Industrial Geelong.

Visited by the Interstate Conference of The Institution of Civil Engineers.

October 30th, 1923.

INDUSTRIAL GEELONG.

Compiled by the Faculty of Engineering,

The

Gordon Institute of Technology.

G. R. KING, F.R.V.I.A., *Principal.*

City of Geelong.

Incorporated	12th October, 1849.
First Meeting of Council	9th February, 1850.
Proclaimed a City	8th December, 1910.
City Hall Erected	7th June, 1917.
Valuation	£196,174, with a rate of 2/9.
Area	3012 Acres.

NEWTOWN & CHILWELL.

Created a Borough	9th March, 1858.
Valuation (Unimproved)	£437,831, with a rate of 5½d.
Area	1422 Acres.

GEELONG WEST.

Created a Borough	29th May, 1875.
Proclaimed a Town	22nd March, 1922.
Valuation	£74,337, with a rate of 2/8.
Area	859 Acres.

Population of Greater Geelong, approximately 35,000.

Geelong as an Educational Centre.

TIME was, and within living memory too, when the place that possessed a school of any kind at all, enjoyed thereby a certain distinction. It is possible that the village in which Dotheboys Hall was situated, boasted itself over the villages which did not possess even a Squeers.

That day has passed. There is now no centre of population which is not provided for, so far at least as elementary education is concerned, according to its needs. The year 1872 witnessed in Victoria the birth of a movement which has given to every city, town and even village, its primary school of good standing. The existence of such schools is, to-day, an accepted thing, common to all alike, devoid of novelty or rarity, though none the less valued by the thoughtful. The differences, therefore, which mark off one city from another in matters educational must now be sought in the secondary and technical spheres. It is in these above all that our city excels.

Geelong's right to be called the Bradford of Australia has long been admitted. Her right to be ranked on a level peculiarly her own in the world of education is no less obvious. The combination is a somewhat unusual one. The industrial movement and the scholastic have grown side by side, without, at first, much visible connection between them. It could hardly be maintained that the first founders of our premier industries were in any sense men of the schools. There has been, however, particularly of late, a growing recognition of the related value of the educational to the industrial factor, and an increasingly deliberate shaping of the one to fit the other. Not that this means any adoption of the facile dangers of too-early specialisation. The wiser principle is steadfastly adhered to, that there is but one root for learning's branches, and that root must be fully grown. It has been a pleasure to hear this note struck again and again by prominent leaders of education in Geelong.

The half-dozen primary schools which serve the needs of the city and its suburbs are of that type and character which the State service must naturally supply to a place of such size and importance. Among them, the name of Flinders School was for long an outstanding one in the annals of State education. It conjures up memories of such old-time stalwarts as G. F. Link and A. Hanson.

Until a few years ago, the education of the children of the Roman Catholic faith was provided for by their parochial clergy. In recent years, however, the administration of education, so far as Geelong proper is concerned, has been handed over to the Christian Brothers, who have erected very fine schools, in which both primary and secondary courses are made available. The education of the girls is in the hands of the Sisters of Mercy. At their convent in Newtown separate establishments are conducted for secondary and primary teaching, resident and day boarders being taken in connection with the former. They have also fine primary school buildings in Geelong proper and at Geelong West, as well as St. Agnes', a High School for girls who live in Geelong, but for whom the convent schools are too far away.

The Geelong Grammar School and the Geelong College are included in that aristocracy of educational activity known as the Public Schools of Victoria, Geelong being the only provincial city so favored. It would be scarcely too much to claim that nowhere else, perhaps in the world, could a town of only 40,000 people be found possessing two such schools as these. Founded in 1857, the Grammar School stood on the hill-top in Moorabool St. until its removal in 1912 to its present site on the north-western shore of Corio Bay. It has been described in England's leading newspaper as "the best-known Public School in Australia." Geelong College, which dates from 1861, was for long linked with the honoured name of Morrison, and many of its brightest memories are inseparably associated therewith. Both these schools have what many consider a distinct advantage as compared with the Public Schools situated in Melbourne. They are not too big. Their spirit has more of the family than of the regiment about it.

Closely associated in many respects with these first-class boys' schools, stand institutions of a like order for their sisters. The amazing growth of the Church of England Girls' Grammar School tells its own story of progress. In every direction has the school spread itself out. Of more recent date, the Presbyterian Girls' College has risen phoenix-like on foundations that had previously been laid down by Miss Harris, in the well-known Newtown Ladies' College. Another school of the highest standing is the Central College, which takes pupils of either sex from the kindergarten to the university. When the factor of personal continuity is considered, this school can claim to stand by itself in Geelong, having been under the same Principal considerably longer than any other institution.

The introduction of State secondary education in Geelong was due to a very expressive demand, particularly from the country districts outside the city, for higher educational facilities for young people. The Gordon College assisted the movement, and offered the use of buildings and equipment to enable an immediate start to be made. The subsequent growth of the Technical School rendered it necessary that a special High School building be erected; and in 1910, through the interest of the then Mayor, Ald. E. Philpott, a site in the botanical gardens was offered to the Education Department. The then Minister for Education, Hon. A. A. Billson, with the Director of Education and several others interested in the movement, visited the Gardens in company with Ald. Philpott, whose enthusiasm was so unbounded that he intimated they were at liberty to choose any site they liked in the park. That far-sighted administrator, Mr. Frank Tate, immediately pounced on the northern portion overlooking the Bay. Park-lovers, however, saw to it that that site was not lost to the community, even for so excellent a purpose as that of higher education. Since its inception, the High School has suffered from one drawback only, a too rapid succession of headmasters. Greater stability in personal control should supply a truer test of progress and possibilities.

The development of technical education is, of course, a corollary of modern civilisation. The institution erected in 1885, in memory of the late General Gordon, has in recent years developed on very extensive lines. It comes, from the nature of things, more clearly into the ken of the industrialist and the technical expert than any of its local contemporaries. Technical schools in the earlier days were built up on lines laid down by those who established Mechanics' Institutes. Later on there was a development following the Great Exhibition of 1851, when "Schools of Art" were established to promote design in craft productions. Hence it was that for many years prior to 1885 there existed in Geelong a Ladies' School of Design, also a Technological School founded in 1869, under the capable direction of the late Robert de Bruce Johnstone, who became a force in the city, and after whom Johnstone Park is named.

The Technical School development pure and simple followed in more recent years, when the falling-off in apprenticeship first began to manifest itself. The extraordinary progress of mining in Victoria was directly responsible for the establishment in this State of some very high-grade Schools of Mines, all specially functioning in the training of mine managers, assayers, and other technicians associated with the mining industry. Technical education to-day necessarily sub-divides itself into three distinct types of schools:—

(a) Vocational Training.
(b) Supplementary Industrial Training.
(c) Professional Diploma Course Training.

The pioneers did not foresee the ultimate possibilities when they laid their plans for a Technical School in Geelong. Their ideas were limited to a large assembly hall and four small class-rooms. For a number of years the institution seemed to be at a standstill, until, in 1895, a Government grant enabled the Council to erect what is now the central portion of the building. The major growth of the institution is a matter of quite recent years, and it may be put on record that one finds a striking illustration of the strong hold it has on the interest of the people in the fact that the additions, which from time to time have been made, have almost all been erected as memorials. It began as a memorial to General Gordon; the group of buildings for the Art Department was erected as a memorial to the late G. M. Hitchcock; the Chemical Laboratory has

been erected as a memorial to the late E. H. Lascelles. A further addition to the north facade is to take the form of a memorial to the late T. E. Bostock, and already a proposal has been put forward for a western wing to the north facade, as a memorial to the late James Harrison.

The Gordon functions in a special and easily-perceptible way. It stands midway between the Public Schools and the University. Its graduates are now occupying the highest positions in our big engineering and industrial enterprises, while the architecture of Victoria, it may be claimed, is being influenced in no small measure by the local principles of Sir Christopher Wren and Inigo Jones. As an Institute of Technology, the status of the Gordon is unquestioned. While the diploma courses represent its highest developments, the training of the super-workman and the skilled leader of artisans receives the same thorough attention, while its vocational training, as expressed in the Wool and Textile Department particularly, has called forth the highest praise from such experts as Senator Guthrie.

The movement in regard to the development of a Textile School for Victoria is largely the outcome of the high-grade operations in the Wool Department of the Gordon; and it is interesting to record the fact that just recently a visit was paid by Professor Barker, Head of the Textile Section of Leeds University, when he investigated local conditions and proposals at the request of the State Government.

The maximum attendance at the school was, of course, during the period of vocational training, when close on 500 soldiers attended the school in various Departments for intensive training. In this regard Geelong led the way in its initial efforts to handle satisfactorily the returned soldier problem, and the Council and management of the Institute were congratulated by the Repatriation Department on the success that attended their operations.

The Institution appeals to the engineering profession by reason of the strong bias that has been exercised in recent years, and in this regard one should make particular reference to the Faculty of Engineering, which comprises the principal professional practitioners in the city. Its energies have been directed in the past to raising the standard of work, and (what is more important) bringing its influence to bear in satisfactorily introducing the graduates to positions suited to their attainments. The success that followed the Engineering Faculty, in fact, warranted the Council in forming a similar body for the advancement of the architectural profession.

The present attendances at Geelong Schools are as follows, though it should be remembered that the maximum is always to be found at the beginning of the year, not the end:—

State Primary Schools	3820
R.C. Schools (including orphanages)	1629
Gordon Institute of Technology	864
High School	309
Geelong Grammar School	290
Geelong College	260
C. of E. Girls' Grammar School	245
Presbyterian Girls' College . .	130
Central College	116

Geelong's Woollen Industry.

