THE MELBOURNE ELECTRIC SUPPLY Co. Ltd.
(Geelong Branch).

Visit of Inspection to
THE GEELONG POWER STATION
by the Members of The Rotary Club of Geelong.
30th. November, 1926.

Arrival. 2.15 p.m.

Entrance. The party will be conveyed by car from the Club Rooms to the Depot, and assemble in the Quadrangle. They will be asked to form groups of five persons, and procedure will be explained by the Secretary. As quickly as groups are formed, they will be despatched under care of a Guide, each group starting at a different view point as hereinafter.

Guides. Six Guides will be provided, each to take charge of one group. Each Guide will be given a set route with a different starting point, and will then rigidly carry out the order of route given to him. He must not take up a view ppint which is already occupied by another group, but hold his party back until his predecessor vacates. Guides will receive instructions on the morning of the 30th. at 11 o'clock, in the Secretary's room. They must discourage the lagging behind of members of their group at any one view point, and proceed to the next view point as nearly as possible to the time schedule, the idea being that no parties will clash, and all complete the circuit and assemble again in the Quadrangle at the time mentioned. The guides must not "demonstrate", but confine themselves to watching the time, and seeing that their party keeps, as nearly as is reasonably possible, to the schedule.

Demonstrators. At each view point an expert demonstrator will be stationed. His duty will be to demonstrate the apparatus in his section, answer questions, and generally make the view-point under his charge as interesting as possible to the visitor. At the conclusion of the inspection Afternoon Tea will be dispensed in the Works Hands' Room, after which the party will be conveyed by special cars, in the charge of inspectors, to the centre of the City.

LIST OF DEMONSTRATORS.

A.	Receiving Office & Tramways' Room	Mr. S. Watson.
B.	Executive Offices - Correspondence Room	Miss Cant.
B.	Drawing Office	Mr. C. McIntosh.
C.	Turbine Floor - Switchboard	Mr. R. Norris.
D.	Turbine Basement - Fan Room	Mr. W. Grundell.
E.	Pump Chamber	Mr. C. Nairn.
F.	Boiler Room Basement	Mr. J. Blake.
G.	Firing Floor	Mr. A. Milne.
H.	Economiser Floor	Mr. G. Clarke.
I.	Car Depot	Mr. T. Thomas.
J.	Workshops, Garage, Coal Pit	Mr. D. Peddie.
K.	Stores and Paint Shop	Mr. H. Humphries.
L.	Laboratory	Mr. F. Ponting.
M.	Main Office	Mr. A. Molland.
	Central Office	Mr. E. Boyd.

LIST OF GUIDES.

Mr. H. Jeffries.
Mr. D. Davies.
Mr. C. Bennett.
Mr. R. Wilmot.
Mr. J. Wilks.
Mr. E. Williams.

NEW POWER PLANT

for Geelong, Victoria, Electricity Supply, from the COMMONWEALTH ENGINEER, November, 1923.

Visitors to Geelong cannot fail to be impressed by the large mass of buildings forming the electric supply power house with its offices, situated in Corio terrace, facing the bay. These buildings, together with the 164 ft. chimney, which form such a landmark for those approaching the city from the sea, have recently been erected in connection with the very considerable extensions which have been made to generating plant and to the system of supply. In this article it is proposed to describe those alterations which have been made and the present conditions of supply, but before so doing it may be of interest to devote a few words to the early history of this progressive undertaking.

In the year 1899 an Order-in-Council, covering the municipal areas of Geelong, Newtown and Chilwell and Geelong West, was granted to Messrs. F.J. Leary and J.A. Dawson, well-known residents of Geelong. At that time the population of the whole of Geelong was only 25,000, and in those days of the carbon lamp and few electric motors the establishment of an electricity supply undertaking in so small a town was certainly not a very attractive proposition. However, the Electric Light and Traction Co. of Australia (now the Melbourne Electric Supply Co.), being at that time in negotiations for the establishment of electricity supply undertakings in both Melbourne and Adelaide, considered that it could, without too much risk, include the Geelong supply within its activities, and the consequence was that the Order-in-Council was transferred to the company in May, 1899, the term of the Order for thirty years expiring on February 20, 1929.

