

1925.



THE PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA
Senator Reid

Pursuant to Statute
By Command
In return to Order

PARLIAMENTARY STANDING COMMITTEE
ON PUBLIC WORKS.
11th June, 1925

REPORT

TOGETHER WITH

MINUTES OF EVIDENCE

RELATING TO THE PROPOSED ESTABLISHMENT OF

AUTOMATIC TELEPHONE EXCHANGE AT BRISBANE CENTRAL.

Presented pursuant to Statute; ordered to be printed,

[Cost of Paper.—Preparation, not given; copies; approximate cost of printing and publishing, 5.]

Printed and Published for the GOVERNMENT of the COMMONWEALTH of AUSTRALIA by H. J. GREEN,
Government Printer for the State of Victoria.

No. —F.14727.—PRICE

MEMBERS OF THE PARLIAMENTARY STANDING COMMITTEE ON PUBLIC WORKS.

(Fourth Committee.)

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

Senate.

Senator John Barnes.†
 Senator Hattil Spencer Foll.†
 Senator Patrick Joseph Lynch.†
 Senator John Newland.†
 Senator William Plain.*
 Senator Matthew Reid.†

House of Representatives.

Arthur Blakeley, Esq., M.P.
 Robert Cook, Esq., M.P.
 David Sydney Jackson, Esq., M.P.
 George Hugh Mackay, Esq., M.P.
 James Mathews, Esq., M.P.

* Ceased to be a Member of the Senate, 30th June, 1923. † Appointed 6th July, 1923. ‡ Resigned 25th June, 1923.

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

No. 110, DATED 6TH SEPTEMBER, 1924.

4. PUBLIC WORKS COMMITTEE—REFERENCE OF WORK—AUTOMATIC TELEPHONE EXCHANGE, BRISBANE CENTRAL.—
 Mr. Atkinson (for Minister for Works and Railways) moved, pursuant to notice, That, in accordance with the provisions of the Commonwealth Public Works Committee Act 1913-1921, the following work be referred to the Parliamentary Standing Committee on Public Works for its investigation and report thereon, viz.:—
 Establishment of an Automatic Telephone Exchange at Brisbane Central.

Mr. Atkinson having laid on the Table plans, &c., in connexion with the proposed work—

Debate ensued.

Question—put and passed.

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AUTOMATIC TELEPHONE EXCHANGE AT BRISBANE CENTRAL,
QUEENSLAND.

REPORT.

The Parliamentary Standing Committee on Public Works, to which the House of Representatives referred, for investigation and report, the proposed establishment of an Automatic Telephone Exchange at Brisbane Central, has the honour to report as follows:—

PROPOSAL.

1. The proposal is to erect a telephone exchange building on Commonwealth property in Elizabeth-street, Brisbane, and to install therein an automatic telephone switching system having an immediate equipment of 10,000 subscribers' lines and capable of accommodating additional future development in the central area for a period of 20 years.

REASONS FOR PROPOSAL.

2. It is represented that the new exchange is required for the reason that the capacity of the common battery manual switchboard now serving subscribers in the Central Exchange area is almost exceeded, and it is impracticable owing to building limitations to extend the plant in the existing building. It is claimed that an up-to-date plant in a new building is necessary in order that a more efficient service may be rendered to present and prospective subscribers in the area.

ESTIMATED COST.

3. The estimated cost of the work as submitted to the Committee is set down at:—

	£
Site (acquired in 1913)	17,610
Building	80,000
Air-conditioning, heating, ventilating, vacuum-cleaning and air-compression plant	10,000
Exchange equipment for 10,000 lines—	
(a) Central Exchange	£244,850
(b) Other exchanges	1,450
	246,300
Equipment for subscribers' premises	59,110
External Line Plant (conduit, cable and aerial lines)	34,400
Cut-over of exchange equipment, including portion of line plant	250
	447,670

and the time fixed for completion three years from date of approval.

COMMITTEE'S INVESTIGATIONS.

4. The Committee visited Brisbane, inspected the existing manually-operated plant, viewed the site of the proposed exchange, examined plans, and obtained from the Chief Commonwealth Architect full particulars of the building proposed to be erected. Evidence was also obtained from the postal and works engineers as to the equipment to be installed and the system of treatment proposed for regulating the temperature and humidity of the air. In this connexion also, evidence was obtained from a heating and ventilating engineer, and inspections were made in Sydney of the air-conditioning plant installed at the automatic telephone exchange at City North and the ventilating systems in operation in Wrigley's Cheyung Gum Factory, and in Union House.

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SITE.

5. The site upon which it is proposed to erect this building is a block of land upon which the old Police Court of Brisbane stands. It adjoins the existing General Post Office, Brisbane, on the south-west side, has a frontage to Elizabeth-street by a depth of 134 feet 6 inches, and was acquired by the Commonwealth in 1913 at a cost of £17,610. In view of the cost of the land, the Committee made inquiries as to whether a site equally suitable for the purpose could not have been obtained somewhere else at less expense. It was ascertained in evidence, however, that from developmental studies made, this locality was fixed upon as the theoretical telephone centre of the Central Exchange area, and that for some years past arrangements have been made for the whole of the telephone cable system of the City to converge at this point. The cost of altering that plan would be very great, and would offset any saving that might be effected by purchasing a cheaper site if it were possible to do so. It is also reported to be advantageous from a building point of view, and under the circumstances the Committee is satisfied that it is suitable for the purpose for which it is intended.

BUILDING.

6. The proposed building will be a fire-resisting structure of the first class, containing seven floors, and with a flat roof. The plan has been considered in harmony with the work of rebuilding the Brisbane General Post Office, which it is anticipated will shortly be projected. The internal dimensions of the telephone exchange building are to be 64 feet by 133 feet 6 inches, and it will have lighting on three sides. The structure is proposed to be of reinforced concrete walls with concrete floors and concrete stanchions supporting the roof.

7. It is proposed that the building shall be lined, and veneered with granite on the basement and ground floor, the upper floors to be veneered with freestone for the whole frontage in Elizabeth-street, and for two bays down the lane.

8. The ground floor will be 17 feet in height, the first, second, and third floors 15 feet 6 inches each, and the fourth and fifth floors 13 feet 6 inches each, from floor level to floor level. The total height will be 104 feet from the level of the basement floor to the level of the flat roof and the total effective floor space about 53,000 square feet. The plans indicate open floors which will permit of such sub-division as may be necessary. Access to the building will be obtained from Elizabeth-street and from Arcade-lane behind. From these entrances fire-proof staircases to the full height of the building will be provided, and also a lift in connexion with each staircase. Mezzanine floors will be introduced for the purpose of providing eleven blocks of lavatories, and access thereto will be given from the staircase on the Arcade-lane side.

9. From inquiries made, it was ascertained in evidence that the whole of the accommodation intended to be provided is likely to be required to meet estimated expansion of the various activities during the next 20 years. The present allocation of the space is proposed to be:—

Semi-basement	..	Cable lead-in, air-conditioning plant, power units and accumulators.
Ground floor	..	Main distributing frame, test desks, wave carrier and telephone repeaters, mechanics' locker room and bin stores.
First floor	..	"B" level switches for 10,000 subscribers, and a portion of "F" level switches, for a portion of the proposed 7,000 subscribers.
Second floor	..	Held in reserve for "W" level switches and part "F" level switches, which will carry about 13,500 subscribers. To be used in the meantime for portion of the staff at the State Engineer's Branch.
Third floor	..	Manager of telephones and staff and portion of State Engineer's staff.
Fourth floor	..	Trunk switchboards, trunk recording and inquiry positions, information and observation desks, and class rooms.
Fifth floor	..	Male and female retiring rooms, dining and recreation rooms.

10. It was stated in evidence that 3,000 feet of floor space is now being rented for the State Engineer in Perry's Buildings, Brisbane, for which the Commonwealth is charged a rental of £26 per week. In the new building as proposed, 3,500 square feet of floor space will be available for this officer, leaving ample room for development of the staff in the immediate future, and resulting in a saving of this £1,352 per annum.

11. In regard to the dining-room accommodation, the Committee is of opinion that if further space is necessary for the general work of the Department, provision for same might conveniently be made available on the fifth floor, and accommodation for officers to obtain their meals provided in a lightly built structure on the flat roof.

12. From inquiries made, the Committee is satisfied that the building will be well lighted, and that sufficient water and pressure are available to deal with any possible outbreak of fire.

13. The Committee agrees with the location of the telephone exchange building in relation to the development of future postal facilities for Brisbane, and recommends that the building be erected in accordance with the design submitted; to be veneered with granite on the basement and ground floor, the remainder of the front of the building and for about 36 feet along the lane from Elizabeth-street to be veneered with freestone.

AIR-CONDITIONING PLANT.

14. In accordance with the usual practice followed, provision is included in this building for an air-conditioning plant designed to eliminate dust and regulate the temperature and humidity of the air in the switch rooms. This building is to consist of seven floors, each 133 feet by 64 feet, and of an average height of 15 ft. 6 in.

The proposal submitted to the Committee is to condition the air of the four lower floors which will be used as a telephone exchange, and with a view to keeping the installation costs as low as possible it is intended to provide a plant capable of alternately supplying air to any two floors simultaneously. The equipment will be capable of changing the air of two floors simultaneously six times per hour, requiring a total plant capacity of 25,000 cubic feet of treated air per minute. No provision is made for heating or ventilating the three upper floors.

15. The plant will consist of a volume fan, air washer and heater, boiler, refrigerator, water cooling tank, circulating pumps, and duct reticulation for distributing the conditioned air throughout the parts of the building to be dealt with.

16. The estimated cost of this proposal is as follows:—

Ductwork, registers, hangers, erected	.. .. .	£ 1,700
Fan, motor, and foundations	.. .. .	300
Air heater, circulating pump, piping and accessories, and fuel hopper	.. .. .	600
Air washing sprays, pumps, eliminator plates, air-conditioning battery, spray pump, and motor	.. .. .	1,500
Ammonia compressor, condenser and refrigerating coils	.. .. .	3,000
Central system of vacuum cleaning	.. .. .	1,400
Compressed air cleaning service for four floors used as telephone exchange	.. .. .	500
Contingencies (say)	.. .. .	900
Total	.. .. .	10,000 (say)

17. The Committee is aware from this and previous investigations that an air-conditioning plant is considered essential in automatic telephone exchanges by reason of the fact that the manufacturers of the equipment do not guarantee reliability unless the atmosphere in the switchroom is kept free from dust and the relative humidity below 70 per cent.

18. In view of the amount of work entailed in installing this air-conditioning plant and the large expenditure involved, the Committee made inquiries as to whether it would be possible to extend the system to deal with the atmosphere in the portions of the building other than those in which the telephone equipment will be located. Information was obtained that this could be done, and that the cost would be as follows:—

Air treatment plant as paragraph 16	.. .. .	£ 10,000
Ductwork, registers, hangers, &c., for two upper floors	.. .. .	1,000
Fan, &c.	.. .. .	100
Air heater, &c.	.. .. .	300
Air washer, &c.	.. .. .	600
Ammonia compressor	.. .. .	2,000
	.. .. .	14,000

19. Records show that the mean summer temperature at Brisbane is 76.7 degrees Fahr., and that in every month of the year a mean relative humidity of 70 degrees or over may be expected on some days. Investigations made in other parts of the world indicate that, apart from the question of comfort, the efficiency of employees is considerably lessened in proportion as the temperature of the air of the room in which they are working rises above about 68 degrees Fahr.

20. Under these circumstances, the Committee unanimously approves of the following resolution proposed by Mr. Gregory and seconded by Senator Reid, namely:—

That as air-conditioning is essential for the proper care and protection of the automatic switching apparatus, the proposal to install an air treatment plant be approved. Moreover, as the Committee is of opinion that on a number of days in Brisbane the climate is such as to have a detrimental effect on the employees, the air treatment plant be extended so as to be capable of effectually dealing with the air contents of the upper floors of the building.

FINANCIAL ASPECT.

21. It was stated in evidence that the total annual charges for the proposed automatic system as at date of cut-over with 3,400 lines connected are estimated at	£99,092
and five years after that date at	£110,072
The estimated revenue at date of cut-over is set down at	£158,668
and five years after at	£183,773
The assets thrown spare if the automatic equipment is installed on 1st July, 1927, are estimated to have a recoverable value of	£75,970

COMMITTEE'S RECOMMENDATION.

22. The Committee is therefore unanimously of opinion that the proposed installation of an automatic telephone exchange at Brisbane Central as proposed by the Department should be put in hand as early as possible.

SUMMARY OF RECOMMENDATIONS.

23. Briefly summarized, the recommendations of the Committee are:—

- (a) That the proposed installation of an automatic telephone exchange at Brisbane Central be put in hand as early as possible. (Paragraph 22.)
- (b) That the building be erected in accordance with the design submitted and in harmony with future development of the proposed new General Post Office. (Paragraph 13.)
- (c) That the building be veneered with granite on the basement and ground floor, the remainder of the front of the building and for about 36 feet along the lane from Elizabeth-street to be veneered with freestone. (Paragraph 13.)
- (d) That if further floor space be necessary for the general work of the Department, dining-room accommodation be made available in a lightly built structure on the roof. (Paragraph 11.)
- (e) That the air treatment system as proposed be installed and be so extended as to be capable of effectually dealing with the air contents of the upper floors in the building. (Paragraph 20.)

H. Gregory
H. GREGORY,
Chairman.

Office of the Parliamentary Standing Committee on Public Works,
Federal Parliament House, Melbourne, 21st March, 1925.

MINUTES OF EVIDENCE.

(Taken at Melbourne.)

TUESDAY, 16th SEPTEMBER, 1924.

Present:

Mr. GREGORY, Chairman;

Senator Barnes	Mr. Mackay
Senator Reid	Mr. Mathews.
Mr. Cook	

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

1. *To the Chairman.*—I have prepared sketch plans of this proposed telephone exchange. The proposal is to erect a telephone exchange building on Commonwealth property in Elizabeth-street, Brisbane, and to install therein an automatic telephone switching system having an immediate equipment of 10,000 subscribers' lines: also heating, ventilating, dehumidifying, air compressor, air cleaning, vacuum cleaning, and air washing plants. The proposed building will be a fire-resisting structure of the first class containing seven floors, and the plan has been considered in harmony with the work of rebuilding the Brisbane General Post Office, which it is anticipated will shortly be projected, and a comprehensive use of the available site for the purpose of the post office and the telephone exchange. The new exchange is required for the reason that the capacity of the common battery manual switchboard now serving subscribers in the central exchange area of Brisbane is almost exceeded. It is impossible to extend the plant in the existing building, which is very old, and because it is not of a fire-resisting character it is a menace to the existing telephone service. It is necessary, therefore, to provide an up-to-date plant to render more efficient service to present and prospective subscribers in the metropolitan area of Brisbane. It is expected that the new building will afford accommodation for development for a period of twenty years from the date at which the present system is cut over for the projected new automatic system. The site upon which it is proposed to erect the building was acquired for telephone exchange purposes a good many years ago at a cost of £17,610. The estimated cost of the new building, exclusive of the cost of the site, is £80,000. The ventilating, heating, de-humidifying, air-compressor, air cleaning, vacuum cleaning, and air washing plants will, it is anticipated, cost an additional £10,000.

2. *To Mr. Mathews.*—I cannot give evidence regarding the equipment; that is a matter for the post office engineers.

3. *To the Chairman.*—I hand to the committee a plan of the site.

4. *To Mr. Mackay.*—The site was purchased ten or twelve years ago for the erection of this building. It is the site upon which stands the old police court of Brisbane. It adjoins the post office block. It was not a transferred property under the Constitution. Having in mind the necessity for better provision for a telephone exchange, I recommended the Government to acquire the site from the State Government, which had no further use for it, as the police court was placed on another site. It would probably have been sold to

others had we not taken steps to acquire it. It is at present being used, and has been used since the Commonwealth purchased it, for various purposes, including some branches of the State Government departments. The necessity for having the telephone exchange at that telephonic centre is a pressing one. The whole of the lines now gravitate to that point which is absolutely in the centre of Brisbane.

5. *To the Chairman.*—I have shown on the plan two buildings to comprise the General Post Office. The area held by the Commonwealth has a frontage to Queen-street, the main street in Brisbane, of 198 feet, and it has a frontage to Elizabeth-street, which is also an important street, of 246 feet. The depth between those two streets is 297 ft. 10 in. Half way along that depth two lanes, each 26 feet wide, give access to the site, one from Edward-street and the other from Creek-street. These lanes also give access to the back entrances of business properties facing Queen-street and Elizabeth-street, and they are extremely valuable adjuncts to the value of the site as a building site. The majority of the members of the committee know that at the present time the lane passes right down the centre of the Commonwealth property, connecting Queen-street and Elizabeth-street. That lane has been enjoyed by the people of Brisbane ever since the present post office buildings were erected. To maintain it would be very inconvenient from a building stand-point. After considering the problem, not only of the erection of a telephone exchange, but of the utilization of the whole site for the purposes of the Postmaster-General's Department, I came to the conclusion that that lane would necessarily have to be closed. To take its place I consider that the main post office building should be put in the centre of the site with a lane passing down each side of it. The present lane goes through the centre of the property from Queen-street to Elizabeth-street, and is about 15 feet wide. In its place I propose to substitute two lanes each 16 ft. 6 in. wide—a quarter of a chain—on each side of the proposed new post office building. If that suggestion were carried out, the Government property facing Elizabeth-street would be separated into three parts, the centre part having a frontage of 165 feet, the southern wing a frontage of 66 feet by a depth of 136 ft. 6 in., and the northern wing a frontage of 82 feet by a depth of 136 feet. It is proposed to erect the telephone exchange on the southern wing. It is the smallest of the three areas, and it so happens that it is just about the area necessary for the telephone exchange. I discussed this matter with the engineers of the Postal Department, who were anxious to have the northern site, with a frontage of 82 feet, for the telephone exchange; but I considered that this would not have such a good effect in connexion with the rebuilding of the post office. The telephone engineers have now agreed to the proposal to erect the telephone exchange on the southern wing. Although this site is at present occupied by many buildings of diverse kinds and importance, it must be regarded as one government site, and it is very important that the committee should know how it is proposed to deal with this valuable property before any movement takes place to erect a building on it.