AT first sight, Romance and Business seem as far as the poles apart. But Business, being part of real life, has its romantic as well as its purely material side, as records of the progress of nations, cities, and men testify. There is, undoubtedly, a touch of the romantic in the rise of Geelong as a wool selling centre. Not that its progress has been of the mushroom order, sensational, but unstable. Rather has it been of the solidly-advancing order, since it first dawned upon the somewhat prejudiced wool-growers of an earlier day that, after all, it would be better to sell their fleecy merchandise on the spot than to send it to London, and pay freights when they had a market at their doors. But that is anticipating. The foundation on which Geelong's importance as a wool market is laid lies largely in the fact that it is the natural outlet for a district producing the brightest and the highest class super-silky wool in the world. The reason for this pre-eminence in quality has its genesis in the climatic conditions and the nature of the soil, so eminently adapted for the production of these good wools. The Western District is, indeed, the place par excellence on this planet for growing these wonderful clips. You could not, for instance, grow the same wool in the North of Australia, nor in England. Our merino sheep would not be the same in New South Wales. Some types of country cannot grow anything but Lincolns; other country is adapted for crossbreds. In this connection, drought, though it bring ruin to many a man, is not devoid of a redeeming feature. If the country were flowing with green feed all the year round, our merino sheep would not exist. The merino subsists on light pastures, and in dry areas; if these became rich and luscious, this particular type of sheep would disappear from them. The Scriptural land, flowing with milk and honey, would be no good for merinos. Australia grows a very big percentage of the world's merino wool (and when we say "Australia" we largely mean the Western District of Victoria).

In the case of the Western District it would be unfair to mention the magnificent climatic advantages for the production of merino wool without paying tribute to its good fortune in having such fine sheep men coming into it in the early days. The wonderful management of the men on the land must not be overlooked. Such pioneers as the Cumming family, among the very oldest of the pastoralists; the Russells, of Barunah Plains; the Russells, of Carngham; the Beggs Bros., of Beaufort; the Dennis'; the Campbells, of Langi Kal Kal; the Russells, of Langiwilly; the Wilson family, of Ercildoune and Mount Bute (Samuel, the head of the family, afterwards became Sir Samuel Wilson); the Curries, of Larra; the McArthurs, of Camperdown; the Manifolds—these are but a few of the names of the men who helped to make the Western District wool famous. These people have bred sheep to such an extent that they have got them so defined as to form a class of sheep of their own. That is to say, breeding solely within their own flocks for years, they have each defined their own style of pure Western District merino, possessing all the general characteristics of the pure merino, with that "something" which enables the expert eye to decide instantly "That is wool from Barunah, Carngham, Beaufort," or other places, as the case may be.

Since those far-off days when Geelong was only a storing place for wool pending its shipment to England, the Pivot has travelled far. It took years to overcome the prejudice of the wool growers against their own natural market, and if it had not been for the faith that was exhibited by the brokers of those days as to the future of wool selling here, the trade would not have reached the dimensions it has. But gradually the growers realised that it was more profitable to sell on their own seaboard, besides having a control over their wool, which was not possible when it was shipped for sale in London.

Still, it was slow work, both in Geelong and Melbourne, as is evidenced by the fact that after 10 years, in season 1867-68, the total offerings and sales of the various Victorian brokers were as follows:—

R. Goldsbrough and Co., 43,078 bales catalogued, 18,478 bales sold.

London and Australian Agency Co., 26,389 bales catalogued, 9,046 bales sold.

Cunningham and Macredie, 19,817 bales catalogued, 6,954 bales sold.

C. J. Dennys and Co., 10,567 bales catalogued, 3,647 bales sold.

G. Synnot, 9,250 bales catalogued, 2,537 bales sold.

Guthrie, Bullock and Co., 4,368 bales catalogued, 1,077 bales sold.

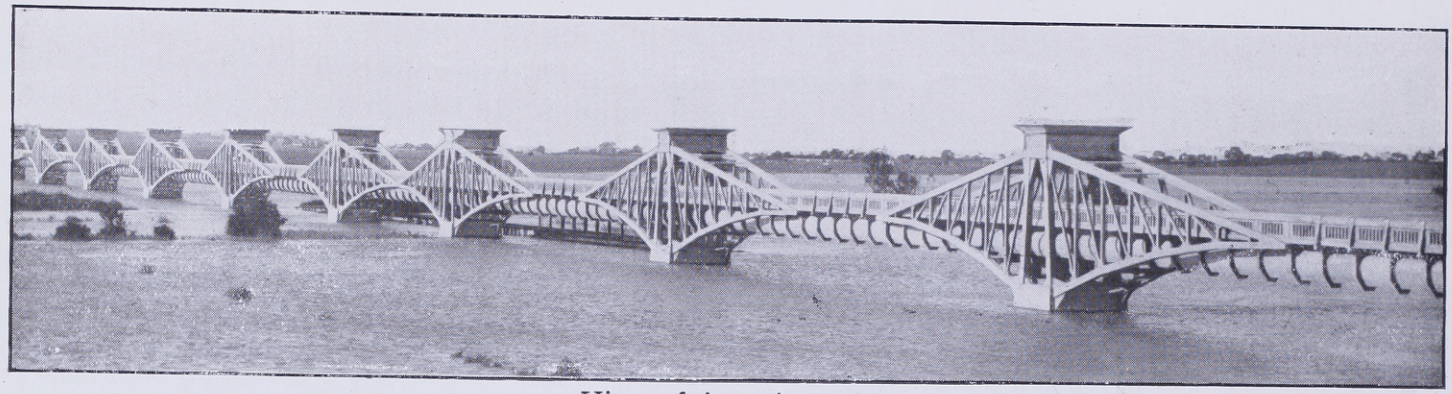
What must strike the seller to-day is the large proportion of wool then offered, but not sold. In those times, it was rare for a grower not to reserve his wool, generally at a price beyond its market value. Now we find it equally rare for him to place reserves on his consignments. He knows that the competition of buyers at the Geelong sales is now so representative of the manufacturers' needs, in every corner of the world, that the full market value of the day is always obtainable. Every country of the world is represented at Geelong's usual auction sales. A very important feature at the present time is that quite a big percentage of the wool is wanted for America and Japan, and it does not pay to send it all the way to London, for subsequent shipment to these countries. Wool is being shipped direct from here to America, Japan, France, Italy, and India, besides the usual Continental ports. Only a comparatively small proportion of Australia's wool goes to London to-day, and that principally from parts which have not got established selling centres.

The old principle that "Nothing succeeds like success" applied here. As the mountain declined any longer to come to Mahomet, Mahomet had to go to the mountain. The Yorkshire manufacturers found it expedient to go to Australia for wool—or get "left."

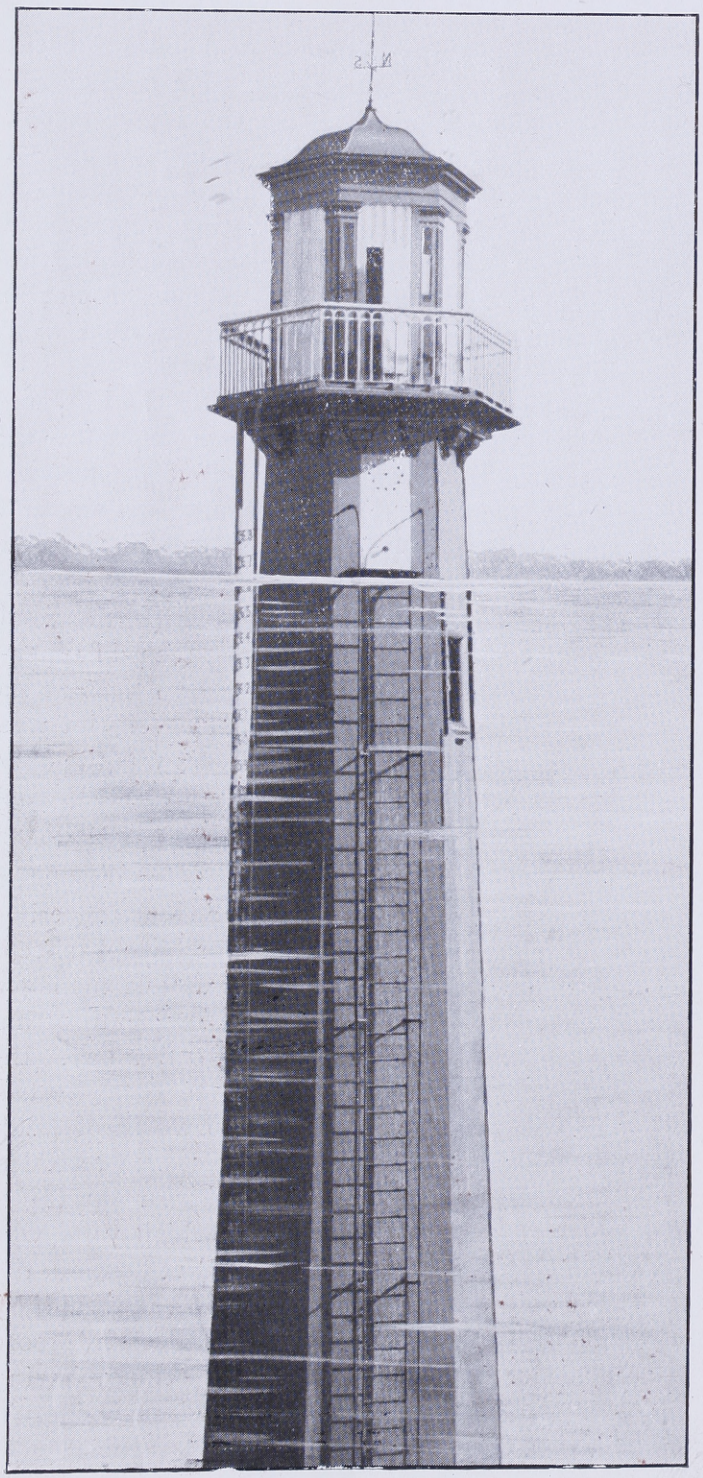
Starting in 1857 with catalogues totalling under 4,000 bales, the Geelong wool sales have since developed an aggregate of over 150,000. In season 1919-20, for example, 158,514 bales were sold in this port. The first wool sale in Geelong of which their appears to be any authentic record took place at the stores of C. J. Dennys, in Victoria Terrace. The date was December 9th, 1857, and the catalogue consisted of 238 bales—how insignificant compared with the mammoth catalogues to-day! The first lot consisted of 132 bales branded D.B. belonging to the Dennis family, in the Wimmera. (The same brand, it may be mentioned, is still being sold at Dennys, Lascelles Ltd. stores). On reference to the catalogue of that historic day (the original is still in existence), we further find that J. Bray had 30 bales, and S. B. Corrigan 45 bales of scoured wool. In later years the wool was offered in Mack's Hotel dining room. Then sales were held in a room built on the present site of Messrs. Dennys, Lascelles office. Afterwards this was pulled down, and this firm's office built, with an auction room on top where small lots are sold by all brokers to this very day. Later on, at Victoria Hotel, a wool auction room was built on the ground floor; but the Geelong sales reached such dimensions that it became imperative to build a complete new auction room, equipped with a gallery, to accommodate the brokers' clients. And so the present Wool Exchange came into being. It was designed, after exhaustive inquiries as to the requirements, by Messrs. Laird and Buchan, architects, and at the opening in September, 1907, the president of Victorian Wool Buyers' Association commended the Geelong brokers for their enterprise in providing one of the most convenient wool sales' rooms in the Commonwealth. That the new quarters were needed was proved by the great advance that had taken place in Geelong's business. By the last pre-war season (1913-14) 115,013 bales were dealt with, and, although there was a big decline in the two succeeding seasons, things became brisker and brisker afterwards, until the 1913-14 total was left far behind.