The company, having appointed Mr. J.A. Dawson as its resident engineer in Geelong, lost no time in erecting the necessary buildings and putting in the first instalment of generating plant. At the time in question general three-phase supply for small towns was rarely used, single-phase supply was only used in comparatively few large undertakings, and no one doubted but that continuous current was the proper form in which to supply electric energy in small areas. It was, therefore, decided to install the continuous current, three-wire system with a pressure of 440 volts between the "outers", and the first sets consisted of two 100 kw. Belliss-Brush steam dynamos, and two boilers of the dry-back, return tube type, operating at 120 lb. steam pressure. A Green's economiser was also erected. A brick chimney, 120 ft. in height and 4 ft. internal diameter, was likewise provided. An 800 ampere-hour secondary battery was installed. Condensing water was pumped from the sea through a cast iron rising main by an electrically operated pump situated at sea level.

The distributing net-work consisted of an underground system in the centre of the city and an overhead system in the remaining portion of the city and suburbs. It is probable that at Geelong bare overhead cables were used for the first time in connection with general electric supply, the practice up to that date, at any rate in Victoria, having been to use cables with impregnated braided insulation, the uselessness of which under atmospheric conditions had, however, been fully demonstrated long previously in other countries.

This continuous current pioneer installation continued to operate until recently, extensions, of course, being made from time to time, so that just before reconstruction three further sets of 300 kw. each were in operation, and three Stirling boilers with superheaters and chain-grate stokers had displaced the original small dry-back boilers. Induced draught had also been fitted. The whole of these alterations and extensions were carried out under the supervision of Mr. G.G. Jobbins, who had succeeded Mr. Dawson on the latter's resignation in 1904, and it is likewise under Mr. Jobbins' able direction that the whole of the very considerable recent reconstruction has been carried out.

In consequence of an agitation for tramways in 1907, in spite of the fact that the financial success of tramways in small towns is always a decidedly doubtful matter, the company, recognising that with its electric supply undertaking it was in the best position for carrying out a scheme of tramways, decided to accept the risk, with the result that on March 14, 1912, the first cars were run in Geelong. This involved the laying of some four miles of single track, with termini at the railway station, the wharf and in South Geelong, Newtown and Geelong West, a pioneer system of petrol buses being arranged for East Geelong in anticipation of an increase in the population within that area. The electrification of the East Geelong bus route has recently been effected, and the system is in process of being considerably extended by extensions to North Geelong and to Belmont.

As in the course of time the city of Geelong began to grow and new industries to be established there, it became increasingly evident that the limits of a direct current supply were rapidly being reached, and that, unless a system were introduced which would enable energy to be cheaply distributed at a distance from the power house, the usefulness of the undertaking to the community generally would be much circumscribed. The war, however, made it quite impossible to consider any radical change at the time, and it is only within the last four years that it became possible to definitely decide on the introduction of a modern three-phase system and to proceed with the extensive alterations and additions which such a radical change involved.