The proposed post office, in order to make it an economically suitable building, will be a very large structure, and will require light on all sides. It will be an island building. It is also proposed to use the northern wing for post office purposes, and I suggest that it be given up to the parcels post office, or, if necessary, used in conjunction with the main building by the erection of a bridge over the dividing lane. The probable evolution of the whole building scheme will consist first of all of the building for the telephone exchange as I have suggested, and a building of equal height on the northern wing in Elizabeth-street, having a frontage of 82 feet, to which all the services of the post office, with the exception of the telegraph operating branch, can be transferred during the rebuilding of the main post office. The telegraph operating branch will probably be transferred to an upper floor in the telephone exchange building, and left there temporarily or for all time. With the exception of the operating branch, I think that all the other services of the post office could be temporarily accommodated in the northern wing. The width of the existing lanes to Edward and Creek streets is 25 feet, and the width of the proposed lanes on each side of the post office would be 16 ft. 6 in. In the proposed scheme the existing lane would go through the basement of the post office connecting Edward-street with Creek-street for vehicular and pedestrian traffic for post office purposes only. It is also suggested that this through lane under the post office connect from Elizabeth-street at the centre of the post office building, practically where the existing lane is now. There would be an opening in the building on the basement floor, and the lane would gradually slope down. It is a first-rate site for vehicular and pedestrian access.

6. *To Senator Reid.*—The Commonwealth Bank is situated in Queen-street, and adjoins the southern side of the Commonwealth property. The telephone exchange site is situated behind the bank building, but faces Elizabeth-street. Under the proposed arrangement, the bank property would be given light on one side.

7. *To Mr. Mathews.*—A lane 16 ft. 6 in. wide would be quite sufficient for lighting purposes. For post office construction we have adopted the practice of letting in light areas in the building from the side, and under the proposed scheme there will be three such areas in addition to the light from the lane. The Post Office Department has not yet intimated its agreement to my plans, but it wishes the erection of the telephone exchange to be immediately proceeded with, and I am anxious for architectural reasons that the design of the telephone exchange shall be in harmony with that of the future post office.

8. *To the Chairman.*—I think that the southern wing is a most suitable site for the telephone exchange. There is not a great deal of capital involved, and I do not think that any other suitable site in the centre of Brisbane could be obtained for anything like £17,000.

9. *To Mr. Mathews.*—The proposed telephone exchange building will have seven stories.

10. *To the Chairman.*—Ten or twelve years ago this property was purchased as a telephone exchange site, the Government realizing that it would be a loss to build an exchange on any other site. All the lines in Brisbane are now concentrated on that point, and the post office engineers may be able to indicate to the committee what the economic loss would be if any other site than this were selected. This property adjoins the present telephone exchange. I do not think that any investigations were made for the purpose of choosing another site of less capital value. I doubt whether any land in that vicinity could be obtained at a reasonably low price.

11. *To Senator Reid.*—The idea is that the telephone exchange building will be used for the electrical side of the post office. It may be that the Telegraph De-

partment will be housed there temporarily, if not permanently, while the post office is being rebuilt.

12. *To the Chairman.*—At the request of the Postmaster-General's Department a building of seven floors has been designed. The exterior dimensions are 66 feet by 136 ft. 6 in., and the building will have light on three sides. As is usual with all telephone buildings and other important buildings, this building would be of fire-proof construction, that is, built of concrete or brick walls, or both, with concrete floors and concrete stanchions supporting the floors. The internal dimensions would be 64 feet by 133 ft. 6 in. If brick, the walls would be 11 inches or 14 inches thick, but I think 14 inches. If concrete the walls would be 6 inches thick. We would thus be enabled to have a solid wall instead of a hollow wall. In a building of this kind the walls are no more than curtains to exclude weather, they have no constructional value at all. The weight of the building is transmitted to the stanchions. The walls can be treated architecturally in any way thought fit, plain concrete or plain brick. They can be treated to imitate stone or veneered with stone or granite. The building will have seven floors and a flat roof. The ground floor will be 17 feet in height, the first, second, and third floors 15 ft. 6 in. each, and the fourth and fifth floors 13 ft. 6 in. each. All these dimensions are from floor level to floor level. The total height would be 104 feet from the level of the basement floor to the level of the flat roof. The plans indicate open floors, as it is not yet known what subdivisions may be necessary for the lay-out of the equipment. Possibly the Chief Engineer of the post office will indicate to the Committee what the lay-out of the equipment will be, and to what use each floor will be put. He is working to a programme of requirements twenty years' ahead. That is his instruction, and I understand that this building has been planned accordingly. Access to the building will be obtained from Elizabeth-street and from the lane behind, Arcade-lane. From these entrances to the full height of the building fire-proof staircases will be provided, and also a lift in connexion with each staircase. In the case of the staircase on the Arcade-lane side, access will be given to lavatories. By introducing mezzanine floors for the purpose of providing lavatory accommodation, there will be eleven lavatories, which will be a considerable economic saving of cubical space.

13. *To Mr. Mackay.*—In providing this number of lavatories consideration has to some extent been given to the building being used for some time by other branches of the department. Each lavatory will contain three water closets and a urinal, three wash basins, and a slop sink for cleaners. I think it is on the ample side. It is wise to put the rooms there, although for the present the fittings need not be put in some of them.

14. *To Mr. Mathews.*—If they were made larger, a greater quantity of air space would be taken out of the floors themselves. I know that girls are to be employed in the building, and it is not thought desirable that officials should have to go a long distance from their work. This is the only economic way of dealing with the matter, and obtaining out of the building every inch of space possible. Every cubic foot of the building will cost, probably, 1s. 9d. in lavatory blocks all the space above 8 feet high would be lost. In all our buildings now we are introducing that idea.

15. *To the Chairman.*—It is proposed to have the lifts alongside the staircases. That is wise proceeding in every building. The staircases and lifts should be surrounded in each case by walls. If an outbreak of fire occurred in the lift it would not affect the staircase. If there are fire-proof doors on each floor separating the lift, the staircases, and the lavatory, there will be a complete cut off. Two staircases are provided for, one giving access to Elizabeth-street, and one to Arcade-lane. I do not think there is great danger in having staircases and lifts alongside each other. In the area

containing the lift and the staircase there will be nothing inflammable. I should say the only wood in the area will be the floor of the lift cage. Everything will be of metal and concrete. In some of the American States I do not think they insist upon the provision of fire-proof doors between the stair and lift area and the warehouse proper. In Melbourne that provision is insisted upon. On the south side of this building there will be a blank wall. It would not be wise to have a couple of air wells there. The north side of the building will be practically a glass side. I anticipate that the light will be quite satisfactory. A good square light area will be taken out of the side of the General Post Office itself if the plan that I have prepared is approved. We could not spare the room to put air wells on the south side of this building. To do so would very much lessen the usefulness of the building. On account of the equipment it is desired to have an open floor without any obstruction. The provision we are making will ensure the best lighting that it is possible to get. If we put the telephone exchange upon the site of the other side of the General Post Office we might introduce light on both sides. It is far more necessary for post office officials to have light and air on each side on account of the far greater number of persons to be considered than it is for the telephone people. The front of the building will be in Elizabeth-street. I have not yet quite made up my mind what to suggest in the way of embellishment. The estimate that I have made has been based upon a concrete building, lined, and veneered with granite on the basement and ground floor, the upper floors being veneered in freestone for the whole frontage in Elizabeth-street, and for two bays down the lane. The post office plans provide for a required footpath space up both Queen and Elizabeth streets. The building that I propose for this site and its sister building on the other side will come up to the present alignment. The exterior treatment would have to be carried down to the alignment of the post office, a distance of about 36 feet.

16. *To Mr. Mathews.*—We would treat only Queen and Elizabeth streets in this way.

17. *To Senator Reid.*—We would have an ordinary cement front going up the lane. I should like better than anything to have a brick building with stone or granite mouldings. They have beautiful bricks in Brisbane. My trouble is that the Elizabeth-street portion of the General Post Office may not be proceeded with for twelve years, and probably we should not be able to secure five that portion bricks of the same colour as those used in this and the sister building, and the Queen-street frontage of the General Post Office. The success of any brick design would depend upon obtaining bricks of the same colour. The Government would not agree, I think, to buy the bricks now and store them up. The interest on the capital outlay would be very great. The mouldings would go only a little distance along the wall, and be very sparingly used.

18. *To Mr. Mathews.*—Brisbane is building a town hall estimated to cost some £600,000—more than the two portions of the post office and the telephone exchange combined.

19. *To the Chairman.*—Personally I should cut freestone out entirely and go in for brick and granite. The freestone in the Parliament House, Brisbane, is decreasing, should we hesitate to use north bricks in conjunction with brick. Until the committee visits Brisbane I should not come to any decision regarding the material to be used. Some of the most chaste buildings in America are built of brick. The proposed new building will be entirely taken up by the telephone exchange. Certain floors may be used for the staff. I am assured that the telephone exchanges will need one whole building. For some years at any rate the telegraph operating staff may be transferred to an upper floor in this building whilst the General Post Office is being rebuilt. If an out-and-out plaster building were erected a saving of £5,000 on any estimate could be effected.

F.14727.—2

20. *To Mr. Mackay.* I suggested, and the committee approved of my suggestion, that for the Commonwealth office in Brisbane we should have a concrete building plastered to imitate freestone. We discussed the matter with the State Works Department, but they said that they wanted stone. In deciding upon the material to be used in this building we have only public opinion to satisfy. I want to economize as much as possible. The two lifts for which provision has been made are considered to be necessary. If you are working at one end of the building, and have to go to a similar position a couple of floors below, a good deal of travelling is entailed. With only one lift it would not be a convenient building. At least two staircases are necessary to make it a useful, happy building. The height of these walls has been rendered necessary because of the equipment that is to be installed. The walls are not higher than those in the exchanges that we have been erecting recently around Melbourne. They are 17 feet from floor to floor, but the effective height will be only 14 ft. 6 in. On other occasions we have done away with beams. We have gone in for the cantilever style of construction. There is a limit to the span when you employ that construction. We have never so far gone beyond a span of 25 feet. Here we have a span of 82 feet, and that construction is not economical, and we have to go back to the beam system. The portion of the post office that I suggest will be left standing for twelve years, is the old brick building that was built about 20 years ago, and extends half way up the lane. The present post office buildings, between the centre lane and the new telephone exchange will be removed.

21. *To Mr. Mathews.*—I do not think that it is intended to bring stores into the main General Post Office building, but it must be understood that a structure of nine stories would be a huge building.

22. *To Mr. Mackay.*—I believe that the Government proposes to erect the post office building on the northern wing facing Elizabeth-street, corresponding to the telephone exchange building on the southern wing, and this will free the site for the new building, except that I suggest that the four-story brick building now facing Elizabeth-street be allowed to remain.

23. *To Senator Reid.*—I do not think that there would be any opposition from the people if the present right-of-way were taken away and two lanes substituted. Probably for the time being portion of the building through which one of the proposed lanes would run would remain standing until the post office were created. My scheme has not yet been approved by the Postmaster-General, but it is only considered by his officers. It may not be agreed to at all. A telephone exchange building of seven floors was designed at the request of the Postmaster-General's Department.

24. *To Mr. Cook.*—The total estimated cost would be about £200,000, exclusive of engineering services, which would cost about £10,000. The price paid for the site was £17,610, but the whole of that property would not be available, as it is proposed to utilize a strip of 16 ft. 6 in. of it for a new lane. That site is worth a lot of money now. It is proposed to erect a building of brick and concrete, or entirely concrete, and to veneer that portion facing Elizabeth-street and 36 feet of the building down the lane with granite for two floors, and above that with freestone. The cost of a building in concrete and brick, or entirely of concrete, would be practically the same. Brick walls are thicker than those of concrete, and, consequently, a concrete building would permit of more floor space. A concrete wall would be 6 inches thick, and a brick wall from 11 to 14 inches thick. The cost of veneering with granite and freestone would be about £5,000. If this building were for private purposes I should not hesitate to recommend a concrete building plastered on the outside, but public opinion has to be considered. Almost every public building in Brisbane is built of stone. This legacy handed down from the days when stone was

cheap still exists, although the cost of stone has increased enormously. For the purposes of the Government I should recommend a building of brick with granite mouldings, in order to give that class of building a chance to justify itself in Australia. Farmers' buildings in Sydney is a good example of this type of construction. It was on my advice that the Government twelve years ago purchased the site for telephone exchange, and for once the Commonwealth is in a splendid position regarding the construction of a new General Post Office. It is a magnificent site, situated in the centre of the city, and will serve the purposes of the department for a century hence. If this telephone exchange is not provided in Brisbane in three years' time the commercial loss to the community will be serious.

24 To Mr. Mathews.—The Commonwealth Bank authorities and the private owners of the land adjoining the Commonwealth property have not been asked to vacate portion of their land in the provision of new lanes 10 ft. 6 in. wide. These new lanes, if provided, would be the Government's own property, and I should recommend that a notice be posted at the entrances to that effect.

25 To Mr. Mackay.—The post office could not function properly without these lanes.

26 To Mr. Mathews.—The people of Brisbane would welcome the provision of two lanes in place of the existing lane. The present lane could not possibly remain in view of the requirements of the new post office. I suggest that trees should be planted on the area of land available from the street alignment to the actual building. The effective floor space of the proposed telephone exchange of seven stories would be about 73,000 feet. This building would provide for 10,000 subscribers. I do not remember the floor space of the Melbourne Exchange, but I know that an extension of it is now contemplated.

27 To Senator Barnes.—A height of 17 feet is proposed between the floor levels so as to accommodate the telephone exchange equipment. Taking into consideration the thickness of the floor and the thickness of the beam supporting the floor, this will allow a clear head room of 14 ft. 6 in. If the whole of the seven floors are not required for the telephone exchange, I presume that the unused portion would be occupied by the clerical branch, the mechanics' workshops, or by other departments. Although the design for the main post office building provides for nine stories, probably none of us will be alive when that building is fully completed. The present-day requirements will be met, and the building will expand on the system now laid down. It would be economical for the Government to build the nine stories, and to rent the space not required by it to business people, but I think that the Government would probably refuse to enter into competition with private enterprise. The rental value of such a building of nine stories would be enormous, and would soon repay the cost of construction. I anticipate that this work will be commenced this year, and will take eighteen months to complete. I am informed that unless this building is finished in three years it will be a calamity for Brisbane. Postal engineers probably will take eighteen months to fix up their equipment.

(Taken at Melbourne.)

WEDNESDAY, 17TH SEPTEMBER, 1924.

Present:

Mr. GURCOCK, Chairman;

Senator Barnes Mr. Mackay

Senator Reid Mr. Mathews.

Mr. Cook

John Murray Crawford, Chief Electrical Engineer, Postmaster-General's Department, Melbourne, sworn and examined.

28 To the Chairman.—I am primarily responsible for the proposal to erect a telephone exchange building

on a site already acquired for the purpose in Elizabeth-street, Brisbane (at the rear of the General Post Office), and to install therein an automatic telephone switching system having an immediate equipment of 10,000 subscribers' lines. It is anticipated that the proposed building will accommodate the future additional development in the central area for 20 years. The reasons for the proposal are that the capacity of the present common battery manual switchboard (portion of which was placed in operation in 1909) in the Central Exchange, which serves subscribers in the area, is practically exhausted, and it is impracticable, owing to building limitations, to extend the plant in the present building. An up-to-date plant in a new building is necessary in order that a more efficient service can be rendered the existing and prospective subscribers in the area. The vacated space in the present exchange will then be available for urgently required additional accommodation on the postal side. The estimated cost of the work is—

Site (acquired in 1913)	£17,610
Building (estimated by Works and Railway Department)	80,000
Air conditioning, heating, ventilating, vacuum cleaning, and air compression plant	10,000
Exchange equipment for 10,000 lines—	
(a) Central Exchange	244,850
(b) Other exchanges	1,450
Equipment for subscribers' premises	59,110
External line plant (conduit, cables, and aerial lines)	31,400
Cost of cutter of exchange equipment, including diversion of line plant	250
	£247,670

The actual revenue for the year ended 31st May, 1924, and the annual revenue it is estimated will be obtained on the date of opening, and with five years' development is shown hereunder—

Number of lines connected at 31.5.24	Actual revenue received for the year ended 31.5.24	Estimated number of lines 1,757 (first date of delivery)	Estimated revenue 1,757	Estimated number of subscribers 1,752	Estimated annual revenue 1,752
7,842	£ 135,691	8,400	£ 158,668	9,150	£ 185,773

The proposed site which was acquired in 1913 is adjacent to the present post and telegraph building, and has a frontage of approximately 66 feet to Elizabeth-street, and a depth of approximately 136 feet extending to Arcade-lane at the rear. 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 10,000 subscribers' lines, but the building will be designed to accommodate the future additional development in the central area for 20 years. The financial aspect is as follows:—

	As at date of takeover 1st July, 1923	As at 1st July, 1924
1. Capital cost—new	£247,670	£270,280
2. Capital cost—new and in situ	704,233	748,018
3. Annual working expenses of proposed automatic system	41,935	49,366
4. Total annual charges for proposed automatic system (when 8,400 lines connected as at 1st July, 1923)	99,092	110,672
5. Annual revenue—		
Actual for year ended 31st May, 1924 (accounts certified produced), £135,691	158,668	—
Estimated as at 1st July, 1927	—	185,773
6. Assets recoverable or thrown spare if an automatic exchange is established on site on 1st July, 1927—		
(i) Book value	162,008	—
(ii) Recoverable value	75,970	—
(iii) Cost of recovery	2,370	—
7. Estimated annual working expenses of existing manual system (when 7,250 lines are connected)	58,514	—
8. Estimated annual charges for existing manual system (when 7,250 lines are connected)	96,536	—

It is estimated that 8,400 lines will be connected to the proposed automatic exchange as at 1st July, 1927, but the existing manual exchange cannot be extended to accommodate that number of lines. The difference between sub-items (i) and (ii) of item 6, namely, £86,038, 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 assets which is irrecoverable. It is made up as follows:—

Exchange equipment	£56,420
Sub-station equipment	26,283
External line plant	1,330
	£86,038