Like all great branches of commerce, the wool trade in Geelong has had its quota of record happenings. In 1894, for example, when wool was at its bedrock, there were no reserves, and every lot was sold in Dennys, Lascelles' room. This was the only occasion on record on which every lot put up was actually sold without getting out of the box.

A record of somewhat different, but none the less interesting, kind, attaches to an auctioneering hammer owned by Mr. T. G. Moore, wool, sheep, skin, and hide auctioneer, and insurance manager for Dennys, Lascelles Ltd. It is a memento of his wool-selling career, and he uses it to this day. Inscribed on it is the fact, that up to date, he has knocked down with it £11,000,000 worth of wool. As each million was reached, the fact was recorded by engraving on the hammer. But for the intervention of the great war, during which wool was practically all appraised, not offered at auction, the figures would have been even larger. It would, by the way, appear from official records that Mr. Moore is the senior wool auctioneer in Geelong, having been licensed in 1893, but Mr. Wood, of Dalgety's, runs him a close race for the honor.



View of Aqueduct.



View of Valve Tower.

Water and Sewerage.

PRIOR to 1907 the water supply of Geelong was under the control of the State Government. At the end of that year an enabling Act was passed by the State Parliament, constituting the Geelong Municipal Waterworks Trust, and transferring the whole of the works of the then existing system. In 1910 the Trust was re-constituted under the Geelong Waterworks and Sewerage Act, with the added authority to borrow for, and construct, sewerage works.

WATER SUPPLY.—The supply to the city is by gravitation, and serves a population of 37,000. It is drawn from three watersheds totalling 25½ square miles. The upper has an area of 18½ miles, and is situated on the Dividing Range, in the Wombat State Forest, 60 miles from Geelong, and midway between Ballan and Daylesford, at an average altitude of 2,100 feet. The two lower watersheds, with a combined area of seven square miles, are adjacent, on the Stony Creek, Steiglitz Ranges, 27 miles from Geelong, at an altitude of 1,100 feet. Five reservoirs have been constructed—one on the upper, and four on the lower watersheds—with a total storage of 2,709 million gallons, the largest being situated at Stony Creek, with a capacity of 801 million gallons. The embankments of these reservoirs, with one exception (a concrete arch 43 feet high) are of the usual type, viz.: earthen embankments with core walls of clay and concrete with three-to-one inner and two-to-one outer slopes. The highest is 84 feet (old Stony Creek), and was originally constructed by the Government. It may be of interest to state that at the time of its construction in 1867, it was regarded as one of the high embankments of the world, being mentioned by Wegmann

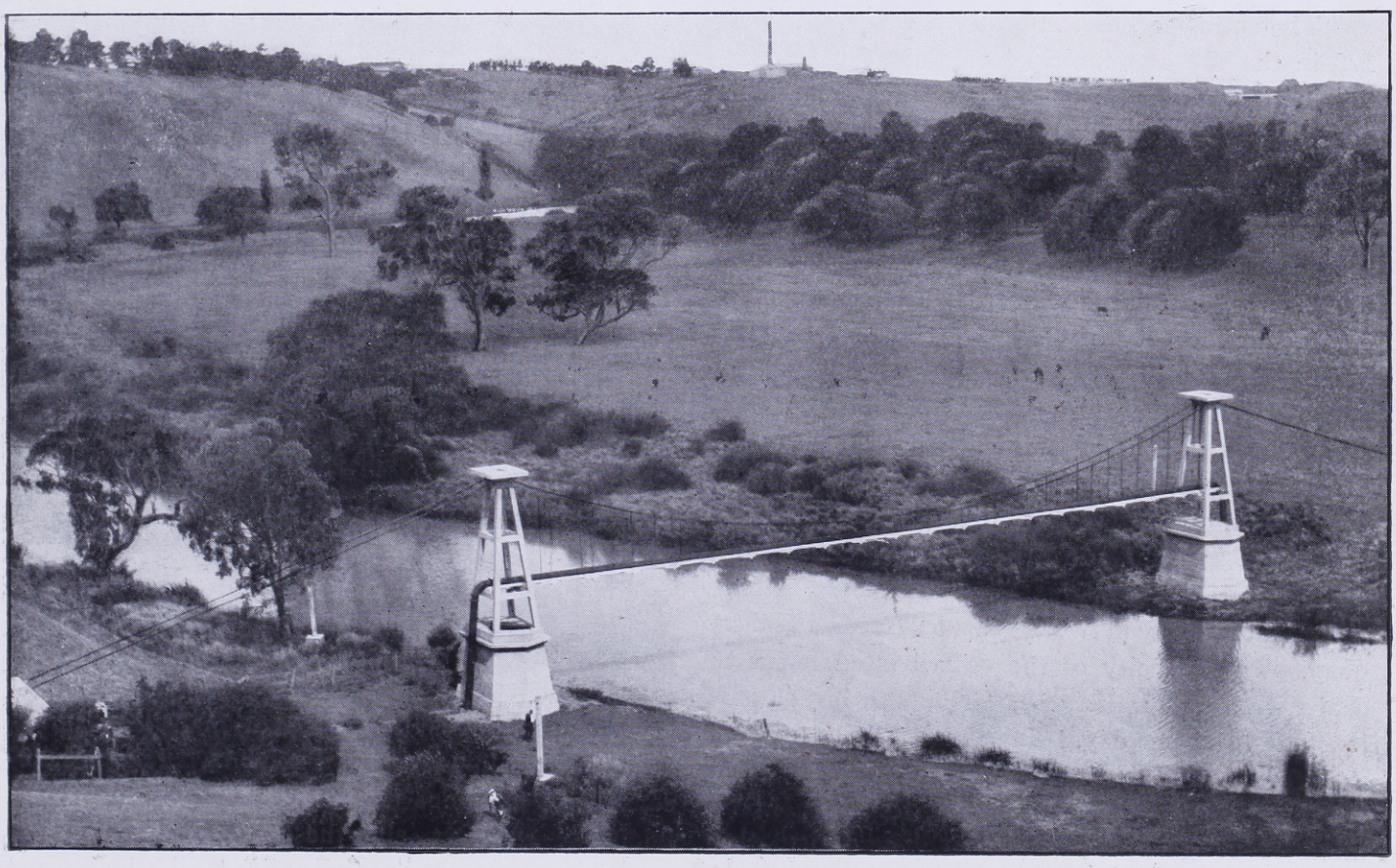
in his work on Dams. The water from the reservoir in the upper catchment is brought down 8 miles by the Moorabool River to a diversion weir at an altitude of 1,740 feet, and thence by 22 miles of open unlined and pitched channel to the reservoir at Stony Creek. The average fall of the channel is 4 feet per mile, with a number of vertical drops along the route. From Stony Creek, 5½ miles of open brick aqueduct conveys the water into small pipe-head reservoirs at the Anakies, at an altitude of 843 feet, 20 miles distant from Geelong. The fall of this aqueduct is 6 feet per mile, and the district being rugged, it was necessary to construct along its course six flumes and eleven tunnels. The aggregate length of the flumes is 1,150 feet, and the tunnels 1¾ miles. The carrying capacity of this aqueduct is 5 million gallons per day. From the pipe-head at the Anakies, two 14 inch mains take the supply to five service basins with capacities varying from 1½ to 7 million gallons, the total capacity being 25 million gallons. These basins are situated outside the city at altitudes of 330 feet and 270 feet respectively, the distribution from these being divided into two zones (high and low level). The aggregate length of mains and sub-mains is about 198½ miles, the diameters of the pipes ranging from 24 inches downwards.

