



1922.



THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA
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PARLIAMENTARY STANDING COMMITTEE
ON PUBLIC WORKS.
Clerk of the Senate.
3-10-22

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE PROPOSED

ESTABLISHMENT OF AN AUTOMATIC TELEPHONE EXCHANGE

AT

SOUTH MELBOURNE, VICTORIA.

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

Third Committee.

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

Senate.

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

House of Representatives.

- Llewelyn Atkinson, Esquire, M.P.¶
The Honorable Frederick William Bamford, M.P.
David Sydney Jackson, Esquire, M.P.**
George Hugh Mackey, Esquire, M.P.
James Mathews, Esquire, M.P.
Parker John Moloney, Esq., 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. 205 OF THE DECEMBER, 1921.

31. PUBLIC WORKS COMMITTEE—REFERENCE OF WORKS—AUTOMATIC TELEPHONE EXCHANGES, CANTERBURY, SOUTH MELBOURNE, AND BOX HILL.—Mr. Groom moved, pursuant to notice, amended, That, in accordance with the provisions of the Commonwealth Public Works Committee Act 1918-1919, 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 Victoria:—Canterbury, South Melbourne, Box Hill.

Mr. Groom having laid on the Table plans, &c., in connexion with the proposed works— Question—put and passed.

PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

AUTOMATIC TELEPHONE EXCHANGE, SOUTH MELBOURNE, VICTORIA.

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 an automatic telephone exchange and equipment at South Melbourne, has the honour to report as follows:—

INTRODUCTORY.

1. Telephone subscribers in the South Melbourne area to the number of approximately 7,700 are served by the manual switchboards in the Central and Windsor Exchanges. It is represented that the accommodation at the Central Exchange is now fully taxed, and that steps should be taken to establish a new exchange to serve the present subscribers and meet prospective development in the South Melbourne area.

PRESENT PROPOSAL.

2. The proposal submitted to the Committee is to erect a telephone exchange building at the corner of Green, Bank, and Crown streets, South Melbourne, on a site which was acquired by the Commonwealth some years ago, and to install therein an automatic telephone switching system having an immediate equipment of 3,000 subscribers' lines and an ultimate capacity of approximately 7,000 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 this area over a period of at least fifteen years.

ESTIMATED COST.

3. The estimated immediate cost of the work as submitted to the Committee was set down at:—
Site (already acquired) £1,290
Building 5,913
Air conditioning, heating, ventilating, vacuum cleaning, and air compression plant 3,350
Exchange equipment, including that necessary at other exchanges 66,900
Equipment for subscribers' premises 25,375
Line plant (conduit, cables, and aerial lines) 8,134
Diversion of external line plant 676
Cut-over of equipment 100
Total £111,738

COMMITTEE'S INVESTIGATIONS.

4. The Committee visited the site at South Melbourne, and traversed portion of the area intended to be served by the proposed exchange; inspected the air-conditioning plants at Collingwood and Geelong, and obtained from the Chief Commonwealth Architect full particulars

as to the building proposed to be erected, and from the postal and works engineers details of the equipment to be installed, the methods to be adopted for regulating the temperature and humidity of the air, &c.

Site.

5. The land upon which it is proposed to erect the telephone exchange was acquired by the Commonwealth in 1912, and is situated at the intersection of Bank, Crown, and Green streets, South Melbourne, the remaining boundary being a right-of-way between Green and Crown streets. The block has a frontage of 55 ft. 3 in. to Crown and Green streets and 101 ft. 9 in. to Bank-street and the right-of-way.

This site is the theoretical telephone centre of the area, and is practically in the business centre also. It has a good high situation, and, in the opinion of the Committee, is eminently suitable for the purpose for which it is intended.

Building.

6. The building is designed to be of one story, constructed of brick, and with a parapet wall. The accommodation provided will include a switch-room 66 ft. 2 in. long by 52 ft. 7 in. wide; a battery room 33 ft. 2 in. long by 22 ft. 6½ in. wide, and an air conditioning room 22 ft. 6½ in. long by 18 ft. 3 in. wide. In addition, there will be the usual retiring room for the staff, with lavatories. A flat concrete roof will extend over the battery room, air-conditioning room, and luncheon room.

7. It has become the Commonwealth practice to put in fireproof concrete ceilings over all switchrooms in the different telephone exchange buildings, but in this instance some difficulty arises on account of the width of the switchroom being 52 ft. 7 in. Two methods of providing a ceiling were mentioned to the Committee—one the provision of a light concrete ceiling hung from the roof trusses, or a heavier concrete ceiling supported by stanchions.

8. It is stated that the existence of stanchions will, to some extent, reduce the floor space available in the switchroom, but in view of the fact that the hanging ceiling will not give the same security to the equipment in the event of fire, the Committee is of opinion that the heavier and more fire-resisting ceiling, supported by stanchions, should be adopted—the Works and Telephone officials consulting as to how this can be arranged with the least loss of space and minimum displacement of equipment.

Air-Conditioning Plant.

9. The Committee paid special attention to the fact that in connexion with this and other proposals now under consideration it is the intention to install in each exchange an air-conditioning plant estimated to cost from £3,100 to £5,500.

These plants, designed to eliminate the dust and regulate the temperature and humidity of the air in the switchrooms, are said to be necessitated by the fact that the manufacturers of the automatic switching equipment do not guarantee reliability unless the atmosphere of the switching room be kept free from dust, the temperature below 70° Fah., and the relative humidity under 70%.

10. Evidence placed before the Committee showed that a deposit of dust or moisture on the more delicate parts of the mechanism might materially interfere with the efficiency of the service rendered to the public, and convinced members of the necessity of eliminating dust and moisture from the air in the switch rooms. The next point was to consider whether this condition could be attained at a lower cost than that estimated by the Department, and to this end visits of inspection were paid to the Automatic Telephone Exchanges at City North (Sydney), Collingwood and Geelong, Victoria, and the systems of air-conditioning adopted in these places were carefully examined.

11. Although it was stated that in the United States various schemes are resorted to for conditioning air in office buildings, factories, &c., no evidence was adduced to show that any system is extensively used in connexion with automatic telephone exchanges, and it is claimed that, in this respect, the Commonwealth is as far advanced as is any other country. Even here, however, the matter is still largely in the experimental stage, and so far the efforts made to condition air in automatic telephone exchanges such as Perth, Malvern, Geelong, and City North (Sydney) have not been entirely satisfactory. The plant recently completed at the Collingwood Exchange has been constructed as the result of knowledge gained by experiments at other exchanges, and, theoretically, should do all that is claimed for it. This plant has not, however, been installed long enough to demonstrate this in actual practice, and until it has done so, the Committee does not feel justified in recommending an expenditure for this service, which, taken over the number of automatic telephone installations in prospect, will amount to many thousands of pounds. At this stage, however, it contents itself with the observations that, while convinced from all the expert evidence placed before it, the economic life and efficiency of the service rendered to the public by an automatic telephone exchange depends largely on the air in the switchroom being

kept free from dust and moisture, sufficient time has not yet elapsed to show whether the methods proposed by the Department for arriving at this desideratum will be entirely effective. The Committee, therefore, recommends that careful observations be made and records kept of the results achieved by the recently erected plant at Collingwood, and that no steps be taken to install any future air-conditioning plants on the lines of that at Collingwood until the results obtained show same to be justified.

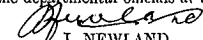
Financial Aspect.

12. It was stated in evidence that the total annual charges of the proposed automatic system as at date of cut-over would be £19,883, and five years later they would amount to £22,742, while the total annual charges for an alternative Common Battery system would be, at date of cut-over £21,676, and five years later £26,033.

13. The revenue estimated to be obtained from the installation is set down at £32,965 per annum at date of cut-over, and five years later at £46,430 per annum. The assets thrown spare if the automatic be installed are said to have a recoverable value of £33,314, and the difference in annual charges in favour of establishing the automatic system are given at £1,793 at date of cut-over, and at £3,201 five years later.

COMMITTEE'S RECOMMENDATIONS.

14. Under these circumstances, the Committee has no hesitation in recommending that the proposed installation be put in hand as recommended by the departmental officials at as early a date as possible.


J. NEWLAND,

Vice-Chairman.

Office of the Parliamentary Standing Committee on Public Works,
Parliament House, Melbourne, 29th August, 1922.

MINUTES OF EVIDENCE.

(Taken at Melbourne.)

THURSDAY, 10th AUGUST, 1922.

Present:

Senator NEWLAND (in the chair);

Mr. Bamford, Mr. Mathews,
Mr. Jackson, Mr. Parker Malouey,
Mr. Mackay,

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

To Senator Newland.—The proposal is to erect a telephone exchange building at the corner of Green, Bank, and Crown streets, South Melbourne, on a site which has been acquired by the Commonwealth, and to install therein an automatic telephone switching system having an immediate equipment of 3,000 subscribers' lines and an ultimate capacity of, approximately, 7,000 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 this area over a period of at least fifteen years. The subscribers in the proposed area, who numbered, approximately, 1,716 on 30th June, 1921, are served by the manual switchboards in the Central and Windsor Exchanges. As the accommodation at the Central Exchange is fully taxed, steps should be taken to establish a new exchange to serve the subscribers and meet prospective development in the South Melbourne area. It will, therefore, be necessary to erect a new building on the site acquired, and install therein a new telephone exchange plant. This proposal will enable subscribers' lines to be constructed of shorter length, and, as a result, better service will be provided for the subscribers in the proposed South Melbourne exchange area. A considerable amount of wasteful expenditure on line plant will thus be obviated. The estimated immediate cost of the work is:—

Site (already acquired)	£ 1,290
Building	5,913
Air conditioning, heating, ventilating, vacuum cleaning, and air compression plant ...	3,350
Exchange equipment, including that necessary at other exchanges	66,900
Equipment for subscribers' premises ...	25,375
Line plant (conduit, cables, and aerial lines) ...	8,194
Diversion of external line plant	676
Cut-over of equipment	100
Total	111,738

The approximate revenue received, and the revenue it is estimated will be obtained on the date of transfer, viz., 1st January, 1924, and with five years' development is shown hereunder:—

Average number of subscribers' lines connected during 1919	£ 1,430
Approximate annual revenue received during 1919	17,705
Estimated number of subscribers' lines (1.1.24) ...	2,130
Estimated annual revenue (1.1.24)	32,965
Estimated number of subscribers' lines (1.1.29) ...	3,000
Estimated annual revenue (1.1.29)	46,430