The economic life of a common battery manual exchange switchboard is estimated to be fifteen years. The present switchboard was placed in operation in 1909, and a considerable portion of it will have reached the end of its life by 1927. The economic life of manual substation equipment, i.e., equipment in subscribers' premises, is estimated to be only ten years. On an average, the present substation plant will have served over half of its useful life by 1927, and, at that date, it is estimated, will have depreciated by £28,288. It is estimated that it will take three years to put the new exchange into working order for several reasons. First of all, we have to prepare detailed specifications for the exchange, and then we have to call for tenders. That usually occupies six months, for all the tenders come from overseas. After the plans and specifications are prepared and sent to England and America, two or three months have to be allowed to the prospective tenderers to prepare their figures, and it is usually quite six months before the tenders are submitted to us. They then need very careful consideration. For a large exchange this consideration usually occupies several months. After the order is placed, the manufacturers have to make the equipment, which may take about twelve months to install the equipment in the building. In all the circumstances, we think three years is a fair time to allow for putting the exchange into working order. We understand that the building will take eighteen months to erect, and that it will be quite ready for the equipment to be put into it as soon as it is received. The Works and Railways Department have always had buildings ready for us previously, and we anticipate that that will be the case this time. The site of the building cost £17,610 when it was purchased in 1913. I cannot say what price would be asked for it to-day, but I doubt very much whether it would be less than £25,000. The site is at present occupied by the old police court buildings, which, of course, will be demolished. It is not essential that the site selected should be in a main street of Brisbane, but it is essential that it should be at the copper centre of the subscribers' lines. Every yard a half exchange is removed from the theoretical centre adds many pounds to the cost of the cable. Each large sized cable costs 30s. a yard. Ten cables thus cost £15 a yard. If an exchange is removed a quarter of a mile from the theoretical centre the extra cost of every ten cables is £9,000. There is also a quarter of a mile's additional cable transmission losses. Therefore there is a double loss. It is not essential to have an automatic exchange part of or adjacent to a post office, nor is it necessary to choose a site to which the public may have ready access. If a cheaper site equally suitable for our purpose could be obtained in Brisbane we should make use of it, but a site is available, and it has been found impossible to secure one. We make a telephone survey to ascertain the economic centre, and if we find that it drops just about where the post office is situated, there is no need to look for a site very far from the post office. If, however, it drops about a couple of chains away from the post office we immediately investigate the pos-

sibility of securing a site for an exchange at that spot. As we know the actual cost per yard of building an exchange away from the exact telephonic centre, we know exactly what we can pay within reason to secure a site at that centre. I was in Brisbane in May last when that phase of the question was fully thrashed out. Our investigations have not indicated to us that any other site is available in the city within a reasonable distance, and at a reasonable cost. It is not essential to build an exchange in a prominent part. We prefer back thoroughfares provided we can get adequate light. We avoid main streets because of the dust, the cost of the land, and the impossibility of securing adequate lighting. With Mr. Murdoch I went into the matter of lighting the proposed building very carefully. It will have good light on three sides, even from the 16-ft. lane on the north side if the wall of the building opposite is whitened. On the Elizabeth street side there will be good light; there will also be good light from the 26-ft. lane, and Mr. Murdoch assures me that on the 16-ft. lane the whole of the available space outside the pillars, which will be as narrow as possible, will be occupied by large windows. We shall have adequate natural light right down the aisles of the switches. The switches will be placed to take the greatest possible advantage of the light available. This has not always been done in exchanges, but now we always lay out the switches at right angles to the plane of the light. The building itself will be so constructed, so that there will be practically no risk of fire. The windows will be wired glass. An automatic exchange is not like a manual exchange with exposed cables running behind the switches. In manual exchanges there is sometimes a good deal of risk of fire coming from underneath the switchboards, but in an automatic exchange the switchboards are enclosed in iron frames with iron sides and iron top rails, and here the risk is where the cables run out from the frames above the switchboard. Danger can only arise from an internal fire. There would be little risk to the exchange even if an adjacent building were on fire. The fire brigade would be on the scene long before the exchange could be affected, and by keeping away from the side of our building I do not think there would be the slightest danger of our cabling catching fire. The risk, therefore, is reduced to an outbreak within our own building. Against such a possibility we shall install chemical extinguishers between the frames, place sand buckets at convenient points, and have asbestos blankets near the frames. No automatic exchange in the world has to my knowledge so far been burnt down. We have conferred with the officers of the Works and Railways Department to ensure that our requirements will be met in the building to be erected. They have been very anxious to meet our wishes in every way. At the outset we propose to install provision for 10,000 subscribers, and we shall occupy immediately three, and ultimately four, of the floors of the proposed building. The basement, which is only partly underground, will be 13 ft. 6 in. from floor to ceiling. The ground floor will be 17 feet high. The first and second floors will be 6 in. high, and the top two stories will be 13 ft. 6 in. high. In the basement we shall install the battery room, the motor generators and the air conditioning plant. On the ground floor we shall install our main frame for an ultimate capacity of 27,000 subscribers. On this floor also will be located the repeaters and test desks, also retiring rooms for the mechanics. Our estimate of twenty years' development is in the neighbourhood of 27,000 lines, so we are providing not only for immediate requirements, but also for the estimated development 20 years ahead, the main frame must be laid out to accommodate the future growth, so that it will take care of the whole of the subscribers' lines entering the exchange. The lavatory accommodation is within the external walls of the building, but is situated on the mezzanine floors at the landings of the

staircases. Ultimately the switchboards will occupy the first and second floors, but the second floor will not be required for this purpose for the next five or seven years. However, there will be no difficulty whatever in placing the State Engineer and his staff on that floor. At present they are located in Perry's Buildings some distance away from the exchange. On the third floor the Telephone Manager will be located, and on the fourth floor will be the trunk lines board, which, at present, is housed in the post office. The number of trunk lines to be accommodated is about 454, so that the whole of the fourth floor will be required to accommodate the trunk line switchboard and the necessary desks for monitors, supervisors, and recorders. On the fifth floor it is proposed to provide a retiring room and a luncheon room for the whole of the staff. There will be at least 64 operators and supervisors engaged on the trunk line switchboard. If sufficient space is available, I think the floor will probably be used as a common dining room for all the post office employees in Brisbane, numbering about 600. I do not think there will be any space permanently available for telegraph operating room. We could leave the State Engineer and the Telephone Manager where they are at present, and accommodate the telegraph operators in the new building, but I think they will have sufficient accommodation in the post office when the Telephone Manager is moved. The State Engineer rents 3,000 square feet of floor space in Perry's Building. For this space the department is now paying an annual rent of £1,982. In the new building 3,500 square feet of floor space will be available for the State Engineer and his staff, leaving ample room for development of the staff in the immediate future. The second floor of the new building will be utilized in this way until it is required for the extension of the switch room, which will not be for the next six or seven years. I think that the staff of the Telephone Manager, exclusive of operators, numbers from 80 to 100. The congestion in the post office building was such that it was found necessary to remove the State Engineer and his staff, and part of the space thus vacated was taken over by the Telephone Manager. When he, in turn, is removed to the new building, sufficient space will be available for the telegraph operators. The trunk lines board is now in a very congested state. In the new building it will go on a good floor, with good light, and there will be adequate accommodation for the 50 telephonists and fourteen supervisors and monitors. The whole of the space on the floor will be required for trunk line development. In fact, the staff will need to be increased with that development, which is very rapid. We would not extend a central exchange beyond its economic limit if we found it was economical to establish a second exchange. The number I have given to the committee takes into account two new exchanges at the Valley and Paddington, both of which will be cut into service within the next five years, but when I mention the ultimate number likely to be served, I am confining myself to the immediate City of Brisbane. If, in addition to the present proposal, we fixed on a new centre, put up a new building and regrouped our cables, we should probably pay a very high rental, because the sites would need to be right within the city itself, where all land values are high. In these circumstances it would not be economical to divide the exchange when all the ducts and cables now converge on the post office. The maximum number catered for at the City North Exchange, Sydney, will be about 25,000 subscribers. If we were installing in Melbourne an exchange similar to that which is now proposed for Brisbane, we should make provision for between 20,000 and 30,000 subscribers. In a city where there is great telephonic saturation it is economical to erect a building to enable an exchange to accommodate between 20,000 and 30,000 subscribers. In America sometimes two or three exchanges are accommodated in the same

building. They are known by different names, but they are practically the one exchange. The lay out of Melbourne gives rather less telephonic saturation than exists in Brisbane, and much less than exists in Sydney. Workshops will not be attached to the new building in Brisbane. Separate lavatory accommodation is provided for female employees. The building meets with the requirements of the telephone department. Two lifts will be provided, one at the back and one at the front of the building. It is most desirable to have two lifts. Both lifts will be automatic. We shall use one of them for passengers, and the other for passengers and small apparatus. We shall not use the lifts for taking up heavy cases and heavy apparatus. We have a cat-head for that purpose. We consider it to be much more economical to use a cat-head than to install a lift of greater capacity which would only be required, perhaps, once in every two years. The position of the lifts is satisfactory. The great aim in building an automatic exchange is to have as much clear floor space as possible. Only one row of pillars will be put in this building, and we would like to do away with that row, but of course it is not possible. The weight which will be supported by each pillar was taken into consideration when the plans for the building were drawn.

29. *To Senator Reid.*—The increase in telephone subscribers in Queensland last year was as follows:—10.8 per cent. lines and 10.6 per cent. stations; country, only, 13.1 per cent. lines and 11.8 per cent. stations. Stations are lines plus extensions. Lines are lines directly connected with the exchange. At present there are between 160 and 170 trunk lines in Queensland, and we anticipate that the number will increase to 233 in five years. Immediately a new trunk line is installed it is used to its full capacity. We are in arrears in providing trunk-line accommodation in Queensland, and there is a heavy programme before us. That, of course, is true in every State. In my opinion the building it is proposed to erect is necessary. As soon as the South Brisbane automatic exchange is in operation it will relieve the present Central exchange. Exchanges are to be erected at the Valley, Albion, and Newmarket, but I do not think that any other exchanges will be required in those areas for the next twenty years, though I must admit that I am deficient about trying to estimate requirements for the next twenty years. South Brisbane will be the first automatic exchange in operation. The construction of the Valley Exchange will not be proceeded with for five or seven years. The proposed Newmarket Exchange will also relieve Central when it is constructed. Although the new Brisbane Central Exchange is urgently required, there are not so many applications for a telephone connection awaiting attention in Brisbane as in Adelaide and Melbourne.

30. *To Mr. Mathews.*—The actual cost to us of the site for the new exchange was £17,010, and we have based our figures on that. I think that we must base our estimated profits on costs, for we only pay interest on costs. I have no reason to anticipate either an increase or a decrease in the cost of automatic telephone apparatus. I do not think the automatic telephone companies are making undue profits. I know that one is not, and I do not think that the others are paying unduly high dividends. No automatic telephone material is manufactured in Australia other than the heavy frames. The estimated profit through the installation of this exchange may be ascertained by comparing the annual revenue figures with the annual working expenses. In preparing the figures showing the annual working expenses we have taken depreciation, maintenance, interest, and everything into consideration.

31. *To Senator Reid.*—Australia is treated on quite as favorable terms by the automatic telephone manufacturers as any other country.

32. *To the Chairman.*—By changing over from the O.B. to the automatic system we shall lose practically

£96,000. I gave the details earlier in my statement. By changing to the automatic revenue for the first year of the automatic exchange and the annual working costs, it will be seen that there is an estimated profit of £58,570, so that in two years' working of the automatic exchange we shall have more than recovered the £86,000 which shall be written off as less through the department in connexion with the manual exchange in Brisbane as depreciation, but it is only a book figure. The way we estimate depreciation is as follows:—We take the life of the equipment to be, say, twenty years, and allow a residual value at the end of that time of 20 per cent., so that the annual depreciation charge would be equal to 4 per cent. That amount may not be actually written off year by year, but at the end of the twenty years the full loss, after the value of the plant as demolished assets is taken into account, is written off. That seems to me to be the only practicable way to do it. The loss on the Brisbane C.B. system, when the automatic exchange system is put into operation, will amount to £86,000 roughly, and that amount will be written off. We keep a depreciation account in the department, but it is not an account like a draper's depreciation account, for we do not revalue our assets every year.

33. *To Mr. Mackay.*—Our equipment is regarded as being of full value so long as we use it, and when it has no longer any value to us its value is written off.

34. *To Senator Reid.*—Depreciation of equipment to the extent of 4 per cent. is taken into account in making our statement in this matter to this committee in order that we may be able to show that the proposition that is submitted is sound financially.

35. *To Mr. Mackay.*—I do not see how it is possible to carry on a depreciation account in a big concern like the post office. If we keep our assets in full working capacity until they are demolished, we write the full value off at the time they are demolished. The figures appearing in the annual balance-sheet as depreciation represent, so far as I can make out, a demolished asset returned to a pole which stands for twenty years, is regarded as a new pole until we actually re-erect it—must develop towards the Valley, where later another exchange will be established. The existing Central Exchange is in the vicinity of the intersection of Edward and Elizabeth streets. The proposed new exchange at the Valley will serve all that portion of the city between Petrie Bight and Breakfast Creek. The existing Central Exchange serves practically the whole of the area on the north side of the river other than the areas served by Albion and Toowong, and on the south side of the river the area between Sherwood and Bulimba. When the South Brisbane Exchange is opened—probably about May or June next, it will serve the whole of the south side, and relieve Central of approximately 2,000 subscribers. But notwithstanding the establishment of new exchanges at South Brisbane, Paddington, and the Valley, we shall still require in the centre of Brisbane an Exchange capable of accommodating approximately 20,000 subscribers. The proposed building is designed to meet that development. I admit that the site chosen for it is very valuable, but it is doubtful whether a cheaper site could be obtained near the centre of the city, except in the direction of the Botanical Gardens, and that vicinity is too far away from the telephonic centre to be suitable. If a cheaper site were obtained the economy in respect of it would probably be counterbalanced by the greater capital cost of cable plant. The purchase of land is not a matter for my department. We declare that the most suitable site for our Exchange building, and the Home and Territories Department purchase land as near as possible to the point indicated by us. I have inspected the plans of the proposed building. In my opinion they are quite satisfactory. I do not think there will be any difficulty about the lighting of

building is very old, and all the balconies, staircases, and inner partitions are of wood. In consequence of that there is a big fire risk, and in the event of the equipment being destroyed, there would be no means of restoring the service to subscribers. The operating officers' retiring accommodation has been transferred to a building next door, and we have used the space occupied by the installation of additional equipment, which was estimate will be in full use by July, 1927. The anticipated date of opening the proposed new exchange. Unless a new exchange is opened by that time, the department will be forced to refuse service to new applicants. The Telephone Manager and his clerical staff are being removed to a building now occupied by the State Engineer and his staff, who occupy rented quarters away from the General Post Office, and the accommodation thus acquired is being used to extend the trunk line equipment. When these changes have been effected we shall have reached the limit of the capacity of the existing building.

A new building, to accommodate increased subscribers' lines and trunk lines, is urgently necessary. The trunk line extension in Queensland is fairly rapid, and we anticipate that by 1944 at least 400 trunk lines will be terminating in the Central Exchange building. They will occupy the fourth floor, which has been set aside for them; but there will be room for certain other equipment, including the central observation desk and the class-room switchboard. A new automatic exchange would probably have been provided earlier but for the lack of funds. The existing building is most unsuitable for exchange purposes, and because of the insufficiency of room the equipment is badly laid out. Telephone development in Queensland has been remarkably rapid. The number of telephones in use in the Brisbane metropolitan network at the end of June, 1914, was 7,183, and on 30 June of this year, 1917, an increase at the rate of 125 per cent. The number of telephones throughout the state on 30th June, 1914, was 17,552, and on 30th June last, 33,318. The proposed site, which was acquired some years ago, is near the telephonic centre of Brisbane. The city cannot develop to the south-east—it must develop towards the Valley, where later another exchange will be established. The existing Central Exchange is in the vicinity of the intersection of Edward and Elizabeth streets. The proposed new exchange at the Valley will serve all that portion of the city between Petrie Bight and Breakfast Creek. The existing Central Exchange serves practically the whole of the area on the north side of the river other than the areas served by Albion and Toowong, and on the south side of the river the area between Sherwood and Bulimba. When the South Brisbane Exchange is opened—probably about May or June next, it will serve the whole of the south side, and relieve Central of approximately 2,000 subscribers. But notwithstanding the establishment of new exchanges at South Brisbane, Paddington, and the Valley, we shall still require in the centre of Brisbane an Exchange capable of accommodating approximately 20,000 subscribers. The proposed building is designed to meet that development. I admit that the site chosen for it is very valuable, but it is doubtful whether a cheaper site could be obtained near the centre of the city, except in the direction of the Botanical Gardens, and that vicinity is too far away from the telephonic centre to be suitable. If a cheaper site were obtained the economy in respect of it would probably be counterbalanced by the greater capital cost of cable plant. The purchase of land is not a matter for my department. We declare that the most suitable site for our Exchange building, and the Home and Territories Department purchase land as near as possible to the point indicated by us. I have inspected the plans of the proposed building. In my opinion they are quite satisfactory. I do not think there will be any difficulty about the lighting of

(Taken at Melbourne.)
THURSDAY, 18th SEPTEMBER, 1924.

Present:

Mr. Gantobly, Chairman;
Senator Barries Mr. Jacklin
Senator Reid Mr. Mackay
Mr. Cook Mr. Mathews.

Lawrence Hede Fanning, Superintendent of Telephones, Postmaster-General's Department, sworn and examined.

