to time to the Department by Members of Parliament, Chambers of Commerce, and members of the business community of both Melbourne and Sydney concerning the delays and congestion of the traffic. The Department claims that every line time-saving method that it is possible to introduce has been adopted, but that the delays still continue, and it is not able to relieve the congestion unless an additional line be provided.

PRESENT PROPOSAL.

2. The present proposal is to erect, on the existing telephone poles, an additional circuit, carried on copper wire of a weight of 200 lbs. to the mile, and to instal at Albury and Yass telephone repeaters. These repeaters, which will cost about £250 a set, are something like an electric light bulb in appearance, and have a thermionic valve, which enables the voice currents to be considerably magnified, so that it is possible by their use to obtain on a light wire a transmission equivalent to that obtainable on a heavier wire without repeaters. On each of the two wires composing the circuit it is intended to superimpose a duplex telegraph service, which it is stated is also urgently required.

ESTIMATED COST.

3. The total length of the proposed new line is 580 miles, and the estimated cost of the proposal, as submitted to the Committee, was £37,000. This estimate was framed when copper wire was costing £168 per ton, and as there has been a substantial drop in the price since then, it is probable that the estimate may be considerably reduced.

COMMITTEE'S INVESTIGATIONS.

4. The Committee took evidence in regard to this matter in Melbourne and Sydney, and satisfied itself that the service provided under existing conditions is not satisfactory, and that many business firms refrain from using the trunk line on account of the delay experienced in getting their calls through. Evidence obtained showed that there is an average of about 26 calls cancelled daily in Sydney, presumably because of delays caused through congestion of business—the result being a serious loss of revenue to the Department.

5. *Financial Aspect.*—It was stated in evidence that, as the proposed new line will be utilized for both telephone and telegraph purposes, the interest on the capital cost will be divided between the two services. On this basis the charges allocated to the trunk line proposal are:—

Interest, at 5 per cent. on half capital cost	£925
Repairs and maintenance	625
Administrative charges	240
Operating and supervision	410

£2,200

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EXTRACT FROM THE VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES.

No. 109, OF 19TH NOVEMBER, 1920.

9. PUBLIC WORKS COMMITTEE REFERENCE OF WORK—ADDITIONAL TELEPHONE TRUNK LINE BETWEEN SYDNEY AND MELBOURNE. Mr. Wise moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913* 14, the following work be referred to the Parliamentary Standing Committee on Public Works for their report thereon, viz.:—Erection of an additional telephone trunk line between Sydney and Melbourne.

Debate ensued.

Question—put and passed.

As the revenue for the first year after establishment is estimated to be £6,049, and it is probable that it will steadily increase, the proposed erection of the additional line, even on the above prices, appears to be a sound-business-proposition.

6. The Committee, however, desires to invite attention to the fact that a substantial reduction may be looked for in the estimated cost of this work, by reason of the fall in the price of copper since the original estimate was prepared. The Chief Electrical Engineer stated in evidence that before the war copper wire was obtained by the Department at the market price of electrolytic copper, plus £15 per ton to cover freight and manufacture. At the present time the copper wire used by the Department is drawn at Port Kembla, New South Wales, and the cost of such wire to the Department is the market price of electrolytic copper, plus £57 10s. per ton—a very marked increase on pre-war prices.

7. In the estimate submitted to the Committee copper wire is allowed for at the rate of £168 per ton, but as the price of copper is declining from day to day, and the quotation of the London Metal Exchange on the 12th April was £74 per ton, the price of copper wire to the Department should now not exceed £74, plus £57 10s., equal to £131 10s. per ton, or £36 10s. per ton less than originally estimated. This would mean a reduction of about £3,504 in the original estimated cost, with a corresponding reduction in annual interest and maintenance charges.

8. To enable the Commonwealth, however, to obtain its supplies of copper wire on the most reasonable terms, the Committee is of opinion that public tenders should be invited. The decision arrived at in connexion with this matter is shown by the following extract from the Minutes of Proceedings, namely:—

Mr. Gregory moved that a clause be inserted in the Report to the effect that tenders should be called for supplies of copper wire.

Seconded by Mr. Mackay.

The Committee decided on the motion.

Ayrs (5).

Mr. Bamford.
Mr. Gregory.
Mr. Mackay.
Senator Newland.
Senator Plain.

Noes (3).
Mr. Atkinson.
Mr. Mathews.
Mr. Moloney.

And so it was resolved in the affirmative.

9. *Alternatives.*—Inquiries were made as to the feasibility of establishing a system of wireless telephony in lieu of the additional land-line proposed, but the Committee was informed that wireless telephony has not yet reached such a stage of development as to warrant its installation in this instance.

10. The question was also raised as to whether the adoption of the Bell high-frequency carrier telephone proposition, which allows of a number of messages being sent simultaneously on the one pair of wires, might not enable the present line to deal with all the business likely to be received for some time to come. The Committee was informed that, even if this system be proved commercially practicable, it would be two or three years before it could be installed, and, with the rapid development of business, it is possible that even then the two lines would be required—in any case the second line would be always useful as a stand-by.

11. *Intermediate Stations.*—It was stated in evidence that while it would be possible to allow stations along the route of the trunk line to use it, it is not likely that this will be done, as it is estimated that the whole capacity of the line will be taken up by the two terminal stations.

COMMITTEE'S RECOMMENDATION.

12. After careful consideration of all the facts placed before it, the Committee is unanimously of opinion that the additional trunk telephone line proposed should be erected as early as possible.

H. GREGORY,
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
527 Collins-street,
Melbourne, 26th April, 1921.

TELEPHONE TRUNK LINE—MELBOURNE—SYDNEY.

MINUTES OF EVIDENCE.

(Taken at Melbourne.)

