

1922.



THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA, *brought up by*  
*Senator E. Newbould*

Pursuant to Statute

By Command

On Return to Order

*Gestonahan*

PARLIAMENTARY STANDING COMMITTEE Chair of the Senate.  
ON PUBLIC WORKS. *13-7-22*

# REPORT

TOGETHER WITH

## MINUTES OF EVIDENCE

RESPECTING THE PROVISION OF

### AUTOMATIC TELEPHONE EXCHANGES AT BRIGHTON, GLENELG, AND PROSPECT, SOUTH AUSTRALIA.

# AUTOMATIC TELEPHONE EXCHANGES AT BRIGHTON, GLENELG, AND PROSPECT, SOUTH AUSTRALIA.

## REPORT.

The Parliamentary Standing Committee on Public Works, to which the House of Representatives referred for investigation and report the question of the provision of Automatic Telephone Exchanges and Equipment at Brighton, Glenelg, and Prospect, South Australia, has the honour to report as follows:—

### INTRODUCTORY.

1. As the result of a telephonic survey of the Adelaide metropolitan area made in the years 1910-1921, it was reported that the whole telephone system had reached a stage at which it could no longer be extended on economical or satisfactory lines without an entire re-arrangement. It was decided that the existing equipment should be kept in use until it was approaching the end of its economic life or becoming either worn out or incapable of extension and that, when that point had been reached, any further expansion or any remodelling necessary should be made by the addition or substitution of automatic equipment. Since the Central Adelaide Exchange equipment is the more up to date and newer than the suburban, it was decided that the remodelling should commence in the suburbs.

### PROPOSALS BEFORE THE COMMITTEE.

2. The proposals under consideration involve the erection of buildings and the installation of equipment at Brighton, Glenelg, and Prospect; but Brighton and Glenelg are being treated practically as one work, as it is proposed that Brighton shall be a branch exchange of Glenelg—that is, Brighton will be able to complete a local call, but all transferred traffic must pass through Glenelg.

The details of the proposals are as follow:—

#### (a) BRIGHTON.

3. To erect a telephone exchange building on a site at the corner of Hartley-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 570 lines, and an ultimate capacity of approximately 1,000 lines.

#### (b) GLENELG.

4. To erect a telephone exchange building on a site at the corner of Jetty-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 1,600 subscribers' lines, and an ultimate capacity of approximately 2,500 lines.

#### (c) PROSPECT.

5. To erect a telephone exchange building on a site in Ballville-street, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 1,750 subscribers' lines, and an ultimate capacity of approximately 3,900 subscribers' lines.

6. In each case, it is intended that the initial equipment shall be capable of extension to the ultimate capacity named, thereby affording sufficient accommodation for the anticipated development of the area for a period of fifteen years.

### REASONS FOR THE PROPOSALS.

7. *Brighton and Glenelg.*—Owing to the rapid development of subscribers' lines in these areas, it is impracticable to extend the existing switchboards on account of insufficiency of accommodation. The equipment installed is of the non-multiple magneto type, which is said to be quite unsuitable for operation in a multi-exchange network such as exists in the Adelaide metropolitan area. It is claimed that the installation of automatic equipment in each case will allow of a more efficient service being rendered existing and prospective subscribers in each exchange area.

8. *Prospect.*—This area is rapidly developing, and the present magneto exchange, which is situated in the Post Office, cannot be further extended owing to want of accommodation. The approximate number of subscribers in the area connected with the Central Exchange on the 1st June, 1921, was 697, and, in view of prospective development, it is said to be imperative that an exchange be established in order to afford relief in the Central Exchange which is rapidly becoming unduly congested.

### MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

#### Third Committee.

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

#### Senate.

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

#### House of Representatives.

Llewellyn Atkinson, Esquire, M.P.¶  
The Honorable Frederick William Bamford, M.P.  
David Sydney Jackson, Esquire, 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. ‡ Re-appointed 28th July, 1920.  
§ Ceased to be a Member of the Senate, 30th June, 1920. ¶ Resigned 12th May, 1921. \*\* Appointed 19th May, 1921.

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### EXTRACT FROM VOTES AND PROCEEDINGS OF THE HOUSE OF REPRESENTATIVES. No. 204 of 6TH DECEMBER, 1921.

20. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—AUTOMATIC TELEPHONE EXCHANGES, BRIGHTON, GLENELG, AND PROSPECT, SOUTH AUSTRALIA.—Mr. Groom moved, pursuant to notice, That, in accordance with the provisions of the *Commonwealth Public Works Committee Act 1913-1914*, the following works be referred to the Parliamentary Standing Committee on Public Works for its investigation and report thereon, viz., Automatic Telephone Exchanges and Equipment at the following places in South Australia:—Brighton, Glenelg, Prospect. Mr. Groom having laid on the Table plans, &c., in connexion with the proposed works—  
Question—put and passed.



that area, 3 to 4 miles away from the central exchange. It would be almost impossible to give him satisfactory service to-day without laying down extravagant plant. If that subscriber gets a bad service, not only is that unsatisfactory to himself, but it has a reflex action on the whole service, in that anybody connected with the network, desiring to communicate with that subscriber, would likewise be given a bad service. The reference to sub-station equipment means the equipment used at a subscriber's premises. The reason why I have made references to 1923 is that we endeavour to provide five years' equipment from the date of cut-over, on account of the distance of this country from manufacturing centres.

2. To Mr. Mathews.—Concerning the item of recoverable value of assets, if the automatic exchange be installed, the value of the recovered plant is estimated to amount to £13,233, but that has not been regarded as a set-off against capital cost. The purpose has been to place this proposition before this Committee in its most unfavorable light; that is to say, in regard to the equipment proposed to be adopted. If we were to recommend that a common battery manual system be installed, we would have to adopt this same procedure. That is, if we were to set this item off in relation to the one system we would have to observe the same procedure with regard to the other, so that the outcome would be similar.

3. To Senator Newland.—With regard to the estimate of the number of subscribers, the total of 1,750 represents the number of lines estimated to be connected five years after the date of cut-over, while the ultimate capacity of 3,300 refers to a period fifteen years thereafter. The latter period has been adopted as one to which we can look the furthest ahead. The initial installation of the equipment will accommodate 1,750 subscribers' lines. This can be added to from time to time up to a total of 3,300 lines. Fifteen years is the utmost to which we can reasonably look ahead in connexion with telephonic development. The position at present is such that we must install some means of relief in connexion with the Adelaide central exchange. In the Prospect area to-day there are two dangers to be faced; one has to do with giving local subscribers an unsatisfactory service so far as transmission and reception applies, and the other concerns the fact that the central exchange is becoming overcrowded. Within four or five years we must have a new exchange in the central area. The plans for the proposed works embody the latest improvements known. I have given the utmost thought and consideration to the matter of the air conditioning plant. The system here proposed is that of the Works and Railway officials, and the figures are such as have been supplied by that Department. We are always endeavouring to find some more economical system. Our experience to date shows that these air conditioning plants must be installed, humidity being a grave consideration. So urgent are our requirements, however, that these proposed works could be gone on with independent consideration of the installation of air conditioning plant. If by experience we were to find that we could do without this expensive equipment we would be only too happy to refrain from installing it. Such is not the experience in any part of Australia at present, however. We are experimenting and making every effort in every direction. In Collingwood, for example, we are installing an air conditioning plant on trial for the Melbourne network. If experience proves that it is all right, or that it can be improved upon, we shall make the fullest use of our information. No subject has received more attention in the Engineering Department than this. I have given the closest consideration to it for six or seven years. With regard to the item of

£16,608 for line plant, much of that which is already in use will be used again, but we are bound to put down a certain amount of new line plant. As much as may be economical will be put underground. This will include the main cable routes, but the lines to subscribers will be, in many instances, overhead. It has been estimated that the capital cost of the new plant will be £72,886. That is made up of the cost of the site, the new building, the air conditioning plant, the exchange equipment, the equipment for subscribers' premises, and the line plant, together with the miscellaneous expenditure associated with the cutting over with the exchange and other plant. We have a certain amount of plant already installed or in situ, and the value of that is the difference between the item of £34,330 and £72,386—roughly, £12,000. It is proposed to bring in our cables to the Prospect exchange from the main street, which the building will front. With regard to our estimate of revenue, which in 1920 was £5,342, and which we expect in 1923 will be £11,612, there were 509 subscribers' lines in 1920, and the average revenue from each was £10 10s. Since that period the fees have been increased by 25 per cent. The ground rent has been increased from £6 to 8s, and the cost of a call is now 1d. in lieu of 1d. There will be 1,016 subscribers connected at the date of the cut-over, the revenue from each of whom will average more than £11. In our estimates we have allowed for depreciation and current rates of interest, but the Department does not make allowance by way of any sinking fund. Repairs necessary to be effected are provided for out of maintenance votes, a specific sum being appropriated by Parliament for that class of work. My personal view is that, with the provision of new exchange equipment, the establishment of a sinking fund would be wiser. However, the subject is one of policy. The Prospect site was selected after most careful examination. The method is to have studies made of the area under consideration, by which we arrive at the theoretical telephone centre of a district. The price for the Prospect land is very reasonable. There is ample accommodation on the block for our requirements, which will include linesmen's accommodation. There will be an accommodation also for the mechanics; there will be a battery room from which to operate the plant and the usual lavatory conveniences. With respect to the proposals for establishing automatic exchanges at Glenelg and Brighton, South Australia, the proposals are—

(a) *Glenelg Exchange.*—To erect a telephone exchange building on a site at the corner of Jetty-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 1,000 subscribers' lines and an ultimate capacity of approximately 2,500 lines. It is proposed that the initial equipment shall be capable of extension to the ultimate capacity named, thereby affording sufficient accommodation for the anticipated development in the Glenelg area.

(b) *Brighton Exchange.*—To erect a telephone exchange building on a site at the corner of Hartley-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 570 lines and an ultimate capacity of approximately 1,000 lines. It is proposed that the initial equipment shall be capable of extension to the ultimate capacity named, thereby affording sufficient accommodation for the anticipated development in the Brighton area. The financial aspect of this proposal has been included under Glenelg, because of its close relation thereto.

*Glenelg and Brighton Exchanges.*—Owing to the rapid development of subscribers' lines in these areas, it is impracticable to extend the existing switchboards, owing to insufficient building accommodation. The equipment installed in these exchanges is of the non-multiple magneto type, which is quite unsuitable for operation in a multi-exchange network such as exists in the Adelaide metropolitan area. The installation of automatic equipment in each case will allow of an efficient service being rendered existing and prospective subscribers in each exchange area.

The estimated immediate cost of the works is—

	Glenelg	Brighton
Sites (already acquired)	£ 542	£ 125
Buildings	4,660	3,060
Air-conditioning, heating, ventilation, vacuum cleaning, and air-compressor plant	3,100	2,750
Exchange equipment, including that necessary at other exchanges	34,789	14,857
Sub-station equipment	6,497	2,503
Line plant	12,633	6,160
Cost of cut-over	66	34
Totals	62,286	26,438
Total, Glenelg and Brighton	88,724	

The revenue derived, and the revenue it is estimated will be obtained on the date of transfer, viz., 1st July, 1925, and with five years' development, is shown hereunder—

	Number of subscribers on 31st Dec. 1923	Estimated Annual Revenue on 31st Dec. 1923	Estimated Annual Revenue on 1st July 1925	Estimated Annual Revenue on 1st July 1930
Glenelg	392	£ 3,914	£ 10,580	£ 17,051
Brighton	114	1,065	3,875	6,496

It is proposed that the buildings for the Glenelg and Brighton automatic telephone exchanges shall be of simple design, and built on the latest fire-resisting principles.

*Glenelg.*—The immediate installation in the proposed exchange is for an equipment of 1,000 subscribers' lines, but the building will be designed sufficiently large to accommodate an equipment of a capacity of approximately 2,500 lines.

*Brighton.*—The immediate installation in the proposed exchange is for an equipment of 570 subscribers' lines, but the building will be designed sufficiently large to accommodate an equipment of a capacity of approximately 1,000 lines.

Item	£		(\$ years after cut-over)	
	Glenelg	Brighton	£	\$
1. Capital Cost—New	62,286	26,438	78,450	25,911
2. Capital Cost—New and in situ	76,376	29,598	88,246	30,871
3. Annual Working Expenses of Existing Manual Systems as at 30th June, 1923	3,579	1,273	104,774	128,417
4. Annual Revenue—Actual, 1st July, 1920	3,914	1,065	4,852	
Estimated, 1st July, 1923	10,580	3,875	4,970	
Estimated, 1st July, 1928	17,051	6,496	14,665	17,851
5. Annual Working Expenses of proposed Automatic System as at 1st July, 1923	3,288	1,089	24,147	4,261
6. Total Annual Charges for proposed Automatic System as at 1st July, 1923	10,432	3,868	17,768	5,701
7. Annual Working Expenses of proposed alternative Common-Battery System as at 1st July, 1923	4,826	1,636	12,788	4,900
8. Total Annual Charges for proposed alternative Common-Battery System as at 1st July, 1923	11,190	4,416	14,953	10,052
9. Capital which it will be necessary to expend on the existing Manual System if an Automatic Exchange is not installed on 1st July, 1923	9,039	6,280	15,600	20,899
10. Assets recoverable, or thrown spare if Automatic Exchange is installed—			14,310	
(i) Book Value	5,507	1,481		
(ii) Recoverable Value			6,988	
(iii) Cost of Recovery	388	103	4,398	
Difference in Annual Charges in favour of establishing an Automatic System	758	550	1,308	2,155
				1,915
				3,201

Regarding item 10 of the foregoing statement, the difference between the totals for Glenelg and Brighton of sub-items (1) and (3), viz., £2,940, is an amount which will have to be written off in the Departmental accounts as representing the proportion of the capital outlay on the original asset which is irrecoverable. The areas in this neighbourhood are not so thickly populated as that at Prospect, and we are not providing for such relatively large increases of subscribers. With respect to the reference covered by the financial aspect wherein I have spoken of the capital which it will be necessary to expend on the existing manual system, if an automatic exchange is not installed the alternative would be that we would simply have to provide a service of the present type, the cost of which, however, would be absolutely waste money. It is impossible to give a proper service with the present type of equipment. It would be possible for the Department, in the event of nothing else being decided upon or permitted, to make slight additions at the Glenelg exchange by taking in part of the present Post-office building, but at Brighton we would have to extend the Post-office itself. In these areas, as in Prospect, the sites have been acquired after careful survey of the districts and consultation with various authorities. Similarly, allowance has been made for interest and depreciation, but there is no consideration of sinking fund in connexion with the capital expenditure. As to the accommodation upon the proposed sites, there will be no need at Brighton for a linesmen's shed immediately, but the land will be available as developments may make such provision necessary. At Glenelg, a linesmen's shed will be required, and one is being erected right away.