The first step in the new direction was to make certain of a plentiful supply of condensing water. Past experience had shown that the nature of the ground between the power house and the shore was such that it was quite impossible to rely upon any type of pipe duct. For instance, breakages in the cast iron rising mains put down from time to time were frequent. It was, therefore, decided to bring the water from the bay at sea level by means of an underground tunnel to a well below the power house floor level, and to place the pumping machinery in a subterranean chamber at the power house, just above the shaft of the well. Difficulties, however, were anticipated in the construction of this duct owing to knowledge of the experience which had been obtained by the sewerage board in the construction of its main sewer across the route to be followed; and certainly these anticipations were realised, for, as it turned out, the work of excavation and construction of the ferro-concrete duct ultimately put down proved to be a most difficult and at times exceedingly delicate task. The total length of the duct is 600 ft. and its floor is situated 6 ft. below minimum low water level. Owing to the elevated ground on which the power house stands, the depth between engine room basement level on which the condensers are accommodated and the duct floor level is 40 ft. Owing to the nature of the ground to be traversed a great deal of consideration was devoted to the shape and reinforcement of the duct, but ultimately the rectangular cross section of twin duct, as shown in Fig. 2, was adopted. The method of construction was to carry out by the open cut method the first part of 240 ft. until the hill was reached, involving the building of a coffer dam at the sea entrance and extensive steel sheet piling along the sides of the excavation. The difficulties here were considerable, for on opening up the ground it was discovered that, probably since Geelong was a port, enormous masses of ballast in the shape of rubble and stones of all sizes, even exceeding the size of paving setts, had been discharged on to the shore, and it can be conceived that the driving of piles into this material and the maintenance of water-tight conditions were not at all easy. The rest of the distance was tunnelled, and again most difficult conditions were found about half way, where material little better than silt had to be passed through. All difficulties were ultimately overcome--certainly at the expense of a much greater expenditure of time and labor than had originally been estimated--and it is with great satisfaction that the company's engineers are able to state that a recent inspection of the duct after pumping out disclosed a perfect condition. In fact, matters were so satisfactory that not even marine vegetable or animal growth could be discovered along the walls of the ducts, a contingency which had been much feared in consequence of experience with the original cast iron rising mains and elsewhere. So clean were the ducts that instead of pumping them out once a year for inspection, as it was originally decided to do, it is estimated that this work will hardly be necessary at more frequent intervals than, say, of four to five years. It is possible that this absence of marine growths is mainly due to the pumping system having been so laid out that the direction of flow in the ducts can be reversed, which is done every week.

The pumping arrangements are in so far interesting, as full use is made of the syphonic principle, the entrance to the condensers being situated at 37 ft. above low water level and the highest point in the pipes carrying the water away from the condensers 45 ft. above that level. It is, therefore, possible to use the syphonic principle to the fullest extent practicable under ordinary working conditions, that is, the syphonic head obtained is practically that corresponding to the vapor temperature of the circulating water leaving the condenser. This temperature is about 83 deg. F., and the average corresponding head which is obtained is 32 ft. Of course, this large head could not be maintained unless the air, which percolates through pump glands, etc., and which is held in solution in the circulating water, were withdrawn from where it accumulates at the top of the syphon. This withdrawal is effected by a motor driven double acting 12in. stroke by 12 in. diameter, 120 r.p.m. air pump, connected to a suction head or pot, from which air pipes are taken to the various highest points in the syphonic system where accumulations of air might be expected. In order to prevent the possibility of any circulating water passing over into the air pump in case of high pressure brought about, say, by the closing of valves or otherwise, this suction head is placed at a considerable and sufficient height above the top of the syphonic system. It will be seen, therefore, that, although the lift is considerable, the very complete use which is made of the syphonic principle greatly reduces the pumping power required.

The pumping plant consists of three 18in., 720 r.p.m. (two 22in., 487 r.p.m.) single stage centrifugal pumps supplied by Messrs. Kelly and Lewis, direct coupled to suitable three-phase motors, the centres of which are situated 23 ft. above (below) minimum low water level. These pumps deliver into a common pipe, which in its turn supplies the main circulating water header laid under the engine-room basement through a 24 in. Venturi meter. The pumps were guaranteed to deliver 300,000 gal. of water per hour (600,000) against a total head of 32 ft. (47 ft.) for an expenditure of energy of 62 b.h.p. (190 b.h.p.) and at 720 r.p.m. (487 r.p.m)

In order to provide for the pumping out of the 660 ft. of tunnel at times of inspection and also for the purpose od keeping at least one generating set in operation in case it became necessary to carry out repairs on the syphonic system and the pumps and valves connected thereto, a 10 in. centrifugal pump, capable of supplying sufficient water to keep one of the larger sets running, has been installed, which pump draws its water direct by a separate suction pipe from the tunnel well and delivers it to the condensers unassisted by syphonic action.