TUESDAY, 23rd NOVEMBER, 1920.

Present:

Mr. GREGORY, Chairman;	
Senator Foll.	Mr. Mackay.
Senator Newland.	Mr. Mathews.
Mr. Atkinson.	Mr. Parker Moloney.
Mr. Bamford,	

Frederick Golding, Chief Electrical Engineer and Director of Radio Services, sworn and examined.

1. *To the Chairman.*—I am aware of the reference submitted to the Committee. The proposal is to erect a telephone trunk line between Melbourne and Sydney. This has been submitted in consequence of the present serious overloading of the trunk line already existing between the two cities. The Department is losing revenue, and the public is being badly served on account of the congestion. Many calls are cancelled between Sydney and Melbourne, and *vice versa*, on account of the delay which occurs in giving the service. It is impossible to say what amount of revenue is being lost on account of our inability to give the service, but the present trunk line is showing a surplus of about £7,099 per annum. The gross revenue from the existing line is £12,099. The total working costs amount to £5,000. The estimated cost of the new trunk line is £37,000, and the financial position is that the cost of the working is estimated at £2,200 per annum. It is proposed to use this trunk line for dual purposes, that is, for telegraph as well as for telephone work. We should superimpose upon the new line a telegraph service, which is very urgently required between Sydney and Melbourne. Therefore, we are charging against this trunk line proposal half the interest on the capital expended. I am calculating the interest at 5 per cent. That will make the interest charge against the trunk line proposal £925. Repairs and maintenance are estimated at £625; that is about 31 per cent. These figures are the charges which I consider proper to the Sydney-Melbourne trunk line new proposal: interest on capital, £925; repairs and maintenance, £625; administration charges, £240. The operating—that is, the cost of telephonists, counter clerks, and supervision in the actual operation of the trunk line—£410; making a total of £2,200. That total is wholly chargeable to telephones. It is usual against all these proposals, in estimating, to charge 10 per cent as the amount to cover working costs; that is, repairs and maintenance, and administration and operating; and, adding £1,500 to the £2,200 which I have given in detail, that would make an amount equivalent to 10 per cent. on the total cost of £37,000. As regards the financial aspect, even if we charged 10 per cent. on the total cost against the trunk line proposal, we should still have a surplus on the two lines of £5,599. The existing charges against the present trunk line are £2,800, as estimated by our Chief Accountant. So the financial aspect is, in my opinion, beyond question.

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The details of the construction of the line are, as regards costs, as follows:—Copper wire and sundry materials, including telephone repeaters, will amount, for the New South Wales portion, to £18,546. The Victorian portion will total £6,765, making a grand total for wire, sundry material, including repeaters, of £25,301. The labour cost is estimated: New South Wales portion, £4,150; Victoria, £1,429; total, £5,579. The incidentals—that is, travelling allowance, freight, &c.—are: New South Wales portion, £1,930; Victoria £809; total £2,739. The administration charges—that is, the engineers, staff, and general administration for New South Wales and Victoria, and also including Central Office administration charges—are, for New South Wales alone, £2,154; for Victoria, £1,127; total, £3,281. Then there is an item of £100 in Victoria required for the preparation of the route. That is to say, certain alterations have to be made upon the existing route. The copper wire is apart from those incidentals and is estimated, for the New South Wales portion, £12,600; for the Victorian portion, £5,646. This is No. 10 wire. The estimate was framed when wire cost us £168 per ton. The costs have gone down considerably since then, however. The report in to-day's *Argus* states that electrolytic copper bars, upon which we have to estimate, are quoted at £95 a ton. That will make copper wire about £153 per ton, as against £168 when this estimate was framed. I have not altered our estimate, although the present indications are that we will get our copper wire at a much cheaper rate than I had estimated when this proposal was first prepared for submission to Parliament. It is practically impossible to estimate what the additional revenue will be, because we are turning away so much business at present. We do know that the present surplus over all charges is £7,099. It is quite likely—in fact, I anticipate—that the revenue within the first year will be 50 per cent. above what we are getting at present. Our gross revenue to-day is £12,099. With regard to the copper market, there have been fluctuations in the price of wire during the past year. On one occasion, the price advanced about 30s. a ton, but within the past month it has been falling, and it is still falling. On the 14th November it was quoted at £100 to £102; the latter is the price which we have to take, because we have to take the price of the bars. On the 15th November the price was £98 per ton; on the 12th, £97 10s. This morning, the quotation as for the 19th is £95 per ton. The pre-war price of copper wire was £84 per ton delivered in Australia, and the average manufacturing cost, including freight to Australia, was about £15 per ton. Now we are paying for manufacture £57 10s. per ton. If the copper market were quoted in London at £69 per ton, we could be pretty well sure of getting the copper manufactured and delivered in Australia at £84 per ton. As I say, we are now paying for manufacturing £57 10s. per ton, including freight. That is, when copper wire is quoted, as it is at present, at £95 per ton, we have to pay £95 plus £57 10s. In the present proposal it is our intention to use a lighter wire than formerly. In this connexion, we propose to instal, at Yass and at Albury, telephone repeaters. These are

an invention introduced since the construction of our previous telephone trunk line between Sydney and Melbourne, and by means of the invention we are able to get an equal transmission equivalent on a very much lighter wire. My original proposal was to use a 150 lb wire. I propose now to use a 200 lb. per mile wire which is the No. 10. It is a much lighter wire than was formerly used. As for our estimate of saving in copper wire through the installation of these repeaters, where we were originally using 600 lbs. per mile wire, we now propose to use 200 lbs. so that we will be saving two-thirds of the price of copper wire per ton. The wire which we propose to use is drawn at Port Kembla. We can get the wire in Australia more cheaply than we can import it and pay duty upon it. The repeaters are an automatic invention. There will be required very little additional labour, and that can be provided by the mechanics already stationed at Albury and Yass. The repeaters will cost about £250 per set, and there will be the two sets. The cost of their upkeep will be, roughly, from £20 to £40 a year. I can assure the Committee that an effective saving will result from this proposed innovation. The interest charges on the heavier wire would completely swamp the cost of maintenance of the repeaters. The whole of the proposed work will be done departmentally. That has proved satisfactory in similar circumstances in the past. We have our own staff permanently engaged on such work. We have men specially trained, and it is the wisest method to use our specially trained staff, particularly where we are handling copper wire. It requires experienced workmen to carry on with that material without damaging it.