4. To Mr. Jackson.—The question of reduction of rentals, with the introduction of the automatic exchanges, is one of policy on which I am not prepared to give an opinion. There is no firm in Australia manufacturing air conditioning plants that will meet our requirements. As a result, different pieces of machinery are purchased by the Works and Railways Department, and officials of that Department construct the plant themselves.

5. To Mr. Mathews.—As for the question of installing automatic exchanges at various suburban centres, rather than dealing with central exchange systems, the reason for our procedure is that we are making the new installations in the areas, most urgently requiring attention. There is no question of the wisdom of dealing with smaller outer exchanges before touching the central exchanges. Incidentally, the Prospect proposal will relieve the Adelaide central exchanges very materially. The Glenelg and Brighton exchanges will not do so to anything like the same extent, but even such relief as will be afforded will not be adequate at the central exchanges. I would prefer to install the central exchange first; to do that in respect of all the main exchanges, and to deal with the outlying exchanges last. But the money is not available for the larger projects at present, and we are bound to endeavour to secure these suburban installations as rapidly as possible in their ratio of urgency. Wireless will not do away with automatic installations. There are many classes of service to be given by an exchange of the present manual and automatic character which no wireless service could give. And I cannot conceive how any one could measure the amount of service given by a wireless exchange. I do not expect that the automatic system will have been scrapped owing to the advances of wireless during my lifetime. It is hoped that the Collingwood exchange will be ready for operation by July or August next. Very careful note will be taken of the working of the air conditioning plant there, but I would not like the factor of experiment to hold up these other propositions, for the work is too

urgent to admit of delay. We must have equipment of some kind, in order to carry on, and at best we cannot hope to get these proposed works inside of two years.

6. To Senator Foll.—My experience with automatic equipment is that it is the best we can get at the present time. There are four firms producing such systems as will operate in a multi-exchange network. The Department has not adopted any one of these four types. Our method is to invite public tenders for an automatic switchboard, and when the details come to hand, the tender which best meets the needs of the Department is accepted. Of the three systems which we have tried in a multi-exchange network, all are giving satisfactory service. If we were to adopt one system solely we would be in the hands of that particular company, and the Department is most anxious to avoid such a situation. I do not favour the flat rate of charging for telephone services. If a flat rate were adopted in association with an automatic system, a large amount of equipment would be required to carry peak demands. At present, with subscribers being required to pay for each individual call, the traffic is reasonably distributed over the business portions of the day. If a flat rate were adopted subscribers would not be financially interested to the same extent in their use of the telephone, and our present peak loads would probably become overwhelming. These peak loads occur two or three times daily. They are usually between 9 and 10 a.m., 2 and 3 p.m., and 7 and 8 p.m. That means that during twenty-one hours in every day, much expensive plant, which would have to be installed to cope with the peak demands, would be lying more or less idle, purely as an outcome of giving subscribers a flat-rate service. I doubt whether a maker of these installations could design a plant to give a satisfactory service under flat-rate conditions; the internal trunking would have to be very generous. For the City Manual Exchange in Sydney, the ratio of calls during the busy hours is 10.3 as to 1; that is to say, there are 8,140 subscribers connected to the City Exchange, Sydney; that was the total on the last day of last year. Of that number, in the busy hours for the day there would be, continuously, 814 subscribers calling at the one moment. Regarding ordinary conditions of service, the automatic is absolutely the best. I am asked what encouragement there is for the general public to favour the automatic service if the cost is to be no cheaper and the service is to be no more comprehensively efficient in busy hours. The point is that subscribers will get a much better service with automatic equipment.

7. To Senator Newland.—As to the matter of reductions of staffs owing to the installation of automatic services, with the large number of exchanges which have been installed throughout the Commonwealth, I do not know of one officer who has been dismissed. The Department has used the officers, whose services are no longer required, in other branches of the service. I am asked, having dispensed with the services of the telephonists and having used them in other branches, should not that fact show some saving, in respect of the telephone branch. It does. In the case of the Prospect exchange, for example, I have shown that there will be a difference in favour of the automatic system amounting to £705 for the first year, and rising to nearly £2,500 in the fifth year. The saving will be made principally from the non-employment of telephonists. I wish to point out, however, that all the various services of the Postmaster-General's Department do not pay. There are some services on which a loss is made. The Department tries to give reasonable service over the whole of the Commonwealth, in every branch. As an outcome of my experience, which has

been considerable, although I have not actually run one, I am convinced of the necessity for the installation of air conditioning plants. I have installed automatic exchanges and have had charge of their maintenance. From my knowledge of the deterioration of equipment where there has been no air conditioning plant, I have been forced to the conclusion that something should be provided. I have experimented in specific directions, and am anxious to arrive at the very best thing possible. I am acquainted with the systems at work in Perth and in Adelaide. Monthly records from Perth are received, and, in my opinion, it is giving reasonable satisfaction. I am satisfied that the Department can successfully overcome the air conditioning problem; all we want is a little additional time. As to the area which can be served by an automatic exchange, we endeavour to arrange that subscribers' lines shall not exceed 2 miles in length; that is to say, we would serve a total distance of 4 miles—2 miles in opposite directions. The life of an automatic plant is reckoned at fifteen years; that is the economic life. The plant may last twenty years, but by that time it might be so out of date as to be found to be running at a loss. Certain parts, of course, will not last anything like fifteen years. The parts that wear most rapidly, however, may be replaced, speaking generally, very easily and cheaply. With respect to the working of the telephone exchange in Adelaide, so far as I know our standards of service are being maintained, and I have not heard of any complaints above the ordinary percentage from that source.

(Taken at Melbourne.)

FRIDAY, 17TH MARCH, 1932.

SECTIONAL COMMITTEE.

Present:

Senator NEWLAND, in the Chair;

Senator FOLL, Mr. Mathews.

Senator PLAIN,

Harry D. Tiemann, Dry Kiln Expert, United States Forest Service, sworn and examined.

8. To Senator Newland.—The Commonwealth Government has engaged my services in a consulting capacity through the United States Forest Service. I know of quite a number of different kinds of air conditioning plants used in spinning and weaving works and other works of the kind, but I do not know that I have ever known of such plant used in a telephone exchange. There are quite a number of patented plants on the market. In general, they consist of a fan for forcing the air into the room, and a heating device of some kind, with an air moistening device, usually free steam or a spray of water. Of course, these plants vary according to the patents of the different companies. The difficulty is not so much in adding humidity to the air as in automatically controlling the conditions. I judge that what you need here is not to add humidity, but rather to extract it. All these plants, so far as I am aware, are expensive, as compared with the cost of an ordinary heating apparatus. The machines with which I am acquainted are used more in the northern climates of the United States where we have a cold winter; I do not know that they are used at all in the south of the United States. Under these circumstances, the problem is one of humidification rather than of de-humidification. As a rule, humidity has to be added to the air rather than extracted from it. There are various systems for spraying water in order to add humidity in the case of

wool. The simplest I know of consists of a rapidly rotating disc from which the water is sprayed out in a very fine mist. In that apparatus, however, there is no means for removing moisture from the air; if the air gets too damp it will stay damp. There are two or three different types of apparatus on the market which can de-humidify as well as humidify; and that, I take it, is the kind of apparatus you need. I am acquainted with some apparatus of the kind, and the difficulty in regard to it is, as I say, the automatic control. Where there is proper control they work very successfully. The de-humidification machines are used mostly in factories and spinning and weaving works, where the atmosphere is too dry in the winter and too humid in the summer; as a rule, it is a case of the air being too dry. In general, the apparatus consists of a duct made of galvanized iron, with a fan at one end. Then comes the heating coil of steam pipes for raising the air to the required temperature, and then a fine spray of water, with eliminators, zig-zag plates, for removing the spray from the air. The automatic control generally consists of introducing more or less live steam into the air, thus changing the temperature of its dew point. This apparatus is not used at all in the season of timber. In my dry process I make use of a somewhat similar principle which is also applicable to the regulation of humidity in rooms. It consists of a spray of water passing downward through a narrow chamber, and the temperature of that water is regulated; for any high humidity hot water is used, and for a low humidity cold water. The same thing exactly would apply to humidifying a room. At the laboratory in Madison, from where I come; we had about seven different workrooms for manufacturing, testing, sewing and varnishing air plane propellers during the war. This work necessitated the constant regulation of the temperature and humidity in the rooms, the outside conditions varying from 95 degrees, with, perhaps, 80 per cent. humidity in summer time to 80 degree below zero, with a probable humidity of 60 per cent. outside in the winter time; this would mean practically a zero humidity within doors. This device had to take care of three rooms under both extremes, and it answered the purpose admirably. I have discussed this subject with Mr. Davis, of the Navy Department, and also with one of the Commonwealth engineers, connected, I believe, with the Postal Department; at any rate, the latter discussion had reference to the regulation of humidity in telephone rooms, and probably to the very propositions now before the Committee. I do not remember whether the discussion had reference to automatic exchanges or to manual exchanges. I can only give you approximately the relative costs of the apparatus which was obtained for the rooms to which I have referred. The vendors wanted 39,000 dollars for an installation for the control of four or five of the rooms. I put in a spray apparatus at a cost of about 3,000 dollars. This will afford the Committee some comparison of cost. All this kind of apparatus is expensive for the work it does, due to the fact that it is patented. There are two principal concerns in America who hold two patents working on this same idea.

9. To Senator Foll.—I do not think I have sufficient data on which to express an opinion as to what would be the best apparatus for use in automatic telephone exchanges. I do not know particularly what the Committee have in mind, and it would be rather precarious for me to say offhand that I thought one instrument better than another. I think the cost of the different machines runs about the same; they are sold by company concerns. Where you have simply to humidify the air, as in spinning factories, a very cheap apparatus can be got for the work; it is a simple idea to

sprinkle moisture or steam into the air; but when you must have a device that will also take moisture out of the air, there is quite a difficult engineering problem. Apparently, what the Committee requires is some apparatus that will accomplish both results. If, as I am informed, the variation of the temperature in Brisbane, for instance, is between 40 and 90 degrees I do not think there would be found any difficulty in preserving the same humidity, practically all the year round.

10. To Mr. Mathews—In the laboratory at Madison we were making all kinds of tests as to the stability of air-plane propellers. The manufacturing room was about 30 by 60 feet, and contained, perhaps, five different machines. There would be altogether about six workmen employed there. Another room was a glueing room, kept at 90 degrees temperature with 90 per cent. humidity. This room was used only in the setting up of the glue, the blades being left there until the glue dried. The others were mostly storage rooms. The problem was to find out what variation occurred in the shape of the air-plane propellers due to the shrinkage and swelling of the wood, and also to determine the absorption of moisture by the wood when covered with various kinds of protective coating. The changing of the air conditions should be very beneficial to the health of those employed, because the air is cleaned; the spray of water absorbs the carbonic acid gas. These tests were made with a view to ascertaining the effect on the wood itself, and not on the machines employed.

11. To Senator Newland.—The effect on the machines used in the rooms did not come into our calculations. The idea was to control a humidity ranging from 30 to 90 per cent., and the proposition was one of holding the conditions constant. The conditions would not have any detrimental effect on very fine machines, which would not tend to rust, but quite the contrary, for, if you hold the air under a constant humidity, there is no danger of it. It would be decidedly beneficial so far as the durability of the instruments is concerned.

(Taken at Adelaide.)

MONDAY, 20TH MARCH, 1922.

SECTIONAL COMMITTEE.

Present:

Senator NEWLAND, in the Chair;  
Senator FOLL, Mr. Mathews.  
Senator PLAIN,

James Simecoe Fitzmaurice, State Electrical Engineer,  
Postmaster-General's Department, Adelaide, South  
Australia, sworn and examined.