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 3,000 lines; but the building will be designed sufficiently large to accommodate an equipment of a capacity of, approximately, 7,000 lines. The financial aspect is shown by the following particulars:—

	£	Five years after October.
1. Capital cost—new	111,738	120,946
2. Capital cost—new and in situ	171,260	180,468
3. Proportionate annual working expenses of existing manual system as at 1.1.24	9,769	—
4. Annual Revenue— Approximate—received during 1919	17,705	—
Estimated, 1.1.24	32,965	—
Estimated, 1.1.29	46,430	46,430
5. Annual working expenses of proposed automatic system as at 1.1.24	4,493	6,021
6. Total annual charges for proposed automatic system as at 1.1.24	19,883	22,742
7. Annual working expenses of alternative common battery manual system as at 1.1.24	8,188	11,237
8. Total annual charges alternative common battery manual system as at 1.1.24	21,076	23,033
9. Assets recoverable or thrown spare if automatic exchange is installed— (i) Book value	40,405	—
(ii) Recoverable value	33,314	—
(iii) Cost of recovery	3,714	—
Difference in annual charges in favour of establishing an automatic system	1,793	3,291

Regarding item 9 of the foregoing statement, the difference between sub-items (i) and (ii), viz., £13,091, 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, and is made up as follows:—

(a) Sub-station equipment	£ 26,634
(b) Line plant	6,457
Total	£13,091

No depreciation has been shown for exchange equipment, as this equipment, which is to be used in the Central and Windsor Exchanges, when released, will remain in position to serve new subscribers. The amount shown for (a), viz., £6,634, represents ordinary depreciation due to wear and tear; and that for (b), viz., £6,457, represents the depreciation of line plant which will be thrown spare. The number of subscribers connected with the Central Exchange at present is 11,977, and the number of subscribers awaiting service in the Central area is 1,398. It is proposed to open the Collingwood Exchange at the end of September, and the approximate number of subscribers who will be transferred from Central to Collingwood is 1,620. Of the 1,398 awaiting service in the Central area, 354 will belong to the Collingwood area when it is opened automatically, and the subscribers connected with the Central Exchange, excluding Collingwood, will then be 10,387. The number awaiting service at Central, excluding Collingwood, is 1,044, making a total on the Central Exchange of 11,401. The ultimate capacity of the Central Exchange when it was installed was for 11,700 subscribers' lines, but a couple of years ago, when we found we were in a very awkward situation and would not be able to connect more subscribers in the Central area, we tried to find a way out of the difficulty by connecting some of our own services on a special portion of the switchboard and by dividing the multiple and local circuits of some of the subscribers' lines. Firms like Buckley and Nunn, for instance, had groups of inward and outward lines which they called the Exchange and the Exchange called them, but these groups were not used for common purposes. We found that by dividing portion of the equipment on some of these lines we could make further accommodation available, and we have done that to the extent of about 200 lines. The switchboard now accommodates 11,900 subscribers' lines, and, no doubt, we could connect a few more in that way. The total number of connections with the Central Exchange,

apart from Collingwood, would be 11,401, and, as the possible capacity of the Central Exchange is 11,900, it leaves 500 subscribers' lines spare for future growth. The development in the Central Exchange has been exceedingly variable. I have analyzed it over a period since 1911, and I find that it ranges from 0.6 per cent. to 10.3 per cent. I have taken what I consider to be a very conservative estimate, namely, 5 per cent., that is, I anticipate that the subscribers in the Central Exchange area, excluding Collingwood, will grow at a rate of 5 per cent., and at that rate the 500 spare lines would barely last a year. Immediately we put the Collingwood Exchange into operation it will not meet our needs for 500 new subscribers, because the old lines will still be listed in the telephone list. It will be a very gradual process to connect new subscribers to the Central Exchange, in order to avoid confusion through people calling up for wrong numbers. As a rule, subscribers do not destroy the out-of-date lists, and, in order to avoid confusion, the Department cannot allot new numbers the moment lines become available. Our ordinary practice is to reserve a disconnected number for six months, but we have had to depart from that rule during and since the war in order to meet public convenience. I think I have shown the urgency for the early establishment of an automatic exchange at South Melbourne. The opening of the Collingwood Exchange will afford relief to the extent of only 500 lines, but when we open the South Melbourne Exchange, Central will be relieved to the extent of 2,130 lines, if we cut over on the 1st January, 1924. That would provide for at least a few years' growth in the Central Exchange area. Proposals are in the hand, however, to meet still further development in the city proper. Feasible proposals have already been made for the establishment of an exchange at North Melbourne, and we shall eventually transfer a number of subscribers from Central to that exchange. Within a couple of years we should be able to afford all the relief that is required, provided there is no unforeseen delay in the carrying out of the contemplated works. I think the accommodation proposed will be ample to meet anticipated needs for a period of fifteen years. I have gone into the question of the population, and provision is made for an ultimate capacity at South Melbourne of 7,000 subscribers' lines. If necessary, another story could be added to the building. The estimated expenditure has been arrived at from the latest ascertained costs, which are based on prices paid for the Malvern Exchange, on the latest current tender prices for telephones, and, similarly, for line-construction material. From present indications, I do not think the work will be as costly as estimated, because prices are falling. I do not anticipate any difficulty in securing all the automatic equipment required, because at present there is greater competition than I have ever experienced in the Department for the supply of apparatus generally. For financial reasons, when dealing with the financial aspect, for showing the total annual charges for an alternative common battery manual system was to afford a comparison with the cost of a different system. My own opinion is that automatic equipment is the best obtainable at present, but I placed the other information before the Committee in order to give another view-point. The spare accommodation as the result of the establishment of the proposed exchange will be used elsewhere. In the South Melbourne area there were on 30th June, 1922, 1,716 lines connected with the Central and Windsor exchanges. Approximately 500 of that number were connected with Windsor and the balance with Central. When the South Melbourne automatic exchange is established, naturally the Central and Windsor exchanges will be free of these lines, but we do not propose to dismantle the switchboards, we shall keep them to provide for future accommodation in those exchanges. There must necessarily be a certain amount of confusion through having a

manual system working in conjunction with an automatic exchange. The conversion process must be a gradual one, and confusion will always exist while more than one system is in operation. We have no automatic plant in the city area at present. The automatic plant in the city will be Collingwood, which was put in operation by the end of September next. I was consulted in connexion with the preparation of the plans for the building at South Melbourne. I have worked in conjunction with officers of the Works and Railways Department, and I am satisfied that our requirements will be met. There is sufficient provision for our needs for the future, and if the development we anticipate is exceeded, there should be no difficulty in adding another story to the building, which will, I understand, be constructed to admit of that course being followed. The site was acquired in 1912, and I understand that the price includes any fees payable. I fancy the actual price was about £1,281. I have no idea of land values in the South Melbourne area. In this instance the site was obtained before I came to reside in Melbourne.

2. *To Mr. Parker Moloney.*—The price of the land was put at about £20 per foot. I do not think that the establishment of a new exchange would result in any cutting down of staff at the Windsor or Central exchanges, but I would prefer that question to be answered by the Telephone Manager. Notwithstanding the number of automatic exchanges we have installed in the Commonwealth, I have never known of an officer being dismissed. As a rule, the services of every officer can be utilized in one Department or another. They are mostly permanent officers, and the loss of girls owing to resignation for the purpose of marriage and for other reasons is considerable. This enables the Department to a great extent to avoid dispensing with the services of any of its officers. The land at South Melbourne is at the theoretical centre of the area. It is a good high situation, and is practically in the business centre also. I cannot say whether £20 per foot would be its present value or its value ten years ago. All the negotiations for the purchase of land are conducted through the Home and Territories Department. The practice is to visit districts cautiously, and look out for suitable sites. There is no display of publicity. After having arrived at the theoretical centre we survey the area for vacant blocks, and then we pass the information on to the Home and Territories Department, which negotiates the purchase for us. I cannot state what steps that Department takes to arrive at the true market value.

3. *To Mr. Mackay.*—I do not know whether there were any buildings on the land when it was bought. The length of line in the proposed exchange would not be more than 2 miles, approximately. That is the length we aim at. Thus the exchange would serve an area of about 4 miles in extent. A short line is the ideal one for a subscriber's telephone. The copper or bronze of which the line is constructed has electrical characteristics which, in certain instances, interfere with the volume of speech. If the line is over a certain length we get bad speech by using ordinary conductors, and the employment of bigger conductors would add to the cost of construction. Now we use the smallest gauge conductors within safety limits, and we find that when a line exceeds 2 miles the transmission is unsatisfactory to the subscriber with the common battery system of 24 volts if the resistance exceeds 300 ohms. There would not be an exchange of 2 miles unless the telephone were centrally distributed, it may pay us to lay one cable with heavy conductors to feed those particular lines rather than establish another exchange. It is simply a question of economics. At the Geelong Exchange we have only a heating plant, and my information is that if they have

one day's rain nothing much happens; but if the rain continues it is necessary to close the doors and windows and resort to artificial heating. At Collingwood the air-conditioning plant has been partially in operation for a few months, but the plant has been held up because it has been impossible to procure different parts. The plant, so far as I am aware, has not been wholly handed over to the Department. We shall not take it over until we are satisfied. This will be the first up-to-date plant to be installed. All our previous efforts have been more or less of an experimental nature, and they have not been satisfactory. We are including provision for air-conditioning plants in our estimates, but the nature of the plants to be erected will depend on the result of our trial. We will not order more than the present plant at Collingwood until we are quite satisfied as to its efficiency.

4. *To Mr. Bamford.*—The material I referred to as becoming cheaper is mostly telephones and cable. I was making no reference to the price of building material. The difference between the initial capital cost of the South Melbourne Exchange, and that shown for five years after the date of the cut over, is made up because of additional cables for subscribers' lines and new instruments.

5. *To Mr. Jackson.*—We hope that the air-conditioning plant being erected at Collingwood will be a valuable object lesson. I have studied this question very closely during the last six years. The Chief Electrical Engineer made inquiries abroad, and he found that as much was known in Australia as anywhere else on the question of air-conditioning. People abroad have to get their experience just as we are paying for ours. We certainly wish to obtain it in the most economical way, and that is why we have not gone ahead and put in air-conditioning plants everywhere. We have one only in each of the Perth, Adelaide, Melbourne, and Sydney areas. There are twelve automatic exchanges in Sydney, and yet we have only one of these plants there. In the Vaucluse Exchange, in Sydney, where there is no air-conditioning plant, electrical repairs have been necessary because of excessive action solely due to humidity. In the Mosman Exchange there are certain cables which are generally laced with waxed string, and these have had to be opened up and artificially heated to drive out the moisture, in order to give a proper service. If the cables are hermetically sealed at the various units in the exchange, the deposit of moisture from the rise and fall of the temperature would be worse than ever. In other exchanges, also, we have experienced similar trouble, due entirely to humidity.