2. To Senator Newland.—I estimate that the revenue which the Department is losing at present owing to cancellation of calls, due to trunk line being engaged, and for other reasons, is £1,541 per annum. There are many people who make application for calls in the hope of getting an early preference, and they cancel those calls before they have matured. That brings in no revenue. The number of cancelled calls in connection with the Sydney-Melbourne telephone trunk service totals about 6,849 per annum. Very many people to-day do not use the telephone trunk line on account of the almost inevitable delay, but prefer to send urgent telegrams. If we can give the service, I am confident that our revenue will increase very rapidly. By giving the service, the telephone system in all cases is used very much more extensively. If we are able to give the service, I feel certain that the revenue will increase 50 per cent. in the first year. We will be using the wooden poles which are at present in use, and we will not require to replace many of them. My estimate for incidentals, and the general estimate, covers all alterations and renewals which may be necessary. Originally, we had light iron poles erected between Sydney and Melbourne, but the load became too heavy, and the wooden poles, which were found the most satisfactory for carrying loads, were placed in their stead. The superimposing of a telegraph service upon the trunk line will not interfere with telephonic communication; that is, so long as the instruments are properly adjusted and the right apparatus is used. We expect to get all the copper wire we require from the Port Kembla works. The repeaters have to be imported. This invention is not being manufactured in Australia at present, and there are certain features of it which are likely to prevent its manufacture here for, at any rate, some time to come. The British Post Office and American telegraph and telephone companies are using repeaters similar to those which I propose to install on this line, and I am satisfied that they will be successful. I have not tried experiments with them

over long distances in Australia, but in Queensland we have them on a line between Brisbane and Rockhampton. The results have been most excellent, and, added to the fact of their wide commercial usage in other parts of the world over similar long distances, I am confident of the success of the repeaters between Sydney and Melbourne. As to any alternative which might have to be taken, if the repeaters were not a success, I repeat that they are being used over much longer lines, and with lighter wires, and with every success. I have no hesitation in recommending their installation.

3. To Mr. Parker Meloney.—We have two telegraph lines on the present trunk line. The Canadian Duplex system is installed. On the present trunk line we are transmitting four telegrams simultaneously. As for making a comparison between the estimated expenditure and maintenance costs of the proposed line with the original trunk line, the estimated expenditure for repairs and maintenance upon the proposed line will be greater. That is to say, the charge made on the telephone side will be greater in proportion than the charge made upon the existing telephone trunk line. We are making greater use of the trunk line at present from a telegraphic point of view than we can expect to do in using a 200 lb. wire with the two sets of repeaters. We may eventually succeed in installing the Canadian Duplex system, but I desire to go carefully. The estimate of 10 per cent. is the charge which we calculate for maintenance, interest charges and working expenses on all our lines. The fall in the price of copper wire, as indicated in the quotations of the past few days, is not the lowest price quoted since the war. The indications are that the price is gradually coming down again. As for the project of installing wireless telephony, that system cannot be used in any way in connection with this proposition. Wireless telephony has not yet developed commercially except in one place, and that is upon an island about 25 miles off the coast of California. There the system has been developed by the Bell Company, and I understand that it is operating commercially. I have communicated with the United States to ascertain whether it is a success. I interviewed a representative of the Bell Company yesterday. He happened to be over in Melbourne from Sydney. But he had no information upon this matter. Wireless telephone messages have been actually heard between Great Britain and America, but only as a freak; just as I have heard European stations in wireless telegraphic communication with a comparatively small wireless telegraph plant in Western Australia. As a commercial concern, however, wireless telephony at present is quite out of the question. It has not yet developed to such an extent as to justify us in considering its commercial application at this stage.

4. To Mr. Mackay.—It has been recognised by the Department for two or three years that a second trunk line between Sydney and Melbourne is urgently required. The reason why the work was not proposed to be put in hand earlier was mainly on account of financial stringency. Shortage of material was also a factor, but the financial consideration held chief sway. As a matter of fact, we could have got the copper wire a couple of years ago. The estimated number of calls on the present trunk line is 100 per day. Those calls do not spread evenly over the day, however, but frequently come in rushes. The fee for telephone communication between Sydney and Melbourne is, for a three minutes' conversation, 5s. As for the question of reduction following upon the establishment of this second line, that is entirely a matter of Government policy. I should add, however, that this is the cheapest telephone trunk line over the distance in the

whole world. In America the cost of conversing over a similar distance, in similar circumstances, would vary from £1 to 25s. The charges are not upon the same scale in all the States. If we were to adopt the standard charge for the shorter line, on the Sydney-Melbourne trunk line the charge would be greater.

5. To Mr. Bamford.—I am familiar with the proposition that the Willis group of islands, off the coast of Queensland, should be brought into wireless telephonic communication with the mainland. This would be chiefly in the interests of meteorological information. It would be practicable to install wireless telephony upon those islands, but not wireless telephony at distance; namely 240 miles is too great. The reason why it is not practicable from a financial point of view to install even wireless telegraphic communication is that, as I have just said, the main purpose of the installation would be to convey meteorological information. Its chief value would be to warn the mainland of the imminence of cyclones, and the trouble would be that just at the very time when it would be necessary to make use of that installation, the atmospheric conditions would be such as to make its use impossible, or, at any rate, to seriously interfere. This question of statics, I might add, forms the chief trouble in connexion with wireless telephonic communication over long distances at present.