12. To Senator Newland.—I am a member of the Institution of Electrical Engineers, London, and the American Institution of Electrical Engineers respectively, and before joining the Government service served an engineering apprenticeship at Mori's Dock and Engineering Company, Sydney. I have occupied my present position for nearly four years. Prior to that I was State Engineer in Western Australia. I have been in the Department since 1883. During the period in which I was State Engineer in Western Australia the automatic system was installed. Before that we had a very old system, namely, a magneto series multiple. For

some time after the cut-over, difficulty was experienced owing to the subscribers having to be educated in the method of handling the apparatus, and also to the fact that insufficient training was provided. Those difficulties were eventually overcome so effectively that the Chamber of Commerce held a special meeting in order to congratulate the Department on the splendid service rendered. I have also received letters congratulating me on the system. On my departure from Perth I was convinced that the citizens were fully satisfied with the automatic system, and had no desire to return to the manual. The question of establishing an automatic telephone exchange at Prospect can be better considered by briefly reviewing the position of the whole of the metropolitan system in the first place. The whole system has now reached the stage at which it can no longer be expanded on economical or satisfactory lines without an entire re-arrangement. It is congested, and some exchanges are to a great extent obsolete. In order to meet this condition of affairs a telephonic survey of the metropolitan area was made in the years 1910-1921. As a result of this survey a definite plan of action was decided upon. A proposal was submitted to the Chief Electrical Engineer, and approval given by him to the exchange layout, and numbering scheme. It was decided that the existing equipment should be kept in use until it was either worn out or incapable of extension, and that when this point had been reached, all expansion beyond and any remodelling necessary would be met by the addition or substitution of automatic equipment, and the more up-to-date and newer than the suburban remodelling should commence in the suburbs. One of the chief reasons for the adoption of the policy for expansion by automatic and the ultimate conversion to automatic working throughout the network was that the automatic system lends itself to a more economical cable layout than does the manual, in that numerous exchanges may be scattered throughout the network, and the average length of the subscribers' lines thereby reduced without appreciably adding to the cost of apparatus. Thus the layout provides for more exchanges than now exist with the manual system. It is proposed to add further satellite exchanges from time to time as the necessity arises. The principal and most necessary of the automatic exchanges (other than Prospect) provided for by the survey is Glenelg, for the reason that this area is rapidly developing, and the present magneto exchange which is situated in the Post Office cannot be further extended owing to want of accommodation. Service has been refused in the Glenelg area, and at present there are approximately sixty waiting applicants in the area; which will be served by the proposed exchanges. Thus it is obvious that the question of establishing automatic exchanges at Glenelg and Brighton is considered to be of equal importance to that of establishing an automatic exchange at Prospect. Glenelg and Brighton are both popular seaside places where rapid development is expected. Brighton has only recently enjoyed the privilege of a railway service, and the layout of the country provides for considerable extension. The present system at Glenelg and Brighton is magneto. At Glenelg there are six A positions and one multiple B position, and at Brighton there are two A positions. The equipment at Glenelg is nearing the end of its useful life. The cable strips and lightning arresters are mounted on baseboards on the wall, and the development is outgrowing this arrangement in accommodating the equipment. The installation of automatic equipment will allow of an improved service being rendered, and prevent the necessity of refusing applications in the near future. It will be seen that Glenelg and Brighton are treated as

one proposal. At the present time Glenelg and Brighton are two separate exchanges, but it is proposed to make Brighton a branch exchange, that is, Brighton will be able to complete a local call, but all transfer traffic must pass through Glenelg. The systems employed in the network are—

Exchange.	Type.	Present Capacity.
Central	Main switchboard Western Electric C.B. No. 1 Extension Post Corner 24V.	7,500
Unley	Western Electric semi-automatic.	1,600
Norwood	"	1,440
Port Adelaide	Siemens semi-automatic	1,000
Glenelg	Magneto	600
Henley	"	350
Strling	"	320
Brighton	"	260
Woodville	"	200
Semaphore	"	200
Blackwood	"	200
Norton Summit	"	25
Summertown	"	60

The following figures show a comparison of some of the exchanges with regard to exchange, subscribers, and line faults—

Exchange.	Station.	Faults for December, 1921.	Faults per Station.	Faults per Day for 1,000 Lines.
Central	10,656	1,128	108	5.1
Unley	1,880	138	087	2.81
Norwood	1,391	131	095	3.07
Port Adelaide	1,410	206	141	4.56
Glenelg	540	113	208	0.74
Brighton	202	35	173	5.69
Henley	353	27	077	2.48
Woodville	223	23	103	4.58
Semaphore	134	14	145	4.05

The following show exchange faults only—

Exchange.	Lines.	Faults for December, 1921.	Faults per Line.	Faults per Day per 1,000 Lines.
Central	6,682	486	073	2.35
Unley	1,228	18	012	0.38
Norwood	1,283	29	023	0.74
Port Adelaide	847	20	035	1.13
Glenelg	604	50	081	3.58
Brighton	163	4	025	0.81
Henley	335	4	012	0.39
Woodville	200	3	015	0.48
Semaphore	129	8	064	2.07

At present there are approximately 600 applicants who are being refused service in the metropolitan area, and it is estimated that the figures would be doubled were it known that service could be given. The proposals are—

(a) *Glenelg Exchange.*—To erect a telephone exchange building on a site at the corner of Jetty-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 1,600 subscribers' lines and an ultimate capacity of approximately 2,500 lines. It is proposed that the initial equipment shall be capable of extension to the

ultimate capacity named, thereby affording sufficient accommodation for the anticipated development in the Glenelg area.

(b) *Brighton Exchange.*—To erect a telephone exchange building on a site at the corner of Hartley-road and Brighton-road, which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 570 lines and an ultimate capacity of approximately 1,000 lines. It is proposed that the initial equipment shall be capable of extension to the ultimate capacity named, thereby affording sufficient accommodation for the anticipated development in the Brighton area. The financial aspect of this proposal has been included under Glenelg because of its close relation thereto.

Owing to the rapid development of subscribers' lines in the Glenelg and Brighton areas, it is impracticable to extend the existing switchboards owing to insufficient building accommodation. The equipment installed in these exchanges is of the non-multiple magneto type which is quite unsuitable for operation in a multi-exchange network such as exists in the Adelaide metropolitan area. The installation of automatic equipment in each case will allow of an efficient service being rendered existing and prospective subscribers in each exchange area. The estimated immediate cost of the works is—

	Glenelg.	Brighton.
Sites (already acquired)	£ 542	£ 125
Buildings	4,600	3,000
Air conditioning, heating, ventilating, vacuum cleaning, and air compression plant	3,100	2,750
Exchange equipment, including that necessary at other exchanges	34,780	11,867
Sub-station equipment	9,407	2,503
Line plant	12,002	6,100
Cost of cut-over	60	34
Totals	62,286	29,438
	Total £88,724	

The revenue derived and the revenue it is estimated will be obtained on the date of transfer, viz., 1st June, 1923, and with five years' development is shown hereunder—

	Number of Subscribers' Lines connected on 30th June, 1920.	Annual Revenue received, 1st July, 1920.	Estimated Number of Subscribers' Lines, 1st July, 1923.	Estimated Annual Revenue, 1st July, 1923.	Estimated Number of Subscribers' Lines, 1st July, 1928.	Estimated Annual Revenue, 1st July, 1928.
Glenelg, 392	3,014	900	10,500	1,600	£ 17,551	
Brighton, 114	1,065	340	3,875	570	£ 6,406	

It is proposed that the buildings for the Glenelg and Brighton automatic telephone exchanges shall be of simple design and built on the latest fire-resisting principles. The immediate installation in the proposed exchange at Glenelg is for an equipment of 1,600 subscribers' lines, but the buildings will be designed sufficiently large to accommodate an equipment of a capacity of approximately 2,500 lines. The immediate installation in the proposed exchange at Brighton is for an equipment of 570 subscribers' lines, but the building will be designed sufficiently large to accommodate an

equipment of a capacity of approximately 1,000 lines. I submit the following table of the financial aspect:—

Item.	—		(Five Years after cut-over)	
	£	£	£	£
1. Capital cost, new	Glenelg 62,280	76,466		
	Brighton 24,438	33,911		
		88,724	110,307	
2. Capital cost, new and in situ	Glenelg 75,571	89,510		
	Brighton 29,393	36,871		
		104,774	126,417	
3. Annual working expense of existing manual systems, as at 30th June, 1923	Glenelg 3,679			
	Brighton 1,273			
		4,852		
4. Annual revenue— Actual, 1st July, 1920	Glenelg 3,914			
	Brighton 1,065			
		4,979		
Estimated, 1st July, 1923	Glenelg 10,590			
	Brighton 3,873			
		14,463		
Estimated, 1st July, 1928	Glenelg 17,051	17,051		
	Brighton 6,406	6,406		
		24,147	24,147	
5. Annual working expense of proposed automatic system, as at 1st July, 1923	Glenelg 3,288	4,201		
	Brighton 1,689	1,530		
		4,377	5,791	
6. Total annual charges for proposed automatic system, as at 1st July, 1923	Glenelg 10,432	12,798		
	Brighton 3,866	4,096		
		14,208	17,768	
7. Annual working expense of proposed alternative common battery system, as at 1st July, 1923	Glenelg 4,826	7,255		
	Brighton 1,835	2,797		
		6,661	10,052	
8. Total annual charges for proposed alternative common battery system, as at 1st July, 1923	Glenelg 11,100	14,953		
	Brighton 4,416	6,060		
		15,000	20,959	
9. Capital which it will be necessary to expend on the extension of manual system, if an automatic exchange is not installed on 1st July, 1923	Glenelg 6,039			
	Brighton 5,280			
		14,319		
10. Assets recoverable or thrown spare if automatic exchange is installed— (i) Book value	Glenelg 5,507			
	Brighton 1,481			
		6,988		
(ii) Recoverable value	Glenelg 3,838			
	Brighton 1,101			
		4,939		
(iii) Cost of recovery	Glenelg 388			
	Brighton 103			
		491		
Difference in annual charges in favour of establishing an automatic system	Glenelg 768	2,155		
	Brighton 550	1,016		
		1,308	3,201	

Regarding item 10 of the foregoing statement, the difference between the totals for Glenelg and Brighton of sub-items (i) and (ii), viz., £9,049, is an amount which will have to be written off in the departmental accounts as representing the proportion of the capital outlay on the original asset, which is irrecoverable. Until we have the full automatic system throughout we cannot hope for the relief we would like, because all the transfer work from the various suburban exchanges must pass through Central, necessitating a staff there to deal with it. If Central were automatic all transfer work from the suburban, central, and other exchanges would be done automatically. Dealing with the table of faults I have given, I may explain that Norwood is a dusty area compared with Uley. The trams which pass the exchange cause a lot of dust. Port Adelaide again is

notoriously dirty. The faults at Glenelg are due to the magneto exchange in operation there. There are always faults in magneto exchanges, especially those situated close to the sea. The small percentage at Henley is attributable to the fact that we have a lot of our lines underground there. We have underground wires in other places, but the proportion carried overhead is greater in comparison with Henley. The Glenelg exchange is at present a disgrace. The magneto has been re-ventilated previously but the work has not occurred. The exchange is in the Glenelg post-office, where there is hardly enough room to do the telephone work. Land has already been secured for the proposed Glenelg and Brighton exchanges. The Brighton exchange will be a sub-station. The proposed site of the Glenelg exchange will be undoubtedly superior to the present site at the post-office. Brighton-road may be dusty, but the site chosen is the telephone centre which will enable us to lay down the cable scheme at the least possible expense. The cause of the high percentage of faults in the Glenelg system is attributable to the number of overhead lines in that area. The new site is further removed from the sea. Automatic appliances are very susceptible to damage from dust, but the doors and windows in the new exchange will be kept shut. No new subscribers can be taken in Glenelg at the present time, because the building where the exchange is situated is too small. I have explained in my statement that £14,310 would need to be spent on a temporary building at the new sites if an automatic exchange be not installed at Glenelg and Brighton. Of course, I do not recommend that course. The wires will be put underground at both Glenelg and Brighton, and a lot of this work has already been done by returned soldiers, the cost being part of the complete scheme. In other words, the work already done or that to be undertaken in the matter of underground wires will not increase the estimate of £88,724 for both Brighton and Glenelg. I was consulted by regard to the plans, and I am quite satisfied with the proposed buildings. There is complete co-ordination between our Department and the Works and Railways Department in this regard. The air conditioning plant in Perth is a heating plant, but the mechanics complained very bitterly at times when the doors were closed, as they had to be when there was any dust about. I have heard that since my departure from Perth a form of ventilating plant has been installed. The first air conditioning plant the Department has had in use was erected in Adelaide, and the plants for the automatic exchanges will be practically on the same lines. The plant in the central exchange cost over £4,000. The conditioning of air in a manual exchange is a big proposition as compared with the conditioning of air in an automatic exchange. In the Central Exchange, Adelaide, there are 100 telephonists or officers on duty in one room at one time exhaling carbonic gas and moisture. This has to be shifted, and it certainly requires a bigger plant to do this, and to keep the air in the room clean and pure than would be required with an automatic exchange employing half-a-dozen mechanics. The purpose of the air conditioning plant in an automatic exchange is to keep the mechanism at a uniform temperature, and prevent dust from settling on it. It has also to keep the humidity below a certain percentage. We endeavour to keep that humidity in the neighbourhood of 70 degrees. The plant in use in the Adelaide Exchange was designed by Mr. Dixon, the Chief Mechanical Engineer of the Works and Railways Department. The postal authorities had nothing to do with the installation of it, but it seems to me to cover all that is necessary for an air conditioning plant in an Adelaide exchange. The dust is extracted from the air before it passes into the ducts. It has to pass through three separate sprays of water so

that any dust or impurity, such as carbon, floating in the air is arrested. If the water is too cold it can be heated. If it is too hot it can be cooled. If the humidity is too high it can be varied. There is an air conditioning plant at Port Adelaide, but it is merely for clearing the air. No attempt is made to reduce the temperature or vary the humidity, as is possible with the system installed in the Central Exchange. It is not satisfactory, and we have made an alteration which is an improvement, but lots of these air conditioning plants are merely in the experimental stage. The establishment of three new automatic exchanges in Adelaide will eventually reduce the number of telephonists and increase the number of mechanics, but with the growth of outside exchanges and with the larger number of telephonists required for trunk line and clerical work the girls who are thus replaced will all be absorbed. There is no likelihood of any general reduction in the staff on account of the establishment of these exchanges.