6. *To Senator Newland.*—Unfortunately, we have not so far got a satisfactory plant erected. The one giving the best satisfaction is that in Adelaide, but I do not say that it represents the last word in the matter. It was certainly the best attempt prior to the Collingwood experiment. The plant in Adelaide, however, is for a manual exchange, and it was erected partly for the benefit of the equipment, but chiefly in the interests of the staff.

7. *To Mr. Jackson.*—I do not know definitely whether the result has been beneficial to the equipment, but I believe it will be. In Adelaide the equipment is entirely different, because it is manually operated and has a voltage of 22. In Sydney, much of the equipment is automatic, with a voltage of 46, and that is a greater stress on the various conductors. The plant in Sydney is in the City North Exchange, and it is not satisfactory. At Geelong I hope to be able to demonstrate the wisdom of having air-conditioning plants.

8. *To Mr. Bamford.*—I am hopeful that the new plant at Collingwood will prove to be just as serviceable for, say, Brisbane as for Melbourne, despite variations in climatic conditions. The plant is not fully

necessary to cope with humidity; it is essential, also, in order to eliminate dust and dirt. We must have a plant to keep out the dust, so it can be made to serve the two purposes.

9. *To Mr. Mackay.*—The initial cost of the proposed exchange at South Melbourne is £111,738, and in order to insure the proper working of the system we propose to spend £3,350 of that total on an air-conditioning plant, therefore, I do not consider the expense too great in proportion to the total outlay. I have no hesitation in saying that we are going on right principles in our experiments in the Adelaide and Collingwood exchanges, and fair service has been given by the plants installed elsewhere. In one specification that I prepared I invited manufacturers to tell us the cost of a complete plant, but, although they were willing to help us, they could not offer a solution. As far as dealing with the humidity is concerned, the plant simply consists of an Ideal boiler with a heating system. There we also require a vacuum cleaning plant. That much is essential, and if we eliminated the cost of coping with the humidity I doubt if it would save more than £400 or £500.

10. *To Senator Newland.*—Some of the conduits are near the South Melbourne site. No cost that I am aware of has been omitted from the particulars I have presented to the Committee.

(Taken at Melbourne.)

MONDAY, 14TH AUGUST, 1922.

Present:

Senator NEWLAND (in the Chair);

Senator PLAIN, Mr. Mathews,
Mr. Jackson, Mr. Parker Moloney,
Mr. Mackay,

George Herbert Morgan, Telephone Manager, Postmaster-General's Department, Melbourne, sworn and examined.

11. *To Senator Newland.*—The proposed automatic telephone exchange at South Melbourne is, in my opinion, necessary to relieve the congestion in the Central Exchange. I have had a statement prepared setting out the estimated expenditure on salaries to telephonists and supervising officers at South Melbourne in 1924. The total amount is £3,659 8s. 9d. This is made up of telephonists' salaries, allowances to telephonists, monitors' salaries, allowance to monitors, and supervisors' salaries and allowances. I have also a statement of what the operating costs would be in 1929. That is made up similarly, except that by that date the exchange would have grown to such an extent that a traffic officer would be required at a cost of £207 per year. If the same allowances are paid then as now, the total operating expenses would be £5,444 1s. 9d. These figures refer to the manual exchange. I have read through the statements prepared by departmental engineers regarding the cost of an automatic exchange, but I am not in a position to say whether I agree or disagree with them. There is a necessity for making the system uniform. This is essential in the best interests of efficiency. In Melbourne at present there are three systems, the non-standard magneto boards, the manually operated multiple boards, and the automatic exchanges. These have to work in conjunction with one another, which is both difficult and costly. No other city in the world has such a difficult system to operate. I had the privilege of going through America in 1914, and I saw there manually operated boards and automatic exchanges. Subscribers to the automatic systems are not given service with the manually operated boards. The Western Electric

Company, which controls the manually operated boards, had a preponderance of subscribers. They were trying to perfect machinery for automatic working, but they were finding it a very big problem. They had a few million subscribers in the United States, and the cost of converting to the automatic system would have been enormous. I think, however, that they realize that the automatic system must come eventually. The automatic system in Los Angeles impressed me very much. The manual system in America is more efficient than ours. I attribute that to the fact that they have only one class of switchboard, while we have three. I have hardly had enough experience to be able to say whether the automatic system is preferable to the manual, but whatever system is adopted it should be uniform in the large centres. The automatic system does all that is claimed for it, but in this city we have hardly given it a fair trial. We have it doing local work and transfer work. If a subscriber at Ascot desires to speak to a subscriber at Brighton, the caller has to be answered by an operator at Ascot, transferred to another operator at Central, and transferred to a second operator at Central, who has to set up the Brighton number. Thus the call has to go through three persons before reaching the automatic machinery. If there were no delays there would be a lapse of thirty seconds before the call would be sent on its way on the automatic. Latterly developments in the telephone branch have been hampered for want of money. We have not had sufficient equipment to carry the traffic in busy times. We have done our best to meet emergencies, but there are rushes at times which we cannot cope with, such as on Saturday mornings and race days. I do not claim to be in a position to analyze the engineering figures. I do not know that the apparatus could be obtained any cheaper than the price at which it is quoted. In an automatic exchange such as would be installed at South Melbourne, only two telephonists would be employed. They would be on the complaints and information desk; one between the hours of 8 a.m. and 3 p.m., and the other between the hours of 3 p.m. and 10 p.m., and could attend to all requirements. Their salaries would be about £250 per annum, including allowances. The figures quoted to the Committee of the annual working expenses of the proposed automatic exchange, namely, £4,493, and the working expenses of the common battery system, £3,881, would include the provision of telephonists in the manual system and mechanics and other officers engaged on the engineering side of the automatic system. When we are intending to convert a manual exchange to automatic we know two months ahead. In order to avoid the necessity for dispensing with the services of operators we do not employ them permanently during the last twelve or six months. When we cut over the Brighton Exchange we had fifteen operators there. It took two to look after the complaints and information desk at Brighton, and four to handle the desks that were placed in Windsor and Central Exchanges. That left only nine who had to be absorbed in the other exchanges. Last year we trained 150 telephonists. I do not think there will be a surplus of telephonists for some years to come. Any who are displaced at one exchange can always be absorbed at the new exchanges that will be opened from time to time. The majority of the exchanges opened in the country accommodate from fifteen to twenty subscribers, and generally can be operated by a telegraph messenger. When the load exceeds fifty units, a temporary exempt telephonist is provided, and when it exceeds 135 units we consider that a trained telephonist is necessary. Any girl who belongs to the town and is qualified and desires to take the position, is allowed to do so. No telephone operators will be thrown out of employment by changing over from the manual to

the automatic system. Before a girl becomes proficient in operating she must go through a course of training of one month in a school and three months in an exchange before she is considered to be efficient and capable of doing a fair load. The Department is always training mechanics for the class of work required in automatic exchanges, and there is always a class known as "cadet mechanics." The provision of an exchange at South Melbourne would relieve the congestion in the Central Exchange. The Central Exchange would be relieved to the extent of about 1,350 lines.

12. *To Mr. Mathews.*—I cannot say how long ago it was when the land was purchased for the South Melbourne Exchange, but I know that it has been purchased, and that the work should go ahead at once. In such matters the engineers look ahead and acquire land as near as possible to the telephonic centre of a district. The provision of an exchange at South Melbourne would reduce rents to a number of subscribers in that district who are now connected with the Central Exchange, and are outside the two-mile radius. There are 500 subscribers connected with Windsor Exchange who really belong to South Melbourne.

13. *To Mr. Parker Moloney.*—I would like to see the proposal for an exchange at Northcote gone on with, and the provision of an exchange at North Melbourne should certainly be pushed forward.

The witness withdraws.

Lawrence Bede Fanning, Telephone Traffic Officer on the Central Staff of the Postmaster-General's Department, Melbourne, sworn and examined.

14. *To Senator Newland.*—I deal with matters submitted to the central office of the Postmaster-General's Department in connexion with the organization of the telephone branches in the different States, and also any matter affecting the operation of the telephone regulations or the conditions under which telephone services are provided. I have not had an opportunity to investigate fully the proposals before the Committee, or to consult with the Departmental engineers on the matter. I have looked into one of the proposals, but my inquiries are not sufficiently advanced to enable me to make a definite statement. After a few days I would be prepared to give a definite opinion one way or the other. The exchange required at South Melbourne is to meet the congestion in the Central Exchange. At the present time there are over 1,500 applicants waiting for connexion to the Central Exchange, Melbourne. A new exchange at South Melbourne as part of a plan to relieve the congestion that exists in the city and will permit of those who are waiting getting a service. It would also provide for the development in the South Melbourne area. New exchanges should be automatic. The present switchboard in the Central Exchange has reached the limit of its capacity. The board was built to accommodate 11,700 subscribers, and we cannot put on more subscribers even if there were room to extend the equipment. It would be possible to provide more facilities for answering subscribers, but no provision could be made on the multiple of the switchboard. On no board in any part of the world, except perhaps one or two places where they have freak switchboards, do the number of subscribers exceed 10,000. The size of a switchboard is determined by the physical reach of a telephonist. When a telephonist wishes to make a connexion up to the top of the multiple, she must be able to do so with reasonable comfort. The board is divided into two sections. The subscribers' lines come on in the answering section, where the calling or line