6. To Mr. Atkinson.—In the financial statistics which I have provided the Committee, there is not specific provision for a sinking fund. We do not have a sinking fund. We allow a sum of money by way of maintenance, such as will keep the line in perfect condition. Copper wire will last easily a quarter of a century. Our maintenance costs generally cover the matter of renewal. We do not actually set down a sinking fund, but we cover the contingency.

7. To Senator Foll.—In reply to the question of whether we could get sufficient material and have at our command a sufficient staff to carry on both the works—that is the Sydney-Melbourne trunk line, and the Sydney-Brisbane line simultaneously—we could do both at the same time. We would employ temporary labour in order to replace our permanent men, who would have to be put on to handle the copper wire. We would proceed with the work, and I have no doubt that our supplies of wire would come to hand as required. I am asked why it is intended to do the Melbourne-Sydney job before the Sydney-Brisbane job, although there is already telephone trunk communication between Melbourne and Sydney, and Brisbane is not yet in touch. The proposed new Sydney-Melbourne trunk line is already provided for upon the estimates for this year. The Sydney-Brisbane job is provided for upon next year's estimates. The reason for that is that the Sydney-Melbourne connexion was the more pressing from the departmental point of view. We would be getting greater revenue from that line, whereas the Sydney-Brisbane proposal will not be a financial proposition for the first year. In giving preference to the Sydney-Melbourne connexion the convenience of the public and the interests of the greater number of people are being considered. The Sydney-Melbourne service is inefficient to-day on account of the overloading of the present line. A far greater number is concerned in that line than would be in the Sydney-Brisbane line. Therefore, the Department considered that that was the more urgent of the two propositions, particularly, as I have said, in view of the fact that the Brisbane line would not pay at all at the start. The telephone trunk line to Adelaide is a paying proposition. More business is done between Adelaide and Melbourne than is likely to be done between Sydney and Brisbane. There is a considerable mining

association between Adelaide and Melbourne. With respect to the Bell high frequency carrier telephone proposition, we have done everything possible at our end to secure necessary information. The company has told me that they will be prepared to show me the whole thing when I have an opportunity to visit America; but so far we have been unsuccessful in securing the necessary details. The invention is entirely that of the Bell Company. I am asked whether in this system of telephony is proved by the Bell Company, or from any source, to be commercially practicable, we will need this second trunk line between Sydney and Melbourne. We may not do so. At any rate, it will always be a standby, and it is possible that business will increase so rapidly that we should require all the additional services that this new invention may provide us with. It may be some two or three years before we can instal this new invention, even supposing that the Bell Company will be prepared to sell to us, and, meanwhile, the loss and inconvenience to the public in Melbourne and Sydney would be so heavy as not to justify us in holding up the construction of the second line. I do not think it would be wise for us to hold up the Sydney-Melbourne project until we have ascertained the facts of the telephone installation by the Bell Company. In view of our experience, it is not altogether certain that we will secure the benefit of this invention at all. We have laid off for the past twelve months on account of this, among other reasons—the chief of which, as I have just indicated, has been financial stringency.

8. To Mr. Mathers.—Users of the telephone will not be in any way inconvenienced by the fact of the line being employed for telegraphic purposes simultaneously. They should not know, when they are conversing, that the line is in telegraphic use. The Bell Company has brought its new invention to a commercial success, I am given to understand; but they retain the secret of vital parts of their process, and one can only await the further development of the system. Copper wire is used for long distance purposes in preference to iron wire, because it very considerably facilitates telephonic communication. Iron wire is not the most suitable for the conducting of voice currents, which vibrate at from 800 to 1,600 vibrations per second. Iron wire will not conduct those voice currents over long distances satisfactorily. I am satisfied that not more than two sets of repeaters will be required. It may be possible later to put in one set of repeaters at Wagga, and to do away with the others. But those others would still come in handy for the improvement of some other long distance services. I would put one on the Melbourne-Adelaide trunk line, which is not altogether satisfactory. The use of iron wire in connexion with telephony over short distances, say, up to 50 miles, gives as good service as copper wire. However, besides the factor of its being considerably less useful over longer distances, there is the factor of corrosion. It is not advisable to use iron wire in cities and big towns where there is smoke and fumes and the like. As an instance of the damage done to iron wire, at Broken Hill, many years ago, iron wire was erected, and it lasted only a few years. It was replaced by copper wire, some of which stands to-day after about twenty-five to thirty years' use. The conductivity of iron wire is about seven times less than that of copper wire. As a matter of fact, we erect iron wire and copper wire on the same run of poles, so that any comparison from that angle is not of great value. We have had to hold up subscribers who desired to make use of the Melbourne-Sydney trunk telephony at times, for two hours and longer. There is a standing instruction that no one may secure more than one extension of three minutes, over the original term of three minutes, if other subscribers are waiting.

(Taken at Sydney.)

WEDNESDAY, 15TH DECEMBER, 1920.

Present:

Mr. GIBSON, Chairman;

Senator Foll,	Mr. Bamford,
Senator Newland,	Mr. Mathews,
Mr. Atkinson,	Mr. Parker Moloney.

John Murray Crawford, State Engineer, Postmaster-General's Department, New South Wales, sworn and examined.