18. To Senator Foll.—The subscriber benefits by the establishment of an automatic exchange. He is able to test his own line by calling up his own number. He has not to wait for a telephonist to take his call. Under the Strowger system, the only automatic system with which I am acquainted, when a subscriber makes a call he can tell immediately if it is going through. If the person he calls is engaged he gets the engaged signal similar to that given on the common battery system. He has not to wait until a telephonist plugs in and asks, "Are you still waiting?" If the calls go through he will allow a certain time to intervene, and if there is no reply he will switch off and call up another subscriber. Under normal conditions there is no getting wrong numbers unless it is the subscriber's fault. When a person is fully acquainted with handling the automatic system he can make a call in much quicker time than he can under the manual system. The subscriber is not likely to get a cheaper service. At present I doubt very much if we can properly record the full number of calls made upon the manual. Possibly we are not able to record 10 per cent. of the calls, and as this 10 per cent. will be recorded under the automatic the Department's revenue is likely to be increased by 10 per cent. A call is not registered against a subscriber if he gets the engaged signal, or if he cannot raise the person he wants. Of course, if the subscriber calls a wrong number and the person so called in error lifts his receiver the charge is made against the subscriber, but that is also done under the manual system. I do not approve of toll rates. I think that a man should pay exactly for what he gets just as he does in the case of electric light, gas, or water service. Every inducement is offered by the Department to get people to have telephones, but we cannot supply the demand. We hope to do so by installing big plants, but the demand in the last two or three years has been enormous. I attribute this to the high cost of wages. It is cheaper to have a telephone than to employ a man on wages. The subscriber to the automatic exchange will not be charged any less than the subscriber to the manual exchange. He will not benefit in pocket, but he will benefit in time and patience.

14. To Senator Plain.—We have at present only three semi-automatic exchanges in the Adelaide area, a Siemens semi-automatic at Port Adelaide, and Western electric semi-automatics at Uley and Norwood. Instead of having a magneto exchange at Uley and Norwood, we have a machine operating the switchboards, and the telephonists at Central handle the calls. I had considerable experience of the automatic system in Perth, where I was State Engineer at the time of the installation of the system there. There was terrific trouble at the start, for the simple reason that we cut-

over from an almost obsolete method to the most up-to-date. At first every one was practising on the new system, and in consequence of the lack of trunking facilities to meet such a condition, a large percentage of calls failed to get through.

15. To Mr. Mathews. We cannot take any more subscribers at Glenelg now. There are already sixty waiting applicants who will be served by the new exchanges. The present number of subscribers is 508 at Glenelg, and 183 at Brighton. I do not know how many applicants are waiting at Brighton, but it is a growing district. The block at Glenelg secured for the new exchange is 74 ft. by 105 ft. 7 in. About one-third of that area will be available for extensions of buildings. The block at Brighton is 50 ft. by 60 ft., but it is only proposed to put up a sub-exchange there. There is some idea of erecting a new post-office on this block also. At the start of the Perth automatic exchange there was not more than 10 per cent. trunking. We subsequently provided 20 per cent. for ordinary subscribers, and as high as 40 per cent. for private branch exchange lines. There was then no trouble experienced in giving a satisfactory service. To augment trunking we have only to put in additional switches, so that if the trunking peak is high it is simply a matter of a slight expenditure to make the service efficient.

16. To Senator Newland.—The principal and most necessary of the automatic exchanges provided for by the telephone survey of Adelaide is Prospect, for the reason that its establishment will save considerable expense in connecting subscribers on the north side of the city with the Central Exchange. Service has been refused in the Prospect area for some time, and at present there are approximately 130 waiting applicants in the area that will be served by the new exchange. Furthermore, the establishment of an additional exchange in the Prospect area will somewhat relieve congestion now existing on the central manual switchboard. It is anticipated that approximately 697 subscribers will be transferred from Central to Prospect at the cutover. This switchboard has reached such a condition that action must be taken at once to relieve it if the position of being unable to connect further subscribers in the city area at the end of this year is to be avoided. At present there are approximately 600 applicants who are being refused service in the metropolitan area, and it is estimated that the figures would be doubled were it known that service could be given. The proposal is to erect a telephone exchange building on a site in Bellville-street, Prospect, South Australia, which was acquired in May, 1919, for £155-2s-6d., and to install therein automatic telephone switching equipment having an immediate capacity of 1,750 subscribers and an ultimate capacity of approximately 3,300 subscribers' lines. It is proposed that the initial equipment shall be capable of extension to the ultimate capacity named, thereby affording sufficient accommodation for the anticipated development in the Prospect area. Owing to the development it would not be possible to accommodate the existing and new subscribers in the Prospect area on the Adelaide Central Exchange, and it is proposed to increase the capacity of Central—from 7,200 to 8,400; also increase the trunks, and these extensions will take up all available space. It would not be economical to further extend the central equipment, and it is estimated that the present equipment will only be sufficient to take the subscribers in the city area. A further consideration is the cable plant, where there is not sufficient accommodation, and it would be costly to put down a plant to bring all subscribers into Central. If an exchange be established, the existing cable plant can be used to provide the necessary junctions, and it is considered that the establishment of an auto-

matic exchange is the most economical proposition. If the establishment of an exchange in the area is approved it will be possible to render a more efficient service to existing and prospective subscribers than is possible under present conditions. The estimated immediate cost of the work is:—

	£
Site, already purchased	155
Building	4,930
Air conditioning, heating, ventilating, vacuum cleaning, and air compression plant	3,100
Exchange equipment, including that necessary at other exchanges	40,374
Sub-station equipment	7,010
Line plant	16,608
Cutover of equipment	100
Diversion of line plant	100
	£72,886

The revenue derived and the revenue it is estimated will be obtained on the date of transfer, viz., 1st July, 1923, and with five years' development is shown hereunder:—

Average No. of subscribers' lines connected during year ended 30th June, 1920—509	
Annual revenue received 30th June, 1920—£5,342	
Estimated No. of subscribers' lines, 1st July, 1923—1,016	
Estimated annual revenue, 1st July, 1923—£11,612	
Estimated No. of subscribers' lines, 1st July, 1928—1,750	
Estimated annual revenue, 1st July, 1928—£20,000	

It is proposed that the building shall be of simple design, and built on the latest fire resisting principles. The immediate installation in the exchange is for an equipment of 1,750 lines, but the building will be designed sufficiently large to accommodate an equipment of a capacity of approximately 3,000 lines. The following table shows the financial aspect:—

	£	Five Years after Cutover	£
1. Capital cost, new	72,886	89,842	
2. Capital cost, new and in situ	84,330	101,286	
3. Proportionate annual working expenses of existing manual system, as at 30th June, 1923	4,011		
4. Annual revenue			
Actual, 30th June, 1920	5,342		
Estimated, 1st July, 1923	11,612		
Estimated, 1st July, 1928	20,000		
5. Annual working expenses of proposed automatic system, as at 1st July, 1923	3,391	5,166	
6. Total annual charges for proposed automatic system, as at 1st July, 1923	11,456	16,680	
7. Annual working expenses of proposed alternative common battery manual system, as at 1st July, 1923	5,274	8,878	
8. Total annual charges for proposed alternative common battery manual system, as at 1st July, 1923	12,191	17,283	
9. Assets recoverable or thrown spare if automatic exchange is installed:—			
(i) Book value	15,616		
(ii) Recoverable value	13,232		
(iii) Cost of recovery	343		
Differences in annual charges in favour of establishing an automatic system	735	2,494	

Regarding item 9 of the foregoing statement, the difference between sub-items (i) and (ii), viz., £2,384, is an amount which will have to be written off in the departmental accounts as representing the proportion of the capital outlay on the original asset which is irrecoverable. We hope to transfer 697 subscribers from

the Central Exchange to the Prospect Automatic Exchange, but even with this transfer, Central will be too full. There is a proposal for the establishment of an automatic exchange in the West Adelaide area. We have already shut down upon new subscribers in the central area, but will be able to relieve the position when we get extensions. Nevertheless, it will be necessary to build an exchange in West Adelaide within four years. We have land at Henley Beach, at the rear of the present Post Office, but it will be too expensive to build on. Another site for the proposed automatic exchange will be selected in the vicinity of the existing exchange, which will not appreciably affect the telephone centre. I base my opinion that there will be a considerable increase in Prospect subscribers upon personal interviews with would-be subscribers. People who know that they cannot get connexion will not submit applications. I am quite satisfied that the estimate I have given is on good safe lines. The financial statement I have submitted is prepared on the average anticipated increase of subscribers. We make a survey, and we know the work anticipated from the area. We have also before us the natural growth of population, and we plot a curve. By extending this curve we can see what the estimated growth of population will be in the area to be served by an exchange. To a certain extent the wires are now underground between Central and Prospect, but we do not propose to put in any further underground wires between the two, because it would not be economical to do so if we established an automatic exchange at Prospect. The present underground wiring when Prospect is cutover will be used for junction lines to Central. If we continued the undergrounding there would be a certain amount of capital thrown away, and not recoverable for at least the next ten years, when, perhaps, the growth of population might be sufficient to utilize the conduits between central and the northern areas of Adelaide. There is no plant at Prospect which could be made available for another centre. The undergrounding will be extended to this extent: The present pole lines serving the subscribers will be connected by underground cables to the exchange. It is not proposed to carry out a complete undergrounding scheme in Prospect, but it is necessary to do some of the work in this direction, and, as a matter of fact, we have returned soldiers employed upon it now. The undergrounding of wires considerably reduces maintenance costs. Central exchange is now up to its limit, and the establishment of an automatic exchange at Prospect will not relieve central staff very materially except to the extent of local calls in Prospect, which under the automatic system will be made by the subscribers themselves. All transfer calls from Prospect subscribers will have to pass through central. If Central were automatic, transfer calls would be made automatically. The establishment of the exchange at Prospect should relieve the central staff to the extent of about 25 per cent. of the calls from Prospect subscribers. The transfer calls from Prospect subscribers would be about 75 per cent. The semi-automatic exchanges at Unley and Norwood afford no relief to the central staff, because any call made by a subscriber in either place has to be handled by the central staff. I am in favour of having one system throughout. When we have several systems we are compelled to keep spares for each, and there is a certain amount of difficulty in training our engineers. In working out the financial position of the Prospect exchange all charges such as interest and depreciation have been taken into account. The site has already been secured. Although it was purchased some time ago the telephonic centre has not varied.

17. To Mr. Mathews.—It will be possible to establish satellite exchanges to the north-east of Prospect. The tramway must go out that way, but the district is at

present undeveloped. There might also be a satellite exchange at Dry Creek. Satellite exchanges are undoubtedly beneficial. Their establishment leads to economy in cables.

18. To Senator Plain.—In July, 1923, we propose to transfer 1,016 central subscribers to Prospect, and in 1928 we anticipate to have at least 1,750 Prospect subscribers.

19. To Senator Newland.—We are looking fifteen years ahead. Before that time arrives we will have other proposals going. It would not be advisable to put-up a building that would satisfy fifty years' requirements on our present information. The Prospect equipment would be able to cope with the increased traffic of Prospect district and the northern portion of Adelaide for the next fifteen years. Satellite exchanges can be added in other districts if they go ahead.

20. To Mr. Mathews.—The establishment of the Prospect exchange will not relieve central to any appreciable extent. As I have explained before, all transfer traffic from Prospect to central or to another exchange must pass through central. There are two classes of service—the local traffic, which means calls within the Prospect area, and the transfer calls to other exchanges—which cannot be done automatically until central and the other exchanges become automatic.

(Taken at Adelaide.)

TUESDAY, 21st MARCH, 1922.

SECTIONAL COMMITTEE.

Present:

Senator NEWLAND, in the Chair;

Senator FOLL, Mr. Mathews,  
Senator PLAIN,

James Simcoe Fitzmaurice, State Electrical Engineer,  
Postmaster-General's Department, Adelaide, South Australia, recalled, and further examined.

21. To Mr. Mathews.—The telephone exchanges of Adelaide area have been arranged so that Woodville, when converted to automatic, will take the northern portion of Hindmarsh, and West Adelaide will take the southern portion of Hindmarsh, and also Torrens-ville. In Central we are limited, but under the proposed conditions we intend to increase Central by 1,200 lines by the addition of extra positions. When these are taken up we must extend Central by automatic. However, that will be the last stage. The general idea is to build up the outside automatic exchanges prior to disarranging Central. I would prefer the Central converted to automatic first, because it is the centre of the commercial community, but it is a new exchange compared with the others we propose to convert, and which are obsolete and congested. In view of the position of the finances it would not be right for me to recommend a conversion of Central at the present moment when it is giving good service. West Adelaide will be built before Central is converted. Of course, Central must benefit to the extent of the local calls on local exchanges. All mechanical appliances are capable of improvement, and improvements are constantly being devised. I have no fear of the ultimate success of the automatic system, and I do not think that within the next twenty years the development of wireless telephony will do away with the existing automatic system. For one thing wireless telephony will not be sufficiently secret.

Any person with a receiving apparatus can readily tune it to any wave length.

22. To Senator Plain.—The Brighton block will be big enough for the proposed sub-exchange, and there will be ample room for extension if a post-office is not also erected on the block. Provision is being made for 1,000 subscribers at Brighton. In November, 1920, there were 158 subscribers. It is anticipated that the subscribers will number 940 in 1923, 421 in 1925, 546 in 1926, 827 in 1926, and 960 in 1928. The Brighton block is much more central than the old post-office site.

23. To Senator Newland.—The Department should make greater profits out of the automatic system than are got from the manual system.

24. To Mr. Mathews.—The larger an automatic exchange is the more economically it can be worked. That remark does not apply to a manual exchange. The telephonists at present employed at Glenelg and Brighton will be absorbed in some other way. More mechanics will need to be employed in these two exchanges.