signals are placed. The signal lamps are immediately in front of the operator, and level with her line of vision. When she wants to connect with any one of the 11,000 odd subscribers she has to plug into a multiple. Every subscriber's line is multiplied around the room, so that each number is in front of every girl. The most urgent proposal is that at South Melbourne. Even if we got the approval straightaway, I do not think that we could install the board in less than two years. Specifications have to be prepared and tenders called for. Six months have to be allowed for this, and then the tenders have to be considered. The manufacturer requires from nine to twelve months to fulfil the order, and eight or ten months on top of that to install the apparatus. Most of those who are waiting for service in the city are business people. At the present time there are 1,293 applicants for telephone service in the Central area. Central subscribers to the number of 1,620 will be transferred to the new Collingwood Exchange plus 163 who are now waiting for service in the Collingwood area. In addition 200 subscribers connected to Hawthorn and Windsor will be connected to Collingwood. It does not follow, however, that by transferring 1,620 subscribers from Central that accommodation will then be available at Central for 1,620 new subscribers. This is due to the fact that the introduction of the Collingwood Exchange will bring about a new set of conditions. Every call for Collingwood will have to be transferred through the automatic sending position. When a telephonist receives a call for Collingwood she will have to press a key to put her into connexion with a telephonist on the semi-automatic position. Where calls are transferred from manually operated exchanges to automatically operated exchanges, the telephonist on the auto sending position repeats the number, sets it up on a keyboard, and presses a key, and the call goes out to Collingwood. This operation brings about an increase in the amount of work to be performed by each telephonist in the Central Exchange, and the labour value of each call will be higher than it is at the present time, when each telephonist can complete a call between a Central subscriber and a prospective Collingwood subscriber without help. The condition of affairs mentioned will continue to exist until the Central Exchange is converted to automatic. We shall be able to put back on to the Central Exchange from 550 to 600 subscribers. It is impossible to determine the number exactly until we know how the Collingwood Exchange will affect the position. At present, our estimate is 552, which would still leave 578 waiting for service who could not be connected until either South Melbourne or North Melbourne Exchange has been completed. The completion of Collingwood, South Melbourne and North Melbourne exchanges would completely relieve congestion in the city. The public would then be able to get telephone services without delay. I do not think that the figure I have given of the number of people waiting for service, namely, 1,293, represents the total number of people who want service. Many of them inquire about the prospects, find that they will have twelve months to wait, and go away without lodging any application. In the city of Melbourne we are a long way behind, and in a very serious position. I think North Melbourne Exchange should be completed first, then South Melbourne, and then Canterbury. I have no doubt that South Melbourne should be automatic. I think we are right in extending the automatic system, but I do not think that we ought to scrap an existing manual exchange and convert it to automatic until it has reached the limit of its useful life.

15. *To Mr. Parker Moloney.*—There is a difficulty in getting telephone material. At the present there is a serious shortage of cable. I know that cable is on order for Malvern and Brighton, and the latest advice

is that we are not likely to get it, although it has been ordered for nine months. I think the shortage of magneto telephones has been overcome. I could furnish the Committee with the total number of persons who desire to become subscribers, with particulars as to what is holding them up. The Department has a definite scheme for overtaking the arrears of work. With the new loan the whole of the arrears will be overtaken, it is expected, within three years. I think that £2,850,000 will be spent this year if Parliament approves. If we had the necessary money, shortage of material would not hinder us so much. As far as I can understand, the position in other parts of the world is better to-day than it was some time ago. The post-war troubles are gradually being overcome. There are more telephone manufacturing companies in the field to-day than there were four or five years ago, and I think that in the future we shall be able to get material more cheaply and more readily than in the past. I understand that the question of getting apparatus locally has been investigated, but I do not know with what results.

16. *To Mr. Mahay.*—Proposals for new automatic exchanges are initiated by the State Engineer, who is charged at present with the responsibility of developing the telephone system. Members of his staff make development studies. They study the growth of a town, make surveys, and ascertain the proper points at which to establish exchanges. They put up proposals for new exchanges as occasion arises. The State Engineer prepares the engineering details of the proposal, and submits them to the Chief Electrical Engineer, who concurs or otherwise. The State Engineer, having obtained the Chief Electrical Engineer's concurrence, places the proposal before the Deputy Postmaster-General with a view to getting approval of the expenditure. If the proposal involves an expenditure of over £1,000 it goes from the Deputy Postmaster-General to the Secretary. An interesting report has recently been presented to the British House of Commons on the telephone service in Great Britain. Officials visited America, and after their return made reports and recommendations. The Government approved of certain increases in the rates. There was an outcry against these proposed increases, and the question was referred to a Select Committee. The Committee dealt with the question of rates, and recommended a reduction. The development of the telephone system was also referred to by the Committee, and in its report it makes the following reference to the subject:—

Automatic telephony falls into the category of questions of policy. Steady progress is being made in developing the type of apparatus, especially in the United States. Apparently the first cost is so high that it cannot be said that its adoption would necessarily reduce the cost of giving service, and it is evident that the expectation on the part of the public that the automatic system would immediately cure all service defects is not likely to be fulfilled, although there is no doubt that a faster service would result on the majority of calls. The actual type of apparatus to be employed requires careful study in each case, and no general ruling can be made. The evidence shows that the Post Office have installed, or are planning to install, equipments of each type which is available, and until the commercial results of the introduction of automatic apparatus are ascertained for this country, your Committee do not recommend unduly hasty adoption of the system. The quality of the service is a point on which public opinion has a right to be heard, but the means of attaining it is a technical matter which is chiefly one for the Administration. The report was tabled on the 20th March of this year, and the Committee's decision was arrived at after examining many of the principal engineering officers in England. In South Africa they have also dealt with the question of installing automatic exchanges, and have deferred action owing to high prices. The last report of the Postmaster-General's Department of the Union of South Africa says:—

The installation of automatic systems in the larger telephone centres of the Union, such as Johannesburg, Cape Town, Port

Elizabeth, and Pietermaritzburg, is engaging the attention of the Department. . . . The prices quoted in the tenders recently obtained for these works were obviously based on the high manufacturing costs then current, and, according to the report of the Engineer in Chief, who proceeded to Enroland to inspect tenders and to inquire into the position generally, it is clear that the present is by no means a favorable time for ordering large installations of the automatic type, especially as prices are signs that the early future may bring a fall in prices.

That is what I had in mind in suggesting deferring such propositions. There is nothing to indicate why they are expecting a fall in prices. Recently tenders were received for telephones, and they showed a considerable reduction in price, which is a fair indication that prices are likely to fall still further. Prices of automatic equipment are very high. Collingwood cost £20 per line. Prior to the war, the cost was £8 or £9 a line. Whilst prices are not likely to drop to the pre-war level, I think they are likely to decline below what they are at present. The estimates for automatic exchanges are on the basis of £20 a line.

17. To Senator Newland.—I think the question of the type of appliances will take care of itself in the future. There will be competition between different manufacturers. In the past there has been practically only one company—the Automatic Electric Company, of Chicago—manufacturing automatic telephones. The Western Electric Company are making the equipment on a large scale. Theirs is the panel type. I do not know whether it will fit in with the Strowger type, also Siemens Bros. are designing an automatic plant which will work in conjunction with other automatic installations. I am not competent to express a definite opinion on the merits of these systems. I know what the Strowger system will do, but I cannot say whether it is the best type have had, a single automatic exchange there is no question but that it has worked efficiently. In regard to automatic telephones, that is to say, the equipment used at the subscribers' end, there is plenty of competition. There are the Kellogg people, the Stromberg-Carlson Company, the Federal Telephone Company, Siemens, and the Western Electric Company, all competing for the supply of this equipment. I cannot express an opinion about air-conditioning plants, which is largely a matter for the Works and Railways Department.

(Taken at Melbourne.)

TUESDAY, 15th AUGUST, 1922.

Present:

Senator NEWLAND (in the Chair);
Senator Plain, Mr. Mathews,
Mr. Jackson, Mr. Parker Moloney,
Mr. Mackay,

John Smith Murdoch, Chief Architect, Commonwealth Department of Works and Railways, sworn and examined.

18. To Senator Newland.—The site upon which it is proposed to erect a telephone exchange building at South Melbourne is at the intersection of Bank, Crown and Green streets, the remaining boundary being towards a right-of-way between Green and Crown streets. The site has a frontage of 55 ft. 3 in. to Crown and Green streets, and 101 ft. 9 in. to Bank-street and the right-of-way. Of these thoroughfares, Bank-street is the most important, but Crown-street is also a good one. The proposed building is of the type into which the Committee has previously inquired. The building will be one story, and the

accommodation to be provided will include a switch-room 66 ft. 2 in. long by 52 ft. 6 in. wide, a battery-room 33 ft. 2 in. long by 22 ft. 6 in. wide, and an air-conditioning room 22 ft. 6 in. long by 18 ft. 3 in. wide; in addition to which there will be the usual retiring room for the staff, with lavatories. The construction is to be of brick, one story, with parapet walls. On this particular building we do not propose to have overhanging eaves. A flat concrete roof will go over the battery-room, air-conditioning room, and staff room; and, since the plan of the building was drawn, we have now made it a practice to put in fireproof concrete ceilings over all the switch-rooms in the different telephone exchange buildings which we are called upon to construct. In this particular building some difficulty arises inasmuch as the width of the switch-room is 52 ft. 6 in. It becomes rather expensive to provide a concrete ceiling over this room unless the Postmaster-General's engineers will so arrange equipment in order to avoid a row of concrete supports which would have to be put up the centre of the building. If that cannot be arranged, I propose to hang a light concrete ceiling on to the roof trusses, as in the original Adelaide Telephone Exchange. That has proved quite successful, although, of course, it does not provide the same security against fire as does the Postmaster-General's Department is agreeable. If shall put in five stations, which number will be necessary in order to carry the flat ceiling. These would be concrete stanchions about 1 foot square; they would interfere to some extent, necessarily, with the accommodation within the room; but it may be possible to arrange the layout of the equipment so as to avoid them. We have had to build in this way in certain other exchanges. The alternative method would be to put up beams of a large depth, perhaps, in this case, 4 feet deep, to span the 52 ft. 7 in. width.

19. To Mr. Mackay.—As to the point whether a fireproof ceiling is a matter of importance in a one-story building situated as this will be, the Collingwood Exchange may be regarded as the first, and experimental, building of this character. We did not provide concrete ceilings, and have been sorry for it since. Perhaps the actual risk of fire is slight, but the services are so important, and its derangement would be so serious to the community, that cost of fireproof construction as against possible financial loss in commercial circles have to be weighed together. The business loss might be almost incalculable, while the cost of putting in a fireproof concrete ceiling is not very great; it would never exceed £200.