36. *To the Chairman.*—I visited Brisbane last year, in company with the Director of Posts and Telegraphs, for the purpose of ascertaining whether we could carry on with the existing manual exchange in Brisbane Central, or whether it would be necessary to erect a new exchanger. The inquiries made disclosed that the accommodation now occupied by the Central Exchange, in the rear portion of the second floor of the General Post Office, is not capable of further extension. The

the building. I know of no objection to it on that score. With regard to the building itself the basement will be used for the cables, battery, &c.; the main frame on the ground floor; and the automatic equipment on the first and second floors. On the third floor we propose to locate the Telephone Manager and his staff. His duties will be to take charge of the whole of the traffic and commercial activities of the telephone branch, not only for Brisbane, but also for the whole of Queensland. It is estimated that by 1944 he will have a staff of approximately 150 officers, and will require at least 5,700 square feet of floor space in addition to space for counters, shelving, cabinets, &c. His staff at present consists of about 25 officers. The fourth floor will be used for the trunk line equipment, which will extend down both sides of the room. Ultimately we expect to have 400 trunk lines in Brisbane, and a staff of probably 85 or 90 operators. In addition there will be on the fourth floor the central information desk, observation desk, and instructional classes. A doubt exists whether the available floor space for the trunk room will be sufficient. It may be necessary to use portion of the third floor, but everything will depend upon the progress that takes place. If development proceeds as rapidly as is anticipated, the fourth floor will not be sufficient for the whole of the trunk line equipment. It is proposed to use the fifth floor as a luncheon-room for male and female employees and also for retiring quarters for the female traffic staff. In the telephone branch alone it is expected that ultimately there will be 412 officers, who will occupy the fifth floor during meal hours, whilst the operating staff will be occupying it all day long. Provision must also be made for the mechanical staff, the probable strength of which I am unable to say at present. At present there are 35 trunk line operators. I could not say off-hand what the number will be when we go into the new building; but, as I have stated, we are putting in twelve additional operating positions, and we estimate that they will be used by the end of next year, so probably there will be a trunk line staff of about 50 operators and supervising officers. I have not heard of a proposal to use the flat roof for luncheon-rooms, but that would be possible. I am aware that the whole of the floor space of such a building will be exceedingly valuable, but I have no doubt that ultimately the whole of the accommodation will be required. At present the State Engineer and his staff are renting quarters in the heart of the city. Immediately the new building is available room will be found for them. It would not be desirable to utilize any of the space in the basement, or on the ground or first floor, for any other purpose than that which I have indicated. The only saving in space that would be possible at the outset would be on the third, fourth and fifth floors; but in the course of a few years the whole of that accommodation will be required for the accommodation of the trunk line equipment, and the staff of the telephone branch. I see no objection to the proposal to have the luncheon-rooms on the flat roof. Possibly we shall have to utilize it for that purpose, because we may find it necessary to install a cafeteria for the convenience of the staff. Probably the fifth floor will not give enough room, and we may be forced to go out on the roof. We expect to be providing meals for nearly 600 people in the building, and we must have a separate rest-room and sick bay for the female members of the staff. I agree with the statement supplied to the Committee concerning the financial aspect of the proposal. I agree also with the statement of the anticipated development of the telephone system in Queensland. It is anticipated that Queensland in this respect will develop more rapidly than any other state in the Commonwealth, and I speak with a fairly wide knowledge of that state. At present

a large number of subscribers connected to the Central Exchange are situated beyond the distance fixed for the minimum rental charge, and have to pay excess mileage rates. Similarly the whole of the subscribers in the Sherwood area being more than two miles distant from the Toowong Exchange, with which they are connected, are required to pay excess mileage fees. Many subscribers in the Paddington, Yeronga, Bulimba, and Newmarket areas are in the same position. The ordinary ground rental for subscribers within 2 miles of a telephone exchange is £5 per annum; but where the premises are situated beyond that distance there is an extra charge, at the rate of 10s. per quarter mile. Some of the subscribers in the Brisbane metropolitan area have to pay £6 and £7 per annum ground rent. It is likely, therefore, that when the new exchanges are available there will be very substantial telephonic development in Brisbane. To indicate the rate of development I may state that the telephone revenue from all sources in Queensland has increased during the last ten years from £135,000 to £400,000. In Queensland, as in the other states, the supervision and control of the traffic and commercial activities of the telephone branch are centralized in the capital city; but recently the question of decentralizing telephonic activities has been considered, and we are now establishing country centres in the various states. For example in Victoria, instead of the whole of the administrative work being done from Melbourne, there will be branches at Ararat and Bendigo; and in New South Wales there will be branches at Lismore, Armidale, Nowcastle, Gosford, Wagga, and Dubbo. An opportunity offers the system will be extended to Queensland and other states.

37. To Senator Reid.—The present Central Exchange at Brisbane is very much overcrowded. The roof is low, and the ventilation and lighting are bad. A new building is essential. The present building was considered unsuitable as far back as 1913, when steps were taken to acquire the site of the proposed new exchange. The instruction room will be used for the training of telephone operators. Every operator has to receive a month's training, a girl being given a thorough grounding in the work before she takes her place at a switchboard. It is possible that for five or ten years, space will be available in the proposed new building on the third, and, perhaps also, the fourth floor for other employees of the General Post Office, Brisbane. The present building is so overcrowded that the telephone workshop had to be removed, also the telegraph mechanic and his staff, the Stores Branch, and, finally, the State Engineer, with the whole of his staff. We expect the new building to be available in about three years' time. If there is any delay, and if the new building is not available by 1937, telephonic development will be seriously hampered, and we shall have to ease down on a fairly extensious. It is the only exchange to which subscribers in the city area can be connected. The Alibon Exchange has already reached the limit of its capacity, both in regard to switchboard accommodation and the building. It will be possible for us to carry on at Toowong for about three years longer. The only metropolitan exchanges are at Sandgate and Wynnum. We have already managed out a fairly big programme of new works for Brisbane. I am convinced that the site proposed is the best that can be obtained. Elizabeth-street is not very long; and I doubt if cheaper land could be got towards George-street or Creek-street; in fact, unless we went beyond Albert-street, the land would probably be even more costly than the proposed site. It would be undesirable to acquire a site in the flood area, below Elizabeth-street.

38. To Mr. Jackson.—The site before the Committee was recommended by our department, and was purchased by the Home and Territories Department in 1913, and I cannot see that there would be any financial or other advantage in disposing of it and

acquiring another site. I am quite certain that no vacant block of land suitable for the purpose could be obtained. It would be necessary to buy an occupied block, and the buildings on it would increase the purchase price.

39. To Mr. Mathews.—I am satisfied that the expenditure over £500,000 is warranted. After all, the biggest expenditure will be for equipment, and even if the cost of the site and building were reduced, the reduction in the total expenditure would be very slight. Whatever building or site is chosen, the cost of equipment would be the same, and any other site that would be suitable might involve increased capital expenditure on the lay-out of the cables, which would more than offset any saving on the land. The development figures for Brisbane have been carefully studied, and the estimate of expenditure upon equipment has been reduced to a minimum.

40. To Mr. Mackay.—The theoretical telephone content is determined more by the density of development, or number of lines, rather than by the average length of lines leading to the exchange. In determining the location of an exchange it is essential, in order to eliminate unnecessary costs on external plant to establish the exchange in such a position as will enable all subscribers to be reached with an average wire mileage as low as possible. Of course it would be desirable to so locate an exchange that all lines leading to it would be of approximately equal length, but that condition could not be realized in any city, and much less in Brisbane, where the contour of the city is irregular, and the population is peculiarly distributed.

41. To Mr. Cook.—We shall have in the proposed new exchange an operating staff of 262 officers, and in the telephone branch 150 officers, making a total of 412. If the line and mechanical staffs are included, at least 500 officers will be working in the building. Dining accommodation for such a large number will occupy a lot of space, but there is no advantage in supplying the operators with hot meals unless they can get them in the building. There is no other building near the site of the proposed new exchange in which dining accommodation could be provided except the General Post Office, in which the space is equally valuable. No system of serving meals outside of the building in which the operators are employed would be satisfactory. I have said that possibly it will be necessary to use the top floor of the new building because I do not think that the fifth floor will provide sufficient accommodation for refreshment-rooms and retiring-rooms for the female officials. I have not the slightest doubt that the expense involved in the proposed building is warranted. Telephonic development in Queensland generally, and Brisbane particularly, is likely to be more rapid than in any other part of Australia.

42. To the Chairman.—The humidity of the atmosphere in Brisbane at times is very great, and it causes distress to the operators in the Exchange. I do not know whether the plans of the building and air-conditioning plant provide for the recirculation of treated air to every floor. I know from experience that air-conditioning is very necessary in all offices in Brisbane, and I shall discuss with Mr. Crawford the advisability of providing at the outset for this to be done on all floors.

(Taken at Melbourne.)

FRIDAY, 26th SEPTEMBER, 1924.

Present:

Mr. GREGORY, Chairman;	Mr. Jackson
Senator Barnes	Mr. Mackay
Senator Reid	Mr. Mathews.
Mr. Cook	

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

43. To the Chairman.—In providing an air-conditioning plant for the Brisbane Central Automatic Telephone

Exchange it was not proposed to ventilate the two upper floors, which will be used for general office purposes. But I have prepared an estimate of the cost of extending the air-conditioning plant to those two floors, or alternately providing a ventilation and air washing plant for them without the use of the refrigerator or the humidifier. I have seen the plans of the proposed building, and I have inspected the site. This is to be a large building of seven floors. I am aware of the general climatic conditions in Brisbane, and I am aware of the conditions that respect on the meteorological records. When installing the air conditioning plant it would be wise and desirable from the point of view of the comfort of the staff to provide ventilation for the whole building. In the original estimate no provision was made for this. I have prepared a number of minor schemes for the ventilation of buildings apart from the air conditioning of switch rooms. In the case of Brisbane Central it is proposed that the building shall consist of seven floors each 133 feet x 64 feet, an average height of 15 ft. 6 in. It is proposed to condition the air of the four lower floors which will be used as a telephone exchange, and, with a view to keeping the installation costs as low as possible, it is proposed to provide a plant capable of alternately supplying air to any two floors simultaneously. The equipment will be capable of changing the air of two floors simultaneously at the rate of six times per hour, requiring a total plant capacity of 25,000 cubic feet of treated air per minute. No provision is proposed for heating or ventilating the three upper floors. The plant will consist of a volume fan, air washer and heater, cooling coil, evaporator, water cooling tank, circulating pumps, and duct leading to the parts of the building to be conditioned. The plant will be located in the basement, and fresh air will be drawn from outside through louvred openings in the north wall at the level of the windows on first floor, and carried to the fan suction through a vertical duct having a cross-sectional area of approximately 20 square feet. After passing through the conditioning plant the air will be discharged into a vertical duct located about the centre of the west wall, and thence into discharge registers in the ceiling, located between the two secondary beams adjoining the main duct, and extending right across the building. Extraction ducts for the removal of air will be provided at each end of the building. These will consist of vertical shafts of approximately 10 square feet area, extending from basement to roof, and connected to an extraction register in the ceiling of each floor, located between the two secondary beams at each end of the building. The upper ends of each vertical shaft will have an outlet above the roof, and the lower end will be connected to the fan suction, each end being fitted with a damper. Air will thus be discharged into the building from the ceiling, through registers extending across the building, and will leave through the outlet registers in the ceiling at each end, the circulation of air thus being from the centre of the building towards each end. The air leaving the building through the outlet registers may either be discharged to atmosphere through the top of the extraction shafts, or returned to the fan suction through the bottom of the shafts and re-circulated, as desired, by operating the dampers at each end of the extraction shaft. The fan will be capable of delivering 25,000 cubic feet of air per minute against a resistance equal to an inch water gauge, and will be driven by a 10 horse-power electric motor. The air washer will have a cross-sectional area of 50 square feet (approximately 7 feet high x 7 ft. 2 in. wide), and will contain approximately 300 sprays and 84 eliminator plates. There will be 40-inch "Vento" heaters, 15 sections wide by 3 stacks high by 2 stacks deep, making 60 sections in all, with 644 square feet of heating surface, capable of raising temperature of air 40°F. The boiler will be a cast-iron water boiler of 1,100,000 British thermal units per hour, with a heating capacity capable of raising the temperature of the air 40°F. The spray pump will be capable of pumping 6,000 gallons per hour

against a 100-foot head, and driven by a 7½ horse-power motor. The boiler pump will pump 3,700 gallons per hour against a 10-ft. head, and will be operated by a 2 horse-power motor. The cooling tank consists of a concrete tank in the floor approximately 16 feet x 8 feet x 6 feet deep to contain 3,200 feet of 1½-inch ammonia coil. The refrigerator will have 25 tons refrigerating capacity per 24 hours, and will be driven by a 45 B.H.P. motor. It is proposed to install a vacuum cleaning plant to serve all seven floors, and a compressed air plant to serve the four floors to be used as an exchange. The compressed air is used to blow the particles of dust from the telephone apparatus. The vacuum plant will consist of a rotary vacuum producer located in the basement, together with wet and dry dust separator. Vacuum pipes will be carried from the producer along the ceiling of the basement with fourteen vertical risers extending from the basement to the fifth floor with a hose valve fitted at each floor level. The risers will be so arranged that any part of the building may be reached with a 30-ft. length of hose. The air compressor will be arranged alongside the vacuum producer, with air receiver suspended from basement ceiling, and air pipe re-connection will be carried alongside vacuum pipes with air valve alongside each vacuum valve up to the fourth floor. The plant will be similar in design to that installed at Collins wood, but of larger capacity to suit the increased size of building (two hose plants). The vacuum producer and air compressor will be driven from a counter shaft operated by a 7½ horse-power motor. The estimated dehumidifying plants, and compressed air cleaning to control conditions in four floors used as telephone exchange, and to provide a fixed pipe vacuum cleaning system for cleaning the complete building will be as follows:—

Proposal I.

Ductwork, registers, hangers, erected	£1,700
Fan, motor, and foundations	300
Air heater, circulating pump, piping and accessories, and fuel hopper	600
Air washing, sprays, pumps, eliminator plates, air conditioning battery, spray pump, and motor	1,500
Ammonia compressor, condenser and refrigerating coils	3,000
	£7,100

To provide a central system of vacuum cleaning with fixed piping and arranged with valves placed to allow for cleaning any portion of floors with 30 feet length of hoses. Compressed air cleaning service for four floors used for telephone exchange

	600
Total	£9,000
Contingencies (say) 10 per cent	900
Total (say)	£10,000

Proposal II.

To extend the air treatment plant to two additional floors to control conditions similar to those laid down for the telephone exchange involves doubling the size of the air conditioning plant, and the cost of such work to be added to estimates as in proposal (I.) are:—

1. Duct work, &c.	£1,000
2. Fan, &c.	100
3. Air heater, &c.	300
4. Air washer, &c.	800
5. Ammonia compressor	2,000
	£4,000

The total cost would then approximate £14,000.

Proposal III.

In addition to air treatment plant to four telephone exchange floors, to provide air washing and ventilation to two additional floors, excluding the dehumidifying plant, the estimated cost is:—

Air treatment plant, &c., as Proposal I.	£10,000
1. Ductwork registers, hangers, &c., for two upper floors	1,000
2. Fan motor and foundations	300
3. Air washing, spraying, pumps and water tank	1,000
	£12,300

I can prepare, in the course of ten days or so, three alternative schemes for the ventilation of the building in sufficient detail for the committee to see clearly what is proposed. I understand that the ventilation of the new building of the Union Steam-ship Company in Sydney is effected by an extraction system. The practice in the United States of America varies a great deal, but I have knowledge of the way in which a building in Chicago occupied by Armour's staff is air-conditioned for the comfort of the staff and for keeping out the odours of the district. The plant I have in mind is mostly applied to process rooms such as cigar factories or places where the product would be improved by low temperature drying. A plant on these lines is installed at Wrigley's chewing gum factory in Sydney. It was imported direct by the factory manager for process purposes, and has been in operation for a month or two. It is somewhat on the lines of that in the Adelaide exchange.

44. To Senator Reid.—I shall not overlook the necessity to provide for the heating as well as the cooling of the two upper floors.

(Taken at Sydney.)

MONDAY, 13th OCTOBER, 1924.

Present:

Mr. GREGORY, Chairman.	
Senator Barnes	Mr. Cook
Senator Reid	Mr. Jackson
Mr. Blakely	Mr. Mackay
George Vincent, Heating and Ventilating Engineer, Sydney, sworn, and examined.	

45. To the Chairman.—I have no data relating to the temperature or the humidity conditions in Brisbane. Some years ago I carried out ventilation work in Brisbane, but from memory I am not able to say what is the relative humidity there. I know that Brisbane is a very humid place, and is noted for that and its high temperatures. I certainly think it would be wise to install a thorough system of ventilation in buildings erected there. In a climate like Brisbane it is not possible for officers to carry out their duties properly and render efficient service unless the buildings in which they work are artificially ventilated. As with an automatic telephone exchange, it will be absolutely essential to install an air-conditioning plant to protect the automatic telephone apparatus, a proper system of mechanical ventilation should be provided for the whole building. Brisbane is more humid at a higher temperature than is Sydney, and therefore the relative humidity is greater. The climate of Brisbane is more nearly akin to that of Auckland than to that of Sydney. I have just returned from a visit to New Zealand, where I spent a period of six months. In every automatic telephone building, irrespective of its size, throughout the Dominion, ventilating plants are being installed. The system which they have followed is crude compared with that adopted in Australia. With automatic telephone exchanges it is essential to provide

a certain atmospheric condition to comply with the requirements of the suppliers of the apparatus. In order to supply these conditions, it is necessary to use modern air-conditioning plants. In Sydney plants have been installed by my firm for the elimination of dust and the reduction of humidity as far as possible. The Union Steamship Company and the Commercial Bank, in Barrack-street, have such plants installed. To warm the air in winter time the system adopted is to have a heating battery over which the air is drawn or forced after it has been washed. In that way the temperature is raised, and the air circulated through the building at a comfortable temperature. If the air-conditioning plant is properly designed for the elimination of free moisture, excessive humidity is avoided. There have been isolated instances of plants that have been unsatisfactory from the point of view of the elimination of free moisture, but recently the plants have been designed on an improved basis, by means of which free moisture and entrained moisture are eliminated. The operation of a plant without refrigeration will finally, in many cases, increase the relative humidity in the atmosphere of the building, but in most circumstances it is possible to provide a reasonable condition of temperature and humidity in a building with the operation of a plant and without refrigeration. For instance, take atmospheric air. That air enters a building at a fairly high percentage of humidity. Not saturated with water. If you can get water cool enough, obviously you can lower the percentage of humidity to a certain extent; but if the water is not cool enough—which would be the case if you used water-main water—you will saturate the air at a pretty high temperature, and very considerably increase the moisture content. After the air has been saturated in a spraying chamber it passes through the eliminator battery. In that battery you apply an additional air-washing process, and on the rear plates of the battery which are kept dry, you get rid of a good deal of the free moisture and the entrained moisture. In many cases, of course, you have air that contains 100 per cent. of moisture, but at the same time it has a lower dew point. The heating of this air will decrease its relative humidity, but obviously it will carry through with it some of the moisture, and if the temperature of the air is high it will affect the comfort temperature of the room; but if the temperature is low, such as would be the case if the plant was operating in winter time, or in summer time with cold water, the conditions that you finally secure are quite comfortable. An eliminator battery is merely a succession of vertical sheets of galvanized-iron bent preferably in six sections at an angle of 30 degrees from the straight line and spaced about an inch apart. The rear sections of the battery have projecting lips which catch the entrained moisture. The forcing of the air through the plates sets up a scrubbing action on it as it passes through. The eliminator battery also has flooding sprays, which flood the first four sections. There is a vertical volume of water running down the first four corrugations, which causes a scrubbing action on the air as it passes through it, which is a pitifully a mechanical process. The sheets are coated to prevent corrosion. I do not think it is possible to provide the conditions required in an automatic telephone exchange without refrigeration. That was tried in New Zealand, but proved a failure. Such a system is entirely satisfactory, because if it will get to high a final temperature in the room. Relative humidity means the amount of moisture in the air in proportion to the temperature. A certain amount of moisture in air at one temperature will not cause as great a relative humidity as it will at a different temperature. If you increase the temperature of the air you increase its capacity to absorb moisture. The type of air-conditioning plant which is proposed to install at Brisbane's Central is similar to that which is being installed in the larger exchanges in New Zealand, but the method of installing it in New Zealand is different. The sole duty of mechanical refrigeration is