GENERATING UNITS.

Turning to the engine room it should be premised that the system of supply is one involving generation at 6,000-6,600 volts, three-phase, 50 frequency, and the following generating plant has been erected accordingly:--

A 1,500 kw. Brush-Ljungstrom turbo-alternator operating at 200 lb. per sq. in. gauge pressure at the stop valve and a vacuum of 28½ in. This set is used mainly as a light load set, and in view of this fact it was chosen for the very remarkable efficiency, which, as is well known, is a feature of this type of turbine. This guarantees involved a consumption of only 12 lb. of steam per kilowatt-hour at the steam and condenser pressures above mentioned and 200 deg. F. superheat, a figure which would be a good one if applied to much larger sets of the axial flow type. For those unaware of the constructional details of the Ljungstrom type it might be mentioned that the steam flow is radial from the axis outwards, and that there is no fixed system of blading, but that both sets of blades are carried in concentric rings by two wheels, each free to revolve independently and each direct connected to an alternator of half the total output of the set. In operation, there-fore, the wheels revolve in opposite directions to one another, and are mutually controlled by the synchronising effort between the two alternators. As each wheel revolves at 3,000 r.p.m., the result is equivalent to that of a single wheel in an axial flow turbine revolving at 6,000 r.p.m. It is this high speed, together with the possibility of providing for high expansions with radial flow, which accounts for the high efficiency claimed for small turbines of the type in question. Two further sets of Metropolitan-Vickers manufacture and each of 3,000 kw. output have been installed, and a third set of similar output will be ready for erection within the next few weeks. The turbine contains one Curtis and nine Rateau type wheels, and the full load steam consumption is 12.18 lb. per kilowatt-hour.

The total installed generating capacity of the power house will, therefore, be 10,500 kw., and, allowing for a spare set, the useful capacity will be 7,500 kw., or with overload capacity 9,375 kw., at 0.8 power factor. As the maximum demand on the power house will be mainly due to industrial power and allowing for a diversity factor of about 2.4, this capacity will be equal to providing for a total connected industrial load of about 18,000 kw. All sets are fitted with surface condensers, the cooling areas being, in the case of the 1,500 kw. turbine 2,800 sq. ft. and in that of the 3,000 kw. turbines 4.150 sq. ft. They are guaranteed to give 28½ in. vacuum at a maximum temperature of the circulating water of 65 deg. F. In the case of the 1,500 kw. turbine the air pump is of the Edwards three-throw plunger type and of the Leblanc type in the case of the 3,000 kw. turbines. Scanes' sealing tanks have been fitted in connection with the air pumps of the larger sets. With the Metropolitan-Vickers sets Fox's continuous oil filters have been fitted in the oil supply system.

The cooling air in three out of the four sets is passed through Sturtevant wet air filters. In the fourth set it has been arranged to use the Metropolitan-Vickers closed cooling air system. In this set a thermostat will be fitted, which will give visible and audible signals to the operating staff in case the circulating air temperature should exceed 97 deg. F., when, by pulling a trigger, it will be possible to open the supply to the machine from the atmosphere. Triggers have likewise been fitted to the other sets supplied through wet air filters, enabling inlet and outlet to the alternators to be closed at once should a short-circuit start a fire within the machine.

A novel and interesting adaptation of the Sturtevant wet air filter has been devised, whereby the circulating water used is connected with the oil coolers on the various turbines is derived from the filters. This arrangement enables the use of sea water with its corrisive effects on the oil coolers to be dispensed with, although small auxiliary sea water pumping apparatus is provided as a standby. The resulting heating of the cooling air to the alternators is so small as to be quite negligible.

Likewise contained within the engine room is the following auxiliary plant, viz.:- Three Peebles-La Cour motor converters of 500 kw. each, used for the purpose of converting alternating current to continuous current for the tramways and the continuous current supply area of the city. Unlike rotary converters, but as in the case of motor generators, these machines receive energy at their high tension side at 6,000 volts, thus operating without the use of transformers. A neutral tapping is taken off at the neutral point of the induction motor winding, so as to enable the machines to supply the three-wire continuous current network. This provides for quite satisfactory balancing.