25. To Senator Newland.—When I say that the automatic system will give a more satisfactory service to subscribers and a quicker service, I make no reflection on the staff working the manual system. In fact, we have the finest telephone service in Australia in the Adelaide Exchange, and it is due to the fact that we have a very capable telephone manager and staff. The establishment of the outer automatic exchanges will diminish the work in the Central Exchange slightly; that is, to the extent of the local calls in the local exchanges. In my estimates of costs I have not shown the value of the existing post-office at Brighton as a set-off. The exchange occupies such a small portion of the Brighton post-office. I have no idea of the value of the property. It should be more valuable than the block we have purchased for the new exchange. For one thing it is a larger piece of land. But we are moving nearer to Brighton, because we want to get the telephone centre. We have left details of the construction of the buildings to the architects. We are satisfied with the work they have done for us previously.

The witness withdrew.

Llewellyn Henry Griffiths, Manager of Telephones, Postmaster-General's Department, Adelaide, sworn and examined.

26. To Senator Newland.—I am aware of the reference to the Committee of the proposal to install automatic telephone exchanges at Prospect, Glenelg, and Brighton. The date of my first appointment in the Service is 1st October, 1886, and I have occupied my present position as Manager of Telephones, South Australia, since 1910, prior to which date my position was that of Assistant Engineer, Professional Division, and I have been closely connected with every feature of the telephone business of this State since its inception. The Telephone Manager and his staff deal directly with the subscribers and the public on all matters concerning telephone service, and in the interests of a good service it is better for the Telephone Manager to be a sound critic of the service under his management rather than a strong advocate for same. The subscribers' estimate of a telephone service is, in my opinion, the only real criterion of a satisfactory service, and probably the persons in the best position to judge of the usefulness or otherwise of a telephone service are those who use the system largely. In this connexion the recorded and unanimous opinion recently given of the Central system, Adelaide, by a number of the biggest users of the



system was entirely satisfactory, as expressed, for example, in the following:—

Adelaide, 1st July, 1921.

E. W. BRAMBLE, Esq.,

Deputy Postmaster-General.

Dear Sir,

As an Adelaide citizen of three months' standing, I would like to just let you know how much I have been struck with the courtesy and attention received from your telephone operators and others connected with that branch.

I send this note because, as one who deals largely with the public, I know how seldom it is that you hear of the satisfaction given, but that, on the contrary, the slightest fault is magnified.

I consider that the service here is the best I have had in Great Britain, America, Canada, or Australia, and I would like to take this opportunity of expressing this.

The Adelaide metropolitan telephone system is comprised of the following types of switchboards:—

Central, Common Battery No. 1, Western Electric type.

Port Adelaide, Auto-manual, Siemens type.  
Unley and Norwood, Semi-automatic, W.E. type.  
Glenelg, Henley, Brighton, Stirling, Woodville, Semaphore, Blackwood, Magnetos non-mult.

The Central Exchange is the most popular of the metropolitan exchanges with the subscribers, whilst the Port Adelaide auto-manual system is easily the fastest working and most economical from a staffing point of view of any manually operated switchboard in Australia. The relative safe operator's loads on the various systems are as follow:—

Central (C.B.), Norwood and Unley—225 local calls per operator per hour.

Port Adelaide auto-manual—450 local calls per operator per hour.

Magneto exchanges—150 local calls per operator per hour.

The operators' loads referred to merely show the capacity of an operator dealing entirely with calls completed locally at each exchange concerned. A most important factor, however, also enters into the question, and that is the question of calls transferred from a local exchange to another exchange in the same network. In this connexion we can take calls transferred from Glenelg to Central, and other exchanges as an example. The number of calls transferred from Glenelg to Central and other exchanges represents approximately 64 per cent. of the total originating traffic, consequently the extra work thrown on the operator by means of transferring such calls from Glenelg to the various exchanges concerned reduces the number of local calls she can handle safely from 150 to 120, or less per hour according to the methods in vogue for transferring the calls.

The more exchanges in any network the greater the cost of equipment, junction lines, and operating becomes, and this feature is true of any system, and although the expense to the Department of handling calls directly increases with each new exchange opened, the cost to the subscriber for each call remains the same, i.e., 14d. All calls originating at Norwood and Unley exchanges are automatically switched through to Central, and are handled by the Central operators in the usual way. The reason for not making Unley and Norwood full automatic at the outset is that the originating calls between local subscribers only represented 25 per cent. of the whole. Consequently in this case, as 75 per cent. of the calls originating at those exchanges were practically for Central Exchange, the cost of providing, installing, and maintaining dials, &c., to complete the

small number of local calls was not financially justified. Generally speaking, the position as regards shortage of telephone equipment in certain centres of this State is fast becoming acute. We have, for instance, practically closed down for the time being at Woodville, Henley, and Unley. Central will probably be full within twelve months, and Glenelg before the end of the present year, and even when the necessary funds are forthcoming to push on with the urgent proposals under consideration, some considerable time must elapse before relief is afforded. The Department holds a monopoly of the telephone business, and the position is a difficult one satisfactorily to explain to the many applicants who are most anxious to obtain telephone service. At the end of February, 1922, the number of intending subscribers in this State waiting for telephone service which cannot at present be provided was:—

Metropolitan	..	..	618
Country	..	..	653
			1,271

Each and every telephone system has its inherent mechanical and other weaknesses. Approximately 20,000,000 subscribers' calls (effective and ineffective) are handled yearly in the Adelaide metropolitan area, and when one considers the huge complexity of the apparatus, &c., used in completing each call, the fact that a very small percentage of the total calls misrout is hardly to be wondered at. The dial feature has not, up to the present time, been introduced into the Adelaide metropolitan network. Consequently I am not in a position to express an opinion as to the relative working efficiency of a C.B. manual as compared with a full automatic switchboard. The non-multiple magneto class of exchange switchboard is not at all suitable for busy centres in a metropolitan area, and it is useless attempting to compare such equipment either with an up-to-date manual board or automatic system. The present switchboard at the Glenelg Exchange is of the magneto non-multiple type. The exchange is situated in a small room so congested with equipment that there is not sufficient room space for satisfactory operating requirements. When the present waiting applicants for service are connected, forty-eight further applicants only can be given service under existing conditions at Glenelg, and failing the early installation of an automatic or new temporary manual switchboard within approximately twelve months, it will be necessary to close down on new applications pending the provision of new equipment. Traffic data relating to the Glenelg Exchange and prepared in the telephone branch for the engineering branch is as follows:—

Average daily calling rate, 4.3; average conversation time for each class of traffic—Local calls, 130 secs.; transferred calls, 173 secs.; incoming calls, 168 secs.

Ratio busy hour to daily traffic—M.S. calls, 1 : 6.7; public telephone calls, 1 : 6.0; incoming junctions, 1 : 7.0.

Traffic to Adelaide, 92.2 per cent.; traffic to Brighton, 2.7 per cent.; traffic local ordinary and local P.B.X., 35.1 per cent.; traffic call office, 6 per cent. of originating calls.

Average number calls inward per day, 1,800; maximum, 1,575.  
Number of subscribers' lines to date, 7th August, 1920, 465.

Summary of Total Daily Traffic.—Effective calls, 88.4 per cent.; subscribers' D.N.A., 3.4 per cent.; busy, 9.5 per cent.; ineffective, other causes, .7 per cent.

Calling Rate—Straight Line.—Maximum daily, 4.7; maximum per B.H., 8; ratio daily to B.H., 6.7 : 1.

Calling Rate—Public Telephone.—Maximum daily, 24.4; maximum per B.H., 3.9; ratio daily to B.H., 6 : 1.

Average Conversation Time in Seconds.—Local calls, 130 secs.; outgoing junction calls, 173 secs.; incoming junction calls, 168 secs.

The switchboard at present in use at Brighton Exchange is of the magneto type, and is installed in the Brighton post-office, the one small room serving the purpose of post-office, telegraph-office, and telephone exchange service. The existing conditions militate against satisfactory service, the operator having to contend with many distractions and noises arising from the general conduct of the post-office business. Traffic data relating to Brighton Exchange and prepared for the engineering section is as follows:—

Average daily calling rate, 3.3; average conversation time for each class of traffic—Local calls, 156 secs.; transferred calls, 177 secs.; incoming calls, 200.5 secs.

Ratio busy hour to daily traffic—M.S. calls, 1 : 7; public telephone calls, 1 : 6; incoming junctions, 1 : 8.

Traffic to Adelaide, 66 per cent.; traffic to Glenelg, 10.3 per cent.; traffic local ordinary and local P.B.X., 23.6 per cent.; traffic call office, 8.3 per cent. of originating calls.

Average number calls inward per day, 440; maximum, 546.

Number of subscribers' lines to date, 7th August, 1920, 144.

Summary of Total Daily Traffic.—Effective calls, 84.1 per cent.; subscribers' D.N.A., 2.8 per cent.; busy, 8.7 per cent.; ineffective, other causes, 4.4 per cent.

Calling Rate—Straight Line.—Maximum daily, 4.4; maximum per B.H., 7; ratio daily to B.H. 7 : 1.

Calling Rate—Public Telephone.—Maximum daily, 16.5; maximum per B.H., 4; ratio daily to B.H., 6 : 1.

Average Conversation Time in Seconds.—Local calls, 156 secs.; outgoing junction calls, 177 secs.; incoming junction calls, 200.5.

It is shortage of funds particularly, and, to an extent, shortage of materials that prevents country people from getting telephone facilities. In the majority of cases there is room on the switchboards. It is mostly a question of lines.

27. To Senator Foll.—The Department is not concentrating on relieving the conditions in the metropolitan area. As nearly as possible it is using the funds available equally between the country districts and the metropolitan districts.

28. To Mr. Mathews.—The magneto equipment replaced by the establishment of an automatic exchange will be of great use in country districts. Trouble is frequently caused at the Glenelg Exchange by the locomotives blowing off steam in the street close by.

29. To Senator Newland.—In regard to the proposed automatic exchanges I have merely been consulted in regard to the traffic arrangements and the preparation of data. I have had nothing to do with the selection of sites. The telephone centre is arrived at by a study of development. I take it that a responsible officer has been sent around with a man with good local

knowledge. I have had no experience of automatic exchanges except upon visits to Victoria, but if the automatic system is equal to the Adelaide Central common battery manual system, it will be good enough for the majority of subscribers. With full automatic clearing is almost instantaneous, and this cannot be said of the manual. With the full automatic the subscriber becomes the operator and dials his own call. A subscriber who is waiting with his receiver to his ear worries about the delay of a second or two, but when he is dialling his own call his mind is employed during those seconds. I think that the automatic system lends itself particularly to big areas such as London, New York, Manchester, Sydney and Glasgow. These big centres have reached such a stage that telephone communication cannot be satisfactorily handled by manual appliances. Assuming that the Adelaide Central Exchange is still manual for some years to come, the installation of new exchanges at Prospect and West Adelaide will not materially relieve Central. The percentage of local calls at suburban exchanges is very small. Every subscriber seems to want to get his business through Central to some subscriber in the city. The question of the charge to the subscriber depends largely on the cost of the new system as a whole. It is not likely that the charge per call will be reduced for some years as to whether costs have been reduced. They are not likely to be reduced materially. With the opening of a large number of exchanges' lines is reduced, but at the same time the Department must provide a large number of junction lines to the various exchanges. The subscriber now pays 10s. per annum for each additional quarter of a mile of line beyond the 2-mile radius, so that really with the establishment of suburban exchanges the Department is burdened with an increased cost for junction lines. However, it is only fair, within reasonable limits, that a subscriber should not be penalized for living in a certain locality. It is proposed to increase the capacity of Central Exchange to 8,160 subscribers' lines; that is to say, the equipment will be increased by five sections of A positions and two sections of trunk positions. Unless that is done quickly we shall be obliged to refuse services within twelve months. The erection of the proposed exchange at Prospect will not relieve Central to any material extent. Logically it may not appear to be a sound proposition to extend a manual system in Central that may be pulled out in a year or two to make way for automatic, but we have to give service in the interim somehow, and in any case it would not be economical to scrap a system erected at very great cost, which has not yet finished its useful life. The conditioning plant at the Central Exchange has given us some excellent runs, but at other times it seems to go astray. While the girls sitting at the switchboard seem uniformly to get benefit from it, those working in the centre of the room away from the switchboard seem to experience trouble, due to stagnant atmosphere. There is a feeling of stagnant air there, and I understand that the engineers propose to introduce exhaust fans to overcome the trouble. The theory that the pressure of air pumped into the room is greater than that outside does not seem to be borne out in practice. Consequently, vitiated air remains in the room, and those whose duties compel them to be in certain portions of the room complain very bitterly at times. Journal entries of temperatures, &c., are made three times a day. The traffic officer reports to the engineer in charge, and as a rule the position is improved, but there is that weakness about the system that it is necessary to have some means of keeping the air in motion, or drawing impure air out of the room. Previously we had

exhaust fans, and no vitiated air seemed to remain. However, the plant has improved the condition of workers, particularly in hot weather. The contractors for automatic plants stipulate that the humidity shall not exceed 70 per cent. Adelaide is a comparatively dry centre. The humidity trouble would be more pronounced at Port Adelaide, Semaphore, Henley, Glenelg, and Brighton. I do not know that the engineers have experienced any serious trouble by reason of the absence of an air regulation plant at Unley and Mawson. It is proposed to establish air conditioning plants at all automatic exchanges. I think that a different kind of plant is required for an automatic exchange than that required for a manual exchange. It is, apparently, necessary to pay more regard to the insulation factor in an automatic exchange than is necessary in a manual exchange. In a large area automatic telephone exchanges become very necessary, but the point at which they should be installed is a matter of opinion and policy.