to cool the water. Air-conditioning simply means drawing chilled water by the use of a centrifugal pump through a cooling tank, and circulating it into a spraying battery. The air introduced from outside, or the recirculated air, sprayed by the spraying batteries, is saturated at the design of the duct systems and the whole of that incoming air will be completely saturated. It then passes through the eliminator battery, and finally through the heating battery, where it is warmed up to the temperature that is desired. A great deal of improvement has been effected in the work that has been carried out in New Zealand, but that has been due principally to the design of the duct systems and the air-washing plants. The plant that I installed in Auckland is about the size that is proposed for Brisbane. That in Wellington is larger. There are four exchanges in Auckland which have mechanical refrigeration. The other exchanges may be termed satellite exchanges, and do not embrace refrigeration. The great difficulty that I experienced in Brisbane years ago in regard to ventilation systems was the unintelligent operation of the plants. In the case of this proposed exchange, however, there will be a responsible man in charge, and the conditions will be different. In the case to which I refer it was not possible to run spraying batteries at night, because it would result in getting 100 per cent. saturation of the air without having any means of eliminating it. To put a heating battery on would be absurd. Those plants should have been operated with flooding sprays working over the eliminator battery, with the spraying chamber inactive. In that way the air could be cleaned to the extent of about 85 per cent., or perhaps more, and a certain amount of cooling would be obtained without completely saturating the air as it passed through. That is the only way in which plants can be run without refrigeration during the hot humid nights. In this case, with refrigeration installed, it will be necessary to use portion of the plant for the ventilation and the cooling of the offices. In New Zealand the practice is to condition the trunk line-room in the same way as the switch room. It will be quite possible to extend the ducts sufficiently to cover the whole of this building. It may be advisable to separate the ducts, in cases the ventilating plant is not required to be operated in the two top floors but is required for the automatic exchange portion of the building. That can be done at very little extra cost, and it looks as though it would be desirable to do it. The automatic plant must be the first consideration. No difficulty would be experienced in extending the plant to enable it to operate throughout the whole of the building. I should say that the plant would be required for the exchange room on every day of the year. If that is so you will want to have ducts in the exchange with a constant volume of air passing through at night. The ducts in the district which it would be necessary to condition in the offices would be limited to the hours during which they were occupied. It may be economical to expend a little more at first in providing a separate system of ducts on the fifth and sixth floors, making them independent of the principal plant. By that means maintenance charges would be reduced. On the higher floors I would introduce the air supply at about 8 feet from the floor level on the side walls. The vitiated air should be taken out at about 2 feet from the floor line on the same wall. That is the standard practice in modern ventilation. Experience has proved that it is very useful to introduce air at the floor level. I have proved the efficiency of introducing air at the higher level and removing it at the ceiling. The trouble with ventilation practice is that everybody has his own ideas upon the matter. My principal difficulty is to see that my ideas are given effect to. I installed ventilation systems in 1908 or 1909, when wrong ideas were being followed. I simply followed what is still the standard practice in America. But in America they always provide a heating system. The air can be brought in at a low velocity under the seats, and as soon as there is any coolness in the atmosphere the heating plant is utilized. In Australia, if you install a heating plant it is not used. That

has been my experience. The conditions met with in Australia relate more to heat and dust than to anything else.

If you introduce air through the floor you are limited to a very low velocity. Air flowing in under a cent at 4 feet a second is imperceptible unless it is very cold, when it should not be introduced because it is dangerous. If you take air in through the side wall you can attain a velocity of 12 linear feet a second. So long as it is given the right direction it does not set up draughts. There is only one proper point of entrance and exit for ventilation currents in public buildings. We deal now only with the respiratory zone. The old idea of ventilating the upper part of a room is ignored. People do not worry about ventilation for any part of a room other than that where breathing takes place. The elimination of dust, the obtaining of the correct temperature, the proper movement of air, and the right relation of humidity are now the factors that are considered when installing ventilation systems. The Commercial Bank is an illustration of modern ventilation properly applied. The Union Steamship Company's building is another case in point. Wrigley's imported their plant from America and I installed the ducts. It is not ventilation in the ordinary sense of the word. The necessity for installing air-conditioning plants is obvious, because 70 per cent. of relative humidity in a telephone exchange is the danger limit. As the average relative humidity in the main annual exchange in Auckland for five years has been 83.5 per cent., it is obvious that in all cases it is essential to install these plants, especially when one remembers that the relative humidity there is sometimes as high as 95 per cent. I have seen that point reached several times in Auckland in the winter period. I had conferences with all the officers and discussed the conditions from Auckland to Dunedin. In Dunedin the average relative humidity throughout the year is from 73 to 74 per cent. In Christchurch it is 75 per cent., and in Wellington it is 73.5 per cent. They are all above the danger mark, and it was pointed out to me that the plants cannot be left unattended, even for a short period of time. When the humidity exceeds 70 per cent. the tendency is to destroy the automatic plant. In small exchanges crude heating plants have been installed. They will eventually have to be taken out and proper plants put in. When you decrease the relative humidity by raising the air temperature you raise the temperature in the exchange very highly. They are working in a temperature of 55 degrees, which is trying to the staff. I cannot give figures showing the comparative cost of refrigeration in New Zealand and Australia. That matter does not come within my province. The refrigeration plant has been installed by a firm with whom I have been co-operating.

46. *To Senator Reid.*—The relative humidity in Brisbane and Auckland is very much the same. Hamilton, on the Waikato River, is more humid than Auckland, although it is inland. The Brisbane River must be like the Waikato; a great deal of fog must be brought up along the river-bed. Brisbane is in a hollow, surrounded by hills. Whenever I wanted to get away from the humidity of Brisbane, I went to the outlying hills. Auckland is the most humid place in which I have been, and the readings which I got there astonished me, more because I always considered that our conditions were more drastic. Auckland has the ocean on each side, and there are so many rivers in its vicinity that it is practically surrounded by water. Relative humidity is the amount of moisture in the air in relation to the temperature. Therefore, it is higher in summer than in winter. In Auckland the relative humidity reaches as high as 95 per cent. almost to the point of saturation. I cannot say to what percentage it rises in Brisbane. It was in Brisbane off and on over a period of about eighteen months, but never at any time for a longer stretch than three weeks. I have been there in all seasons of the year. The air-conditioning plant in the exchange room at Brisbane would require to work the whole of the 365 days in the year in order to protect the telephone apparatus. It may be advisable

to have a separate line of ducts for the ventilation of the upper floors, because they would require to be used only when the conditions rendered their use necessary. Whenever the relative humidity is much below 70 per cent., the plant may not be required for the protection of the automatic telephone apparatus. The inlet should be stationed at a height about two-thirds up the wall. The conditioned air that is taken into the room will gradually fall down in streams. Smoke tests have proved that by that means the whole room is bathed in air. If the air is taken in on the side wall, and out at the floor level on the same side, the whole of that portion of the room to the height of the inlet is completely filled with it. In the case of a tall building it may be advisable, particularly in a hot climate, to have an auxiliary exhaust at the ceiling in order to get rid of a big blanket of immure air above the respiratory zone. We breathe out CO₂ the whole of the time, and are continually loading with all kinds of impurities the air in the room. Consequently that air is being poisoned. If it is diluted with fresh air that is fully loaded with free oxygen, perfect conditions are obtained. Any man who understands his business can ensure ideal ventilation conditions if the money is provided for him to do so. In the Commercial Bank they do not warm the air in winter. They say it is not cold, but I say that it is. You cannot during four or five winter months of the year introduce air from outside without lowering the temperature inside the building. If you went to the Commercial Bank on a cold day you would very likely find that the fresh-air system was out off, and that they were working entirely on the exhaust. In the Savings Bank, in Sydney, so many employees were engaged that it was found absolutely necessary to do something to freshen the air supply. They tried all kinds of make-shift appliances, and I eventually installed a fresh-air supply system with the air-washing plant on the roof and the ducts brought down from the roof to the basement. There is no heating plant. In winter time they simply tie the registers up. That is not a complete system. You cannot consider a heating plant as heating; they are inseparable. The great set-back given to mechanical ventilation in America years ago was due to the fact that very often they were dealing with a temperature that was 20 degrees below zero. They introduced air at a high temperature and a low humidity. That brought about conditions that induced catarrh and inflammation of the mucous membrane. Those conditions would not operate in Australia. We would merely need to raise our temperature from 60 degrees to about 90 degrees. At a temperature of 90 degrees you do not rob the air of its natural qualities to any extent, and do not bake it. There is nothing unhealthy or unhygienic in introducing warm air in the winter time, when an inside dry bulb temperature of 65 degrees and a relative humidity of about 50 per cent. will give ideal conditions. If ventilation is properly applied, the fresh air introduced will find its way to every part of the room. Thirty-five years ago the regulations of the State of Massachusetts in relation to school-house ventilation provided that there should be a certain air movement and a certain temperature over the whole floor area and according to the size of the room. The school-house was not considered to be properly ventilated until those conditions were given. They are the conditions that still apply in every ventilation system that is properly designed and carried out. Federal Parliament House, in Melbourne, would not be ventilated if only one portion of it were ventilated. In every part of New Zealand automatic exchanges are being installed. The Western Electric Company imposed certain atmospheric conditions which rendered necessary the installation of air-conditioning plants.

47. *To Mr. Mackay.*—I am familiar with the plants that have been installed in telephone exchanges in the Commonwealth, but I cannot say whether they have been operated successfully. I think the air is introduced through the side wall at the ceiling level, and taken out at the ceiling level on the opposite side. One

exchange in New Zealand had a refrigerating plant installed, costing £2,000. To distribute the air through that exchange, they put in a small fan and small system of ducts. The refrigerating plant was installed merely to cool the water in the tank; it had nothing to do with the distribution of the air. The distribution of air in an automatic telephone exchange should be carried out in respect to the apparatus itself, and not in respect to the room. The practice I have adopted in New Zealand is to ventilate each rack separately. If you spend money upon the conditioning of air, you should do it in the best possible manner. In the main exchange in Wellington I am providing a branch to each rack, so that the air will be taken right into the intricate machinery, and at the same time ventilate the remaining portion of the room through other registers. That method of distributing the air is a great improvement upon the system of air distribution that has been followed in the exchanges in Sydney, where the air is taken in on the side wall, at the ceiling level. In these matters you have to work on certain fundamental knowledge, applying the experience you have gained, and using your own common sense. I do not think that the Commonwealth is paying too much for these plants. The method adopted in carrying out the work seems to me to be the cheapest. I do not say that it is the most satisfactory, or that it will give the best results. I think it is entirely wrong to adopt the practice that has been adopted by the Commonwealth, but it certainly is the cheapest. In New Zealand the work is on a much better basis for securing efficiency, due to the experience of the people who undertake the work. Very few people know the proper method of distributing air through ducts, and it is in that respect that ventilation systems are ruined or made successful. I should say that the Commonwealth would secure a better distribution of the conditioned air through a telephone exchange by putting in a system of ducts different from what they are now putting in. In New Zealand I obtained a fair knowledge of automatic telephone apparatus, and I ascertained what parts needed the greatest amount of protection, and where moisture was likely to do the most harm. It is necessary to take the air into the danger places at a certain velocity and proper volume in order to prevent the moisture from lodging. It is all a question of care and intelligent work. The method of distributing the air in every industry is different. I would not go so far as to say that the system adopted by the Commonwealth is not fairly satisfactory, but I think that the method of distributing the conditioned air through telephone exchanges could be improved by bringing that air into more intimate contact with the telephone apparatus.

48. *To Mr. Jackson.*—I have not seen the plans that have been prepared by the Department of Works and Railways. I have supplied certain parts for similar exchanges. I saw the arrangement of the ducts in the Colingwood exchange. I do not say that the present plan could be improved without adding to the expense. But I do say that the method adopted for the distribution of the air in the exchange room could be considerably improved. The present method does not produce the best results. The Commonwealth would get better results if the department threw their work open to the competition of specialized engineers, and obtained from them a plan, an estimate, and a lay-out of the work.

49. *To the Chairman.*—In the Union Steamship Company's building it is not possible to take all the air in at the side walls. There is a lead-light arrangement in the centre of the banking chamber, and the air is introduced through that. It flows up towards the ceiling, hits the ceiling, and comes down in streams. The conditions there are practically the same as those in the Commercial Bank. The air is completely washed and cooled so far as the water used will permit, and is taken through ducts. The vitiated air is removed by another system of exhaust ventilation. In both cases the machinery is in the basement.

(Taken at Sydney.)

TUESDAY, 14th OCTOBER, 1924.

Present.

Mr. GREGORY, Chairman.

Senator BARNES	Mr. COOK
Senator REID	Mr. JACKSON
Mr. BLACKLEY	Mr. MACKAY

Andrew LEWIS, Chief Mechanical Engineer, Department of Works and Railways, recalled and further examined.

50. *To the Chairman.*—I have prepared three alternative schemes for the ventilation of this exchange, and have sketched plans setting out the proposals. Under the original proposal, No. 1, it is proposed to install the air-conditioning plant and the heating boilers in the basement or the ground floor of the building, and to pass the air out through a central duct attached to the blank wall, distributing it into ceiling registers located on each of the four floors used for telephone purposes. That includes both the so-called trunk room and the floors used for actual telephone operations. It is then proposed to return a portion of the air so distributed through ducts located in the two extreme ends of the building, or near the extreme ends. You will notice the central incoming air register at the centre of the building. The outgoing air will be taken away at the two ends of the building, leaving the floor space and a good height of the wall available for telephone equipment. Since we do not know the exact magnitude of the equipment, there has to be as much economy of space as possible. The air is to be returned to the fans, re-circulated to the air washer, and extracted by means of an extraction fan located on the roof. At times when the atmosphere is particularly oppressive, it will be necessary to draw out as much air as possible and condition the air supplied to the room. It is proposed to locate the condenser house on the roof, and the cooling tank in a pit below the basement level, and to carry the main return ducts, the recirculation duct, and the fresh air ducts underneath the basement level, in order to leave as much floor space as possible available for other uses.

51. *To Senator Reid.*—To extract the air, I would have a big ceiling register, 8 feet wide, across the room, through which the air would be drawn at a very low velocity.

52. *To the Chairman.*—The whole of the plant, with the exception of the condenser and the two extraction fans, will be located in the basement, of which it will occupy about one-fifth. The air will be taken in through a register in the wall facing Arundel, at a point about half-way up the building. It will be drawn down into the air washer through a register flush with the wall. The duct itself will be inside the building. The centre register, through which the air will be taken, will be 32 feet above ground level. When the air has been drawn down to the basement, and cleaned and heated to the temperature desired, it will be pumped up through air by 4 tunnel located on the side wall, and distributed through the ceiling registers to each of the rooms. The ceiling registers will occupy the whole width of the building, and will be flush with the floor beams. The air will be taken out through small registers located at the ends of the building. Under the plan system, a big system of air forced through a small opening at a high velocity. Under this system a lot of air will pass through a very big area at a low velocity. For 95 per cent. of the time the air, as it comes in, will gradually fall to the floor on account of its being cooler than the other air in the building. Air has a tendency to find its own thermal level. Hot air has a tendency to rise to the ceiling. If you force cold air into a hot room, it falls to the floor. The bigger you make the register, the less you feel the falling of the air. We have instruments that prove that it does come down. If we were to provide the means for heating the air in winter, we would increase the cost by

about 30 per cent., which, in my opinion, is not justified. I consider that we can provide adequate heating facilities by a less expensive system.

53. *To Mr. Mackay.*—Heat is more injurious than cold. In winter time the air-conditioning plant will be required to operate only for the benefit of the telephone equipment.

54. *To the Chairman.*—I have described the original proposal, which is estimated to cost £10,000. There are two alternative proposals.

55. *To Senator Reid.*—In winter the extraction fans will not be worked, and the extraction ducts will be shut off. Consequently, the warm air forced through the ceiling will have to find other outlets.

56. *To Mr. Cook.*—An air-conditioning plant is necessary for a telephone exchange, and the one I have described will prove quite satisfactory.

57. *To Senator Reid.*—If the conditioned air entered the room from the side wall, as suggested yesterday by Mr. Vincent, its free flow across the room would be obstructed by the telephone equipment. The velocities which he quoted have been discarded for about eight years, except in very economical plants. Most of the health regulations require a register velocity of 24 feet a second. Our expenditure will be somewhat greater on account of the bigger registers. We aim at giving a velocity of not more than 5 feet a minute right across the room, but the obstructions in the room will slightly increase that velocity, making it possibly 6 feet or 7 feet. The practice of taking the air in through the top and out through the walls near the floor is the first new applied in 1890, but it has been discarded for quite a number of years. It was spoken of enthusiastically as the ideal system, but those who installed the plants could not get them to work up to expectations. The present practice is to let the air in at a height of about 8 feet, and to take it out at the same level. If it is a long, narrow room, it is taken in at one side and out at the other. If it is a big square room, the methods are adopted, such as ceiling vents, in addition to side registers. No set lines can be laid down to suit different types of rooms. Primarily, the use to which the building is to be put must be considered.