9. *To the Chairman.*—The project for duplicating the trunk telephone line between Sydney and Melbourne has been referred to me for report. Undoubtedly, the existing line is overloaded. Particulars as to the extent of the overloading will be furnished by another officer of the Department. I think the present apparatus is the most efficient we can get. To-day there is only one circuit which is carried on a 600-lb. copper line, and on each of the two wires used for the telephone service a telegraph service is superimposed. Thus we really get two duplex telegraph services on the one trunk telephone line. For that particular type of circuit the apparatus in use is the latest. We have other circuits between Melbourne and Sydney which are worked by the Wheatstone (high speed transmission), but it is not possible to work Wheatstone on a trunk line on account of electrical disturbances. It would not be possible to make the service more effective by utilizing the Wheatstone system. We are using two copper lines for speech purposes, and speech frequency may be taken at about 800 vibrations per second. The moment you put on a high speed apparatus like the Wheatstone, in which you have reversals of current of the order of about 5,000 per second, you break down effective telephonic communication. So far as I know, there has been no Wheatstone circuit superimposed on a telephonic trunk line; hitherto that has been impracticable. The extra circuit is chiefly required for telephonic, and not for telegraphic, service, but probably it will be used for both. So far as my knowledge goes, the Wheatstone circuit has not been superimposed upon a telephonic trunk line in any part of the world. In making our estimates we have considered the possibility of utilizing the new line for telegraphy, but the latest instruction we received from the Melbourne office was that, for the time being, we should concentrate on the telephone proposition. I think it is probable that we shall carry out the same arrangement with the new circuit as we have with the existing services, and thereby get two additional duplex services. The total length of the new line will be 580 miles, of which 390 miles will be in New South Wales. We are proposing to use 200-lb. copper wire, which, with the cross arms, spindles, and miscellaneous material, will cost approximately £13,500. We have estimated the wire at £168 per ton, but copper is quoted to-day at from £87 10s. to £89. Adding £87 10s. for the manufacturing cost at Port Kembla, the cost of the wire is reduced on to-day's price to £145 10s. The labour will cost approximately £2,500. In working the main wires we have a proportion of temporary men who are paid wages. We have allowed for wages, i.e., temporary men, £1,700, and for salaries, i.e., permanent men, £245. These figures relate only to New South Wales; I know nothing about the Victorian section. Over and above

those costs, there will be incidental expenditure, such as freight and cartage, camp allowances, fares, out of pocket expenses on tools, &c., amounting to about £1,500. The apparatus, chiefly consisting of two sets of repeaters to be installed at Yass and Albury respectively, will cost £500, making the total expenditure in New South Wales £18,000. In the first instance the Chief Electrical Engineer asked for alternative estimates for 150-lb. and 200-lb. wire, but it was ultimately decided that 200-lb. wire should be erected. I am satisfied that that wire, with telephone repeaters, will give an effective service. I understand that an experimental circuit on 200-lb. wires is now being operated between Brisbane and Rockhampton, and is being extended due west. Repeaters are installed at Bundaberg, and I am told are giving satisfactory results. Our proposals should give us an efficient service, and an economical one, too, because we shall be using 200-lb. wire instead of the 600-lb. wire in the existing line. If the heavier wire were erected we should not require repeaters, but it would involve an additional cost of £25,000 in New South Wales alone. The wire itself would cost an extra £23,000, and, of course, all the associated material would be more expensive. I think the manufacturing cost of 600-lb. wire would be as great as that of 200-lb. wire, but I do not know that any 600-lb. copper wire has been drawn at Port Kembla. I visited the works, but I did not assume for a moment that as we could use 200-lb. wire, there was any reason why I should inquire about the 600-lb. wire. I understand that the works at Port Kembla are the only works in Australia which copolymer can be produced. I am not aware of any specific arrangement between the Government and the manufacturers at Port Kembla for the supply of copper wire. The price will vary with the market price of copper. We have an arrangement whereby the price of the wire is based upon the London quotation for copper on the day on which the order is placed. The manufacturing cost appears to be fairly high. I should say that in America and Britain the difference between the prices of electrolytic copper and copper wire would be about 25s. per ton. I know that the Government have been asked to place orders with the Port Kembla factory, because I have seen reports of deputations to the Postmaster-General, and I think it is reasonable to expect that we should pay a little more for the article manufactured in Australia in order to help the local industry. I cannot give any idea of the difference between the manufacturing costs in Australia and the Old Country. It may be that the Chief Electrical Engineer's figures as to the pre-war price—£84 delivered in Australia, and the average manufacturing cost in England, including freight to Australia, about 21s. per ton—were rather high. Our method is to send forward a collective schedule showing our requirements for copper wire, and the Central Administration in Melbourne arranges to call for tenders and place orders. We in Sydney have nothing to do with the placing of orders for copper wire. The concentration of the ordering in the hands of the Central Administration is in the interests of economy. I do not think there is a difference of anything like £30 or £40 per ton between the manufacturing costs of the imported and local articles. The cost of labour in England to-day is probably double what it was in pre-war time. On that basis we are probably paying about double the pre-war price for manufacture. The 600-lb. wire increases the strain upon the bolts, insulators, &c. It was not intended originally to utilize 150-lb. wire; if I had been asked for a recommendation I would have proposed 200-lb. wire, but the Chief Electrical Engineer