Three-phase current is provided for all motor driven auxiliaries. A battery of the Edison iron-nickel type operates all switchboard relays and provides for emergency station lighting. For the purpose of enabling the use of only one converter at times of light load on both general and tramway supplies, a 150 kw. motor generator is in use as a link between the tramways and the general supply system. A 15 ton Herbert Morris travelling crane runs on gantry rails supported by steel stanchions.

In consequence of the varied services to be given the power house switchgear has assumed quite considerable proportions, and the switchboard platform with its operating panels occupies very nearly the whole length of one side of the engine room. All high tension gear has been constructed on the concrete cubicle system. Alternators are star-wound and in order to avoid circulating currents switchgear is provided enabling the neutral point of only one machine at a time to be connected to earth. No resistance is inserted in the earth connection. Figs. 3 and 4 show views taken within the engine room.

BOILERS.

The boiler house is an entirely new and somewhat imposing steel structure, with brick and concrete filled walls, containing the following steam generating plant:-- Six John Thompson water tube boilers, of which the last two are in process of erection; heating surface 4,557 sq. ft., 200 lb. per sq. in. gauge pressure, four boilers being fitted with Erith-Riley multiple retort stokers and two with stokers of the Underfeed company's chain-grate type. The boilers are built up in batteries of two and are supplied with forced draught, provision having been made at the base of the chimney for the use of induced draught, if ultimately found desirable. Superheaters of 517 sq. ft. heating surface are fitted, guaranteed for 200 deg. F. superheat. As these are the first of this type of boiler to have been installed in Australia, a reference to Fig. 5 showing a sectional side elevation, may be of interest. It will be seen that the boilers are of that type in which tube headers and hand holes do not enter into its construction, in which only straight tubes are used and in which a very large furnace combustion space is possible. The tube plates forming part of the steam and water drums are interesting examples of the work of the hydraulic press.

Ash and soot are delivered into suitable fire-brick lined steel pockets fitted with roller slide ash valves, which discharge their contents into small tip trucks running on a tramway to a ferro-concrete ash tower situated in the yard, now in process of erection and capable of storing 28 tons of ashes. The tower is provided with an ash receiving hopper and a skip hoist operating automatically under push button control.

Each boiler is fitted with a full set of steam flow air pressure and temperature indicators.

Gases are discharged at the top rear end of the boiler into an overhead steel flue, 13 ft. x 7 ft. sectional area, and supported on roller. This flue can either discharge directly into the base of the brick chimney, the top of which is situated at a height of 152 ft. above firing floor and which is 8 ft. in diameter, or through a Green's economiser of 1,536 tubes, with a heating surface of 16,300 sq.ft. In order to remove accumulated flue dust from the base of the chimney without putting it out of operation, a bin fitted with double slides on the powder flask principle is built into the chimney base. All flue dampers are fitted with ball suspension bearings.

The main steam piping has been carried out on the ring principle, the main piping being of mild steel, 8 in. diameter and 5/16 in. thick, with steel flanges weldedon, Taylor rings being used for flange packing. All valves and traps throughout the system are of cast steel and of Hopkinson make. The whole of the cast steel portions of the pipe system, where the use of that material appeared to be necessary was supplied by Messrs. C. Ruwolt and Co., of Melbourne.

The feed water system includes the use of four steam pumps of the Weir type, each capable of delivering 37,000 lb. of water per hour; a Lea recorder for measuring the quantity of feed water; a feed water heater for utilising the heat from the pump exhaust steam, in which the condensate from the turbines is raised some 15 deg. F., together with hot well and auxiliary storage tanks of large capacity and a Paterson make-up water softener and filter. Each boiler is fitted with an automatic feed regulator of the Crosby type, and the Weir steam pumps are likewise automatically regulated as to speed.