No special treatment of the water supply is carried out, other than by screening and sedimentation, the water being drawn off in all cases at fixed depths below the surface by means of floating arms at the service basins. On account of its quality it is largely availed of for industrial purposes, and has led to the establishment of the Commonwealth (Federal) and other large woollen mills in Geelong.

The consumption last year amounted to 783 million gallons, the average being 58.7 gallons per head per day.

The number of meters in use is 5,505, being 38 per cent. of the services.

At June 30th, 1923, the capital outlay on waterworks construction was £475,000.



Suspension Bridge at Queen's Park.

Outfall Sewer at Black Rock.

The rating in connection with water supply is 1/3 in the £1 on municipal valuations of properties, with a minimum of £1 per tenement. The water charge for general purposes is 1/- per 1000 gallons, with an allowance of 7,000 gallons where sanitary supply passes through meter.

SEWERAGE.—The drainage area consists of 8,081 acres, containing about 8,800 tenements, and embracing the City of Geelong, Town of Geelong West, Borough of Newtown and Chilwell, and adjacent parts of the Shires of Corio, South Barwon, and Bellarine. The greater portion of this area is drained by gravitation into the main outfall sewer, which is an oval sewer 4 ft. 3in. x 3 ft. 3 in. with a grade of 1 in 2500, and delivers into the Southern Ocean at Black Rock, situated 9 miles from Geelong, and about midway between Barwon Heads and Torquay. The capacity of the outfall is sufficient to deal with a population of 120,000, allowing 45 gallons per head per day. The present daily average flow for the 24 hours is about 21 gallons per head for the population provided for, rising to a maximum of 46 gallons per head. The reticulation sewers consist of 15in., 12in., 9in., and 6in. diameter pipes, with a total length of about 76 miles, manholes being provided at distances of about 250 feet apart.

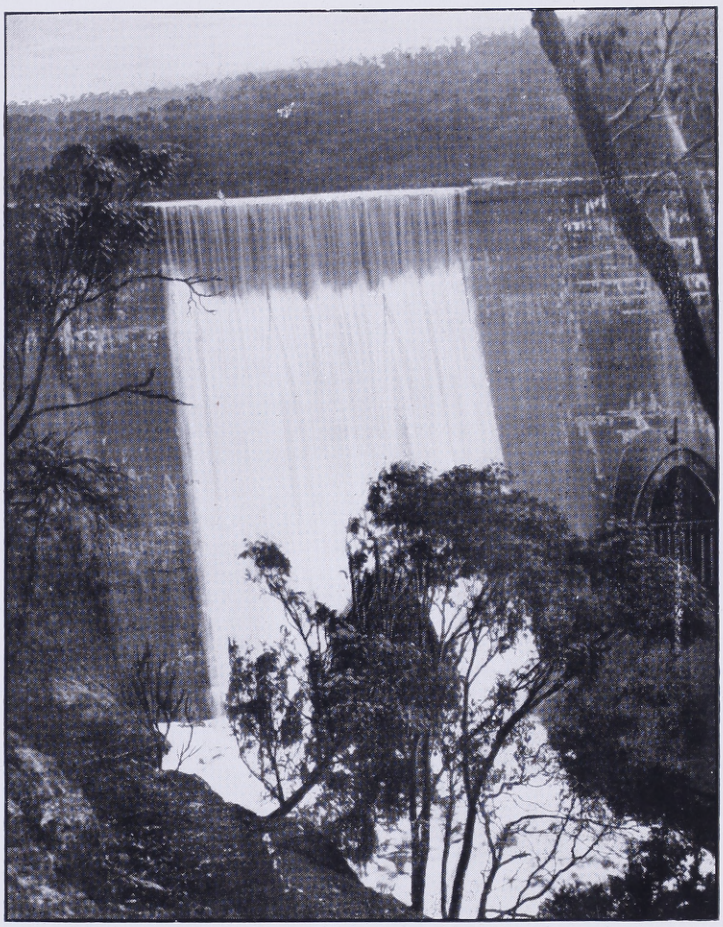
The drainage from the low-level areas, which are situated on the foreshore of Corio Bay and the Barwon River Valley, is provided for by six pumping stations, from which the sewage is forced through rising mains to points on the upper-level system. All the pumping plants are in duplicate at each station, and similar in type, consisting of 4 inch, 3½ inch, and 3 inch centrifugal pumps direct-coupled to electric motors, varying from 3 to 17 H.P. The pumping units vary in capacity from 100 to 400 gallons per minute, the maximum head being 81 feet, and the minimum 23 feet, including friction and other losses.

The main outfall sewer is carried across the Barwon River and flats by an aqueduct of reinforced concrete. The aqueduct crosses the valley at a point where the river and an ana-branch form a small island known as Goat Island. The aqueduct consists of 12 spans of 176 feet, and one on Goat Island of 136 feet, and these, together with approaches at end of structure, give a total length of

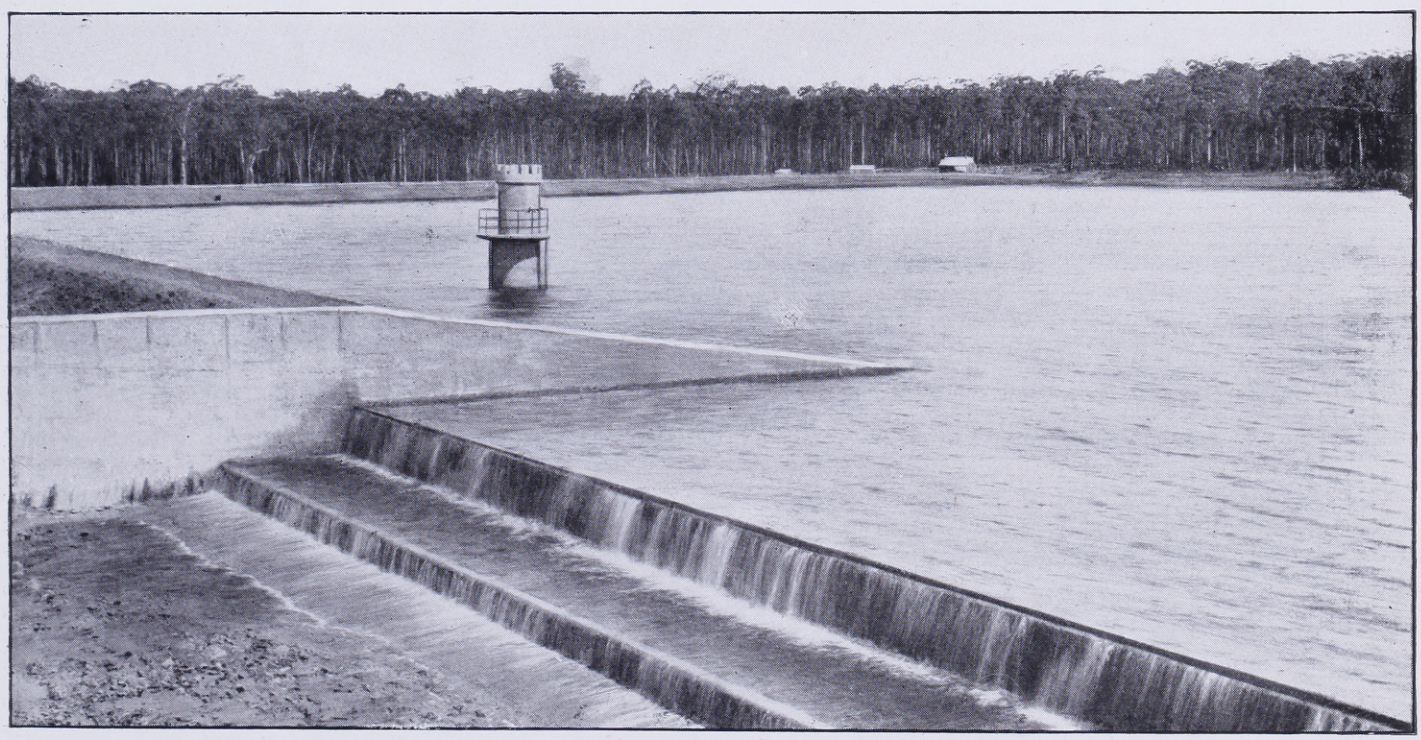
2,480 feet. Each span consists of two cantilever arms projecting 68 feet on either side of the piers, and supporting a central girder of 40 feet in length. In the span on Goat Island this central girder is absent, and there the arms are weighted with mass concrete to balance the load on the corresponding arms. The sewer is suspended by reinforced concrete hangers, while expansion and contraction joints are provided for in the superstructure and pipe lines on each span and end approach. The cost of the structure was £20,000, and the time taken to complete it was 17 months.

At June 30th, 1923, the expenditure on sewerage works was £416,000, and advances for house connections by deferred payment amounted to £141,000.

The sewerage rate is 1/6 in the £1, with an additional rate of 4d. in the £1 on the municipal net annual valuation of all rateable properties.



Concrete Dam, Lower Stony Creek.



Korweinguboora Reservoir.

Electric Supply.

THIS undertaking was first established in 1902, and was continued in operation as a purely D.C. system until 1920, when, in anticipation of the industrial development of Geelong, it was entirely replaced by a three-phase 6,000 volt 50 cycles system of generation and distribution.