30. *To Senator Plain.*—The main advantage of the common battery system over the magneto lies in the fact that the operator can follow each movement of a subscriber's switch hook by means of supervising lamps. On common battery exchanges the caller lifts the telephone off the hook to call the exchange and replaces it when he is finished. At Glenelg and Brighton, to call the exchange, a caller must turn a handle before taking off the receiver, and ring again at the close of the conversation. Under the latter system about 30 per cent. of the users neglect to ring off. They are not accustomed to that system. You must have uniformity of system to have satisfactory working. The adoption of the automatic system throughout the city would not necessarily enable the Department to use the old switchboards to meet country demands. Some of the loads we can carry in the country are very much greater than those we can carry in the city. Whereas at, say, Glenelg, we would want a board with 100 lines per operator, we could, at Port Pirie, have a board with 200 lines per operator. It would not be economical to shift some of the 100-line boards to places where one operator could work a 200-line board. However, there are many centres where the number of subscribers is under 100, and in such places the 100-line boards would be of great service to us. We do not find that applicants from country districts are more numerous on the average than those from the city, but we are merely on the fringe of things in the country districts. When the farmers properly realize, as they are beginning to do, the benefits of telephonic communication we shall have so many applications that there will be a remarkable development. The policy is to do what we possibly can for country districts. We have no definite instructions on the point beyond that we are to give a fair deal all round. I think that the country districts do get a fair deal in comparison with the city. Since it has been the policy specially to encourage connections in the country areas we have done all we possibly could in this direction. In fact, we have gone out of our way to give a slight preference to country applications. We realize that in isolated districts and sparsely populated places where there are few means of communication it is better to provide some facility rather than to extend facilities in the metropolitan area. We quote for exclusive or party lines, but in a large number of cases the country applicant is compelled to do a fair amount of work himself, that is because of the financial aspect of the matter. He has frequently to erect poles from the main line into his property. We have difficulty in getting wire at the present time. Various gauges of wire are used by the Department. As far as I know, there is no particular

objection to the Australian-made wire. But the purchase of wire and other materials is the duty of the State engineers.

31. *To Mr. Foll.*—The present requirements and future needs of Glenelg and Brighton warrant the establishment of an automatic exchange at Glenelg, and a satellite exchange at Brighton. Glenelg is a centre that is bound to develop, particularly towards Morphettville. I am satisfied that the public will benefit.

32. *To Mr. Mathews.*—Suburban traffic in the Adelaide metropolitan network can, it is considered, be satisfactorily handled by the establishment of automatic exchanges. There is naturally a difference of opinion as to which is the better system. Having decided after due consideration to adopt a certain policy and having commenced to carry it out, the sooner it is given effect to the better. Up to a certain number of subscribers' lines, there is not much difference between one of the best modern manual systems and the automatic system. But having decided to establish the automatic system, it is best to carry it right through. A mixture of systems is a disadvantage. An up-to-date common battery system with 5,000 or 6,000 subscribers and an efficient staff will give as good a service as an automatic of the same size, but when the exchange grows beyond that size, the automatic system proves the better. The New York system is, I understand, a manual one, but there they are now erecting a huge board on the western electric panel system of automatic. America has, I understand, 75 per cent. of its exchanges manual, but in all large centres the automatic system is being installed. It is also intended to establish automatic exchanges in London, Manchester, and Glasgow. I enclose an extract from a paper read before the London Centre of the Institution of Post Office Electrical Engineers by Sir William Noble, M.L.E.E. (Engineer-in-Chief to the British Post Office), entitled "Telegraph and Telephone Engineering in the United States. (Impressions of a visit to the United States in 1919)."

"Page 15.—The general introduction of automatic exchange working is probably the main feature in their scheme of progress, and we gave special attention to this matter, discussing it with telephone experts at all the cities we visited, and finding an almost unanimous opinion that full automatic working is the only certain method of insuring the quality of service now demanded by the public. One group of experts were dissentients, and whilst they were as keen on replacing the present method of manual exchange operating, they held the view that the subscriber should not be trusted with the dial, and that the best method was one based on auto-manual or semi-automatic principles."

"Page 18.—The investigations and inquiries made on the spot last November proved that the defects which existed on the original panel equipments in Newark had been remedied by improvements in design, and that the American Telephone and Telegraph Company were not only convinced that full automatic working is the most economical method of effecting telephone communication in large cities, but were satisfied that the advantages of the panel type were sufficiently outstanding to merit its use entirely in large multi-office areas, such as New York and Chicago, the conditions of which may be said to correspond with London, Liverpool, Manchester, Glasgow, and Birmingham."

"The impression obtained from the investigation made of the panel equipment and the facilities

available were very favorable, and I succeeded in persuading the American Telephone and Telegraph Company to give me the option of purchasing a 3,500-line equipment of the panel type so as to enable British post-office engineers to be in a position to get down to the details of the panel equipment simultaneously with the telephone engineers in the United States of America, thus preventing this country from lagging behind in actual experience as regards latest practice. I am glad to be able to report that the secretary agreed to the proposal to install it in London, and arrangements have now been completed to introduce it in General Post Office, South, where it will form the nucleus of a 10,000-line exchange."

"Page 26.—If I now refer to the outstanding features of the panel type automatic, I think it will be evident that the system will be distinctly advantageous for use in large cities, such as London, Manchester, Liverpool, Glasgow, and Birmingham.

- (1) Large groups of junctions are natural to the panel type, trunk hunting over 91 circuits is available, as compared with 10 and 25 in other systems. Larger groups in other systems can only be provided by the inclusion of additional plant, which not only increases the cost, but reacts on the efficiency.
- (2) The bank multiple is open to inspection; cable forms, individual wires, and soldered connections are eliminated from the multiple field.
- (3) Junctions between busy exchanges can be selected direct on a seven-digit basis with only one switch in the originating exchanges as compared with three switches in other systems.
- (4) In the step-by-step system the trunking scheme in multi-office areas is rigidly linked up with the numbering scheme; in the panel type, the inter-office trunking is independent of the numbering scheme.
- (5) Large groups of P.B.X. numbers up to 100 lines are available. In addition, the provision of a special type of P.B.X. switch is not necessary.
- (6) Automatic tandem working is provided for.
- (7) Automatic refundment or collection of the coin deposited by a subscriber using the prepayment type of coin box is arranged for.
- (8) In selectors of the step-by-step type, 10 routes or levels only are available; in the panel type any number of routes from 10 to 45 can be obtained.
- (9) Traffic can be routed as desired without change to the trunking scheme by means of simple cross-connections.
- (10) The dial impulses are received and translated and transmitted by a device termed a sender, which is in use during the setting up of a call only. Consequently less number of switches to keep in adjustment than in step-by-step systems, where dial impulses are received by different switches during each stage of the connection.

(11) Automatic routine testers are provided to prove the sender and selector circuits. As each circuit is tested to be satisfactory, the next idle circuit is automatically switched into test. In the event of a fault arising an alarm is given on the routine test set. This not only reduces a maintenance routine testing costs, but insures reliable operation of the system.

(12) With the system whereby automatic subscribers' dial manual subscribers' numbers direct to a call indicator on the Manual "B" position, the existence of the sender cheapens installation and maintenance costs of the call indicator equipment. With step-by-step systems a group of recorders will probably be needed to store the call until the "B" operator can complete each call in turn.

(13) Owing to the large capacity of the bank multiple in the panel type exchange, the series of mechanical switches concerned in carrying a call is less than in the case with a step-by-step system. To obtain the same trunking efficiency, therefore, the trunking scheme can be designed from a curve with a lower overall probability of lost calls, on the average, than with the step-by-step system. This reduces the amount of plant to be provided.

(14) Improved transmission facilities, such as higher voltage for long-distance calls, equalizing coils and transformers for loaded circuits can be arranged for automatically by the sender. Similar facilities are not available on other systems."

There are other outstanding advantages to which reference could be made, but I think the foregoing indicate that the panel system embodies facilities far in advance of other systems for large telephone areas. The art of machine switching in telephony has developed very rapidly during the last few years. Four or five years ago the most ardent advocate of automatic telephony would have hesitated before recommending the introduction of a small full automatic exchange in London to work in conjunction with the existing large network of manual exchanges, but with the inception of the panel type telephone experts are unanimous in their opinion that the system is the only one which is capable of fulfilling the many requirements of a large telephone area, especially during the stage of transition.

"Page 15.—The auto-manual service at Lima, Ohio, is undoubtedly the best which came under notice; the opinion is held, however, that the rapid service is attributable to the absence of metering and junction working due to the tariff being entirely flat rates, with 99 per cent. of local traffic. These conditions, which make the Lima auto-manual service so efficient, are also those which would insure still greater efficiency with a full automatic system."

The Port Adelaide system embodies many of the features common to the auto-manual exchange at Lima. There are less line faults when wires are put underground. There are no local conditions, as far as I am aware, which will prevent the undergrounding of wires in the Glenelg area.

James Simcoe Fitzmaurice, State Electrical Engineer, Postmaster-General's Department, Adelaide, South Australia, recalled and further examined.

33. *To Senator Foll.*—Yesterday I was confining my remarks purely to the rate per call the subscriber would be called upon to pay, and the number of calls for which he would be asked to pay; but I omitted to point out that the subscribers in the Prospect area would save considerably, because the majority of them are now beyond the 2-mile radius. With the erection of the new exchange, 90 per cent. of the subscribers in that area would benefit to the extent of from 10s. to £2 per annum in ground rent. They are now obliged to pay 10s. per annum for every quarter of a mile they are beyond the 2-mile radius. Of course, they would save to the same extent if a manual exchange were erected at Prospect.

*The witness withdrew.*

Llewellyn Henry Griffiths, Manager of Telephones, Postmaster-General's Department, Adelaide, recalled and further examined.

34. *To Senator Newland.*—Some immediate provision for giving telephone service to the intending subscribers in the Prospect area is most urgently needed. We already hold applications for service from 129 intending subscribers in the Prospect district, some of whom have been waiting since May, 1918. The following are particulars of assumed traffic data for the proposed Prospect exchange, which information has been prepared by my branch for use by the engineers:—

- Average daily calling rate, 4.
- Maximum daily calling rate, 5.25.
- Maximum busy-hour calling rate, 8.
- Ratio average B.H. to average daily total, 1 : 7.5.
- Percentage local traffic, 25 per cent.
- Percentage traffic transferred to Adelaide, 66 per cent.
- Percentage traffic transferred to Port Adelaide, 2.5.
- Percentage traffic transferred to Glenelg, 2.
- Percentage traffic transferred to Stirling, 1.
- Percentage traffic transferred to Henley, 1.
- Percentage traffic transferred to minor exchanges, 2.5.
- Average conversation time for local calls, 202 secs.; transferred calls, 180.4 secs.; incoming calls, 177 secs.
- Average number of calls inward per day (1,500 subscribers), 7,200.

It is intended to transfer to Prospect Exchange approximately 700 subscribers' lines at present connected to Central; but it is not considered that this action will release many subscribers' calling lamps in Central Exchange, after provision has been made for calls incoming from Prospect, and the additional transfer work in Central consequent upon the opening of the Prospect Exchange. It is estimated that the equipment available in Central Exchange will provide for approximately twelve months' growth. Practically the whole of the Prospect district is outside the 2-mile radius of Central Exchange; consequently the existing subscribers in that district who are connected to Central Exchange are paying an extra 10s. per annum for each additional quarter of a mile or portion thereof of line beyond the 2-mile radius from that exchange. The opening of an exchange at Prospect, therefore, will have an important bearing on the question of rentals in the district concerned, and the reduced rentals on the local exchange when installed will obviously strongly influence the growth of telephone subscribers in the Prospect district.

(Taken at Adelaide.)

WEDNESDAY, 22ND MARCH, 1922.

SECTIONAL COMMITTEE.

Present:

Senator NEWLAND, in the Chair;  
Senator FOLL, Mr. Mathews.  
Senator PLAIN,

Charles Herbert Uttley Todd, Commonwealth Works Director for the State of South Australia, sworn and examined.

35. *To Senator Newland.*—The proposed automatic exchanges at Glenelg, Brighton, and Prospect will be constructed with concrete foundations and floors, brick walls, and with slate and timber roofs. There will be chambers for the air conditioning plant, battery rooms, luncheon rooms, and all the necessary conveniences. The dimensions have been supplied in each case by the Postmaster-General's Department, and the Works and Railways Department have designed the buildings in the simplest way, consistent with the practice of the Commonwealth, which is to study utility rather than ornament. In each case, however, the building will be an asset to the district. The Chief Architect (Mr. Murdoch) has reviewed the designs prepared in South Australia, and somewhat improved them, with the result that the buildings will be of a charming, although simple, nature. I think that slates will be much more durable and satisfactory than tiles would be. I have not had any experience of the durability of the Willunga slate which is now being obtained from the quarry; but I have had the opportunity of seeing Willunga slates in position, certified to have been put on buildings sixty years ago, and they are as sound to-day as they must have been when they were put on. It is a good proposition to use Willunga slates near the sea.