asked for alternative estimates for the two weights. I doubt whether 150-lb. wire, with repeaters, would be as effective as 200-lb. wire; the latter would have a greater margin of safety. In my opinion it would be advisable to use the heavier wire with repeaters in order to get a more effective service. Of course, if 150-lb. wire were used, there would be a *pro rata* saving. The manufacturers might charge a little more for the making of the finer wire than for the heavier article, but the cost of the wire varies in accordance with the quantity of material in it, rather than in the manufacture. The life of 200-lb. wire would be a little less than that of 600-lb. wire, but the difference would not be great. Electrical use does not affect the life of copper; a line would have about the same life if it were lying unused as if it were in use. It would, I think, be safe to estimate the life of a copper line at from thirty to forty years. I know of some circuits that have been standing for over forty years. In manufacturing districts particularly the life of copper wire is much longer than that of iron wire, because the oxidation and chemical action is less. Moreover, the scrap value is greater. It will be my duty to supervise the erection of this line in New South Wales. I estimate that the telephone repeaters will cost £250 per set; we propose to install one at Albury and the other at Yass. In appearance they are very much like an electric light bulb, and they have a thermionic valve which enables the voice currents to be magnified considerably. Hitherto, the failure of all telephone repeaters has been that a mechanical agency was introduced, and the inertia was fatal to rapid pulsations. Those we are installing do away with the mechanical agency entirely. They are made by the American Telegraph and Telephone Company, and also by the British Post Office. I have not yet had a set of repeaters, but I have read about them.

10. *To Senator Newland.*—The new trunk line will not add materially to the work of the Sydney exchanges; it will simply add another circuit to those requiring attention. It will not involve the installation of new switchboards in the city. We shall merely terminate the line on the present board in the trunk exchange. The chief extra apparatus will be the repeaters at Yass and Albury. The work of the operators will not be increased. There is a shortage of telephone instruments in Australia, and many people are waiting for connexion. We have been handicapped by the lack of funds, but now that the Treasurer has made money available, steps are being taken to get additional apparatus and material as quickly as possible. Telephone instruments other than small switchboards are not made in Australia, but orders are being placed abroad for a considerable number. I have not included in my estimate figures the cost of maintenance; that is a matter for the Central Office. We base our cost on 3 per cent. for interest and 3 or 2½ per cent. for repairs and maintenance, and 2 per cent. for working. I think the Postmaster-General's Annual Report shows that those estimates work out approximately correct. They are reviewed periodically by the Chief Accountant, and, therefore, cannot be far wrong. The extra lines will mean the employment of additional temporary hands during the period of erection only. After that the present permanent staff will be able to handle the work. The existing line is so overloaded that, during the busy hours of the day, it is not unusual for a caller to wait one or two hours before getting service. The life of 600-lb. wire would not necessarily be longer than that of 200-lb. wire; at my rate, the difference would not be sufficient to warrant us in incurring the

extra cost. So far as weather conditions are concerned, up to a certain point the advantages are with the lighter wire, because the wind pressure on it is less, and there is smaller danger of mechanical damage. On the other hand, the tensile strength of the lighter wire is less, and when subjected to a certain strain it will break. I think the 200-lb. copper wire may safely be used. I have given no thought to the practicability of wireless telephony between the two cities. So far as my reading informs me, wireless telephony is just emerging from the laboratory stage. It is practicable, but I do not know of any place where it is in commercial use. Even where it is installed it is working over only short distances.

11. *To Senator Foll.*—The lighter line with repeaters can be utilized for both telephonic and telegraphic services. The Wheatstone system does not provide for a quadruplex service on a single line. It is high speed machine telegraphy, whilst the quadruplex is hand worked. I have read of the patent operated by the Bell Telephone Company of America, by which a number of subscribers can talk on the one line at the same time. That may be possible between Melbourne and Sydney, but I think it is still little beyond the laboratory stage. The Chief Electrical Engineer is, however, making investigations to ascertain whether it is practicable to use this carrier wave system on the existing line. It is being used in America, but to what extent is rather doubtful. If it were commercially feasible it would mean a big saving, and would probably be the solution of our problem. So far as I am concerned, it is not practicable commercially. The Chief Electrical Engineer has obtained a large amount of information in connexion with his investigation as to the application of the carrier wave system to the existing line, but I think it is a matter for the future rather than for the present.

12. *To Mr. Parker Moloney.*—The repeaters will be operated by the present staff; the only additional labour involved will amount to a portion probably ultimately only one-fifth or one-sixth of a mechanic's time.

13. *To Mr. Bamford.*—Switchboards are being made in Australia, but not wall or table telephones. I was a member of a committee appointed by the Repatriation Department two years ago to inquire as to the possibility of manufacturing telephones in Australia, and the decision came to was that it is not economically practicable at present.

14. *To Mr. Atkinson.*—The only new telephonic device of which I have heard, apart from the repeater, which is only an amplification of the carrier wave system, which allows of a number of messages to be sent simultaneously on the one pair of wires. We have had no opportunity of investigating it experimentally in Australia. We think it is better to proceed with the duplication of the present line than to wait for some practicable improved scheme; we might be waiting for years. There would be no advantages in using the 600-lb. wire except by obviating the use of repeaters. The purpose in view is the transmission of speech from Sydney to Melbourne, and if we can do it with 200-lb. wire, why should we use 600-lb. wire? I do not think the heavier wire would give a better service. We can only be guided by the experience of the American Telegraph and Telephone Company and the British Post Office, together with our own experience in Queensland, which has been quite satisfactory. I do not think there would be any advantage in deferring the purchase of copper wire on the chance of getting it cheaper. The price is probably down now to nearly normal; it may drop a little more, but not much.