58. *To Mr. Mackay.*—The reason for the difference between this plant and that installed at Collingwood is that here we have a little more humidity to contend with, and extraction of heat is more important. It is becoming the practice to take the air in at the top, and out near the top. In winter time the outlet registers will be closed. If they were left open, the tendency would be for the hot air to pass from the inlet to the outlet registers. If they are cut off, that hot air must find its way out under doors and through windows. Consequently, you get a somewhat better thermal circulation. It will not be so effective, but as those conditions will obtain for only about one-twentieth of the period, it is not an important matter. In cold weather brick buildings are warmer than wooden buildings, but if for a week the temperature is at about 104 degrees the temperature inside the building is the same as it is outside. I should say in such circumstances it is essential to air-condition a building that is not used for telephone purposes. A New York commission on ventilation has been investigating these matters for nine or ten years, and eighteen months ago it published a report. It found that the best atmospheric conditions were those in which the dry bulb temperature was 68 degrees Fahrenheit and the relative humidity 50 per cent. Actual work tests were carried out to ascertain the efficiency of the human being at that and other temperatures. It was found that at a temperature of 68 degrees Fahrenheit, and a relative humidity of 50 per cent., a man was able to do 26,711 lb. of work an hour. With the temperature at 75 degrees Fahrenheit, and the same relative humidity, the output fell to 22,000 lb. an hour. When the temperature was raised to 86 degrees Fahrenheit—which Mr. Vincent yesterday said was liable to be experienced in New Zealand telephone exchanges—the output was 28 per cent. less than

with the temperature at 68 degrees Fahrenheit. Mr. Vincent also referred to a more economical method of distributing air in telephone exchanges. He said that he would carry it inside the cases containing the telephone apparatus. That is similar to the method which we saw yesterday at Wigram's, where the conditioned air is carried inside the pans, no consideration being given to the convenience of the operating staff. The air picked up certain vapours from the pans, and the workmen could not escape breathing it. A Government department would not be permitted to run a plant on these lines. We would have to consider the comfort of the staff. In a case like that, I think it would be desirable to do so, either by putting the man in a diving suit, or by conditioning the whole of the air supplied to the room, and placing a little extraction duct inside the pans to draw the foul air away. In our telephone exchanges we have miles of cables that have been specially treated for the purpose of making them fireproof. I have had to investigate troubles that have occurred in telephone exchanges in the treatment of the cables. They use something which gives out quite a musty smell. I have here a cable taken from a roll in a telephone exchange that has a very peculiar smell. It takes anything up to six months to eliminate that smell from the cable after it has been removed. I think I can see a way of overcoming the difficulty. It can be done by providing a good circulation of fresh air in the room. The equipment at City North will be the largest in Australia, and I have every confidence that it will fulfil my anticipations.

59. *To the Chairman.*—I am satisfied that by taking the air out at the ceiling level I shall get better ventilation for 95 per cent. of the time. Better results are obtained from ceiling outlets than from floor outlets. I have no doubt that the fresh air will float down towards the floor. I am quite satisfied that my scheme will provide good conditions for the employees. The second proposal for which I have prepared plans is to extend the air-conditioning plant to provide conditioned air to the two upper floors that it is proposed to use for offices, and that eventually will be used in the basement. The automatic telephone exchange should later developments render that course necessary. The plant will be similar to that shown in proposal No. 1, but it will be double the size. Under the first proposal, four rooms are to be used as a telephone exchange, all under the one control. I would not put in a plant big enough to handle the four rooms. I could put in one big enough to handle two rooms. It could be shut off at any time, and the extraction system kept on. The floors devoted to office purposes will require to be treated both together, and that necessitates doubling the size of the plant and the duct work generally. The extraction plant will be located on the roof, as in proposal No. 1. The boilers and refrigerators will be in the basement, with the air tunnel underneath the floor, so that too much effective floor space will not be taken up.

60. *To Senator Reid.*—The air shaft will be carried to the under side of the roof in order to supply air to the top floor. In the first proposal no provision is made for treating the air on the two upper floors.

61. *To the Chairman.*—Under this proposal the air will be taken in at the same point as in proposal No. 1. The registers and the ducts will be double the size. Large ducts are required because of the low velocity. The size of the ducts could be reduced if the velocity were greater, but that cannot be recommended for a telephone exchange.

62. *To Senator Reid.*—This proposal is estimated to cost £14,000. If it were adopted the full plant for the ventilation of the whole building would be installed, and there would be no necessity to extend the plant later. Large ducts are required because of the low velocity. The size of the ducts could be reduced if the velocity were greater, but that cannot be recommended for a telephone exchange.

63. *To the Chairman.*—I am convinced that a low-pressure system is essential for an automatic telephone exchange. When air is introduced at a low velocity,

there are no draughts. Operators attending to the maintenance of the plant have to work at the level of the inlet and they are affected by the incoming air. I have met that by providing shields to cover that portion of the duct in front of the operator, which they are working. I do not recommend reducing the size of the duct and increasing the velocity at which the air is brought in. It is not possible to get the same distribution of air with a high pressure system as with a low pressure system. Provision has been made for regulating the quantity of air introduced. There is no likelihood of an explosion occurring if all the registers are closed.

64. *To Senator Reid.*—Someone will be charged with the responsibility of seeing that the registers are opened and shut. In my early days on ventilation with high velocity registers, I found rubbish thrown down the registers. The man who is in charge of the building is responsible for its ventilation.

65. *To the Chairman.*—One thousand pounds of the extra £4,000 required for this proposal will be set for the ducts. I should like to see this proposal adopted because I think that within the next ten years all important buildings will have air treatment of this type. It is up to the Government to lead the way, particularly in such a case as this. If it can be definitely said that within ten or twenty years the whole of this building will be required for office use, telephone exchange, it will be necessary to install the full plant now.

66. *To Mr. Mackay.*—It will be cheaper and more satisfactory to ventilate the whole of the building now. We could extend the plant at any time, but it could not be done so well as at present, and possibly any future extension would interfere with the operation of the exchange.

67. *To the Chairman.*—Under proposal No. 3 the conditioned air will be carried up to the first four floors, as under proposal No. 1. The air is extracted from the whole of the six floors by means of roof fans. This is an extension of proposal No. 1 in the direction of extracting air from the two upper floors. In addition, a small air register will be put in the tank that just washes the dust out of the air. It will actually increase the humidity at certain times, and possibly add to the discomfort of the staff, but for quite a long period in the year it will improve the comfort conditions. By this method there is a saving of 40 or 50 square feet per floor compared with proposal No. 2. The cost of this proposal is £2,300 greater than that of proposal No. 1. If the two upper floors are to be used permanently for office use this proposal may be adopted with advantage. I am leaving the original proposal in for the lower floors and taking a small amount of duct space off the upper floors. It is approximately the same as proposal No. 1, with the exception that the two upper floors will have 50 square feet taken off.

68. *To Senator Reid.*—The proposal is to send the dehumidified air up to the first four floors and to have a washing plant on the roof to deal separately with the two upper floors. Consequently there is no connexion between the two installations. Under proposal No. 3 the air for the four lower floors will be dehumidified and cooled, and the relative humidity reduced by room moisture, and that it will not at any time exceed 70 per cent. The air will be drawn in through a register located on the Arcade-lane side of the building, about 30 feet up from the floor level. It will be drawn down ducts at the end of the building to an air-conditioning plant located alongside the back wall in the basement of the building. There the air will be washed with cool water and heated when required. It will be passed through a fan to wall ducts located on the dead side of the building, and distributed to each of the four floors that it is proposed to use for telephone exchange purposes. It will then be carried into ceiling registers right across the room at a width of 8 feet, which will give a very liberal register surface. It will pass through the room at a velocity in the region of about 5 feet a minute to the two ends of the

room. It will be split into two parts at the centre, one part going to one end and another part going to the other end. It will be taken out through extraction registers located in the ceiling at the two ends of the building. Those registers are connected by a vertical shaft or tunnel to the air-conditioning plant, and that will enable a portion of the air to be recirculated through the air-treatment plant. At periods of very high humidity the whole of the air extracted can be taken out by means of fans located on the roof. In connexion with the two upper floors a somewhat less expensive air-treatment plant is proposed, which will merely heat the air and wash it, ordinary water being used for the purpose. At times some discomfort will be caused, inasmuch as the washing of the air by water that has not previously been cooled will increase its humidity. This proposal for the two upper floors is quite up to date so far as general ventilation in Australia has gone. Air conditioning and dehumidifying have so far been used only for special manufacturing processes or automatic telephone exchanges. Architecturally the tank on the top of the building will possibly be a defect. It is not generally regarded as an adornment. The committee saw a similar tank on the ground at Wigram's. This will be about the same size and have the same external appearance. It will be at the back of the General Post Office. Although it will be elevated it will be located on the dead wall side, away from the view that is obtained from the other side of the Brisbane River. It will not have any worse appearance than the ordinary sprinkler tank. If the same consideration were given to the beauty of the tank could be submerged or double-pipe condensers installed. That would involve an expenditure of £100 per annum. Within reason the main consideration is to install an economical plant. This tank will be 18 feet high. There is a 4-ft. parapet, and the tank can be camouflaged.

69. *To Senator Reid.*—It will be obscured from Wickham Terrace by the new post-office building. I think you are justified in putting the condenser house on the roof.

70. *To the Chairman.*—The air could be brought in at a lower level than the ceiling by taking up a considerable amount of wall space with side wall registers. That would increase the cost. The floor space which will be taken up by the ducts and plant under the three schemes I have outlined is as follows:

Scheme 1 Conditioned Air to Four Floors	Scheme 2 Conditioned Air to Six Floors	Scheme 3 Conditioned Air to Four Floors Washed Air to Two Floors	
			sq. ft.
Basement Plant	1,120	1,500	1,120
Ducts	75	109	75
Ground floor—Ducts	70	150	70
Second floor—Ducts	55	110	55
Third floor—Ducts	55	100	55
Fourth floor—Ducts	35	80	35
Roof—Plant	365	670	781

71. *To Senator Reid.*—Generally speaking, when the windows are open the ducts or registers will be shut off. Windows can be opened provided they are not immediately under the incoming air registers.

72. *To Mr. Mackay.*—Scheme No. 2 would be the most effective. It would eliminate any likelihood of alterations in the future when the upper floors are used for exchange purposes. Greater satisfaction would be given to the staff, and their output would be increased.

73. *To Mr. Cook.*—The running cost would be approximately £3,000 a year for scheme No. 1, and £1,400 a year for scheme No. 2.

71. *To Mr. Jackson.*—The plant at Wrigley's is of American manufacture. The arrangement of the cooling coils is somewhat different in America. The practice nowadays is to use Baudelot cooling coils, which are somewhat larger in diameter than we care to use here. The water that has to be cooled is distributed over the coils instead of the coils being submerged in a tank of water. The disadvantages of that plant are numerous. One is that the coils frequently become covered with ice and are ineffective as a cooling medium. The cooling effect on the water is less when there is a coating of ice on the coils. A more important consideration, however, is that of safety.

With larger coils there is a greater tendency to have split joints or burst-pipes, in which case the ammonia in the coils will work its way out into the incoming air. I understand that ammonia vapour has a searching effect on the copper and other metals used in automatic telephone equipment, and I must eliminate any risk of ammonia fumes getting into the room. If there is a leak in an ammonia pipe that is submerged in water the water takes up the ammonia. There are indicators that show when there is a leak, and there is, therefore, no risk of the plant remaining while a pipe is leaking. My original proposal, first of all, embodied these coils that we saw at Wrigley's, but, after a round-table conference, we decided upon the submerged type of coil. Wrigley's have gone a step further than we have, in that the controls are automatic. On their plant they have expended, probably, an additional £200 for automatic features for controlling the humidity. If I installed them I am afraid that they would constantly require adjustment. The inspection of Wrigley's plant has not caused me to think that my proposal requires alteration. Since 1917 I have had in my possession a detailed description of a similar plant that was installed in another factory, the only difference being that the building, due regard being had for the comfort of the staff, in addition to the protection of the machinery. Members of the committee noticed the foul vapours that were generated in Wrigley's factory. If that occurred in a Government establishment we would be compelled to luke fresh air in where the men were working and extract the foul air from the inside of the pans. Recently in Melbourne a conference of State health authorities was held to draw up a scheme for the ventilation and air treatment of factories. One of the regulations framed provides that all foul vapours must be extracted from the machine in which they are generated. That regulation, of course, is subject to the agreement of the states. To comply with the regulation it will be necessary to have an duct tube to draw the vapors from the inside of the chamber and prevent them from penetrating to the room.

75. *To Senator Barnes.*—In the event of scheme No. 3 being installed it will be more costly to convert it to scheme No. 2 in ten years' time than it would be to install No. 2 now. At the present time No. 2 would cost only a few hundred pounds more than No. 3, but in ten years' time the extra expenditure would be anything up to £2,000 or £3,000.

76. *To the Chairman.*—I submit hydrograph diagrams for Brisbane. I have obtained particulars regarding the meteorological conditions in Brisbane for the last six months, and I have plotted out the humidity conditions, particularly in summer weather. From 28th January, 1924, to 4th February, 1924, the humidity exceeded 75 per cent., and on two occasions actually reached 95 per cent.

78. *To Mr. Blakely.*—In one hour's operation at City North I had removed from one of the switch rooms water at the rate of 25 gallons an hour. Those conditions will never again be met with in that exchange. The plant was then being put into commission, and we were taking from the room the moisture that had collected while it was unprotected.

78. *To the Chairman.*—The following figures give the mean shade temperature and mean relative

humidity at Brisbane Observatory during the present year:—

Year	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.
MEAN SHADE TEMPERATURE.								
9 a.m.	80.4	70.5	74.0	68.9	62.8	68.7	60.7	60.9
3 p.m.	83.5	82.7	79.0	70.2	72.2	66.2	67.3	69.4
9 p.m.	76.0	75.0	72.4	69.2	63.9	69.0	69.0	69.5
MEAN RELATIVE HUMIDITY.								
9 a.m.	62	72	69	68	74	69	67	66
3 p.m.	67	68	61	57	66	67	61	60
9 p.m.	80	84	79	73	74	72	84	78

Mr. Vincent yesterday referred to CO₂. CO₂ is not now accepted as a measure of ventilation or air distribution. The lungs contain anything up to 20 per cent. of CO₂ for a period when we are breathing, and the effect of occupancy of a room by a number of persons is hardly measurable. During the last few years a device called the Kata thermometer has been designed. By its air movement can be more accurately measured. It is very similar to an ordinary ether thermometer, consisting of a bulb and capillary strip containing a given quantity of ether. The bulb is heated to something over 100 degrees, and the time taken for the ether to drop from the 100 to the 95 mark on the stem is taken as a relative measure of air movement.

(Taken at Brisbane.)

FRIDAY, 17th OCTOBER, 1924.

Present:

Mr. GREGORY, Chairman;

Senator Barnes Mr. Jackson
Senator Reid Mr. Mackay
Mr. Blakely Mr. Mathews
Mr. Cook

Joseph William Sutton, State Engineer, Postmaster-General's Department, Queensland, sworn and examined.

79. *To the Chairman.*—The proposal to erect an automatic telephone exchange at Brisbane Central originated in Queensland a little before the outbreak of the war. The scheme has been drawn up by me in conjunction with the Chief Electrical Engineer. It is part of a general scheme for the Brisbane network. The proposal is to substitute the existing manually operated automatic service in the Central exchange area by an automatic system designed to permit intercommunication between all the existing and proposed exchanges in the Brisbane network. It is proposed to erect a telephone exchange building on a site already acquired for the purpose in Elizabeth-street, Brisbane, adjoining the present manual exchange site, and to install therein automatic equipment sufficient to accommodate 10,000 subscribers' lines, and capable of being extended to meet the ultimate capacity. The proposal also contemplates the replacement of such of the present manual substation plant as cannot be economically converted to automatic working by equipment designed to afford efficient interoperation with the proposed automatic exchange. Provision is also included for the establishment of a lamp-signalling trunk line for 232 and 464 lines respectively (six lines per position). The Brisbane telephone survey carried out in 1920 has been used as a basis from which growth figures have been calculated. The capacity of the existing manual-switchboard is practically exhausted, and small extensions are necessary in order to carry on until the establishment

of the automatic exchange at South Brisbane. When this exchange is brought into operation, portion of the Central exchange equipment will be released and made available to meet growth in the central area. The accommodation thus made available, together with certain extensions necessary to handle automatic traffic incoming from Albion exchange, will, it is anticipated, meet requirements until about November, 1927. For the purpose of comparison, schedules have been prepared indicating the estimated first cost and annual charges on automatic and manual systems at the 1st July, 1927. The charges show that the proposal to establish an automatic exchange is considerably the more economical, the difference in favour of the automatic system being £25,316 per annum at that date. It is impracticable, owing to building limitations and the existing equipment, to further extend the existing plant, a portion of which has been in use since 1909, and has exceeded what is considered to be its economic life. In addition to the establishment of a new exchange in the central area being essential owing to the worn-out condition of the existing exchange equipment, the provision of up-to-date automatic plant would have the following advantages:—

1. Effect substantial reductions in annual charges.
2. Provide efficient telephone service by substituting the present manual type equipment by the most recent developments.
3. Reduce the danger of dislocation of the telephone service in the city area by fire with which the department is at present faced in the Central exchange, owing to the non-fireproof character of the existing structure. The new equipment will be installed in a fireproof building expressly designed for exchange purposes.
4. Contribute towards release of the site upon which the present Central exchange is situated, enabling the department to replace the present old three-floor structure by a modern building capable of producing greater revenue than at present.
5. Form a step towards the conversion of the multi-office system in the Brisbane network from manual to automatic working, enabling the department to provide a higher standard of telephone service at a lower cost than is practicable at present.
6. Permit future economical extension of the telephone system, an automatic system of 10,000 lines being more readily extended than a manual system of similar capacity.

The whole of the existing trunk line equipment will be fully occupied by the 1st July, 1927. As it would be a difficult matter to remove this equipment from one building to the other, it is proposed to install new equipment in the new building, the existing equipment being dismantled and utilised where necessary in country exchanges. Automatic telephone exchanges are not yet operating in Brisbane, but some are under way. I have had no practical experience of the working of the automatic system, but from what I have read in the technical press, and from what I have heard of the operation of the system throughout the world, I am satisfied that it will give better facilities to the public than are possible under the present system.

80. *To Mr. Mackay.*—The automatic telephone exchange building at South Brisbane is nearing completion, but no apparatus has yet been installed.