Mr. Murdoch proposes to introduce a concrete ceiling, to make the building fireproof; and he has asked me to inform you that, experience having made him a little wiser, he now intends to cut out overhanging eaves, and use parapet walls as a better fire protection wherever there may be any danger of fire from an adjoining property. Of course, if we cut out the overhanging eaves on one side, we must have parapet treatment throughout, which will add to the cost; but this will be well warranted as an insurance against fire. The roof of the chamber for the air-conditioning plant will be flat concrete, with rubberoid covering. Each building will have one side to the street frontage, except at Prospect. There will be no big fire risk at any site. The Postmaster-General's Department are always very anxious to co-operate with the Works and Railways Department. We always go out together and look at three or four sites before choosing one which combines the best possibilities for building and the most advantageous possibilities from the telephone radial point of view. The policy of the Department is to let contracts wherever possible. At Brighton there will be 44 feet between the proposed post-office and the exchange. I do not think that it is intended to dispose of the block on which the post-office at Brighton is now situated; but that is a matter for the Postmaster-General's Department to decide. The estimated cost of the Brighton Exchange given to Parliament was £28,000—my Department's estimate was about £28,000—but it has been somewhat modified since. My estimate for the Glenelg Exchange was £4,500. The estimate supplied by the Chief Architect to Parliament was £4,600. In each case we have been able to slightly reduce the

figure since we got the final data from the Postmaster-General's Department. The alteration of the overhanging eave to a parapet wall will increase the cost at Brighton by £26, and at Glenelg by £45. The walls up to 6 feet high will be plastered in cement, and above that set in plaster and lime washed or colour washed. A system of bagging will enable us to get a very fair surface on the bricks to prevent the accumulation of dust if not plastered. We shall use fireproof windows. We intend to make the buildings as fireproof as possible. Chemical extinguishers will be in tiled inside, and hydrants will be fixed outside. Water would do as much damage to the mechanism as fire would. Any one of the exchanges could be built within six months. The conditions at Glenelg are most congested. We are taking steps to alleviate the position a little; but even then it will only enable the existing number of subscribers to be catered for.

36. *To Senator Newland.*—The Prospect Exchange is similar in design and construction to the Glenelg and Brighton exchanges. It will be 36 feet from the boundary of the block. My estimate of the cost of construction was £4,500. Mr. Murdoch's was £4,930; but when definite data was secured from the Department of the Postmaster-General, Mr. Murdoch's approximate estimate was able to be slightly reduced. To erect parapet walls will add £50 to the cost.

37. *To Senator Plain.*—We intend to put in concrete ceilings, 3 or 4 inches thick. There will be a certain amount of timber required for carrying the slates. The air-conditioning room, and the air so treated is distributed through the building by ducts. Under the suggested modified system the air is conditioned in the room itself. The air is circulated through the building through vertical ducts built in the walls. There are several water sprays located at the tops of these ducts or cavities in the walls, and their action is to draw in air from the room itself or from the outside or partly from both, as may be determined by the arrangement of adjustable dampers. The water sprays wash the air and reduce the temperature, and at the same time induce the circulation which under the old system is obtained by means of mechanical fans. The air is brought down in a saturated condition to a space under the floor, where it passes between eliminating plates, which get rid of the suspended moisture. It then continues under the floor through ducts and comes up by ducts on the other side of the room, being discharged into the room through heating radiators. Thus the same effect is obtained as in the plant installed in the Adelaide Central Exchange, but in a simpler way. No fan is necessary. I anticipate that the D'ionman system will reduce the cost of installations by about 20 per cent. Our estimates for the suburban exchanges in Adelaide are based on the old system; but before we actually commence the buildings we shall have experience of the new systems, and may find it desirable to adopt it. Experience gained in the operation of the plant installed in the Adelaide Central Exchange has shown that certain features are capable of improvement. The conditions to be met in the Central Exchange were different from those in an automatic exchange. In a manual exchange it is chiefly a matter of ventilation and the comfort of the staff. In an automatic exchange we aim at reducing the humidity to a certain point, and I am quite satisfied that the plant designed will give the conditions that are necessary. With the installation of an extraction fan as well as the plenum fan already in operation at the Adelaide Central Telephone Exchange, and with one or two other slight modifications, we shall have a system that will give every satisfaction. In an automatic exchange there are fewer disturbing factors. The human element is a much smaller factor. In a manual exchange we have

38. *To Mr. Mathews.*—I am assured by the experts of the Postmaster-General's Department that it will lead to economy to establish a satellite exchange at Brighton. It will be two and three-quarter miles from the Glenelg Exchange. I think the idea is to benefit the subscribers by bringing them within the 2-mile radius of an exchange, and putting them on the lower rental rate.

39. *To Senator Plain.*—We do not use large slates. The range will be about 22 inches by 10 inches. The roof timbers for slates would be about the same as for tiles. The latter are lighter when they are put on, but in wet weather they become as heavy as a slate roof. A slate roof will be thoroughly waterproof. I prefer it to a tile roof. Slates are more durable. They are less liable to breakage. They are nailed to the roof, whereas tiles need to be wired. The slates are machine bored nowadays. The cost of a slate roof is about 30 per cent. higher than that of an iron roof. There is little difference in price as compared with tiles. The difference may be 5 per cent. or 7 per cent. in favour of the latter. A red brick building with a slate roof is a pleasing combination.

*The witness withdrew.*

Henry Alexander Dixon, Chief Mechanical Engineer, Commonwealth Works and Railways Department, sworn and examined.

40. *To Senator Newland.*—I have seen the plans in connexion with the ventilating and air-conditioning plants proposed to be erected in the Glenelg, Brighton, and Prospect exchanges. It is proposed to include air-conditioning plants for the purpose of controlling the humidity of the air and eliminating dust. Our estimates also include apparatus for vacuum cleaning and the supply of compressed air, and also for

a small staff up till 9 a.m., and then at 9 a.m. there is a large influx of operators, which sets up a disturbing influence difficult to control. The plant has to get rid of the heat and air brought into the operating room by these operators. The adjustment of the various sections of the air-conditioning plant has to be manipulated in accordance with the varying conditions outside. The Postmaster-General's Department has laid it down that certain atmospheric conditions are essential, and that the humidity must be below 70 per cent. We meet these conditions. Adelaide has a fairly dry climate, but the humidity does at times exceed 70 per cent. Last year there was not a single month in which it did not exceed 80 per cent, according to observations taken at the Adelaide Observatory by the Meteorological Branch daily at 9 a.m., 3 p.m., and 9 p.m. Glenelg and Brighton, being nearer the sea, the humidity at those places would be greater, and it is to meet these conditions that we are proposing to install certain types of plant in the exchanges. I do not think that the air-conditioning plant in Perth would be likely to give satisfaction in South Australia. It is of much smaller capacity than the plants we are proposing to install here. Apart from humidity, we have also to deal with dust. The only way in which to eliminate dust is to absolutely seal up the building by keeping the doors and windows closed; and if this is done, it is necessary to supply a sufficiently large ventilating plant to give a decent atmosphere inside. The Perth plant would not do this. It is operated with the doors and windows open, and this does not keep the air inside free from dust. The air-conditioning plant in the Adelaide Central Exchange cost £1,818 10s. 8d. We anticipate that the Glenelg air-conditioning plant will cost £3,100, the Prospect plant £3,100, and the Brighton plant £2,700.

41. To Mr. Mathews.—The buildings proposed will be suitable for the plants we are proposing. If we adopt the modified scheme, the design will require some slight revision in minor details. The Chief Electrical Engineer of the Postmaster-General's Department will return from abroad in a few days, and nothing will be done in the way of installation of these plants until his advice has been obtained. I am not aware that any of the air-conditioning schemes are patented. Air at any temperature will contain a certain amount of moisture, varying with its temperature. If the latter is reduced to a certain point, it commences to precipitate water, and that is the point which is called the dew point. The ducts or cavities which contain the sprays in the Tiemann system would need to be made of impervious material. The air, after being reduced in temperature by means of the sprays, is discharged into the room through hot water radiators, which would not be likely to be in operation in the summer.

42. To Senator Newland.—No official records are made of the humidity at Glenelg or Brighton. The information we have shows that the conditions which the Postmaster-General's Department say are dangerous obtain in Adelaide. If it is necessary to keep the humidity below 70 per cent, I could not recommend any cheaper plant for the purpose. It is not only a question of controlling the humidity. The plant proposed will take care of the heat, dust extraction, and ventilation, and will include a vacuum cleaning plant and a compressed air plant. A humidity of 89 per cent was recorded in January last in Adelaide at 3 o'clock in the afternoon.

43. To Senator Plain.—The Department will have no difficulty in securing the plant. Nearly every part is made locally. Only the cast-iron radiators and boilers need be imported.

44. To Senator Foll.—I do not believe that any royalty is payable on any part of the plant proposed to be installed. I am not aware that any part is subject to patent rights.

(Taken at Melbourne.)

THURSDAY, 30th MARCH, 1922.

SECTIONAL COMMITTEE.

Present:

Mr. GREGORY, Chairman;

Senator Foll, Mr. Mathews,  
Senator Plain, Mr. Parker Moloney.

Edgar Boehler, Supervising Engineer, Postmaster-General's Department, Melbourne, sworn and examined.

45. To the Chairman.—I can say definitely from practical experience that air conditioning plants are necessary in most exchanges. In Sydney last year it came to my notice that at Vaucluse and Mosman Exchanges the equipment was deteriorating wholly on account of the excessive humidity met with in the building. We were replacing parts that would not have had to be replaced for any other cause than that due to humidity. Messrs. Siemens Brothers, the Western Electric Company, and the Automatic Electric Company have made it a condition in their tenders that the humidity of the atmosphere in the exchanges must not exceed 70 per cent. If these contractors stipulate that those are the conditions under which their equipment will operate best, it would be most unwise for us to ignore the fact. We have a makeshift arrangement at Vaucluse and Mosman for air conditioning. We take records at each exchange, because we find that we can deduce nothing from the average humidity, say, of Melbourne as compared with Sydney.

46. To Mr. Mathews.—The humidity is worse in Sydney than in Melbourne, and I should imagine it would be worse still in Brisbane, but we have not taken records there. I suppose it would be least in Hobart.

47. To the Chairman.—The air conditioning plant in Adelaide was installed primarily in the interests of the staff. The conditions there in the summer months were almost intolerable owing to the great heat. We found from records that at certain periods of the year the humidity would make the conditions troublesome. Up to the present we cannot determine what benefit this plant has been. It was put in as an experiment. I was operating it there for a fortnight, with the result that a number of people who were opposed to it at first subsequently expressed the opinion that it was most beneficial to them. It will take some time, however, to ascertain its value so far as the equipment is concerned. I have personally asked each of the three well known suppliers of automatic equipment whether they can offer any solution of the problem in connexion with humidity, and they have answered in the negative. In our last tenders we called for an air-conditioning plant, and the contractor replied that he could not supply it. The contractor is willing to give us information. He gave us details of a plant placed in St. Paul, Minneapolis, but these details did not meet our requirements entirely. We are giving this subject constant attention, and I am afraid we must continue to experiment until we find what is most suitable for our climate.

48. To the Chairman.—We propose in the meantime to experiment with one or two plants. We have one in the City North Exchange, which is not a success, and we will have to remodel it. We also have a plant being erected in the Collingwood Exchange at present, and we will study its effect. Practically half the plant at Perth was installed before we added to it, and the present plant has not been in use long enough to say whether it is a success. A cable can deteriorate rapidly or slowly. If we start to treat a cable when it has already shown signs of deterioration in its electrical characteristics, it takes years to restore it again. If you get a very wet season you instantly note the effect upon cable. When I was in Sydney in August last, water was trickling down the walls of the General Post Office. If this will occur in such a building as that, it will also take place in a telephone exchange and deposit moisture on our cables. We have a tremendous problem before us. We are making special experiments in Sydney, and it would, perhaps, be wise to concentrate our efforts there rather than in Melbourne, but we are the victims of circumstances in that we have already spent about £70,000 on the equipment at Collingwood, and the contractor has stipulated that the humidity must be kept below 70 per cent. I regard it as a duty to experiment in the Collingwood Exchange, as I would do at Sydney also. We endeavour to keep the dust out of the exchanges because it affects the mechanical portion of the equipment. If dust adheres to the contacts of the relays in the equipment the result is poor transmission and reception. The equipment in the Port Adelaide Exchange was erected by an outside firm. I may be mistaken, but I do not think the original plans were prepared by an officer of the Works and Railways Department. I believe that when subsequent alterations were made it was after consultation with an officer of that Department.

49. To Mr. Parker Moloney.—The air conditioning plants running into a cost of from £3,000 to £5,000 have not been tried in Australia before. They have been submitted to us as the most perfect known. The plant being put in at Collingwood is practically the same in principle as that in Adelaide, but we have to provide for a larger supply of air at Adelaide than would be needed in an automatic exchange. At Collingwood we shall carry out our Victorian experiments. I understand that Mr. Dixon, the officer who designed the plans for the Collingwood plant, returned from the war *via* America, and it is his experience that is responsible for the design of the present plant.

(Taken at Melbourne.)

MONDAY, 3rd APRIL, 1922.

SECTIONAL COMMITTEE.

Present:

Mr. GREGORY, Chairman;  
Senator Plain, Mr. Parker Moloney,  
Mr. Mathews,

Frederick Golding, Chief Electrical Engineer, Postmaster-General's Department, sworn and examined.