The Power Station is situated on the south shore of Corio Bay, at the corner of Corio Terrace and Yarra Street, and is designed for a plant capacity of 10,500 K.W. It supplies electricity for domestic, tramway, and industrial requirements, under Orders-in-Council, throughout the City of Geelong, Town of Geelong West, Borough of Newtown and Chilwell, Shires of Corio, South Barwon and Bellarine. The station comprises two blocks of buildings in concrete and brickwork. The general offices, technical and commercial departments, engine and boiler rooms, car shed, work shops and garages occupy the buildings fronting Corio Terrace and Yarra Street. The mains and installation departments, show room, laboratory and meter testing, together with the general stores, occupy the frontage to Yarra and Corio Streets.

The Fuel used consists principally of black coal, brought to Geelong by direct shipment. It is discharged into hoppers, is crushed, and then delivered to the service bunkers by a Babcock and Wilcox gravity bucket-type conveyor capable of handling 40 tons of coal per hour. There are six service bunkers, each capable of holding 200 tons. The coal is weighed by Avery Automatic Scales before being delivered to the hoppers of the stokers.

The Boiler Room is of steel throughout, with concrete floors and brick and concrete filled walls. It measures 113 feet by 68 feet and 59 feet to the underside of the roof trusses. It has a 12 feet high basement, the floor of which is at ground level. Accommodation is provided for six boilers in batteries of two. These are manufactured by John Thompson, of Wolverhampton, and are of the six-drum vertical straight-tube type, with a steam drum above the centre top drum. Each boiler has a heating surface of 4,500 square feet, and a superheater surface of 516 square feet. The rated evaporation is 23,000 lbs. from and at 212 degrees Fahrenheit, the steam pressure being 200 lbs. per square inch, and the superheat 200 degrees Fahrenheit. In addition to the usual gauges, each boiler is provided with draught gauges, a steam flow meter, and a pyrometer indicating the temperature of the flue gases.

The stokers are the Erith Riley Underfeed type, each consisting of 5 retorts, and having a grate area of 80 square feet. Two boilers are fitted with the Underfeed Stoker Company's travelling-grate type of stokers, each having a grate area of 120 square feet. Forced draught is used on all boilers, each stoker having a separate motor-driven fan, the motor also serving to drive the stoker gear. The furnace volume is approximately 1,050 cubic feet.

The stokers discharge the ashes into concrete hoppers suspended under the boilers from the firing floor. A mechanical ash-disposal system is provided for.

The ring steam main is of 8 inch seamless steel pipe, with the flanges welded on. It feeds to the headers in the basement of the engine-room. A suitable arrangement of valves makes it possible to supply any or all the turbines from either leg of the main. All joints are made with Taylor Rings.

The condensate from the turbine condensers is delivered to a cast-iron hot-well tank. From this tank the feed-water passes through a closed heater of 1000 square feet heating surface, where the temperature is raised some 15 degrees Fahrenheit. The water, in passing from the heater to the feed pumps, is measured by means of a Lea Recorder. Direct acting Weir pumps deliver the water into the cast-iron boiler feed main, which is also arranged on the ring system. The boiler feed is automatically controlled by Crosby Regulators.

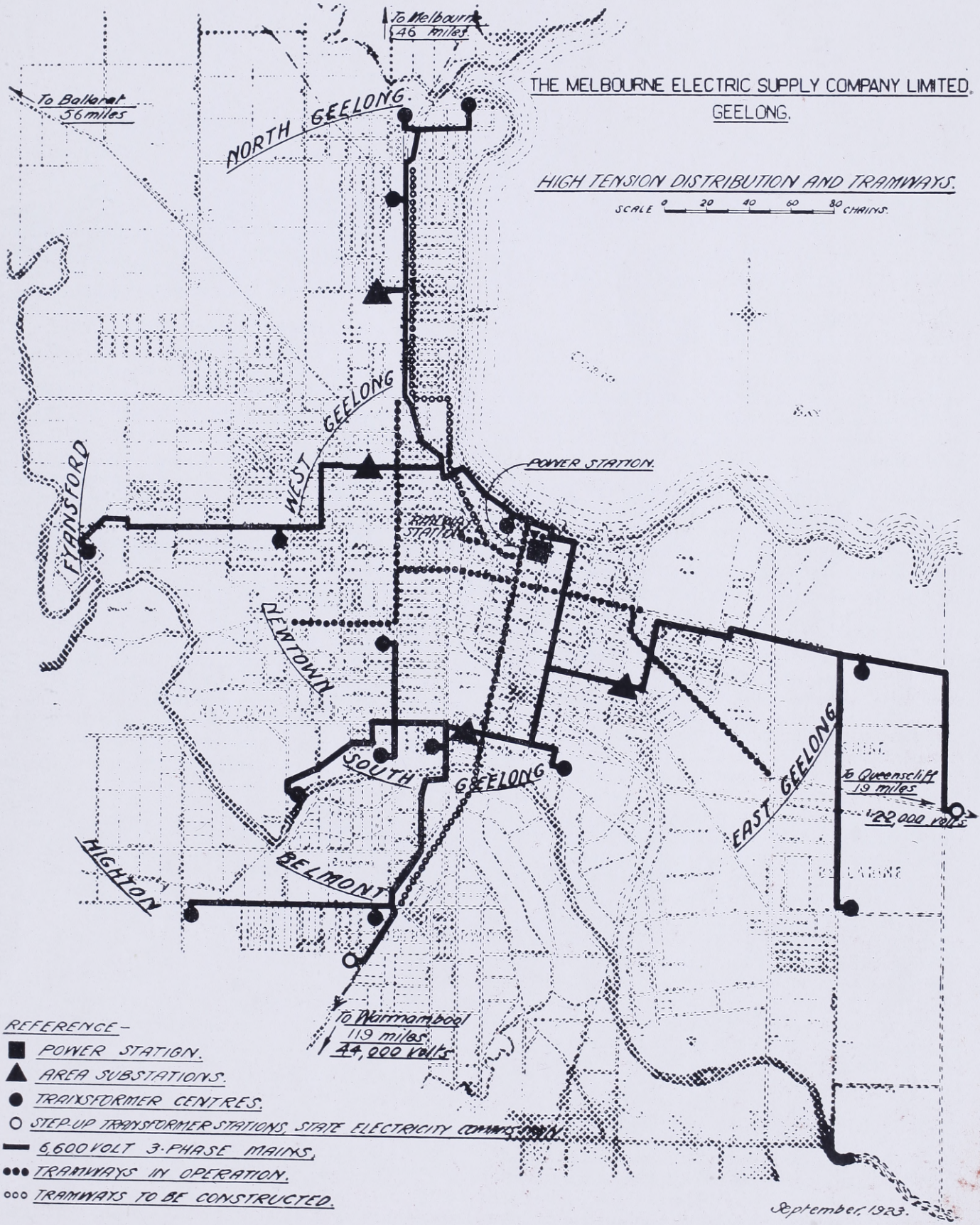
The Economisers are situated 36 feet above the firing floor, each having a heating surface of 8,150 square feet. The main flue, which consists of 3-16 inch steel plate, has a sectional area of 91 square feet, and is lagged with Silex compound. It is supported on rollers, and provision is made at one end, and at the boiler uptakes, to allow of movement longitudinally.

The Stack is of brickwork, the top being 150 feet above the firing floor. The internal dimensions are 8 feet at the top, and 13 feet at the bottom.

An 8,000 gallon fresh water tank on the economiser floor provides a reserve should the town water supply fail.

At present the "make up" water is not treated, but at a later date a Paterson water softening plant will be installed.

The Engine Room is 91 feet by 47 feet, and 22 feet in height to the crane runway, and has a 12 feet basement. It is equipped with a 15 ton Travelling Crane. The generating equipment at present installed comprises one 1,500 K.W. Brush-Ljungstrom, and two 3,000 K.W. Metropolitan Vickers Turbo-Alternators. A third Metropolitan Vickers Set is to be installed. All turbines are designed for a steam pressure of 200 lbs. per square inch, superheated 200 degrees Fahrenheit, and for a vacuum of 28½ inches. The speed of all sets is 3.000 r.p.m.


THE MELBOURNE ELECTRIC SUPPLY COMPANY LIMITED.
GEELONG.
HIGH TENSION DISTRIBUTION AND TRAMWAYS.
SCALE 0 20 40 60 80 CHAINS.
To Melbourne 46 miles
To Ballarat 56 miles
NORTH GEELONG
WEST GEELONG
FYANSFORD
POWER STATION.
RAILWAY STATION
NEWTOWN
SOUTH GEELONG
EAST GEELONG
To Queenscliff 19 miles
22,000 volts
HIGHTON
BELMONT
To Warrnambool 119 miles
44,000 volts
REFERENCE–
POWER STATION.
AREA SUBSTATIONS.
TRANSFORMER CENTRES.
STEP-UP TRANSFORMER STATIONS, STATE ELECTRICITY COMMISSION.
6,600 VOLT 3-PHASE MAINS.
TRAMWAYS IN OPERATION.
TRAMWAYS TO BE CONSTRUCTED.
September, 1923.

The Brush-Ljungstrom Set consists of a radial flow reaction turbine, with two rotors revolving in opposite directions, and each coupled to a 750 K.W. generator. The generators are tied together electrically, the stators being permanently connected in parallel, and the rotors permanently in series. The exciter is direct-coupled. The turbine is rigidly connected to the Allen four-pass surface condenser, having a tube surface of 2,800 square feet, and equipped with an Edwards type three-throw motor-driven air pump. The guaranteed steam consumption on full loads is 12 lbs. per K.W. hour.