20. To Senator Newland.—The cost of a concrete ceiling has not been allowed for in this estimate, but that is not important, since the ultimate cost, even with improvements, may be a little less than the full Adelaide Exchange of the present estimate. In the original proposal we simply hung a ceiling on truss, but I would not place a great deal of reliance on the behaviour of a ceiling of that kind in the event of a fire from overhead; that heat would be bound to distort the light members composing a roof truss; and in the circumstances, the ceiling would be almost certain to fall. The clear ceiling height of the proposed building is, over the switch-room, 14 feet, and, over heights which we are now employing. The site on which the building is to be erected cost £1,200, and the estimate of the building is £5,913. The estimate of putting in a concrete ceiling will; but the proposal for it. The stanchion design will not considerably affect what be involved in putting in a concrete ceiling. The estimate for the air-conditioning plant is £2,350. I do

not know that the experts have arrived at any fresh decisions or procured any new important information in regard to air-conditioning. Colonel Owen and the engineers concerned have been given a great deal of consideration to the subject, but I do not think anything has been obtained which promises much that is new or substantial in the way of reducing the cost. They have been consulting an American engineer of scientific attainments. One of the points to be solved in the future is that, perhaps, in all the climate of Australia it may not be necessary to apply all the these things. While the estimate of the cost may appear to be high, in comparison with the actual telephone equipment in the exchange it does not amount to much. It is only another form of insurance. If it increases the life of the equipment and renders the service much more efficient, its cost cannot be regarded as excessive. The conveniences for the staff in this building include a luncheon-room or recreation-room, lockers, sink, and gas-ring for boiling tea and heating the mid-day meal. There will be the usual provision of lavatories. The roof will be of iron; this will be practically hidden by the parapet wall.

21. To Mr. Mathews.—The architectural appearance of the building fronting Bank-street will be modestly effective. There should not be any criticisms of this practical work from that point of view. In such a neighbourhood the fire risk should be only very slight. The building will be of brick.

22. To Mr. Parker Moloney.—I assume that the price which the Government paid for the land is fair value. I think it is a cheap property; at any rate, it is cheap to the Government, because the block in question is the site best suited for the service to which it is to be applied.

23. To Mr. Mackay.—I should say that the cost of a fireproof ceiling compared with an ordinary ceiling would be about double. There is nothing inflammable about the interior of a telephone exchange, but electricity is considerably used, and there is always the possibility of a short circuit or some such unforeseen happening. The benefit of the fireproof ceiling is that it prevents the interior of the building from being attacked by a fire from outside and coming down from overhead. As to the advisableness of putting in a fireproof ceiling in view of the ideal qualities of this site, it must not be forgotten that in years to come there may be added fire risks by the erection of warehouses and the like in very close proximity. This again, fire may conceivably break out between the ceiling and the roof itself. A concrete ceiling would cut off the danger from that source and preserve the costly plant and equipment.

24. To Senator Plain.—I estimate that the cost of the part of the building which is to accommodate the air-conditioning plant would be about £430; it comprises a concrete floor, concrete ceiling, and four walls. From the bottom of the foundations to the top of the flat concrete roof is 18 feet.

25. To Mr. Mathews.—The building will cover the whole of the ground. I am of opinion that the site is an ideal one.

26. To Senator Newland.—A concrete ceiling hung from the roof would not be a fireproof barrier in the event of fire attacking the building from the top. In such event the heat would first lift the light steel members in the roof, and the effect would be to bring the ceiling down. But such a ceiling would certainly retard a

fire, and that would be an invaluable consideration since the fire brigade station is near at hand. Further, with such a type of roof it would form protection to the plant from damage by water in the event of a fire being attacked by the fire brigade. To some extent the ceiling would be anchored to the walls; but, as I have already stressed, it is not to be preferred to a concrete ceiling supported, in this instance, by stanchions. There would not be very much difference in the cost of the two types of ceilings, but I shall do my best to get the Postmaster-General's Department to concur in the provision of a concrete ceiling supported by fire stanchions. The departmental engineers do not know, but it is just possible that this building may have to go up another story. The accommodation to be provided is intended to be adequate for a period of fifteen years, and the engineers are not in a position to prophesy what may be required thereafter. The plans have been prepared after full consultation with the Postmaster-General's officials. The supervising engineer, Mr. Brecher, is a most satisfactory man to work with. He has rendered every possible advice and assistance. One of our architects is specializing with him in this class of work, and they have full power to confer upon every possible point that may crop up. Their offices are adjacent, and, altogether, they have been able to work thoroughly and harmoniously together, to the great advantage of both Department and the incidental saving of much correspondence. With respect to bricklayers. Bricks themselves are not easy to procure; the output is behindhand; but in other lines the costs are slackening. Timber is slightly down; steel and cement are decidedly cheaper, while iron has eased. The brick position, however, is very acute; the material is pointed out, bricks are not easy to secure, while labour is very scarce. We cannot get tenders for buildings outside of Melbourne; that is due to the paucity of bricklayers. We are paying about 30s. a day to bricklayers if we send men out into the suburbs. There is, of course, a great deal of brickwork going on at present, which accounts chiefly for the scarcity of labour. The trade, and for that reason it would appear that the position with regard to labour may become even more difficult.

(Taken at Melbourne.)

THURSDAY, 17th AUGUST, 1922.

Present:

Senator NEWLAND, in the Chair;
Senator Plain, Mr. Mathews,
Mr. Jackson, Mr. Parker Moloney,
Mr. Mackay

Andrew Lewis, Chief Mechanical Engineer, Department of Works and Railways, Melbourne, sworn and examined.

27. To Senator Newland.—I have held my present position for only two weeks; but I have been acting Chief Mechanical Engineer for varying periods. I have had experience with air conditioning and similar plants for the last twelve years. I have been in the Commonwealth Department for seven years; but, prior to that, I was engaged in the New South Wales Public Works, and in the Railway Electrical Engineer's Branch, where I had experience in connexion

with ventilation schemes for turbo alternators in large power houses where ventilation and dust extraction systems, which are similar to air conditioning plants, are applied. Many types have been tried out, but the latest practice is to use a somewhat similar plant. Refrigerating plants are not used as the air or turbo alternator cooling is at a higher temperature than is necessary for providing comfortable conditions for a staff and for improving the efficiency of the more delicate apparatus employed in connexion with an automatic telephone exchange equipment. In the plant to which I have referred the water is atmospherically, and not mechanically, cooled. An ammonia plant is not used in such systems. The mechanical construction of a turbo alternator set is more substantial, and the allowable limit of temperature is in the region of 100° to 160° Fahr. It is practicable to have an atmospheric temperature with a high percentage of moisture content without risk of damage to such electrical apparatus. The problem is to remove the dust and to cool the winding of the electrical machinery. In connexion with automatic telephone exchanges the comfort of the staff has to be considered, and high temperatures are not desirable. I designed and installed the ventilation plant in the Malvern telephone exchange, and the air treatment plants at Castlereagh-street, Sydney, and Perth automatic exchanges were installed by me. I was also associated with the late Chief Mechanical Engineer installing the plants at the Adelaide telephone exchange and the Lonsdale-street, Melbourne, exchange, and a number of minor works. The experience I have gained in connexion with these plants has convinced me that an installation such as that at Collingwood is quite necessary in order to obtain the conditions required. There may be some small modifications in detail, such as slightly increasing or decreasing a particular section as the result of experience, but, generally, I would say that a plant similar to that at Collingwood is necessary in an automatic exchange. Whether such plants will do all we expect can be ascertained only by actual experience, but I am convinced that we are working on right lines. I believe that any modifications that may be adopted will be only minor, and that future development will be on the lines on which we are working. Any reduction in cost that I can foresee at present will not amount to more than 10 per cent. of the total cost, but I cannot see any opportunity of reducing the cost even to that extent. For the information of the Committee I have prepared a brief description of the air-conditioning plant required at automatic telephone exchanges, and the following information will apply particularly to Collingwood:—

The building includes a main switch room approximately 90 feet by 45 feet by 15 feet, and a battery room 28 feet by 29 feet by 10 ft. 6 in. The equipment is capable of changing the air in switch room six times per hour, requiring 6,000 cubic feet of treated air per minute, and of changing the air in battery room ten times per hour, requiring 1,440 cubic feet of air per minute, making a total plant capacity of 7,500 cubic feet per minute. Six (6) large registers are provided along main north wall of switch room, spaced 15-ft. centres, and 11-ft. centres above floor level for the ingoing air, and return registers are provided in floor along south wall

capable of handling up to 50 per cent. of the ingoing air. The circulation is intended to be across room and falling to floor level. The velocity of air across the main centre plane of room approximates 5.5 feet per minute.

AIR TREATMENT.

The air requires the following treatment:—

- (1) Dust content eliminated.
- (2) Warmed as required to maintain the temperature inside exchange at 60° to 65° F. with an external temperature at or above 32° F.
- (3) Cooled as required to maintain the temperature inside exchange at or less than 75° with an external temperature up to 100° F.
- (4) Moisture content regulated to maintain humidity at 60 to 65 per cent.
- (5) Constant motion of air in switch room with freedom from draughts.

The plant consists of a volume fan, washing and cooling chamber, water elimination battery, heating battery. Dust.—The air is washed to eliminate dust, &c., by passing through two banks of water sprays spaced at 5-inch and 44-inch centres; when in operation these sprays form two fairly thick walls of finely-divided water particles in motion, one set being opposed to the air flow and one set assisting the air flow. The dust removed from the air is carried down with the water to the cooling tank from which provision is made for sludging as required.

HEATING.—The air is passed between "Vento Heater" units, containing 463 square feet heating surface. Hot water is circulated through the inside of heaters by means of a centrifugal pump, and the surface temperature can be maintained between 80° F. and 200° F. as required. The heating battery has a maximum capacity of 360,000 B.T.U.'s per hour, and is capable of raising the air temperature through 42° F.

COOLING.—The air is cooled by direct contact with the spray water which is re-circulated in the system, being forced through spray jets by means of a centrifugal pump having a capacity of 1,780 gallons per hour. On leaving the sprays the water falls to a cooling tank under the washes casing, and passes over refrigerator coils to the pump suction pipe for re-circulation to sprays. The cooling coils have a capacity of 107,000 B.T.U.'s per hour, and are capable of reducing the spray temperature 6° F., which in turn is capable of reducing the air temperature through 13° F., in addition to the normal evaporation cooling effect.

MOISTURE CONTROL.—The air is passed through eliminators consisting of deflectors having the surface maintained wet by means of scrubbing sprays. Surplus water in the form of spray or suspended water carried through with the air is deposited on these wet deflectors. To maintain the relative humidity or percentage of saturation of the air at 60 to 65 per cent. at comfortable temperatures, it is necessary at times to remove a portion of the water vapour content of the air. This surplus vapour is removed by condensation in direct contact with the spray water which is cooled to a practical limit below the required "dew point" or saturation temperature. The vapour condensed is combined with the cooling water and falls back to tank.