81. *To the Chairman.*—It is estimated that if approval is given to the erection of an automatic telephone exchange at Brisbane Central, the building can be completed and the plant installed in about three years. The capacity of the present plant will be fully taxed in about four months' time, and if we do not have the South Brisbane exchange cut in by that time any additional subscribers who would be connected with Central will have to wait until South Brisbane is ready. That

exchange will release from Central about 2,600 lines, and that will enable us to carry on at Central until 1927. If approval is given to this exchange immediately, the construction will have to be expedited, otherwise there will be a period during which we will not be able to connect additional subscribers. I have approved of the site upon which it is proposed to erect the exchange, and I think it is wise to proceed with the building on that site. It was erected many years ago, and we have arranged for the whole of our cable system to converge at that point. The cost of altering that plan would be very great, and would offset any saving that might be effected by purchasing a cheaper site, if it were possible to do that. I do not anticipate that any objection will be raised by the local authorities to the erection of the building, we will require for an automatic exchange. I have no idea of the present-day value of the site. I have a copy of the plans and the elevation of the proposed new building that were prepared by the Department of Works and Railways. One of our officers was sent south, and discussed the matter with the officers in the Chief Electrical Engineer's branch, and, I understand, also with the officials of the Department of Works and Railways. I understand that the general architectural design has been made to harmonize with the proposed new postal block. I am acquainted with the proposals for future buildings for the post office. In applying for space in the proposed new automatic exchange building, we considered our requirements until 1947. We ascertained those requirements by studying curves of growth. We have drawn out curves showing the growth up to the present time, and by projecting those curves we estimate that in 1947 we will have over 26,000 subscribers. We anticipate that the development in future will be greater than it has been in the past, to the extent of about 10 per cent., compound interest. Our experience has been that there is a tendency to increase the popularity of the telephone. I do not expect that wireless will in any way affect the growth of the telephone in the next ten or twenty years. Wireless operates in another sphere. At present it does not interfere with our cable work. It is not suitable for inter-communication between subscribers.

82. *To Mr. Jackson.*—I admit that anything may happen, but so far as we can foresee it is not likely that wireless will interfere with the telephone. There is nothing in science to indicate that such a thing is possible.

82a. *To the Chairman.*—It will be necessary for us to erect exchanges at different points before the capacity of the central exchange is exhausted. To enable us to carry on until the time, an exchange at Fortitude Valley is projected. I have here an outline of the probable development, which shows the expected transition from the present system to the modern system. We hope to get South Brisbane cut in during the first quarter of 1925. The next exchanges are Albion and Newmarket. Those works have already been approved in country exchanges. An automatic telephone exchange is not yet operating in Brisbane, but some are under way. I have had no practical experience of the working of the automatic system, but from what I have read in the technical press, and from what I have heard of the operation of the system throughout the world, I am satisfied that it will give better facilities to the public than are possible under the present system.

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cable to the Central exchange. We are now preparing a proposal to place before this committee. We hope that it will be presented to Parliament in the course of the next twelve months. We also propose to establish a branch or satellite exchange at Nundah. If manual exchanges are put in at Bulimba, Yeronga, and Newstead, they will have to be converted to the automatic system in 1930. In this building we are providing for approximately 26,000 subscribers. The maximum number of subscribers' lines connected to any one exchange has been shown to be about 30,000, but under the latest systems it is possible to increase that number. From the point of view of economy in cable and conduit, it is better, however, to establish different centres as we propose to do. It would not be wise to suggest the erection of a larger building for Brisbane central exchange.

On the technical side, the plans that have been prepared are satisfactory. I have not concerned myself with staff requirements. We asked the Manager, Telephones, for his requirements, and they have been provided for in the plan. If the building is rendered as fireproof as is proposed, I think the fire risk will be quite satisfactory. The artificial lighting of the building will be quite all right. It would be necessary to resort to artificial lighting on occasions, no matter what provision was made for natural lighting. The lighting in this building will be more satisfactory than in many buildings that I saw in America and England. I do not think that the artificial lighting of the building will add to the fire risk. I recommend that a building of concrete and steel be erected. It is proposed to use the semi-base for the cable lead-in, the air-conditioning plant, the power units, and accumulators. They will fully occupy the space in that portion of the building. The ground floor we propose to use for the main distributing frame, the test desks, wave carrier, and telephone repeaters, mechanics' factor room, and bin stores. That floor will provide sufficient space for 26,000 subscribers' lines. It is customary to make provision in the main frame for the full capacity. On the first floor we propose to put the "B" level switches and a portion of the "F" level switches. The "B" level switches will provide for 10,000 subscribers, and the "F" level switches for a portion of 7,000 subscribers. The second floor for the present will be held in reserve for the "W" and part "F" level switches, which will carry about 13,000 subscribers. The third floor will be occupied by the Manager, Telephones, and his staff. I do not think that the second floor will be big enough to accommodate the State Engineer and his staff. So far as I am aware, the space available has not been definitely allocated, but I have no doubt that the postal authorities will be able to utilize it. I am not aware of any proposal to use it at present. I have an engineering staff of about 30 or 50 officers. For that staff we are renting offices in Perry Buildings, for which we pay about £25 per week. I could not say what staff the Manager, Telephones, has. That official is not in any way under me or connected with me. The arrangement is that I have control only over the telephone and telegraph engineering staff. The space available on the second floor will not be left idle; it will be used immediately. I am not prepared to say whether the whole of the third floor will be required by the Manager, Telephones. My control in regard to the trunk lines extends only to the apparatus. The fourth floor will be used for trunk switchboards, trunk recording and inquiry positions, information and observation desks, and class rooms. They will be under the control of the Manager, Telephones. I have nothing whatever to do with the accounts of the Telephone Department. It does not pay us to centralize the work in Brisbane, and we have all our staff controlled from this centre. As a matter of fact, we decentralize; we have engineering staffs in the northern and central portions of the state, and we find it a very great advantage. We have one district engineer with head-quarters at Townsville, and another with head-quarters at Rockhampton. I have given consideration to the ventilation of this proposed

new building. In Brisbane the atmosphere is very moist in the months of January and February. It is true that a relative humidity greater than 70 per cent. in the switch room is injurious to automatic apparatus. As far as the switching apparatus is concerned, it will be necessary to construct a ventilation plant that will keep the humidity at 70 per cent. or lower. I do not think we would be justified in installing an air-conditioning plant for the staff rooms to extract the excess moisture and dust from the air. I have no doubt that the conditioning of the air reduces the temperature in the very hot weather. Rather than install an air-conditioning plant for the floors not required for automatic equipment, I should prefer to save the expense, and have air circulation by electric fans. With our present plant we feel the effect of a very great humidity on our switchboard cables during the months of January and February. It certainly would be better for the operators if the rooms in which they worked were properly ventilated, but it is a question of whether the expenditure is justifiable. I have had no practical experience of an air-conditioning plant and its operations. I have not worked in a modern building in which an up-to-date system of air-conditioning has been installed. My branch has prepared a statement of costs. The revenue returns were estimated by the accounts branch. Information regarding rentals was furnished to me by that branch also. The idea is that they will provide room for us in the new post office building. If this building is to be partially occupied by the postal officials, there will still be an expenditure of £1,250 annually for the rental of outside offices. If they do not require the space we can use it. The fifth floor, I understand, will be used for luncheon rooms and retiring rooms.

83. *To Mr. Mackay.*—In order to arrive at the theoretical centre we made a developmental study. We sent officers out to make a house survey. Their duty was to go from building to building and to form a shrewd approximation of the possibilities. Working on the present number of subscribers, they estimated the possible future requirements. Those figures were checked by the progress made in the population development of the city. Three or four estimates were made regarding the possible number of subscribers in five years, fifteen years, and twenty years. Taking the present centre as a guide, a point was fixed which would require the minimum amount of copper conductor to serve the whole of the subscribers. A line was drawn half way across the subscribers in one direction and half way at right angles. The copper centre is the point at which they intersect. There would probably be three or four copper centres some distance apart for the different periods. The question to be determined then was whether to erect the building near the present copper centre, the intermediate copper centre, or the future copper centre. According to our survey the site in Elizabeth-street is the copper centre. There are no lines crossing the river. We have kept our centre here by adjusting the boundaries on the other side. We propose to establish an exchange at Paddington and another one at Fortitude Valley. The fact that the cables at present lead to the post-office naturally had an influence on us in fixing upon this site. That was a part of the economic consideration. Our telephone requirements for some time will be met by the Albion, Newmarket, and South Brisbane exchanges, working in conjunction with the central exchange. By the middle of 1926 we will gain further relief by taking off the Bulimba and Yeronga subscribers. We are preparing plans and specifications with a view to calling for tenders for apparatus. The smaller exchanges will still be necessary, even when Central, Albion, Newmarket, and South Brisbane are cut over. At the present time we are sending telephone workshops in Margaret-street and stores in Alice-street and Mary-street. We are also renting a polo depot site at Hamilton. This building will not relieve us from the necessity to continue

those rentals. We have made a request for the purchase of about 8 or 7 acres of land in Campbell-street, Fortitude Valley, for the purpose of concentrating our stores and making provision for telephone workshops. It would enable us to save the transport between the stores and the telephone workshops, which is now necessary when apparatus is sent in for repairs. The atmospheric conditions in Brisbane have not affected the health of the staff, but it has been affected by the fumes from the septic tanks.

84. *To Mr. Cook.*—The present building is absolutely ineffective. As a matter of effect improvement or hold up the service. In Brisbane the weather is warmer and more moist in January and February than it is in Sydney. An up-to-date building will make it possible for us to carry on. At the present time we cannot do so. This matter was urgent two years ago. I have no statistics of the relative growth of Brisbane and the other capital cities. The development in Brisbane has been very rapid, and each year it is greater than the previous year. We anticipate that in the future the percentage of growth will continue to increase. In 1911 the number of subscribers was 3,000, to-day it is 8,100. The population of Queensland is more evenly distributed than the population of New South Wales. I consider that its growth has been very satisfactory, and I think it will be maintained in future. If this work were put in operation at once it should be completed by June, 1927. We are ready to proceed immediately. I cannot state the reason for the delay that has taken place so far. We have been agitating for this new building for some time.

85. *To Mr. Jackson.*—With the automatic system the tendency to use the telephone will be greater than it is with the manual system. At the same time, we have not had complaints in Brisbane regarding the working of the manual system. The service that is now being given compares very favorably with that which is obtainable elsewhere under the manual system. We consider, however, that by the establishment of exchanges at some distance from the central exchange a cheaper basic rate will be possible, and a great number of applications for the telephone will be consequent on the reduced rate. Complaints regarding the working of the system are made to the Manager Telephones. He is charged with the duty of giving the service to the public. My duty is to fulfil his requirements. If he requires switchboards or trunk lines my branch supplies him. His officers test the quality of the service. When I referred to the fireproof nature of the building, it is meant to convey that it will be as fire resisting as it is possible to make it, and that it will not be a greater fire risk than in any modern building in which proper provision against fire is made. The water supply here will be quite adequate. The site is on the level, only a few feet above high-tide mark, and that will enable us to get a maximum pressure.

86. *To Senator Reid.*—We have been struggling along with the present exchange for five or six years. From the inception of the present building has been totally unsuitable for exchange purposes. I put the first five sections in fifteen or sixteen years ago. They should never have been put in; the building was a miserable makeshift. When the building was extended to the extent of two-thirds of its present length the view was held that it was time to have a new exchange. Our operations have always been hampered in the present building. We have found it very hard to keep pace with the growth of telephone requirements in the country. We have not been able to build trunk lines sufficiently fast to meet the demand. There have been made upon us. Our restrictions in the city have not hindered the receipt of messages from the country. One adverse effect has been that the long-distance subscribers, under the present system, get a very poor trunk line voice on account of the length of the exchange line. With a new system under which we would have branch exchanges put further out, that diffi-

culty would be overcome. So far as I am aware, the establishment of an automatic exchange here will not have the effect of putting off any employees. The system will be introduced gradually, and the operators in the present manual exchange can be absorbed. It is necessary to have an air-conditioning plant installed for the protection of the apparatus, but apart from that aspect, we have so far been able to carry on without it. This building will meet all our requirements. The South Brisbane exchange it is expected, will be brought into operation about April next year, and that will enable us to carry on until June, 1927. The Newmarket and Albion exchanges will not relieve Central, they will relieve the local exchanges. The South Brisbane subscribers are now connected to Central, and when they are transferred it will afford us relief here. There is already an exchange established at Toowong, and the establishment of an automatic system there will merely provide relief for the Toowong area. South Brisbane at present is our only means of getting relief, and that is why we are trying to push ahead with it.

87. *To Mr. Blakeley.*—I certainly think that it is better for the staff to have scientifically treated air in which to work than to work in unsatisfactory natural conditions. I cannot say whether the efficiency of the staff and its output of work would be increased, because I have had no experience of air conditioning, and know nothing about it. It is a question as to whether it would pay the Government to spend the extra money to condition the air in the portions of the building in which the staff is located. Perhaps it would. The comfort of the staff, of course, is a big factor to be considered. A comfortable staff means increased efficiency. If fans were installed they would merely provide air circulation, and that air would have the same humidity as the air outside the building. When the capacity of this exchange reaches its limit we can work on by affording relief in other centres. I think that a seven-story building is justified. The space that is now wanted at present can be reserved for future extensions when required. There will be no waste space. I understand that it is intended to provide the engineers' branch in the new postal block. If the post-office people do not require to use the space that will be available in the beginning in this building, it can be profitably used by the engineers' staff. That is the only staff that can occupy it. The other staffs that are not occupying rented premises are the telephone mechanics and the stores branch, and they must have special premises.

88. *To Senator Barnes.*—I have not to concern myself with the details of the building, that matter is left to the Department of Works and Railways. There will be no difficulty in regard to foundations, as we are on an solid rock right throughout the postal block.

89. *To Mr. Mathews.*—We are temporarily occupying a floor in Perry's Buildings. Space in that building is also being occupied by the War Service Homes Department and the "Golden Casket." I have not heard it suggested that the space which we are using is required by others. In the central exchange we will reach the limit of our capacity in about one or two months. We cannot extend our apparatus, and we will have a standstill until South Brisbane comes in. There is slight evidence of electrolysis in Brisbane, but we are not troubled to any extent with it for the reason that we are alert and keep the whole system under a constant test. The preventive measures adopted consist of compelling those who are responsible for the leakage of current to restrict that leakage within certain limits that are laid down by statutory rule. We can also take certain precautionary measures ourselves by providing connections between our cables and insulating sections in the cables to prevent the passage of the current. We are constantly on the alert, and thus reduce the damage to the minimum. The tramway system is responsible for whatever damage is done. The efficiency of electric lighting system is negligible. The efficiency of our telephone system has not been impaired, but minor

replacements of sections of cable have been necessary. We have the matter well in hand.

90. *To the Chairman.*—It would be possible to have the luncheon rooms placed on the flat roof. T. C. Beirne and Co. have a room on the top of their establishment. This does not affect our present apparatus very much. It will be essential to condition the air to keep the dust out.

The witness withdrew.

Herbert Hartley Sngdon, Assistant Manager Telephones, at present Acting Manager Telephones, Brisbane, sworn and examined.

91. *To the Chairman.*—The common battery manual is the system at present installed at Brisbane Central. My department is charged with the duty of giving a satisfactory telephone service to the public. Any complaints are made to us. The general opinion of the people of Brisbane is that the service given by the manual system here is a good one. During my tenure of office, covering the last two years, no complaints have been received from the Chamber of Commerce or other big organizations. I had experience with the automatic system in Sydney, and I prefer it to the manual system as I think it gives a better service. My department was not concerned with the preparation of estimates of costs, we merely furnished traffic particulars. We collaborated with the Melbourne officials in regard to the financial statement that has been submitted. I have a statement prepared by the Telephone Manager, and with which I concur, dealing with the matter, and shall read it to the committee. It states that the Central Exchange CB multiple switchboard of 79 operating positions, 54 of which are "A" or subscribers' boards, is fully loaded, and with the exception of a few spare lines, the capacity is practically exhausted. What little accommodation is available for new subscribers will be absorbed before March, 1925. The outcrop of the south automatic area early next year will reduce the Central Exchange by approximately 2,700 lines. The accommodation thus released will enable the Department to accept Central subscribers only up to the proposed date of the new central automatic (1st July, 1927). By that time all accommodation will have been used up. The matter of providing a central automatic exchange is, therefore, one of great urgency. To carry out to the present stage has been a matter of much difficulty by the fact that to meet the ever-increasing requirements it has been necessary to extend the switchboard in such a way as to introduce undesirable working conditions and difficulties as regards supervision of the staff and the telephone traffic. There are not any practical means of further extending the existing switchboard. To maintain an efficient service, an out-crop exchange is essential, and, as it has already been decided to introduce the automatic system at South Brisbane, Albion, and Newmarket, the new Central Exchange should also be an automatic one. The present exchange building was not built for exchange purposes, and it was certainly never contemplated that such a large important public facility as that for which it is now used. The floor space is altogether too cramped, and also considered that the fire risk is a limited. It is also an accommodation for the staff too very grave one, not so much as regards the safety of the staff (who are so well trained in fire drill that no difficulty would be experienced in clearing the building in the event of any emergency), but as regards the general and serious inconvenience to the public which would arise if such an important and necessary public facility were suddenly destroyed and thrown out of action. This will be more readily understood when it is stated that local calls at Central Exchange average 70,000, trunk calls 3,600, while the yearly revenue (rental and local calls) is in the vicinity of £135,000, and the revenue from originating trunk calls £26,650, and a total of £161,650. The exchange apparatus for subscribers' lines producing this enormous revenue should, obviously, be placed, without delay, in