The Metropolitan Vickers Sets consist of an impulse turbine, having one Curtis and nine Rateau Wheels direct-coupled to a bipolar generator, with a direct-coupled exciter. The condenser is in the basement immediately under the turbine. A copper expansion joint makes the connection between the two. The centrifugal condensate pump and the extraction pump are on the same shaft, and are direct-coupled to a squirrel cage motor. The guaranteed steam consumption on full load is 12.18 lbs. per K.W. hour.

In all the sets the air for cooling the generator windings is drawn, by means of fans on the rotor, through the Sturtevant wet-air filters, and, after passing through the windings, is exhausted into the engine-room. In the case of the fourth set, air cooling will be acomplished on the "closed" system.

To provide circulating water for the condensers, twin reinforced concrete conduits are constructed below sea level from the sea front, a distance of 600 feet, to the pump chamber and wells under the Power Station. The supply and discharge mains from the pump wells to the condensers consist of 24 inch diameter C.I. pipes, laid under the basement floor, with branches to each Condenser. The total static head is 42.7 feet, but advantage is taken of the closed system to operate syphonically, thus reducing this head to 12.7 feet. A Ledward and Beckett dry air pump is provided and connected to the top of the system. This facilitates starting up, and takes care of any air which may get into the system. Two Kelly and Lewis pumps capable of delivering 300,000 gallons per hour, and one of 100,000 gallons per hour, are at present installed. A further 300,000 gallon pump is in course of installation. Change-over valves make it possible to use either conduit for the inlet or discharge; by reversing the direction of flow the conduits are kept clear of silt and marine growth. Screening arrangements are provided at both ends of the conduits. A Venturi tube and gauge installed in the 24 inch pipe line measures the water flow.

Current is generated at 6,600 volts. The generators are star-connected with the neutral point brought to the switchboard for earthing. The black enamelled slate switchboard is mounted on a platform along the north side of the engine-room. It is of the vertical pattern, and consists of the synchronising panel at right angles to the main board, the generator, summation and feeder panels. Further along are the D C. panels for the motor-converters, the general supply and traction feeders.

The basement immediately under the switchboard contains the reinforced concrete cubicles, and the H.T. bus-bars, oil switches, and instrument transformers.

The oil switches are manually operated from the switchboard. The A.C. Switchboard instruments are Ferranti, the oil switches and instrument transformers Ferguson Pailin, and the D.C. Switchgear and instruments Metropolitan Vickers.

The converting equipment consists of three 500 K.W. 3 phase 6,600 to 460/550 volt D.C. Peebles Lacour Converters. Change-over switches allow the machines to be connected to either the 460 volt three-wire general supply or to the 550 volt traction bus-bars.

Alternating current is used for all station auxiliaries, supplied through three 100 K.V.A. 6,600/400/230 volt three-pnase transformers. A storage battery supplies the current for operating the relays and the signal lights, also emergency lights throughout the station.

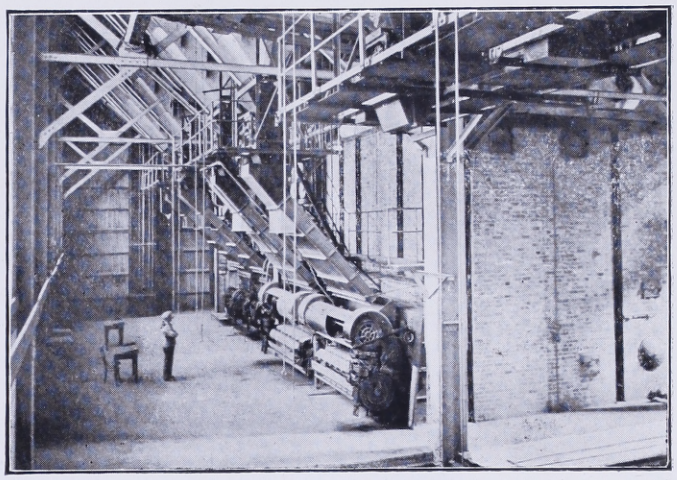
The territory supplied is divided into 5 distribution areas. The City area, about half-a-mile square, is supplied with direct current by means of underground cables. The remaining areas are supplied with three-phase alternating current. Each area has its own high tension distribution sub-station, and a number of pole type transformers. The 6,600 volt Feeders, which consist of three core paper insulated lead covered cables, are taken underground from the power station to trifucating boxes, from which connection is made to the overhead Mains. The overhead Mains have a minimum clearance of 28 feet to ground; they are carried on wood poles spaced two chains apart.

The mains enter the sub-stations overhead, and are connected to the bus-bars, through lightning arrester choke coils. Each area sub-station contains step-down transformers for supplying the district in the vicinity. The low-tension supply is by means of the three-phase four-wire system, the L.T. winding of the transformers being star connected giving 400/230 volts.

At the supply end of all H.T. Feeders, protection is provided by means of overload relays and leakage current relays, while multi-gap arresters provide protection against lightning.

The company operates a tramway system of 6.35 route miles, of which 2.17 miles is of double track, having a total track mileage of 8.52 miles, expressed as single track.

New Power Station.



Boiler Room—South End.

The rolling stock consists of ten single-truck combination cars, seating 36 passengers, and equipped with two 45 H.P. motors; two open-type cars with similar equipment, seating 40 passengers; and two open-type trailer cars. The car bodies were manufactured by Messrs. Duncan and Fraser, of Adelaide, and are mounted upon Brush Type 21E Flexible Wheelbase trucks, with British Westinghouse equipments.

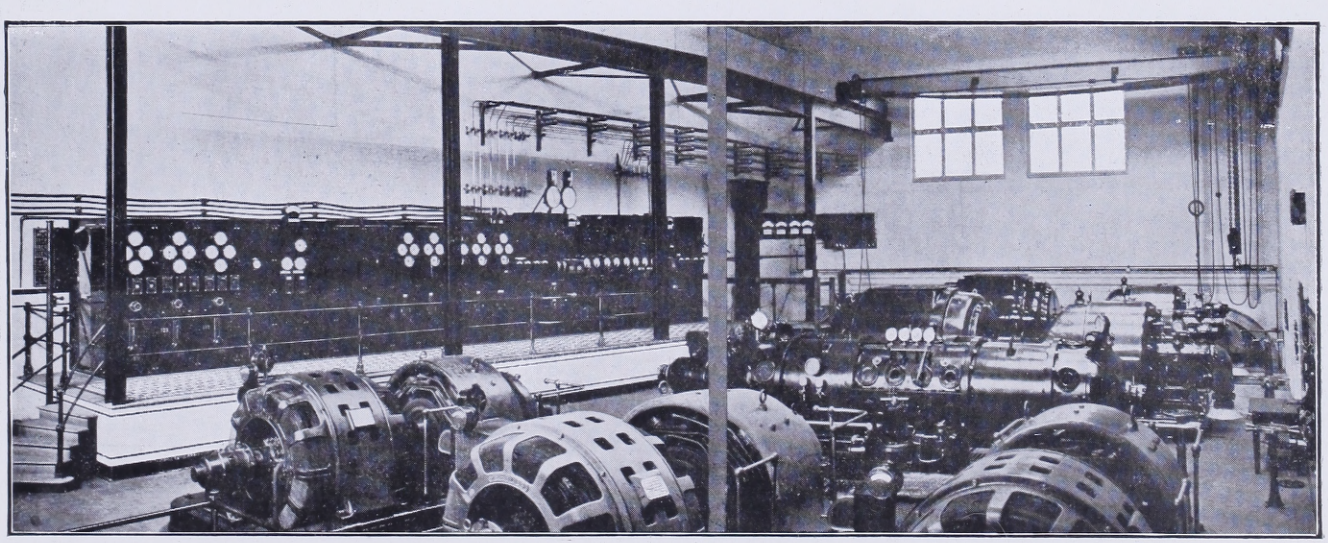
The track is laid with 90 lb. per yard grooved rails, laid on concrete stringers or wooden sleepers. A two-mile section of track has recently been constructed with 80 lbs. Tee-headed rails of Australian maunfacture, laid on wooden sleepers. Track rail joints are electrically welded, and tracks are cross bonded.

In the centre of the city, where the streets are wide, the No. 00 B. & S. grooved copper trolly wire is supported by centre poles, while further out span-wires construction is used. The trolly voltage is 550.

The system is very shortly to be extended, and the rolling stock will be increased by eight new combination cars, and two Birney light-weight Safety cars.

The Company's activities include an Installation Department dealing with the supply and maintenance of industrial power requirements and domestic power, heating and lighting. This department is equipped with show rooms, motor vehicles, and a permanent staff of wiremen.

The Mains and Installation Departments and Tramways operate ten motor vehicles, comprising three-ton and one-ton lorries, tower waggons, a motor road-roller, and a portable air compressor for pneumatic tools.



Engine Room and Switchboard.

Men's Lunch Room. Refinery and Stores.

HARVEST OPERATIONS.

Men throwing Salt on to Portable Conveyors, which deliver it into Elevators.

The Manufacture of Salt.

THE Works of THE CHEETHAM SALT PROPRIETARY LIMITED, situated on Stingaree Bay, near Geelong, were started by the late Mr. Richard Cheetham and the late Mr. A. W. Cunningham, some 34 years ago. The former came out from England, and, after touring the world, fixed on the site where the present works stand as being the best spot of any he had seen for a Solar Salt Works. Some hundreds of acres were leased, and work was commenced on a small scale by Solar Evaporation. The works now cover an area of 1,200 acres.