In view of the fact that the fuel storage yards are some distance from the power house, large storage bunkers have been constructed, the total storage capacity being 1,000 tons. Coal is received in a chute in the yard, where, if required, it can be passed through a crusher, whence it is elevated into the bunkers by means of a Babcock and Wilcox gravity bucket conveyor of a capacity of 40 tons per hour.

DISTRIBUTION.

We may now turn to the distributing system. As previously stated, the object in changing over to alternating current generation was in orger to enable the supply of large amounts of energy beyond the economical radius of continuous current distribution. Continuous current distribution, therefore, already having been established in the central portion of the area, the large amount of capital invested in underground mains, in meters and consuming apparatus on consumers' premises within that area, made it uneconomical to change over the whole system to a three-phase supply; hence it was decided to retain the existing continuous current system within the centre portion of the city only and to transfer to the outer surrounding three-phase network all that continuous current supply which was situated at an uneconomical distance from the power house. The a.c. network was, therefore, built up accordingly, and at present the territory is divided into five distribution areas, four of which are three-phase areas. Each of the latter areas is supplied by high tension feeders at 6,000-6,600 volts, taken to area sub-stations, from which high tension distributors radiate to the various transformer stations. The transformers are of the three-phase delta star type of the Brush Co.'s manufacture, the low tension secondary supply being on the three-phase four-wire system with earthed neutral and 400 volts between phases. Feeders are protected by overhead and leakage current relays. The whole of the alternating current network is carried out above ground with bare hard drawn copper cables.

The area of supply, which in view of the proposed change-over to alternating current distribution has been increased of recent years, now takes in the whole of the city of Geelong, the town of Geelong West, the borough of Newtown and Chilwell, portion of the shire of Corio, portion of the shire of South Barwon, taking in the suburbs of Belmont and Highton, and portion of the shire of Bellarine, taking in the township of St. Albans and the large Cheetham Salt Co.'s works. The extent of the area thus covered is 17 sq. miles, with a population of approximately 36,000. That the company's foresight in making early and ample provision for a modern three-phase supply was fully justified is demonstrated by the great use which has already been made of the new supply; in fact, for a city of the size of Geelong industrial requirements are quite extraordinary and are increasing with great rapidity. For instance, in the short time since the new supply has been available no less than 7,000 h.p. (11,000 h.p.) of new motive power from factories situated outside the continuous current area have been applied for and largely connected, and some further thousands of h.p. are under consideration. At the time of writing, the total amount of h.p. connected or in process of connection on both the a.c. and c.c. system is close upon 10,000 (19,500). On the basis of population this would mean that the Melbourne metropolitan area should have 220,000 h.p. connected as an industrial load, whereas it is only of the order of 100,000 h.p. These figures will show to what extent Geelong is rapidly becoming an important manufacturing centre. Whilst it must be acknowledged that there are many other reasons for this special development, yet there is little doubt that the statement was correct which Mayor Hitchcock recently made to the effect that Geelong was indebted to the company for having so largely contributed towards the possibility of the establishment of new industries in the city by rendering a modern supply of electricity available in any quantity at a reasonable cost.

In laying itself out to make the supply attractive to industrialists, it was absolutely necessary to keep the cost of generation and distribution to the very lowest figure. Therefore, in the new design, special attention was paid to efficiency. With what success may be seen from the fact that, whereas before reconstruction the coal consumption per kilowatt-hour generated was 3½ lb., with the new plant, it is now 2 lb., showing a reduction of no less than 43 per cent, and with increased load it is confidently expected that there will be a further reduction to about 1.8 lb., which, it must be acknowledged, would be a very excellent figure for a power house of the size in question. The area is well covered with mains, the supply being available in 82 (102) miles of street. The number of consumers connected to date is 5,700 (7,850). About 8,500,000 kelvins (18,300,000) were sold during the last twelve months for all purposes, showing an increase for the year of 241 per cent (78). Of this amount no less than 5,500,000 kelvins (13,700,000) were used for industrial power and traction, showing how completely this undertaking is being monopolised by factory requirements. Again, for the same reason, nearly twice the amount of electricity is consumed per mile of street in Geelong as is consumed in the company's metropolitan area. The load-factor for the year was no less than 38 (48) per cent--a very high figure for a city of the size of Geelong--and it compares very well with load-factors obtained in much larger cities, not excluding Melbourne. Before the change-over to alternating current the load-factor was of the order of only 30 per cent. As correctly reflecting the industrial and economic advancement of Geelong, it will be of interest to watch the future development of Geelong's progressive electric supply undertaking.