a fireproof building. Any sudden dislocation of the traffic from fire causes at Central Exchange would also affect in the most damaging way the traffic in every exchange in the metropolitan network, to say nothing of the large number of country exchanges which also would be isolated. Since the Commonwealth Government took over the telephone branch the development has been very marked. Prior to that time telephone growth was very small. Starting in the State period, in the year 1880, one exchange of 30 subscribers produced a revenue of £70, and rising slowly year by year until in 1890 there were eleven exchanges and 1,558 subscribers, which produced a revenue of £12,574. In the year 1900 there were fourteen exchanges, 2,248 subscribers, with a revenue of £16,721. In ten years these figures had rapidly risen to 71, 5,943, and £27,516, respectively. In the next five years there was a remarkable development, the figures at 1915 being 223 exchanges, 16,747 subscribers, with a revenue of £157,461. During the war period the growth, of course, was not so great, but by June 1924 the figures were 499 exchanges, 30,619 subscribers, with a revenue of £474,750. This development shows no sign of decreasing. As a matter of fact, for the past three years, the percentage increase has been greater each year; the percentage increase for the years 1922, 1923, and 1924 being 7.1 per cent., 9.1 per cent., and 11.6 per cent. respectively. These figures are for the whole of the State. The percentages for Central Exchange taken separately for the same years are 6.8 per cent., 7.7 per cent., and 9.6 per cent., respectively. The introduction of automatic exchanges in this network will be the means of materially augmenting these figures, as the exchanges have been so placed as to give cheaper telephone service to a greater number of people than is possible with the present limited number of manual exchanges. On the 1st October, 1924, there were 8,180 lines connected to Central, but although 2,700 of these will be transferred to the south auto, it is estimated that at 1st July, 1927, provided the accommodation is available, there will be 8,200 lines connected, on 1st July, 1929, 9,500 lines; on 1st July, 1932, 9,200 lines—the reduction being due to the opening of the Valley Exchange, which, at 1st July, 1932, is estimated to reach 3,900 lines. On 1st July, 1947, there will be 26,500 lines on Central Exchange. The increase in trunk lines will be just as marked. The estimated number of trunks at 1st July, 1927, is 168; at 1st July, 1929, 200; at 1st July, 1932, 284; at 1st July, 1947, 464. The estimated operating staff, i.e., supervisors, monitors, and telephonists, to handle these lines must be greatly increased to meet development, not only for telephone traffic purposes, but also for telephone contract work. The estimated contract staff at 1st September, 1924, is 30; at 1st September, 1924, 45; and 1st September, 1924, 9. The need to and to keep pace with this very marked development it is essential to have an up-to-date building in Brisbane and to install therein an automatic switchboard, together with floor space for the full activities of the telephone branch; also retiring rooms, dining rooms, and locker, &c., as accommodation for the whole of the staff. It is thought best to make full provision for these requirements at the outset. It is also strongly urged that the roof of the new building be made available to the staff as a roof garden for recreation purposes, also that a cafeteria should be provided. The automatic system has many advantages over the manual, particularly in those cities such as Brisbane, where direct inter-communication is required between exchanges, and in those cities where manual working is done by order wires between telephonists, a call from one exchange to another requiring the services of two and sometimes three operators. The repetition of the request from one operator to the other involves loss of time and introduces an error-creating factor unless very carefully guarded against. Under automatic working the caller deals

required exchange and number direct, thus eliminating the delays of the manual system. Instantaneous advice of the called number is engaged in situations clearing on the completion of a call, quicker service from caller to called party, and a uniform service over 24 hours are also advantages of the automatic system. It is considered that, provided the exchange is designed to take the maximum traffic load, the maintenance of the plant is efficient, and the automatic apparatus is kept properly adjusted, the expense in situations clearing on exchange will give better local service to the public than will a manual. This class of apparatus lends itself more readily to rapid addition than does the manual. This is a very important factor in keeping pace with requirements. The introduction of automatic working at Central Exchange will, of course, be the means of considerably reducing the number of telephonists employed, but no difficulty will be experienced in adjusting the staffs to the new conditions. The outcrop of Central Exchange will reduce the required number of supervisors in the metropolitan area from 7 to 6, monitors from 22 to 16, and telephonists from 236 to 118. Action, however, has already been taken to meet the position by making temporary appointments of vacancies and by reducing the number of telephonists employed. Immediately prior to this outcrop there will be 119 temporary telephonists and 117 permanent telephonists employed. The position will, therefore, be met by dispensing with the temporary employees, thus leaving the permanent officers in the then required permanent positions. The latter point has to be taken into consideration, which must be regarded as a separate unit to that of the Brisbane Central Exchange, which deals primarily with local calls. Owing to the very liberal policy of the Government, there has been an extraordinary increase in the number of country district and trunk lines in the State. This has opened up a great number of new avenues for trunk telephone traffic, and the positions required pending the outcrop of lines terminating at the Central Telephone Exchange. The number of lines as at October, 1922, were 45; 1923, 57; and 1924, 70. The huge trunk programme now under way, when completed, will increase the number of trunk lines terminating at Central to the vicinity of 160 (June, 1926). It will therefore be seen that while a big reduction in staff is necessary owing to the establishment of automatic exchanges, additional permanent telephonists will always be required to meet trunk development. The proposal to install the Central Automatic Exchange is justified from every point of view, and, therefore, is fully concurred in. I do not consider that I have been too optimistic in preparing my estimates; they are based on standards that are laid down, consideration being given to past development. I think that, as the country develops, the demand for the telephone will be greater. Some little time ago approval was given to us by the Central Administration to try out a system of canvassing. We sent an officer throughout the state, and in 57 days he obtained 640 new subscribers. If that policy is seriously pursued there is no doubt that our past figures will be greatly exceeded in future. The canvass was purely an experiment, because at that time we could not keep pace with the growth that was taking place. We are not at present able to meet the whole of the demand. I have seen the plans of the proposed building, and it is quite an American idea that will give us a good fire risk. Purely from a service point of view, the site commands itself to me. Twenty years after the outcrop the space provided on the fifth floor for dining rooms, retiring rooms, &c., will all be required. At the present time I should say that the space required for these purposes is in the vicinity of 3,000 square feet. The cafeteria is an American idea for providing a quick lunch. Each man selects his food and eating utensils and carries them to the cash register, where the value is assessed by the cashier. At one time I was secretary to the Postal Institute in Sydney. We opened four cafeterias. That is the idea we should promulgate here. They could be run by a committee taken from

the staff, the Government providing the requisite floor space and the fittings.

92. *To Senator Reid.*—The staff would provide the cooks, the cost being defrayed out of the receipts from the sale of food.

93. *To the Chairman.*—At the 1st July, 1927, provided that date is adhered to, the Manager Telephones will have 39 officers on the third floor. They will require, approximately, 2,000 square feet of space. I have discussed space requirements with the State Engineer, whose staff is at present located in outside premises. No space has been provided for his clerical staff in the new building. The trunk line staff is controlled by the Manager Telephones. The whole of the fourth floor will not be required for that staff. In the initial stages 104 officers will occupy the fourth floor, but it would be inadvisable to have another staff on that floor. It would be inadvisable to place a clerical staff there, no matter how much space was available. I would not recommend placing temporary retiring rooms there on account of the noise. All operating rooms must be silent. The retiring room must be associated with the dining room. We have a sick bay for girls who are seized with illness which is agreeable to the State Engineer occupying half the third floor with his clerical staff. I understand from him that he could take the second floor, which at the outset will not be required for automatic equipment. Eventually a greater number than 109 officers will be placed on the fourth floor. The estimate is that the number will be 137 officers. The ventilation of that floor will be an important item. In the Sydney telephone exchange we had the Sirocco air scheme, which is a very good system. It withdrew the bad air from the rooms, and kept a continual draught of fresh air passing through. That is the only system of which I have had experience. I do not think we would be justified in spending an additional £4,000 to ventilate the two upper floors of the building. Sufficient ventilation, in my opinion, can be obtained from windows and fans. At the present time the staff is on the second floor, and is not suffering any great hardship. The humidity, I have found, does not affect the girls as much in the exchange here as it does in Sydney. There was a greater percentage of absences from the switchboard in the central exchange in Sydney on account of sickness than there has been in Brisbane since I have been here. I should say they have become immune to the humidity in Brisbane. We are very cramped for space, and are having alterations made to enlarge the space in the trunk room. The present average calling rate at Brisbane Central is 1.27 busy hour. The increased facilities provided by the automatic system will have the effect of increasing the rate. I have not considered what space will be uncaptured in the new building when we take it over.

94. *To Mr. Cook.*—To every 1,000 subscribers there are fewer complaints in Brisbane than there are in Sydney. I cannot say whether the fire risk in the new building will be as perfect as it is possible to make it. It is absolutely essential that it should be fireproof. We had a fire in Sydney on one occasion, and although it was in the basement, the smoke entered the exchange, and was disorganized. I should like to give some points of comparison between the working of the manual and the automatic systems. The automatic has the following advantages:—

1. Subscribers obtain inter-connection without intervention of operator.
2. Elimination of delays and errors inevitable in any system which depends upon the human factor for its operation.
3. Absolute privacy of service.
4. Completion of connexion under 7.5 seconds (five-fifths system).
5. Instantaneous advice if called subscriber engaged.
6. Instantaneous clearing on completion of call.

7. Constant and uniformly quick and accurate service over the 24 hours of the day.

8. Savings in operating, supervision and administration charges, training expenses, and accommodation.

9. Economy of building space. A manual plant requires 30 per cent. more space than an automatic system of similar capacity.

10. Economy in line plant, since the system readily lends itself to subdivision, enabling any number of exchanges to be established at the theoretical centres determined by surveys.

11. No limits to size of exchange or system in a multi-office automatic network. Automatic equipment facilitates extension, and is flexible in meeting exceptional traffic demands.

12. Lower working cost and relative immunity from faults affecting service, automatic switching being interchangeable and readily substituted from reserves tested out ready for use.

13. No new and fundamental equipment changes are necessary to meet changing conditions associated with traffic growth, nor is existing trunking arrangement affected by establishment of new offices.

14. No premature disconnections, since subscribers do their own disconnecting.

15. Greater immunity from interruption owing to epidemics and industrial disturbances.

16. Improved transmission resulting from economic use of a larger number of exchanges permitting shorter substation loops.

17. Increasing modern tendency towards substitution of mechanical devices for human labour, and the general adoption of automatic equipment throughout the world.

18. Higher efficiency of automatic trunk groups resulting from lower manipulative time.

The tendency is for the automatic to displace the manual system. It has made big strides during the last ten years. It is possible, but I should not say it is probable, that in ten years' time some other system may have taken the place of the automatic. With electricity in this modern age anything is possible. The automatic, I consider, will substantially reduce our costs. We have no say in the fixing of the charges; that is a matter of Government policy. Either lower charges or increased profits should be the result of the installation of the automatic. We provide lockers for housing departmental equipment, therefore the lockers in the new building should be provided free of cost to the staff.

35. *To Mr. Jackson.*—I did not take a part in the compilation of the statistics relating to the estimated number of subscribers. That work is done by the Electrical Engineer's branch. There is a development staff attached to that branch. My experience of the automatic system was gained in Sydney. I could not say whether under that system the subscribers' calling rate increased to a greater extent than it did under the manual system. We have no automatic exchanges in the Brisbane network, and I have not access to the Sydney records. The Brisbane exchange compares more than favorably with other places in which the manual system is installed. In spite of that fact, I recommend that the automatic system be installed. I do not admit that frequently a subscriber is charged for a call that is not effective. We tell our subscribers that this is a co-operative system, and that, unless there is co-operation between the person calling, the operator, and the person called, we cannot render an effective service. We ask subscribers to notify the operator of ineffective calls. Unless there is that co-operation there is always the likelihood of a subscriber being charged for ineffective calls. Under the automatic system the subscriber called lifts his receiver the battery is reversed, and a call is automatically registered on the meter.

36. *To Senator Reid.*—I cannot say that the political aspect has had anything to do with the increased business since the Postal Department has been under Fed-

eral control. I think it has been due to ordinary growth. It is possible that the effectiveness of the service in Brisbane has been responsible for the growth that has taken place here. I cannot suggest why the service here has been more satisfactory than it has in other places. The conditions here are much easier for the operators than they are in the Sydney network. We have only five exchanges in the Brisbane network, whilst Sydney, when I left, had 20. The present building in which the operators are compelled to work is a disgrace. I should operators are compelled to work in the partitions off of a portion of the floor in which the operators are housed. I cannot advance a reason for the less amount of sickness amongst the girls in Brisbane compared with Sydney. It struck me as being peculiar. In Sydney we had the experience of a number of girls being taken ill at the one time at the switchboard. The number of girls who are taken ill at the switchboard in Brisbane is negligible. A greater strain is imposed upon the girls at Sydney Central than is imposed upon the girls in Brisbane, but the former do not handle a greater number of calls. The calls per hour are based upon a standard, and the unit value of the work is the same in the two cities. The surroundings in which the girls work are better in Sydney than they are in Brisbane. I should say that the establishment of a cafeteria would increase the efficiency of the staff. They would have better opportunity to obtain hot meals, and there would be no necessity for them to leave the building. After cafeterias were provided in Sydney the staff were more satisfied, and showed greater efficiency. Such a scheme would be appreciated very much by the employees in Brisbane.

37. *To Mr. Mathews.*—I have been in Brisbane for two years and five months. My other service, extending over a period of 26 years, was in Sydney. I have heard of cases of overcharging, and am conversant with the North Shore case. The observations that were made in that case proved that there was no overcharging. With the automatic system there is a greater number of mistakes than take place with other systems. Under the automatic system, if a call goes astray, it stops automatically at a point where a mechanic picks it up.

38. *To Mr. Mackay.*—There are 70 trunk lines coming into Brisbane. It is possible that very great delay may be occasioned if the lines are out of order. The delay is not as great now as it was previously. Last week we had two lines put through to Gympie. On calls to Gympie the average delay now during the busy hours would be about twenty minutes. We now have direct lines to Gympie and Bundaberg, and we hope shortly to have two through to Rockhampton. New trunk lines are erected out of funds specially voted by Parliament for the purpose. If a greater amount were provided the trunk-line service could be extended to meet the requirements of the public. It is not possible to "listen in" with the automatic system, but it is with the manual system. That is greatly in favour of the automatic system. In Sydney air-conditioning of the automatic system. In Sydney air-conditioning plants were installed only in automatic exchanges, and did not come within the jurisdiction of the Manager Telephones. Such plants were not installed where operating staffs were employed. From the point of view of the staff, the conditions are better when the air is treated, but I cannot say whether the extra cost involved would be justified. I am of the opinion that fans should be sufficient. The staff will be housed on the fourth floor, where they will get any breeze that is blowing. Having the fans also, the ventilation should be satisfactory. There will be no automatic switching plant on the same floor as the operators. The plant should be in a room that is air conditioned, but the staff should be quite well served without it. Central office in Melbourne has been aware of the conditions that for some time have existed in Brisbane, reports on the matter having been made to it frequently. In fact, steps are now being taken to partly overcome the congestion.

99. *To the Chairman.*—We will be able to utilize in country exchanges practically the whole of the manual apparatus that is at present in the Central Exchange. In case of an outbreak of fire, it is essential that at least two exits from the building should be provided. The proposed sanitary arrangements are quite satisfactory. It is quite possible for the meters that record the charges to get out of order. I should not say, however, that it would be possible to defraud the department.

1927; 200 at 1st July, 1932. Engineer's staff, 150 at 1st July, 1927; 200 at 1st July, 1932. Owing to the diversity factor, however, it is not likely that more than 50 per cent. of the officers would require luncheon accommodation at one time.

(Taken at Brisbane.)

TUESDAY, 24th OCTOBER, 1924.

Present:

Mr. Gregory, Chairman;	Mr. Jackson
Senator Barnes	Mr. Mackay
Senator Reid	Mr. Mathews.
Mr. Blakely	
Mr. Cook	

John Edward Hinton, Chief Officer Metropolitan Fire Brigade, Brisbane, sworn and examined.

101. *To the Chairman.*—It is not customary for us to be consulted in regard to fire risks or the provision of proper safeguards against fire when buildings are being erected. The City Council very seldom consults the Fire Brigade Board. There is a by-law which restricts the height of public buildings to, I think, 150 feet. On the low levels our water supply is ample to cope with a fire in a building of that height. From the point of view of the automatic telephone exchange I do not consider that the proposed new Commonwealth offices or the automatic telephone exchange present any difficulties that a fire risk point of view. For such buildings I should recommend the use of reinforced concrete or of brick with reinforced concrete ceilings over the more vulnerable parts, to which a great deal of damage may be done by a fire. I should also have reinforced concrete floors in the vulnerable portions. It may be advisable to have wired glass on the lane frontage visible to have reinforced glass on the lane frontage. I understand that the Telephone Department has a very competent staff and sensitive fire alarms, so that it would not be more than five seconds before attention could be called to any outbreak. A new extinguisher has been placed on the market quite recently, and I think it would be very useful in such a place as the telephone exchange. I believe it contains two ingredients which produce a kind of yeast. A 2-gallon extinguisher will cover with foam about 4 square feet. The yeast is full of CO₂. You use it in the same manner as you do the ordinary fire extinguisher. It would be wise to have the exchange connected to the fire brigade by automatic fire alarms. The extinguisher I have mentioned would, in my opinion, be better than asbestos sheets. The exchange at present has another good system of hydraulic drums. The drum carries about 100 feet of small hose. It is a one-man tool. He can turn the water on from the nozzle. If you provide a 2½-in. hydrant with canvas hose it would take a man two or three minutes to straighten it out, and then he would be knocked over by the pressure of water, which amounts to 100 lb. or 120 lb. to the square inch on a low level. He that the exchange staff. I consider that Brisbane is adequately provided with means for meeting an outbreak of fire.

(Taken at Brisbane.)

MONDAY, 20th OCTOBER, 1924.

Present:

Mr. Gregory, Chairman;

Senator Barnes	Mr. Jackson
Senator Reid	Mr. Mackay
Mr. Blakely	Mr. Mathews.
Mr. Cook	

Joseph William Sutton, State Engineer, Postmaster-General's Department, Brisbane, recalled and further examined.

100. *To the Chairman.*—I desire to add the following to the evidence that I gave on Friday regarding the accommodation in the proposed new automatic telephone exchange, Brisbane Central:—In reply to questions asked by you, I beg to state that, after having discussed the matter with the officer acting for the Manager Telephones, it is suggested that the space on the second floor be occupied by a portion of the staff of the State Engineer's Branch. The number of officers occupying this space would be 35 on completion of the building (1st July, 1927), and this number could not be increased in the space. A portion of the floor above, i.e., the third floor, would be used at the outset—1st July, 1927—to house 35 additional members of the engineer's staff, which it is anticipated would increase to 55 five years later. The remaining portion of the third floor would be used to house the Manager Telephones' administrative staff, which would number 39 at 1st July, 1927, and 60 at 1st July, 1932. It is probable that this number would necessitate a crowding. If this is found to be the case a portion of the fourth floor might be utilized to take care of the overflow; otherwise the suggestion is to reserve the fourth floor solely for trunk line switchboards. There would be 104 officers on this floor at 1st July, 1927, and 157 five years later. With regard to the fifth floor, this would be utilized for male and female retiring, dining, and recreation rooms. It is estimated that at 1st July, 1927, there would be 104 members of the Manager Telephones' staff, and 40 members of the mechanical staff, and five years later there would be 157 members of the Manager Telephones' staff, and 55 of the mechanical staff. It is considered quite feasible to provide luncheon rooms on the roof of the building, and it is probable that these luncheon rooms would be utilized by a total number of officers as follows:—Manager Telephones' staff, 150 at 1st July,