The process of making Solar Sea Salt consists essentially of evaporating sea-water by natural means. Sea-water contains 3½% of solids, of which 2½% is salt. At Geelong the average rainfall is 19½ inches, while the evaporation varies from 24 to over 30 inches.

Stingaree Bay has been enclosed by a Coffer Dam a mile long. Into this "Receiving" area the rising tides flow through sluice gates. From this area electrically-driven pumps remove the sea-water to a series of paddocks at higher levels. There are 50 miles of walls in this section of the Works. After flowing in and out of many paddocks, the density of the sea-water rises, until it commences to give up Gypsum (Calcium Sulphate). Further evaporation forces out practically all the Gypsum present. At this stage, the brine contains about 25% of solids. It is then pumped into the "crystallizers." Sodium Chloride (or common salt as it is usually termed) commences to crystallize out of the brine as the evaporation proceeds. More and more brine is added, and when a layer of about 2 inches of salt is formed on the bottoms, the residual liquor ("Mother Liquor") is drained off. By the above process a very high-grade of crude salt is made. Its composition varies within very small limits, because the conditions of its crystallization are controlled. The Mother Liquor is a very dense red liquor whose chief constituents are Chlorides and Sulphates of Potassium and Magnesium, Bromide of Magnesium and Salt. The economic situation has, so far, made it unprofitable to work this Mother Liquor. When the Mother Liquor is drained off, the salt is gathered into cocks, so as to drain off the surplus liquor adhering to the grains of salt.

The salt is then thrown on a series of portable belt conveyors, discharging into 3 elevators, which elevate it into large stacks. These stacks are thatched or covered with tiles. The photographs show the above operations clearly. It is then elevated into trucks, and conveyed to the Refinery.

The whole Works are electrified, and a complete system of wires 5 miles long runs round the works to supply power for pumping brine, conveying salt, elevating salt, and operating the Refinery. Power is supplied by the Melbourne Electric Supply Company Limited.

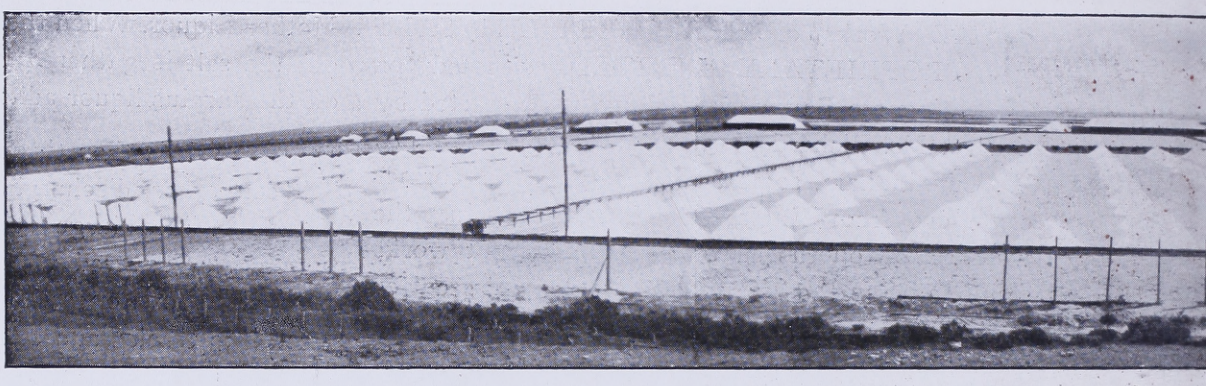
The works resemble a huge chess board. In summer time when the harvesting is being done, it looks like a Military Camp, and the hundreds of salt cocks resemble tents.

The Refinery consists of a large four-storey brick building, which contains the machinery necessary for preparing the crude salt for the market. The present plant has only been in operation for a short time, and it is the most up-to-date plant of its kind in Australasia. Here the impurities are removed, and the salt crushed to suit the various trades. In addition it is sterilised for making butter and cheese, for curing ham and bacon, for use by butchers and bakers, and for table and household use.

A special salt is made for curing hides, and for making ice cream. The crude salt is suitable for sheep and cattle, chemical works, and the destruction of noxious weeds.

After the salt is bagged at the Refinery, it is put on trucks and taken to the Company's Siding, on the Queenscliff line, whence it is despatched to all parts of Victoria. Salt for other States is carted direct to the boat at Geelong.

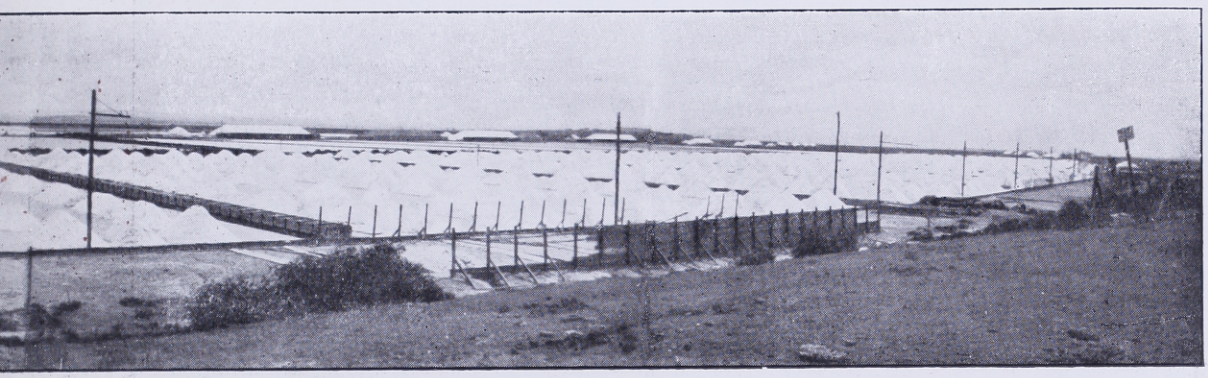
A well-equipped laboratory is maintained to control the processes used, and to carry on research work.



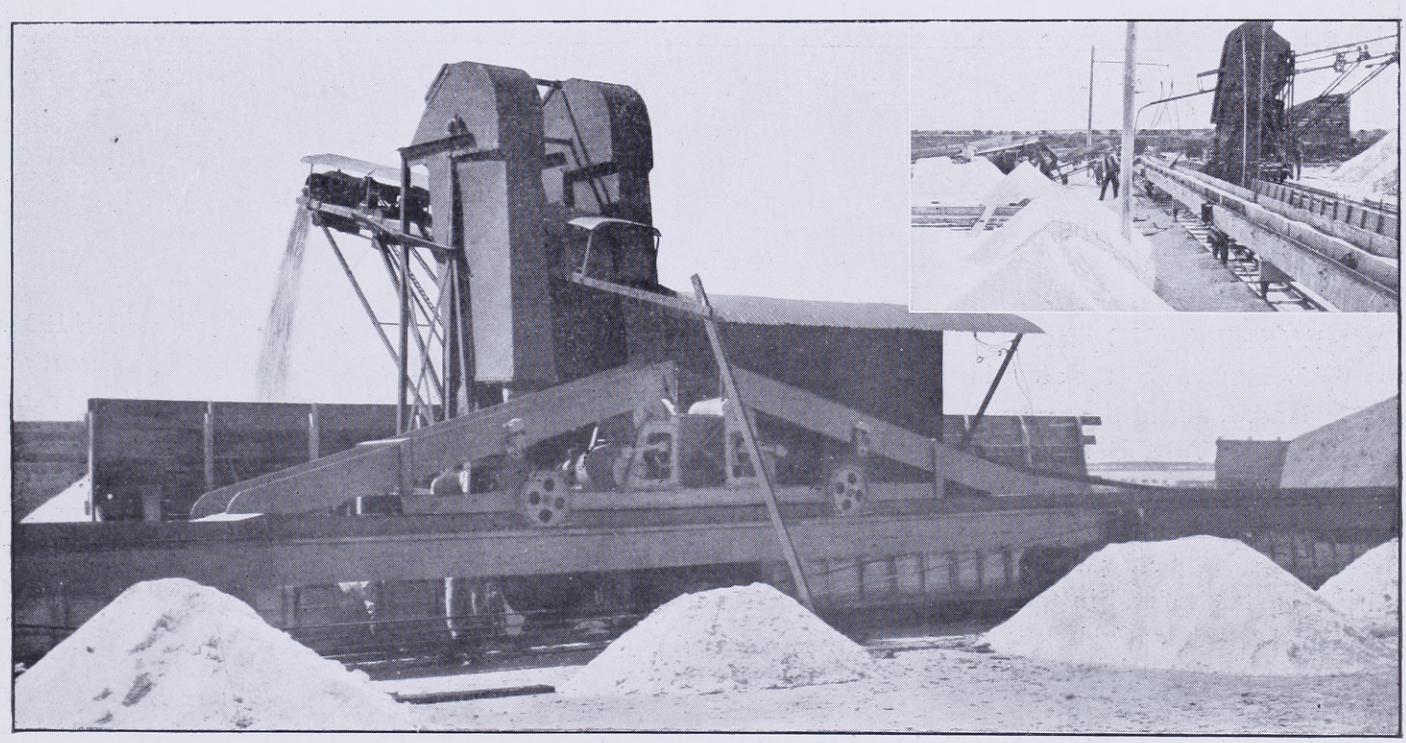
General View, shewing Salt Garden lifted into Cocks

HARVEST OPERATIONS.

Elevators stacking Salt on Wall, fed by machines on left, conveying Salt from Paddock.