15. *To Mr. Mathews*.—Almost the whole carrying capacity of the new line will be taken up by the two terminal stations; therefore, the intermediate stations will not have any chance of using it. In any case, Albury and Goulburn have their own circuits. The existing trunk line from Sydney to Melbourne is not tapped en route. We do occasionally allow intermediate conversations, but there is very little chance of that at present, because we have as much Sydney-Melbourne traffic as the wire will carry. If the new line is not too much in demand it can be used by the intermediate stations. We can divide a trunk line at any point. If there were a lack of business between the two terminals we would allow the line to be used by the intermediate stations. The telegraphy does not interfere in any way with the telephony; we use both the existing telephone wires for a duplex telegraphic circuit. So far from thinking that iron wire has been neglected for telephonic purposes in the Commonwealth, I am of the opinion that a mistake has been made in using so much iron and not enough copper. We have used 400-lb. galvanized wire where, I think, we would have had a much better telephonic service by using 100-lb. copper wire. For a 50-mile circuit iron wire is all right, but country lines are extending, and the 50-mile circuit of to-day may be part of a 500-mile trunk line system to-morrow. Telephonic communication on iron wire is much worse than on copper wire, because the conductor resistance of iron is in the ratio of 5:1 to 1 of copper. Then to obtain the same conductivity the weight of the iron wire has to be five and a half times greater. Therefore, the capacity of the iron wire is also much greater. Over and above the conductor resistance and capacity, there is a serious disability in the inductive resistance of iron wire. For that reason all telephone systems use copper in preference to iron. Very pure Swedish iron would have better conductivity than ordinary galvanized iron wire, and might easily give good service on a short circuit, but we could not get telephonic communications on any iron wire between Melbourne and Sydney, because the capacity is too great.

16. *To Senator Newland*.—Repeaters do not last indefinitely. At first their life was 7, I understand, about 250 hours, but now it is over 1,000 hours. When the bulbs are worn out it will have to be replaced. This will not involve the replacement of all the apparatus; the transformers and condensers will last a considerable time. The replacement of the bulbs will not cause any delay in the working of the line.

The witness withdrew.

Starkie Parkinson, Traffic Clerk, Telephone Department, Sydney, sworn and examined.

17. *To the Chairman*.—On behalf of the manager of telephones I submit to the Committee the following report made to him by the Assistant Manager, Mr. Langworth:—

MAXWELL.
The following report is submitted in connection with the estimated revenue which would be derived from an additional trunk line between Sydney and Melbourne:—

1. The annual revenue produced by the existing trunk for the twelve months ending 30th June, 1920, was £6,788 0s. 0d.

2. In arriving at the estimate, records taken over the last twelve months have been used, which indicate that an average of 78.8 effective calls for Melbourne originate at Sydney daily. An average of 31.2 of these calls called for extensions, and 47.6 calls were cancelled daily, presumably on account of delays caused through congestion of business.

3. For the first twelve months there has been made for a 25 per cent. increase on the existing traffic. This increase has also been taken into account in connexion with cancelled calls and extensions, which are, at present, lost, but which would be gained by the introduction of an additional circuit.

5. The estimate, which has been made for 313 days per year (Sundays excluded), indicates that, approximately, 22,755 calls would be lodged at Sydney, and would pass over the proposed trunk.

6. The additional revenue produced by this number of calls is estimated at, approximately, £5,688 15s. per annum.

7. In view of the foregoing, the following figures will indicate the estimated annual revenue at Sydney produced by an additional circuit:—

(a) Effective calls	78.8 per day
Cancelled calls, at present	47.6 per day
Total calls lodged	102.4 per day
(b) Estimated 25 per cent. increase in calls lodged for first twelve months:—	
102.4 x 25/100 = 25.6 per day.	
Cancelled calls previously lost, but now gained	25.6 per day.
Estimated that 42 per cent. of existing calls require extensions.	
Estimated increase, 25.6 + cancelled calls, 25.6 x 42/100 = 21.5 increased demands for extensions.	
(c) Estimated increase for first twelve months	25.6 per day
Calls at present cancelled	47.6 per day
Increased demands for extensions	21.5 per day
Total daily increased calls to pass over new circuit	78.7 per day
(d) 78.7 x 313 = 22,755 estimated annual calls to pass over new circuit.	
(e) 22,755 x 5s. = £5,688 15s., annual revenue derived from additional circuit. (Existing annual revenue = £0,788.)	

H. LANGWORTH,
Assistant Manager.

14th December, 1920.

SYDNEY-MELBOURNE BUSINESS.

Date.	Calls.	Date.	Calls.	Date.	Calls.
6.2.20	89	24.3.20	84	21.10.20	77
23.2.20	83	7.10.20	76	22.10.20	80
27.2.20	74	8.10.20	81	23.10.20	85
8.3.20	79	11.10.20	84	20.11.20	79
12.3.20	62	14.10.20	70	30.11.20	79
19.3.20	73	16.10.20	77	3.12.20	71
17.3.20	70	18.10.20	82	6.12.20	70
10.3.20	71	19.10.20	64	8.12.20	60
23.3.20	75	20.10.20	85		

20 days ... 1,097 calls ... Average 76.8 per day.
16 days (October 7th to 8th December), 1,221 calls—Average 78.2 calls per day.

EXTRACTS FROM GENERAL REVIEWS.

Date.	Effective Calls.	Extensions.	Cancelled.	Average Delay.
28.1.20	68	29	23	55.4
25.3.20	79	21	20	77.89
24.5.20	72	30	34	68.9
25.9.20	72	29	18	62.5
27.10.20	71	37	35	62.7
Daily Average	73.4	31.2	25.6	63.8

Annual Revenue (12 months ending 30.6.20) = £6,788 0s. 0d.

It is proposed that the new line shall serve only such country districts as can be included by the capitals. The revenue from them is suggested in the return I have handed in. At the present time the country districts are being served on the existing line as much as is practicable. There have not been many complaints from country districts between Sydney and Melbourne in regard to the difficulty of obtaining telephonic service. The new line will give an increased service to the country districts as far as the transmission will allow. The Melbourne-Albury trunk line passes over a different circuit. The new line is mainly for the service between the two capitals. There have been

complaints from Albury, Wagga, and other intervening places, and we have proposals in hand for giving additional facilities to those places. This new trunk line is proposed solely for the purpose of giving more effective service between Melbourne and Sydney.