Revised Aug.-1926.

PRINCIPAL POINTS OF INTEREST.
in order of Route of inspection.

A. TRAMWAY MOTORMEN AND COBDUCTORS' ROOM.
Locker Accommodation.
Roster.
Emergency Outfits.

RECEIVING OFFICE.
Check system.
Conductor' Outfits.

WORKS HANDS' ROOM.
Locker Accommodation.

B. EXECUTIVE OFFICES.
Engineer) Intercommunication Telephone
) control, fifteen stations.
Secretary) Dictation by "Dictaphone".

Correspondence Room.
"Dictaphone " Transcribing Machines.
"Roneo" Copier.
Filing system and records.

Drawing Office.
Plans of Geelong and District shewing Public Lighting, Tramways, High and Low tension Mains reticulation, and Substations.
Flat roof above with apparatus and equipment for taking blue and white sun prints in connection with the reproduction of drawings.

C. TURBINE FLOOR.
Three Metropolitan-Vickers Turbo-Alternator Sets each of 4, 000 H.P.
One Brush-Ljungstrom Turbo-Alternator Set of 2,000 H.P.
These sets are examples of the most modern turbine design.
Three La Cour convertors which are supplied from the afore mentioned Turbo-Alternator Sets with alternating current at 6,600 volts which they convert to direct current at 460 and 550 volts for City supply and Tramway operation.
Main Station Switchboard from which the various supplies of high and low tension electricity are controlled and recorded.
Note the remote control of all high tension switchgear which removes any element of danger to the operator from the handling of high tension electricity.

D. TURBINE ROOM BASEMENT.
Four condensers which receive the exhaust steam from the turbines and condense it by allowing it to pass over tubes through which cold sea water is pumped.
Extraction and air pumps remove this condensed steam, together with any air which has passed over with it, and pump it to the hot-well situated in the boiler room. From here it is again pumped into the boilers by the feed pumps.
High tension switchgear in concrete cubicles under main switchboard.
Transformers and switchboard supplying and controlling the station power and lighting.

E. PUMP CHAMBER.

Sea water enters from Corio Bay by means of one of the twin concrete tunnels. It then passes through automatic travelling screnes to the vertical 22" pumps which pump it up to the turbine room basement and through the condensers.

It then returns to the sea by means of the other of the twin tunnels.

F. BOILER-ROOM BASEMENT.

Air-Filter Room.

Air Filters wash and clean the air which is drawn into the alternators as a cooling medium.

Oil coolers and filters which cool and purify the lubricatin oil for the turbo-alternator sets.

Forced-Draught-Fan Room.

Forced Draught Fans supply air to the boiler furnaces on the floor above.

Ash Tower.

Ashes are discharged from the boiler furnaces into concrete bins where they are quenched with water.

They are then emptied from these bins into a truck which conveys them to the automatic skip hoist which is provided for hoisting the ashes into the Ash Tower where they are stored until removed for use on Council's footpaths and for tram track construction purposes.

Automatic Soot Handling Apparatus.

Soot collect in receptacles provided in the bottom of the flues and in concrete bins under the boilers. A suction fan automatically draws the soot from these receptacles and bins and discharges it into a storage tank called a Cyclone Head. From this tank the soot is carted to the tip.

G. FIRING FLOOR.

Six water-tube boilers with automatic stokers.

The coal for the furnaces is fed from the overhead bunkers through automatic weighing machines to the hoppers at the front of each boiler.

The coal supply valves at the bunker outlets are controlled by the Fireman from the Firing Floor.