I have also a detailed description of an equipment, with brief notes as to its functions. It is as follows:—

Name.	Capacity.	Driven by.	Used for.
Heating Service.			
Boiler with Pressure Gauges and Thermometers	344,000 B.T.U.'s per hour	..	Heating water at low pressure
Boiler Circulating Pump with Valves and Piping	1,500 gallons per hour	1 h.p. motor	Circulating hot water between boiler and heating battery
Heating Battery with Expansion Tank and Piping	473 square feet direct radiation surface	..	Heats air to suit conditions required

Name.	Capacity.	Driven by.	Used for.
Ventilating Service.			
Centrifugal Fan	7,500 cubic feet air per minute	5 h.p. motor	Draws fresh air supply from outside building, and circulates air through washer conditioner and heater. Maintaining circulation in switch-room, and forcing conditioned air into battery-room. Flows with screen and cover, passage for fresh air to conditioning plant.
Fresh Air Inlet	2' 3" x 2' 3"	Distributes conditioned air into switch and battery rooms
Conditioned Air Registers and Connection Pipes	Provides passage for portion of air in switch-room up to 60 per cent. of supply, returning same for re-treatment
Return Air from Switch-room, Registers, and Ducts.	Thoroughly mixes water with air, and reduces air to temperature required for conditioning, and precipitates solid impurities into cooling tank for removal of sludge
Air washer	64 washing sprays	..	Air is divided into streams between zigzag plates; sprays maintain portion of surfaces wet, and air in following zigzag course comes into contact with wet surfaces and deposits surplus water particles with dust and impurities into vertical channels connecting to cooling tank
Eliminators and Scrubbers	232 square feet, with seven sprays	..	Lifts water from cooling tank, and supplies water to sprays
Spray Pump	1,800 gallons per hour	3 h.p. motor	..
Cooling Plant.			
Refrigerating Compressor ..	Approx 6" dia. x 10" stroke x 120 revs. per minute	17½ h.p. motor	Circulates ammonia vapour, enabling it to extract heat from cooling tank, and transfer it to condenser, where heat is removed by means of the cooling water
Condenser, Circulating Pump	1,800 gallons per hour	..	Circulates water over water cooler and condenser, enabling water to be used over and over again
Cooling Tank	11' x 6' x 3' 3", contains 1,075 of 1½" cooling pipes	..	Ammonia circulating through coils extracts heat taken up by water when washing and cooling air, also cools the water to the temperature required for correct humidity. It also a sludge-depositing tank, from which impurities taken from air are periodically removed
Condenser and Water Cooler	Water cooler, 100 square feet; condenser feet, 1½" pipe	..	Distributes water over large perforated surface through which outside air passes, and extracts heat taken up by water in passing over, and cooling ammonia vapour in condenser coils
Vacuum Cleaning and Compressed Air Service.			
Vacuum Producer with Dust Extractor	40 cubic feet of air per minute	..	Maintains a vacuum of 3½" mercury at the valve plates situated at convenient positions in building. The dust disturbed in sweeping and dusting is drawn into loose pipes and carried through dust collector, where dust is deposited for removal at convenient times
Air Compressor	6" x 3" duplex	5 h.p. motor	Fitted with storage reservoir and dehydrator. Supplies a jet of compressed air for blowing dust from surface of telephone equipment too delicate to be touched by sweeper. Jet is used in conjunction with vacuum cleaning hose, which collects the air containing the disturbed dust
Battery-room Extraction System Motor-driven Fan	Fan, 1,400 cubic feet per minute	1 h.p. motor	Extracts from battery-room, discharging to atmosphere

The following is a schedule of itemized estimates:—

Ventilation, fan, ductwork registers, &c.	£650
Air conditioning and washing	625
Refrigerating plant, with condenser	1,600
Heating	550
Compressed air cleaning	300
Vacuum cleaning	325
Battery-room extraction	100
	£4,050

Of this amount some £520 has been expended on plant (motors and boiler) manufactured in Great Britain. Some £140 has been expended on American plant (heater units), and the balance is Australian. The original estimate of the cost was £3,500; but that was made before detailed plans of the equipment were completed—perhaps two years ago.

28. To Mr. Jackson.—The increase in cost is to some extent accounted for by the fact that we have modified our plans. The estimates were prepared on sketch plans, and we have subsequently found it necessary to modify the details which has made the cost somewhat higher. There has also been some slight increase in the cost of the plant. I believe that the plant will do all that is required, and will fulfil the requirements of the Electrical Branch;

29. To Mr. Mathews.—The installation at Collingwood has only been completed for three days, and, consequently, it has not been handed over to the Postal Department. At present we are testing it. It was necessary to heat the building before the equipment was ready in order to protect the plant during erection, and the window panes, which were removed, are now being replaced. There is, of course, a great fluctuation in Melbourne temperatures, and the plant has been designed to meet all emergencies. We are supplying fresh air to the battery room, as the vapours which are given off when the batteries are being charged have to be withdrawn for the protection of the plant, and to insure the comfort of the staff. A fan is installed for drawing off the foul vapours, and fresh air is pumped in through this air conditioning plant. The battery room is separated from the room in which the main apparatus is situated. If the water were left for six or eight weeks a deposit of 2 inches of mud would be found at the bottom of the tank. In the summer time a deposit of about 1 inch of mud is found after every two or three days. The estimated cost of the heating apparatus is £550, and this is made up by the cost of the boiler and the heater inside the conditioning plant, and also the circulating pump for distributing the water between the boiler and the heating units. At first glance the cost may appear excessive; but it must be remembered that much of the

apparatus cannot be seen as, for instance, the cooling coils, which represent, approximately, 1,000 feet or in the tank underneath the floor. A smaller plant to solve about 1,000 lines would cost about £2,750. A large plant would cost from £7,500 to £8,000, apart from the building. As an engineer, I think the Department is justified in assuming that the apparatus will do what is required.

30. *To Mr. Parker Moloney.*—The plants which I have had experience in New South Wales are somewhat different to the air-conditioning plants installed in automatic exchanges. The dust extraction and washing is similar; but the cooling by mechanical means is different. I have not had a lengthy experience of air-conditioning plants which are similar in every detail to that now under consideration. In order to provide ventilation for electrical machinery we commenced by using dry air screens in the form of cheese cloth for extracting the dust, through which the air was pumped to the electrical plant. We found, however, that the screen became impregnated with dust, and when they became superheated particles of dust separated from the cheese cloth were carried through with the air. When it became apparent that such screens were ineffective, we experimented with water sprays, and also tried wet plates to catch the particles of dust which were later washed into the sink. We then introduced air washing by means of sprays, and that system is now in force. I have received a pamphlet issued by the American Blower Company, which describes an air-conditioning plant which was installed at Grand Rapids ten years ago, and which is somewhat similar to those now under consideration. I have been in communication with the firm, and have been informed that the plant is giving satisfaction. Similar plants are now in use in America in connexion with blast furnaces for dehydrating air before entering the furnaces, and they have been found of great advantage from a combustion and coal-saving point of view.

31. *To Mr. Mackay.* We are aiming at making the building air-tight, but we have not reached the stage of other countries by installing double switch room to insure that the air inside is blown outward through the joints, if there are any, and all air entering the building, therefore, comes through the air-conditioning plant. When the temperature in Melbourne is very high, particularly during the summer months, and dust storms are prevalent, the plant will have to be in operation for twenty-four hours a day, but, under favorable conditions, an average of eight hours per day should be sufficient. The present equipment has been designed from plants manufactured by a half dozen firms in America, and, perhaps, one or two in Great Britain. We have adopted the best features from any plants of which we have a knowledge. As far as I can ascertain, no patent rights are particularly objectionable, and it would be unwise for any one to remain in the battery room for more than five minutes unless provision were made for purifying the air. Even if the whole of the ceiling were open vapours would still be given off from the batteries being charged, and it would be in the main switch room, and not the battery room. The comfort of the staff has to be considered, but the protection of the plant is more important. At Collingwood, for instance, the staff will number from four to six. With a 10,000-line plant we would require a refrigerating plant of probably 20 tons capacity. At Collingwood the plant has a capacity of 8 tons, and the smallest installation would require a plant of 1½ to 2 tons capacity. The refrigerating costs would, therefore, be proportionate to the tonnage of the plant. A fan for a very small exchange would not be more

than one-fourth of the size of the one at Collingwood. Owing to the smallness of the staff it has previously been thought that it would not be necessary to change the air in the switch room more than once an hour. The operating conditions are such that the staff would not be comfortable with less frequent changes than six per hour, and the plant would also suffer to some extent. A plant of 1,000-lines capacity would be quite unsuitable for a larger exchange as it would not introduce sufficient fresh air. The plant at Collingwood has only been in operation for three days, and we will watch its operations closely for perhaps the next two years. I am sufficiently satisfied with the efficiency of our present installation to favour the introduction of further plants, and I believe the Committee will be justified in recommending additional installations. I realize that it would be disastrous if it were found later on that the plants were quite unsuitable for the work for which they were designed, and in view of my experience, which extends from ten to twelve years, I am led to the conclusion that we are acting on right lines. There may in future be some slight modification in the design, but the ultimate effect would be the same.

32. *To Senator Newland.*—I believe the plant installed at Grand Rapids, is somewhat similar to that erected at Collingwood, although there are some slight modifications in detail. If anything I believe it is smaller than the one at Collingwood, as it treats only 5,500 cubic feet of air per minute as against 8,500 feet at Collingwood. The system of refrigerating is approximately the same. The cost of installing the plant is not given; but such figures would be of little use, seeing that it was erected ten years ago. The cost of the plant at the switch room at Grand Rapids is 54,000 cubic feet, and that at Collingwood 60,000 cubic feet. I communicated with the American Blower Company, and asked if any developments had occurred in connexion with this particular type of plant, and in a reply dated 10th October, 1921, I was informed that the plant had been in continuous operation, and has been giving satisfactory results.

(Taken at Geelong.)

TUESDAY, 22nd AUGUST, 1922.

Present:

Mr. MATHEWS (in the chair);

Senator Foll, Mr. Mackay,
Senator Plavin, Senator Plavin,
Mr. Jackson, Mr. Parker Moloney.

Robert Stark Frater, Foreman Mechanic, Telephone Exchange, Geelong, sworn and examined.