50. To the Chairman.—I have recently returned from a trip to Europe and America, where I made special investigations into electrical matters, including automatic telephone exchanges. I found that the automatic system is replacing the manual throughout the world in exchanges having 500 subscribers and upwards, and I strongly favour its extension in Australia. In any network of exchanges it is quite practicable to install plants produced by different manufacturers. For instance, Siemens automatic, the Automatic Electric Company (generally known as the Strowger system),

and the Western Electric Company's rotary system, could all operate satisfactorily within the one exchange network. We might have the Bell Company's system in operation in Melbourne, the Siemens plant operating in South Melbourne, and the Automatic Electric Company's plant installed at Ascot Vale. But that would not be the best possible arrangement. It would involve a slight additional expenditure in trunking one system into another, but that expenditure might be offset by the advantage in preventing a monopoly by any one firm of manufacturers in a city network. In drawing up our plans and specifications we endeavour to avoid this danger. The automatic systems which have been installed in Australia have operated satisfactorily except where we have had trouble due to humidity, but our difficulty in that respect was no greater than is experienced in other parts of the world. In the United States of America all the telephone exchanges are privately controlled. In England and Germany, and in Europe generally, they are controlled by the State, but in some countries there are both State and private enterprises. During the last few years the cost of installing telephone exchanges has increased considerably. That is due mainly to the post-war conditions that operate throughout the world, and particularly to the congestion of orders in excess of the manufacturers' capacity to supply. That congestion is gradually disappearing, and already there have been reductions in manufacturers' prices. I anticipate further reductions. I am preparing for my Minister a comprehensive report giving the results of my investigations into the various phases of telegraphic and telephonic work, including the charges paid by the public. I may not anticipate that report, except to say that generally the charges in Australia are less than in any other part of the world. It must be said, however, that where very high charges are levied, as in America, the public get a superior service. There is more money available for capital expenditure, and a more efficient service is the result. America leads the world in regard to telegraphic and telephonic services, but the annual charges to the public are higher than in Australia. I believe that if the capital were available to put Melbourne on a proper basis with a modern automatic system, the maintenance cost would be reduced. Of course, the capital cost of the automatic system is greater than that of the manual, but the comparison of maintenance costs is in favour of the automatic. Therefore, the automatic is the cheaper investment. It may be that Mr. Hesloth anticipated when the automatic system was first introduced into Australia that it would mean a reduced cost to the Department to the extent of about £1 per subscriber. I cannot say whether that figure holds good to-day; probably it does. However, we have not a complete automatic network anywhere in Australia yet. I note the letter which Mr. Sheldon wrote from New York to this Committee, in which he states that the automatic system has an advantage over the manual in regard to revenue to the extent of 1 dollar to 10 dollars per subscriber. I cannot offhand express an opinion upon that statement, but I will study the matter and let the Committee know my view later. I believe that if up-to-date automatic systems are installed the maintenance costs will be so reduced that, notwithstanding the additional interest and sinking fund to be provided, a cheaper service can be given to the public than is possible by the common battery and magnets systems. The operation of the automatic system in Australia has not yet led to my conclusion, because the cost of installation increased above previous costs by between 60 per cent. and 100 per cent. If capital cost, wages, and maintenance increase, necessarily the subscriptions must be advanced. I do not think that the rates charged to the public have been increased out of proportion to the increased capital cost.

Within a month I will let the Committee have a general report on this phase of the proposal now before them. Air conditioning plants are required in almost all exchanges if an efficient service is to be given. In many American buildings, even those which do not contain telephone exchanges, air conditioning plants are installed for the sake of the general health of the employees. Without such an installation in connection with a telephone exchange the apparatus and the general service suffer, whether the exchange be automatic or manual. There are very few cities in America in which the humidity does not exceed 70 per cent. at some period of the year. During the intense cold of the winter months the whole plant is not operated. In cities like Minneapolis and St. Paul the winter temperature is 30 to 40 degrees below zero, but in summer time the temperature is very similar to that of Brisbane. It will be seen that in those places air conditioning is absolutely necessary. At Honolulu the air conditioning consists of merely running hot air into the enclosed cabinets containing the apparatus. The effect of that is to drive the staff out of the room. That primitive method, although suitable for small exchanges, would not be satisfactory in Australia. An inferior air conditioning plant leads to trouble from humidity and waste of money. That is what I am endeavouring to avoid in Australia. I propose to install at Collingwood a first-class air conditioning plant with auxiliary apparatus, such as vacuum cleaners. Operating that complete plant as a test, we shall be able to discover what portions can be omitted from the plant to be provided at other exchanges, but at the same time it is not advisable to recommend that any portion of the plant suggested by Mr. Dixon should be cut out. The Perth and Malvern automatic exchanges have air conditioning plants. The Malvern Exchange gave a lot of trouble last winter on account of the humidity—trouble that would have been avoided had a plant similar to that proposed for Collingwood been installed. The estimated cost of the plant at Collingwood was £3,500, but the officers of the Works Department now say that it may cost a little more. The telephone apparatus at present installed there has cost about £63,000, and when the Collingwood Exchange is fully equipped the total cost of this apparatus will be about £160,000. Having regard to the big value of the plant, an expenditure of £3,500 to insure its efficient working is comparatively small. I have not personally observed the results given by the air conditioning plant in the Adelaide Exchange, but the official reports show that up to the present it has operated satisfactorily. In some of the manual exchanges in America electric fans, enclosed by wire frames, are installed on the floor for the purpose of stirring up the air. The experience is that the atmosphere becomes dead, and at about the height of the attendants' faces is vitiated. These fans stir up this dead air, and it is extracted through the walls. The introduction of a similar system in Adelaide would improve the conditions there. The attendants are satisfied that we have done something to improve their lot, and they are not suffering any great inconveniences, but the atmospheric conditions could be made much better by the installation of these fans. It is probable that I shall recommend the installation of these air conditioning plants in all exchanges built during the next few years. It takes about two years for the faults caused by humidity to develop in the relays and cables. A maximum humidity of 70 per cent. is one of the conditions upon which the manufacturers supply automatic apparatus. The officers of the Works Department say that the plant proposed to be installed at Collingwood will keep the humidity below 70 per cent., eliminate dust, and regulate the temperature, and it will be sufficient to serve

that exchange even when it is enlarged to its ultimate capacity. Of course, the regulation of temperature is for the comfort and health of the staff. My trip abroad was for the purpose of making an investigation in regard to electrical matters, and to satisfy myself about the efficiency of the air-conditioning system in operation in America. The request of this Committee to obtain details of the various types of plant in use did not reach me until I had arrived in England. I do not anticipate that the air conditioning plant will entail the employment of additional labour; I think it will be attended to by the man looking after the switchboard. However, that is a matter upon which Mr. Lison can inform the Committee, because he made a special study of the matter in America. It is true that in its early stages the plant in Adelaide gave some trouble, but with the assistance of Mr. Becher it was put in order. Apparently the system was all right, but the machinery was not working properly.

51. To Mr. Parker Meloney.—I cannot say that I have seen in operation anywhere else the particular plant that is proposed for Collingwood, but the general conditions are met by a plant designed on the same lines. Theoretically there is no doubt about the efficiency of Mr. Dixon's proposal. Air conditioning plants are absolutely essential if we are to give a first-class service to the country, and the cost of them is small in comparison with the total cost of the large exchanges. The plant costs vary for large and small exchanges, but experience has shown that the cheaper installations are not satisfactory. I have already referred to Malvern. In addition, the atmospheric conditions in the City North Exchange, Sydney, are unsatisfactory, and require immediate attention, and I believe that an installation similar to that proposed for Collingwood will be necessary in the interests of the staff and the apparatus. That exchange is proof of the unwisdom of a cheap installation. As far as I can see, we cannot get an efficient air conditioning plant for an exchange like Collingwood at an expenditure of less than £3,500. That includes also the cost of a vacuum cleaning apparatus and heating arrangements for the comfort of the staff. When the Collingwood plant has been in operation for some time we shall discover by observations which portions, if any, can be cut out of the proposals for other exchanges. Before I went abroad, I had some statistics prepared comparing the costs of automatic and manual exchanges in the Brisbane network, and the figures were in favour of the automatic. I anticipate a considerable reduction in the capital cost of automatic installations. I regard the automatic system as better and cheaper for the Government and the subscriber. As to whether any reduction in subscribers' fees may be expected as a result of automatic installations, that is entirely a matter of Government policy, but the logical conclusion is that the subscriber should get some financial benefit. It is for the Accountancy Department to say whether the present charges are sufficient to meet the increased cost of the service on account of the advance in wages and prices of material. I would recommend the automatic system for any new exchange or replacement having upwards of 500 subscribers. Humidity leads to a reduction of insulation, leaking cables, and a deposit on the points of contact. If there be humidity and dust in the atmosphere there will be "burning" at the contacts wherever an electric spark occurs. At exchanges such as Mosman and Vauluse, which are close to the sea, a peculiar fault which we are satisfied is due to electrolysis develops in the relay coils. The moisture forms a path along which the electricity moves, and wherever the current leaves the conductor it gradually destroys it. Eventually the continuity of the winding of our relays is broken. This

fault gave us so much trouble that we had to devise a circuit to prevent the current leaving the relay coil at those particular spots.

52. To Senator Plain.—In some parts of Australia air conditioning plants are more necessary than they are in some parts of America. Wherever there is humidity in the atmosphere an air conditioning plant is essential to a first class service. There have been complaints in regard to the Geelong automatic exchange, as a result of which we have had to increase the maintenance staff. If a first class air conditioning plant were installed there it might be possible to reduce the maintenance staff. I cannot say that the apparatus has depreciated, because the maintenance work has kept it in generally good order. However, the humidity there is not nearly as great as at Mosman and Vauluse. At Malvern we experienced more trouble than at Geelong, notwithstanding that Geelong is nearer the seaboard. At Ballarat where the manual system is operated there is no air conditioning plant, and we are not experiencing any serious trouble. But if the automatic exchange were installed at Ballarat I might propose to put in an air conditioning plant, because the automatic apparatus carries a heavier voltage than does the manual, and consequently requires a drier atmosphere.

53. To Mr. Mathews.—On account of the voltage in the manual being lower than in the automatic there is a smaller leakage of electricity and less damage through humidity. An air conditioning plant is necessary in Adelaide for the comfort and efficiency of the staff. In some parts of Europe and England it is not necessary to do more than heat the exchange rooms in winter, because the summer months are not so severe as they are in Australia. The manner in which the comfort of the staff is looked after in America is beyond praise. I have to confess that Australia is behind most other countries in regard to welfare work. I refer particularly to the United States of America, Canada, England, Norway, and Sweden. I did not see much evidence of welfare work in the German exchanges. The conditions there are not such as one would expect from a technically-educated people. In France and in India the welfare work is better than it is in Australia. I refer not only to the libraries and recreation rooms, but also to the manner in which the staffs are fed. Many of the private companies in America supply their staffs with free luncheons. In Chicago there is one immense building which is devoted entirely to welfare work.

RELATIVE HUMIDITY (Saturation = 100) at MELBOURNE, 1921.

	Jan.	Feb.	March.	April.	May.	June.	July.	August.	Sept.	Oct.	Nov.	Dec.	Year.
(1) Mean Humidity, 9 a.m.	60	62	59	70	83	82	80	70	68	62	61	68	70
(2) Maximum Humidity	69	67	65	77	97	99	99	92	98	98	93	97	90
(3) Minimum Humidity	29	29	28	31	05	03	04	09	48	42	44	43	..
(4) Average Mean, 14 years	58	61	64	71	79	82	82	76	68	62	60	67	68
(1) 9 p.m.	47	60	47	51	67	68	68	64	56	55	55	58	57
(2)	92	91	72	78	97	97	96	98	78	94	91	91	..
(3)	19	22	20	30	41	50	48	37	42	32	31	30	..
(4)	49	60	52	55	63	67	66	61	57	53	52	56	56
(1) 9 p.m.	69	70	65	73	85	83	81	68	77	76	72	75	76
(2)	95	97	86	95	99	99	98	97	96	98	94	98	..
(3)	35	32	40	43	06	02	03	02	00	04	08	07	..
(4)	67	68	71	76	81	82	82	70	76	73	71	69	75
No. of times 70 per cent. or more—													
9 a.m.	8	9	6	17	20	26	29	25	10	6	10	12	..
3 p.m.	2	1	2	1	13	12	13	11	3	6	5	5	..
9 p.m.	12	16	15	20	30	25	26	27	25	22	18	22	..

These figures indicate that there are many days in the year when it will not be necessary to run the air-conditioning plant at all. In winter probably all that will be necessary for the staff and the apparatus will be

It must have cost many hundreds of thousands of dollars. On the top floor there is an assembly hall, a stage, a ballroom; on other floors, library, shooting gallery, skittle alley, and every form of recreation that can conduce to the comfort and satisfaction of the staff. Of course, there is a special reason for this elaborate provision, namely, the difficulty experienced in getting the right class of girls to engage in telephone work. The conditions in Melbourne, Sydney, and Adelaide are inferior to any I have seen abroad, but that state of affairs is due to shortage of money. Had sufficient money been available, I have no doubt that the various Postmasters-General would have made the conditions in Australia much better for the staff than they are to-day. I noted that it was the private companies which made the most complete provision for the comfort of the staff. I cannot give any information as to the cost of air-conditioning plants in Britain. Many of them have been added to in the same way as I fear we shall require to augment the Sydney installations. A great many of the air-conditioning plants in Europe have grown up by degrees, and their costs would not be an index of the cost of installing a complete up-to-date plant. I do not think it will be necessary to run the air-conditioning plants for 365 days in the year, but the operation of the Collingwood installation will be watched and statistics obtained. The winter humidity does affect the apparatus, but not to the same extent as the summer humidity. In the winter, although the atmosphere is moist, the operator's hands are cool and dry. In summer she would be handling the plugs and cords with hands that were in a state of perspiration. In Tasmania probably all that would be required in the winter months would be a heating plant, which by raising the temperature to the required degree would also reduce the humidity. I anticipate that in Melbourne also the air can be kept sufficiently dry in certain months by merely operating the heating plant. In regard to the Collingwood installation as a test, I would not scrap an up-to-date self-contained manual exchange handling up to 5,000 subscribers in order to substitute the automatic system. An up-to-date manual exchange of that size is easily handled, and would give complete satisfaction. At my request, Mr. Hill, of the Works and Railways Department, has obtained from the Commonwealth Meteorologist, Mr. Hunt, the following particulars regarding the humidity in Melbourne, and I submit them for the information of the Committee:—

a heating of the exchange room. Dry and wet bulb thermometers will be provided, and the mechanic will put the plant in operation whenever the humidity reaches 70 per cent.