Four feed pumps which pump the water from the hot-wells through the economisers and then to the boilers.

Note special instruments by means of which the combustion of the fuel is controlled and regulated. These instruments ensure the most efficient combustion of the fuel.

H. ECONOMISER FLOOR.

The economisers consist of nests of tubes through which the feed water is passed on its way to the boilers from the hot-well.

The hot gases from the boilers are passed round the tubes and so heat the water by this means. The heat in the flue gases, which otherwise would be wasted, is economised.

Note the automatic scraping gear which prevents the soot from settling on the economiser tubes.

The induced Draught Fan assists in the creation of a draught for the boiler furnaces.

The water softening and filtering plant ensures a clean supply of town water for the boilers for "make up" purposes.

The coal bunkers store the coal for use in the boiler furnaces.

Note the automatic coal conveying and handling plant which places the coal in any of the six bunkers.

I. CAR DEPOT.

Housing of tramcars.
Graded track for emergency exit.
Inspection Pits.

Arc Welding.

Special portable outfit for track or depot. Building up of worn parts.

Wheel Press.

Hydraulically worked, pressure up to 120 tons forcing wheels on to tapered parts.

Tyre-Fixing Well.

Steel tyres heated and expanded by gas ring; placed on wheel and shrunk on by water spray.
Demonstration of "Birney" Safety Car.
Track Maintenance.

J. COAL PIT.

Contains a crusher, hoppers and chutes for grinding and feeding the coal to the bucket conveyor which lifts and places it in the bunkers at the economiser-floor level.

Large coal is crushed to the required size for use in the automatic stokers before reaching the conveyor.

K. GARAGE.

Maintains and houses fleet of six motor trucks and seven motor cycles, together with a motor roller and air compressor, both of which are used on tram track construction work.

Note emergency lorry ready for service at any time.

L. WORKSHOP.

Large Wheel Lathe for turning tram tyres.
Large radial drill for heavy duty work.
Lathes, Shaper, drills, shears and screwing machine for general maintenance work.
Power hammer in Blacksmith's shop.
Oxy-acetylene and electric welding outfits.

M. STORES.

Stores accommodation for general supply, tramways and installations.
Offices and Showroom.

N. PAINT SHOP.

Used for painting tramcars and other items ie. ladders etc.

O. LABORATORY.

Motor Generator, Switchgear, Transformers and testing instruments for testing all classes of electricity meters and measuring instruments.

Chemical apparatus and equipment for carrying out tests on samples of coal, boiler water, oil, greases, etc.

Dark room for photographic work.

P. MAIN OFFICE.

Book-keeping Machines for writing up Day Book and posting to Ledgers.

"Dalton" Electric Adding Machine.

Typewriter with special tabulator for posting Sundry Day Book.

Ledger Cabinet divided into four divisions, "A", "B" and "C" (Suburban) quarterly readings, and "D" (Business) read monthly.

Stationery Department, also Lost Property Store for Tramways.

Q. CENTRAL OFFICE.

Consumers' Card Cabinet containing particulars of connections to our mains, as "Number of Lamps", "Motors", "Meters", etc.

Telephone Switchboard.

NOTE - A special car will be available at Depot, at conclusion of inspection, to convey guests to the centre of the City.

OUTSIDE ACTIVITIES

The foregoing is a brief synopsis of the principal features of the Power Station.

The link between the Power Station and the Consumer is

The Mains Department

which provides for the conveyance of the electric current to the consumer's residence or place of business, and its efficient performance when there.

A sub-section of this Department is that of "Installations", which carries out electrical wiring and installs the many devices for the absorption of electric energy in the service of the citizens.

Another important subsection is that of "Public Lighting", which ensures that the streets of the City and suburbs, from Highton in the South to Lara in the North, Breakwater in the East and Manifold Heights in the West, are made pleasant and safe.

Electricity is also supplied in bulk to the terminal stations of the State Electricity Commission of Victoria for transmission to Warrnambool and intervening towns, and to the Queenscliff Peninsula.