33. *To Mr. Mathews.*—I have held my present position for about eleven months. Before coming to Geelong, I was engaged at the Malvern Exchange for about four months, at the Brighton Exchange and at the Lonsdale-street Exchange for about five months. I have been through various branches of telephonic work in the department, and have been promoted from time to time until I have reached my present position. When I came to Geelong in September, 1921, the present heating system was being installed, and although the moisture in the atmosphere at that time of the year was not very pronounced, the conditions towards the end of March and during April of this year were detrimental affected the automatic apparatus. The heating plant was not handed over until March, and during one wet week prior to that, electric radiators had to be installed at various points, particularly on the end of March. The radiators had to be kept in operation continuously for a week, and since the present heating apparatus has been in use, we have not had the same trouble with moisture. With

the use of electric radiators, and the assistance of more suitable atmospheric conditions, the insulation" was brought back to normal, although it was more than a week before the working conditions were satisfactory. During that period, moisture was deposited not particularly on metal portions of the plant, but on the insulation, which was badly affected. The casing does not prevent moisture getting in, as the switches are not enclosed, as they are in some exchanges.

34. *To Mr. Parker Moloney.*—Prior to coming to Geelong, I had not had experience with a similar heating apparatus. At Lonsdale-street, trouble was experienced owing to low insulation, caused by excessive moisture, which affects the operation of the switches. Such conditions are detrimental to the working of an exchange, and have to be guarded against as far as possible, because when the insulation fails, not only is the service affected, but the cost of maintenance increases. I understand that efforts have been made to improve the conditions at Lonsdale-street, but I do not know what has been done. I am satisfied that air conditioning is the only way of making the atmosphere suitable for the operation of an automatic exchange. The dust particles interfere with the successful operation of the plant, and at present these have to be removed by hand, which is slow and cannot be done effectively. Particles of dust may get on various points of contact, and may cause the line to remain open, and thus affect the calling of a subscriber. During very wet weather, members of the staff have complained of the atmosphere in which they have to work. It would be useless to open the windows to ventilate the room, otherwise the heat given off by the radiators would be minimized to such an extent that it would be worthless. Members of the staff have been absent for a day or two at different periods in consequence of severe colds, and considering the circumstances, it is a wonder that there have not been more complaints. I could not say, however, that the temporary indisposition can be attributed to the atmosphere.

35. *To Senator Foll.*—The present heating plant does not enable the automatic equipment to operate as successfully as it would under ideal conditions, and I certainly would not advocate the installation of heating plants instead of air-conditioning plants. With a proper vacuum plant, all dust that could be moved by an air current would be lifted. I would not favour the use of a vacuum cleaning plant, without an air-conditioning equipment which is designed to prevent damaging substances even entering the building, which is infinitely better.

36. *To Senator Plavin.*—We do not have many complaints from subscribers, mainly because the equipment is under very keen observation all the time, and every effort is made to prevent complaints being lodged. In other centres, I was engaged on construction and not on maintenance, and cannot, therefore, compare the installation at Geelong with similar plants elsewhere. The connector switches are not enclosed; and if dust lodges on a particular part connexion with a subscriber may not be established. If they were enclosed, the conditions would be improved, but dust in the atmosphere would not enter when the casing had to be opened. I have not had experience with an up-to-date air-conditioning plant, but I think that if the air were clear, many of the present troubles would disappear. Dust is as detrimental as moisture; the effects are different, but both undesirable. The present heating plant has improved the humidity, but it has not overcome all the difficulties associated with a moist atmosphere. The temperature in the room is regulated when necessary by opening the windows because the outside atmosphere may be moist or dust-laden. The trunk line switches could

be operated from another room, but the automatic equipment would remain, and would have to be considered just the same. I am strongly in favour of an up-to-date air-conditioning plant being installed.

37. *To Mr. Jackson.*—If the air is not conditioned, an unsatisfactory service may result, and when the weather is particularly unsuitable, the difficulties are intensified. When the switches are cleaned by hand, they are also adjusted, and I could not mention the time between cleaning and adjusting. An adjustment of the terminals would be necessary even with an air-conditioning plant, and the conditions prevailing would govern the adjustments. If this exchange were a privately-owned concern in which I was financially interested, I would favour the installation of an air-conditioning plant.

38. *To Mr. Mackay.*—The building is at present heated with water pumped from a boiler in the basement by means of a small motor. The water circulates through pipes and radiators throughout the whole building, and is then returned to the boiler. I believe the present heating system could be utilized in connexion with an air-conditioning plant. The mechanics in the exchange do the necessary cleaning of the switches. The cleaning of the floors is done by contract labour. The total number of primary line switches in the exchange is 1,600, and the question of further extension is now under consideration by the engineers.

39. *To the Chairman.*—The removal of the trunk line switches to another room is being considered, but the cost of such transfer would depend on what was done; and the quantity of material required. There is ample space in the present switch-room for the staff, provided the air were suitable for working in. When the door is opened, a certain quantity of dust is admitted. Before the floor is swept, specially prepared sawdust is scattered and every effort is made to raise as little dust as possible. Moisture affects the wiring principally between the ends of the cables where they are exposed to the air. In certain circumstances, air conditioning is necessary in a manual exchange, particularly where the moisture in the air is excessive. There is an air-conditioning and vacuum cleaning plant at Malvern, and even though the cost of such plants may be considered high, the expenditure in my opinion is justified. Mechanical wear must be expected, but I can not say the extent to which it is aggravated by dust. The ill-effects of moist atmosphere have been demonstrated, particularly when we had to use electric radiators on different parts of the circuits, wiring, and switches. So far as I have been able to judge, the atmospheric effect is more apparent than the effects of dust. Only minor parts of the equipment have had to be replaced, and that would be necessary under any system. The wearing has doubtless been accentuated by the presence of dust. We have certain toll-tale signs which indicate the presence of defects, such as a switch not functioning in the apparatus, and a percentage of these faults is caused by dust. Moisture lowers the insulation, and at times we have had to renew small parts or re-insulate them.

40. *To Senator Plavin.*—The parts that have been replaced are not expensive, but a good deal of a mechanic's time is taken up in effecting repairs. An air-conditioning plant is necessary to give subscribers the service to which they are entitled.

41. *To Mr. Mackay.*—If the subscribers are satisfied, it is because the plant has been carefully watched. The public prefer the automatic to the manual system.

42. *To Mr. Mathews.*—We rarely hear complaints concerning the recording meters. I have no recollection of a meter over recording, but can recall two instances in which the meters were not operating properly. Generally speaking, the meters are very reliable.

The witness withdrew.

Edgar Beecher, Supervising Engineer, Postmaster-General's Department, Melbourne, recalled and further examined.

43. *To Mr. Mathews*—There are, I believe, several points in the evidence of Mr. Frater which may not be quite clear to the Committee. I understood him to say that the covers would keep out moisture whereas they will keep out only dust. Insulation resistance means the ability of the conductor to transmit the power applied to it without any leakage occurring, and with a conductor suspended in the atmosphere, unless it is perfectly insulated, some of the power will leak to earth. If the leakage is serious the circuit to which the voltage is applied will not operate. With low insulation resistance, there is always the danger of a subscriber not being able to operate the mechanism in consequence of much of the power leaking to earth instead of flowing through the circuit. With low insulation resistance circuits connected with a manual or automatic system cannot be successfully operated because some of the power will leak to the ground. In a manual exchange the current must flow along the line to energize a relay in the exchange the operation of which lights a lamp. If there is low insulation resistance, instead of the power passing along the circuit and the relay to light the lamp it leaks to ground and consequently does not energize the relay and the lamp is not lighted. If the insulation resistance is low the relays in the selector will not allow the moving parts to stop at the necessary point or to rotate in the manner desired, owing to the leakage of power from the circuit. With low resistance there is also the danger of induction from neighbouring circuits. The inductive effects from the starting and stopping of electric trams and that from electric lighting mains would also be perceptible. These are important factors, and all tend to interfere with an efficient service. When dust is deposited on the switches, it invariably finds its way to the contacts associated with the relays of switches. If dust lodges on the switches a subscriber in attempting to dial his number would not be connected to the subscribers number called. He would simply dial on an open circuit line. He would then have to use another instrument, or direct the mechanic's attention to the defect by some other means in order that the defect could be remedied. The mechanic in charge has the plant under his constant supervision, and when defects in the first selector occur they are noticed, and immediately rectified. The life of an automatic equipment has been set down at fifteen years until recently, because plants had not been in operation long enough to form an estimate, and fifteen years was the expected life of an up-to-date manual system. Quite recently, the engineers in the British Post Office have determined that the life of an automatic equipment should be twenty years. From literature I have read, I know there are plants in America that have been in operation for nearly twenty years. A proposal is under consideration for installing an additional 400 lines, to meet the demand for additional services. It is quite practicable to remove the trunk line switch board, which has outgrown its capacity in the present state. It is proposed to extend it, and remove it to another room, but the work will not be costly. The size of the present board will have to be doubled, and the cost involved is estimated at about £4,940. The air in which the trunk line switchboard is to operate should be conditioned, because if an efficient service is to be maintained the atmospheric conditions must be suitable. In the past low voltages were tried and were found inefficient, and if persons are to converse over long distances the voltage must be high, and, generally, the equipment up to date. The common battery manual equipment started operating with 24 volts, but now many modern manual equipments operate on 40 volts.

The automatic equipment commenced with a voltage of 48, but one company is now operating on 60, and within a few years I believe 100 volts will be used. The result will be better transmission. I do not think the cost with a higher voltage would be greater. The plant installed at Lonsdale-street Exchange is really a heating plant, and although provision is made for ventilation, it cannot be compared with that at Collingwood.

44. *To Senator Plain*—I have been asked what effects lighting cables would have on telephone wires if supported on the same poles. If single phase alternating current were employed, such a system would introduce inductive effects on to our circuits, and if the transmission lines fell across our wires, it would throw all lines in that neighbourhood out of service. The fuses in the exchange are designed to carry a certain amount of current and if electric light wires are thrown across ours, a greater current is sent over the subscriber's line, and a subscriber's apparatus disabled until the electric light mains wires have been removed, and the fuses at the exchange replaced. Such accidents, of course, would be rare.