18. *To Mr. Parker Molony*.—We have an additional circuit on order for Sydney to Cootamundra which will provide a better service for Albury, and also a circuit between Harden and Wagga. Provision is being made for an extra wire between Albury, Wagga, and other intermediate places, and that work will be carried out as soon as the material is available. I am not in a position to say how soon these facilities will be afforded. We have requisitioned the circuits, and it is for the engineers to provide the material and carry out the works. The shortage of material is the trouble. A large number of new circuits have been approved, and it is a question as to which will be provided first.

19. *To Senator Newland*.—In some cases a subscriber who cancelled his call might send a telegram, but we regard every cancelled call as a loss of revenue, because even a telegram would mean less revenue than a trunk line call. The popularity of the trunk line conversation is increasing by leaps and bounds. The charge is 5s. for three minutes conversation, and 5s. for each additional three minutes. The maximum time is six minutes if other callers are waiting for the circuit. It would not be advisable to tap the trunk line in order to serve intermediate towns. They would not be connected with a circuit of this kind under any circumstances.

20. *To Mr. Mathews*.—I do not think that a great percentage of the cancellations represents duplicate calls; we regard them all as representing potential revenue.

21. *To the Chairman*.—A man desiring to speak to Melbourne goes to the counter in George Street, and pays a fee. A clerk rings up the trunk line recording desk and books the call, and, when the call matures, the caller is connected to a cabinet in the telegraph office.

The witness withdrew.

Cloude Dillon, Secretary of the New South Wales Inter-State Steam-ship Owners' Association, sworn and examined.

22. *To the Chairman*.—The invitation of the Committee to the Sydney Chamber of Commerce to submit evidence in regard to the necessity for duplicating the Melbourne-Sydney trunk telephone line was referred to my association, because we are more interested as a body than are individual merchants. I made inquiries from the managers of the seven Inter-State Shipping Companies who are members of my association, and I have received the following replies:—

UNION STEAM-SHIP COMPANY OF NEW ZEALAND LIMITED.

We may state that we find one line to Melbourne is not nearly enough, and whenever we require to communicate with that city we have to wait a considerable time after our application for connection has been made. We may say this state of affairs also exists in regard to the line between here and Newcastle, where there is great congestion, and it frequently means a wait of an hour or two before we get the connection after we have applied for same.

AUSTRALIAN STEAM-SHIPS PROPRIETARY LIMITED.

We use the Melbourne trunk line telephone very seldom owing to the long delays waiting after the call has been made. We at present do our urgent business by telegraph.

THE ADELAIDE STEAM-SHIP COMPANY LIMITED.

We have not used the trunk line to Melbourne during this year. We used it occasionally in previous years, but it took

so long to get through to Melbourne, and the conversation was, as a rule, so indistinct during day time that we found it very much more satisfactory to communicate with Melbourne by urgent wire.

MOLLIWRAITH, MORAICHIAN'S LINE PROPRIETARY LIMITED.

Our experience that it is well nigh impossible to get a prompt connection during business hours. As a matter of fact we have practically given up telephoning Melbourne during business hours, sending urgent telegraph messages instead. We do find, however, that we can get reasonably good service by telephoning after 7 o'clock in the evening or before 8 o'clock in the morning, but these messages have to be passed through additional receivers' private houses, and we do not deal with during business hours, as ought to be the case. We trust additional trunk line service will be forthcoming in the near future, as we consider it badly needed.

HUDDART PARKER LIMITED.

We have found the trunk line service in the past so inefficient that in the majority of instances when a quick reply is required, we communicate by urgent telegram. It has happened on occasions that the service has been very prompt and satisfactory, but this has nearly always been when a call has been put through at extraordinary hours such as 4 a.m. or 6 a.m.

From the two other companies connected with the association I have had no written replies, but they informed me this morning that their position was exactly the same as is indicated in the letters I have submitted; they have found it very difficult to get a conversation with Melbourne; they have had to wait three, four, and five hours, and they are now transacting their business by urgent telegram. Undoubtedly, if an additional and efficient trunk line were established between Sydney and Melbourne, there would be a big increase in telephonic business. In shipping business, conversation is more satisfactory than a telegraphic communication. I certainly think the Department will save the majority of the calls that are at present cancelled, and, in addition, there will be an increase in the number of calls. I used the telephone fairly often during the Commonwealth control of shipping, and I found it very handy, but I had to attend 25 per cent. of my calls. Those arguments would apply equally to the proposal to establish a trunk line between Sydney and Brisbane. Three of the seven companies in my association have offices in Brisbane, and a telephonic service would be a great convenience to them. I am sure revenue would be obtained from the shipping companies if they could get an efficient service. I have heard no complaint in regard to the charge of 5s. for three minutes' conversation on the Sydney-Melbourne line, but in the past this service has been very unsatisfactory.

23. *To Mr. Alkinson*.—Outside of my association I have not heard many complaints by business people regarding the Sydney-Melbourne service; probably the matter has never cropped up in conversation.

24. *To Mr. Mathews*.—Looking ahead, I assume that if wireless telephony becomes economically practicable, private firms will establish their own systems, if it is likely to be of any advantage to them, but I do not think city to city communications would justify them in erecting private plants.

25. *To Mr. Parker Molony*.—I think the cancellations are chiefly due to the delay in getting service. The hearing also is defective. About a fortnight ago a Melbourne secretary telephoned to me at my home to inform me that a telegram was being sent, the contents of which he wished to make clear to me. The conversation was at night when, as a rule, the service is more effective, but this particular call was exceptionally indistinct. During the day time the Melbourne conversations are usually indistinct. The present service is ineffective for two reasons, delay and indistinctness.