45. *To Mr. Mathews*—I was not associated with the original introduction of automatic equipment in Victoria, and so far as I know, I do not think air conditioning was then thought to be necessary. It has been found necessary during the past eight years. Although the Geelong plant has rendered good service, I am firmly convinced that air conditioning is necessary for automatic exchanges, particularly of the Strowger type. Delays and inconvenience here have been overcome by endeavouring to anticipate defects. I do not favour a heating and domestic vacuum cleaning plant because the latter would not meet the case. Dust should be prevented from entering the building. When dust settles firmly it cannot be removed with a pressure less than 50 lbs. per square inch, and an ordinary vacuum cannot exert that pressure. Such a plant would also cause great trouble by disturbing the dust at one point and allowing it to settle in another. I have questioned the present exchange foreman and his predecessor and both these officers have assured me that with one day's rain the effect is not apparent, but if the moist conditions extend beyond one day the complaints from subscribers increased because of low insulation resistance. That clearly demonstrates that heating is necessary, but heating only causes the air to become vitiated, and the health of the staff should be considered. The foreman here and the officer now in charge of the installation at Collingwood assure me that in the summer time they had constantly to be at the switches in order to remove dust, and it is useless employing a vacuum plant to prevent dust. We should introduce clean air, and in doing so, would be beginning at the proper end and so incurring a minimum of work in maintaining the plant. The heating plant at present installed could be utilized in conjunction with a conditioning plant. Leagues utilize all the reserve power at our disposal. The generator charges the batteries which give power to the switches, and if there is low insulation resistance on any of the exchange or subscribers' circuits, there is a constant drain on the batteries. If there is a big leakage the batteries have to be charged more frequently than if the insulation resistance was normal. The power leaks away to earth and the only way of making that up is by re-charging the batteries. I only know what is being done in other countries by what I have read. I installed the automatic exchange at Newry, in Sydney, and I do not think the plant had been in operation three months before we had to start restoring circuits with insulation resistance by artificial means. We had to introduce radiators, and the same trouble occurred at Glebe and Balmain. At the Glebe exchange

we tried what is known as the "Hair" hygrometer control system. A light metal contact was fitted to the hygrometer, and when the humidity approached 70 per cent. it made a contact with the power circuit which threw in a switch which in turn operated the radiators in the room. Associated with the radiators were fans which blew hot air throughout the equipment. While that restored the humidity it made it unbearable for the staff because the windows could not be opened, and it was not long before that arrangement had to be abandoned. At Ashfield, in New South Wales, there was very little trouble with humidity, and it was only occasionally that radiators had to be used. But at Mosman, where no power was available, I was in trouble in attempting to reduce the humidity below 70 per cent. because the contractor would not agree to gas fires for the reason that the fumes from the gas fires would damage the apparatus before it was hauled over. After a good deal of persuasion we were allowed to use gas fires. During the installation both at Ashfield and Mosman there was a tremendous quantity of dust, and after tests had been made we found it was interfering with the service to such an extent that boys were employed to keep the plant in operation by calling up members, otherwise users would have been a failure in cutting the plants into service. Briefly, Mr. Golding's opinion is that we are more advanced in the matter of air conditioning than any other country in the world. Mr. Golding did not convey the impression to me that there is not as much need in other countries as there is here with the exception of one case in India where a company installed a manual plant which could not be operated owing to excessive humidity.

46. *To Mr. Mackay*—I could not offhand give the estimated cost of an air conditioning plant for the Geelong switchroom; but I do not think the staff would be very much increased. I have not ceased keeping closely in touch with the latest developments and I should be delighted to say that a more economical system could be introduced. But at present I do not know of a more suitable plant than at Collingwood, which I am sure will meet all needs. If it does we may be able to economise on other plants. On a five figure call 10 seconds is required to make a local connexion on an automatic exchange, but if a lower number is required the time is correspondingly reduced. On the most up-to-date manual plant a telephonist is allowed 16 seconds in which to set up a local call which takes 10 seconds on an automatic equipment. In the case of a transferred call via order wire a telephonist is allowed 8 seconds longer or 24 seconds in all, and the automatic equipment will do the work in exactly the same time, i.e. 10 seconds. Considering the service rendered by an automatic exchange I have no hesitation whatever in saying that the expenditure on an air conditioning plant to insure satisfactory work is more than justified, and is in the end a low insurance premium to provide efficiency.

47. *To Mr. Jackson*—If I were a mechanic employed in the switchroom at Geelong I would represent the matter of working conditions. I know we will get more satisfactory work from the staff at Collingwood than at Geelong owing to the better conditions prevailing. If modern air conditioning plants are not being used in America the automatic exchanges cannot be giving the services which should be expected if them if the atmospheric conditions are the same as here.

48. *To Mr. Parker Moloney*—The plant in India to which I referred was a manual one, and if it had been an automatic equipment air conditioning would have been necessary. Where relatively high voltages are employed and proper transmission and reception is necessary, low insulation resistance on the wires is

liable unless means of overcoming it are provided. Electric light cables are protected by heavy and expensive insulation, but we must of necessity open up our wires in order to connect. Even including air conditioning plants, the annual charges on an automatic equipment are less. Automatic equipments have hitherto cost us £20 per line and, for the latest manual plant, the estimated cost is £10 10s. per line.

49. *To Mr. Parker Moloney*—In Great Britain, experts could not give Mr. Golding any information at all on air conditioning. His opinion was that owing to the more favorable climatic conditions in Great Britain the occasion did not exist to install plants such as we have.

50. *By Mr. Mackay*—If it remained on the apparatus at Collingwood after the vacuum cleaner had been used, it was because it was merely brought forward to show how it was operated.

The witness withdrew.

Thomas Hill, Chief Engineer, Department of Works and Railways, Melbourne, sworn and examined.

51. *To Mr. Mathews*—The question of air conditioning plants came into prominence three and a half or four years ago, when the late Chief Mechanical Engineer, Mr. Dixon, was at the front, and Mr. Lewis was acting as Chief Engineer. Hitherto we had been dealing with heating, the introduction of fresh air, during certain seasons of the year, and had also taken up the question of using compressed air for cleaning even manual exchanges. These systems were being installed in exchanges and public buildings when the question of humidity in automatic exchanges became acute owing to American tenders for automatic equipment specifying a 70 per cent. humidity, particularly in connexion with the City North exchange, Sydney, where humidity is a very important factor. If the humidity is allowed to exceed 70 per cent. the contractors will not guarantee the efficiency of the plant. I do not know whether a similar restriction exists in the United States of America. Heating, introduction of fresh air, and removal of dust are essentials already provided for in many of our public buildings, but the question of excessive humidity opened up the whole matter of meeting the conditions in Sydney, especially in the summer time, where we could not rely upon easily obtaining cool water. Most of the city's supply is taken from reservoirs situated some distance away, whence it is conveyed to a service basin by open channels, and thence through mains into the city. In January, February, and a portion of March, the water is exposed to the sun for a long period, and at times reaches a temperature of 70 to 80 degrees. It is therefore of no use for cooling the air to reduce humidity. It was then considered essential that some other method of cooling should be introduced, and I immediately turned my attention to an ordinary ice-making plant as being the most efficient for the purpose. Approval had already been given for the other devices I have mentioned in connexion with other public buildings, and what is now being asked for is really a cooling plant to cost approximately £1,500 for reducing the humidity of the atmosphere. Considering the delicate nature of the apparatus, I would say that it is a very reasonable price to pay to insure the efficient working of such intricate and delicate mechanism. The Geelong automatic exchange was the first to be installed, and a heating system only has been provided, but if the conditions are to be made as they should be, a ventilation, air washing, and vacuum cleaning plant should be installed. From the water from the tower not be cooled satisfactorily by being allowed to fall through the air, because during such months as January and February particularly, the temperature

of the air is very often higher than that of the water, and even if supplies from the main were suitable, the cost at 1s. per 1,000 gallons would be excessive.

52. *To Mr. Jackson.*—I think that consideration should be given to the situation in which the present equipment is installed, and the construction of an entirely separate structure of one story built on fire-resisting principles appeals to me as being necessary. It would be practicable to put in a fire-resisting ceiling in the present structure, as was done in the cellars of Government House in Melbourne, where fire-resisting slabs were used on the advice of Mr. Lee. The results have proved very satisfactory, and I do not think it would be difficult to make similar provision on a three-story building. If the present structure were to be enlarged or altered to any extent, I would certainly favour the construction of a separate building to accommodate the automatic equipment.

53. *To Mr. Parker Moloney.*—The proposal to install air conditioning plant to reduce humidity is really going only one step beyond what has already been done in other new public buildings, where appliances for heating, ventilating, and vacuum cleaning are already installed. The cooling device is really the only new feature under consideration. As a result of the introduction of the mechanical cleaning appliances the number of employees in the Melbourne General Post Office engaged in the work of cleaning has been considerably reduced in consequence of the expenditure of some £1,600 on a modern vacuum plant, and the work is done more efficiently. The installation of cooling appliances is absolutely essential in Brisbane, Adelaide, Sydney, and other coastal cities or towns where water cooling is impracticable. We have even considered the possibility of securing supplies of cool water from artesian bores. I understand that in Bryant and May's factory in Melbourne the air is specially treated, as temperatures must be kept down in connexion with the manufacture of matches. The proprietors of chocolate and sweets factories are also devoting more attention to the question of improving the air conditions, in order to secure greater efficiency, and it is a very small price to pay for the advantages derived, particularly in such instances as those I have mentioned. In con-

junction with Mr. Lewis, it was decided to install the first plant somewhat on the small side, and we did not go ahead to any extent until certain data were available. In the Malvern plant, provision is made for only one change per hour, and at the City North exchange in Sydney there is also one change per hour. The intention was to economise until further information was available. The plant in Adelaide provides for six changes per hour, and although it gives a satisfactory service the change will have to be increased, because at present pockets of foul air remain between some of the switchboards. The estimates before the Committee are based on six changes per hour, and cannot be regarded as extravagant. I would not have been surprised if exception had been taken to the cost of running the plant which, in Adelaide, went up as high as £20 per week. I interviewed the Adelaide Electric Supply Company, which agreed to reduce the price of current from 2½d. to 1½d. per unit, and during the summer months the running costs have been reduced by from £12 to £15 per week, making the annual cost approximately £260. As regards cost generally, I have no hesitation in saying that we are pretty well down to bedrock, although some slight reductions may be expected owing to fall in prices. It will not, however, be much. The plants we are installing are of a most modern type, comprising simple mechanical details without any novelties, and are what may be termed ordinary commercial devices.

54. *To Mr. Mackay.*—The disparity between the estimates for Box Hill, Canterbury, and South Melbourne, and, say, East Sydney, where the cost was £5,500, may be accounted for by the fact that the highest estimate was for a larger exchange. Our experience at Collingwood has also shown that previous estimates were somewhat low.

55. *To Mr. Mathews.*—Air conditioning is now coming more prominently before manufacturers and others engaged in businesses where pure air is essential. The point I wish the Committee to remember is that all modern public buildings have everything now being asked for with the exception of a refrigerating plant, which is also essential where humidity has to be controlled.