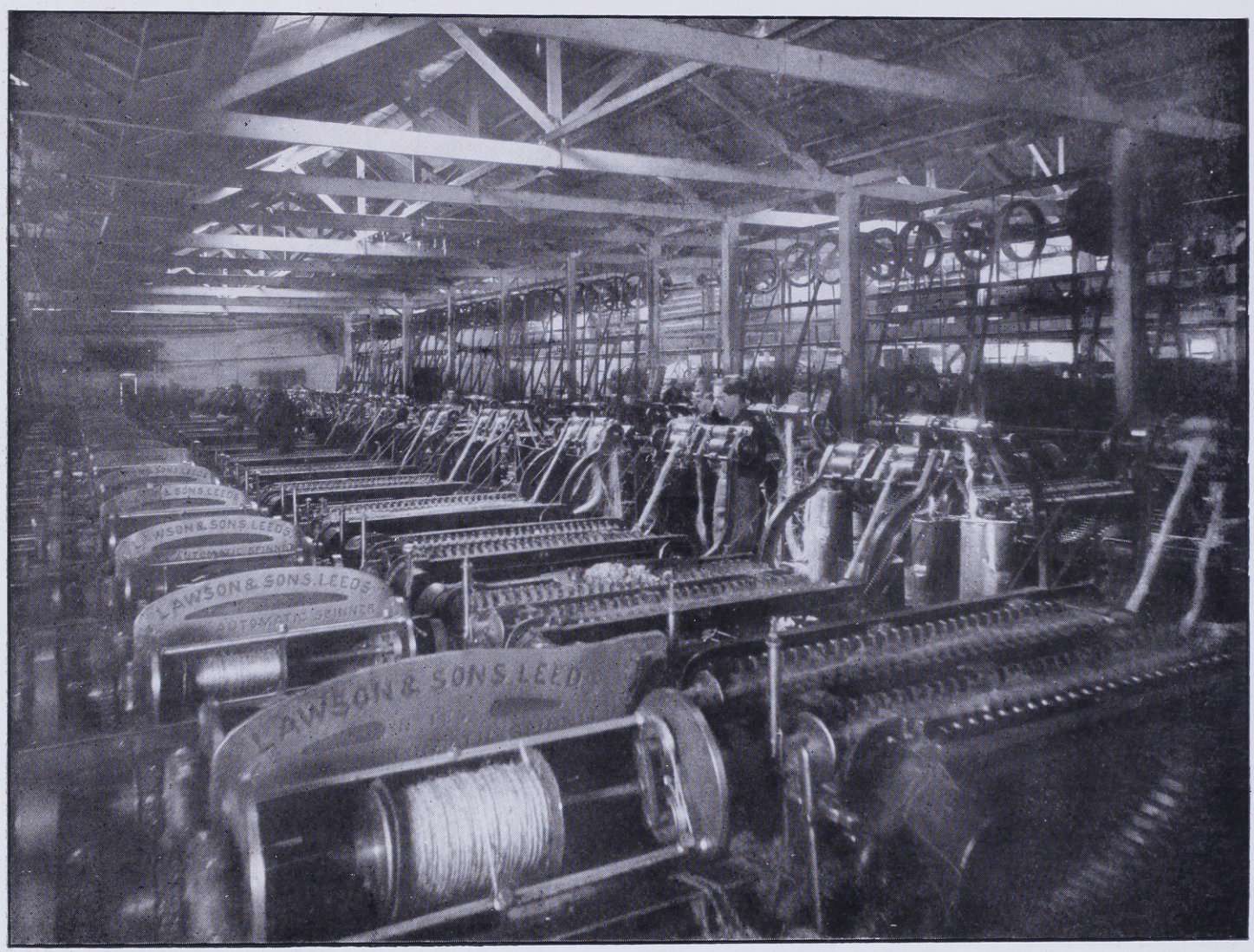


for Stacking, and, in the Distance, Salt stacked on Wall.



HARVEST OPERATIONS.

Conveyor delivering Salt into one of the Elevators, which stacks Salt on Wall.



Portion of Spinning Plant.

Donaghy's Ropeworks.

SEVENTY-ONE years ago, the late Mr. Michael Donaghy, shortly after his arrival from England, founded the first rope works in Victoria, at Marnock Vale, Geelong. In those days everything in connection with the industry was done by hand or leg-work, and a rope-walk was really a rope-walk. The business prospered beyond the limits of its site, and in the early seventies a move was made to West Geelong, where five acres of land had been acquired. That area has since been considerably increased. In the meantime, steam propelled machinery had been installed, and to-day the great establishment fronting the main streets of West Geelong hums and vibrates with the rotation and thrust of many machines.

The present company was incorporated in 1905. Two generations have passed away in the creation and development of the works; and Mr. Frank Donaghy, the grandson of the founder, and the son of John, now presides over the concern. So far, Australia has been able to supply, with minor exceptions, none of the raw materials required for rope and mat-making, although in the early days of her history attempts were made in New South Wales to cultivate the flax, or New Zealand hemp, as it is called. That article is imported from New Zealand; the abaca, or Manila hemp, from the Philippines; the coir yarn from India and the Islands; and the sisal, a fibre from a species of the agave, from Java and New Guinea. A good deal of linseed-

flax is now being grown in Australia, particularly in Gippsland. Some is used at the works, with highly successful results. Much of the Australian grown linseed-flax is exported. A large quantity was recently sold to the Belfast Rope Company, Ireland. The cultivation of this flax in Australia should have a big future. Sisal is now being cultivated in Queensland.

The initial treatment of some of the fibres produces an article so soft, silken and light in colour that it might be likened to the tresses of a fair Saxon. Indeed, it would seem eminently suitable for making such a wig as would be worn on the stage by Marguerite in "Faust." The rope-walk is 2,500 feet long.

The binder twine, "Kangaroo Brand," is another branch of the industry, and is well-known throughout the Commonwealth. The mat-factory, in which mats, of various and artistic designs, are made from the coir yarn, is interesting to the visitor. In this particular factory part of the work is performed by a large number of healthy, good-looking girls, whose skill and quickness are remarkable.

The firm has its own engineering works, at which everything necessary for the repair and manufacture of its machinery, except the casting, is done. During the last ten years the factory has been remodelled and enlarged by fully a third, the number of hands by fifty to sixty per cent., and the turnover by upwards of fifty per cent. A staff of experts is constantly employed improving the machinery, and experimenting, with a view to perfecting methods and increasing production.

The business of the firm extends to all parts of the Commonwealth and the Pacific Islands; it has also a large export trade to Europe and other parts of the world. The extent of the works at West Geelong may be gauged by the fact that 350 persons are employed there.

Section of Preparing Plant.

Excelsior Woollen and Worsted Mills.

THE Excelsior Woollen and Worsted Mills are controlled by Messrs. Godfrey Hirst and Co. Pty. Ltd., and have sprung from the union in the one enterprise of two of the earliest mills established in this State—the old Victorian and the old Barwon Mills.

The Victorian Mill was founded in 1867 under the encouragement of the protective tariff of that year. The directors at the time of the founding were:—Captain Andrew Volum, Charles Kernot, James Scott, James Noble, W. F. Ducker, Robinson, and B. J. Freeman.

The manager was Squire Ward, who came out from the old country. Later he became a director, and Mr. Haigh took his place. The office of the mill was where James Officer and Co. are now situated in Little Malop Street. The first telephone in Geelong ran between the office and the Mill.

The Barwon Mill was established nine years later, the manager being a Mr. Dennis, and the directors, Charles Andrews, F. Andrews, G. F. Belcher, and Meakin. Each of these old mills was closed down at one period for the want of capital. The sole capital available was the return from the industry. The low prices of Victorian woollen goods during the years before Federation and the competition of imports destroyed the original enterprises.

Writing in 1860 on the development of the resources of the Colony, Mr. C. Mayes, civil engineer, observed that Sydney tweed was largely used in Victoria, before the gold fields were discovered and drained the work-people from the cloth mills; now that the fever of the gold digging had somewhat abated, this tweed was again coming into more general use. In making tweed in Victoria, many people would save 12 months' loss of time and interest on money, as well as two or three merchants' and brokers' profits, and the two freights which had been found to equalise the cost of tweed made in England and New South Wales. Yet, though the demand for woollens manufactured in Victoria seemed assured, and the venture safe, in the case of these Geelong woollen mills, which led the way and secured the Government award of £1,500 for the first woollen mills—the gross prejudice against Australian manufactures, and the opposition of the importing interests, so far affected the earnings of the enterprise that the Barwon Mill, which produced tweed, was compelled, for want of capital, to cease operations in 1886. A harder fight was put up by the Victorian Mill, which was also producing tweed, for it only closed down in 1892. In the same year, the Barwon Mills, having been closed down for six years, was bought by Messrs. Godfrey Hirst and Co., and was re-opened as Excelsior Mill No. 1.

Messrs. Godfrey Hirst and Charles Shannon had commenced operations on a small scale in the early eighties, working with hand looms in premises situated in Little Fyans Street, South Geelong, where they produced the first flannel in Australia. The demand for their flannels became sufficiently extensive for the partners to seek fresh capital, and to buy the Barwon Mill. This step introduced Mr. C. H. Smith, manager of the Clyde Works, into a partnership in which he remained up to his death. The purchase of the Victorian Mill, which became known as Excelsior Mill No. 2, followed in 1899.

Want of capital defeated the efforts of the founders of the Victorian and Barwon Mills. The energy and ability of the new proprietors carried the mills through the bitter struggles of pre-Federation years. The past history and the prospects of the Excelsior Mills should force home the lesson to Victorian Government and people that the capital earned in the industry is capital available for expansion. On the capital of the returns from present sales, the Excelsior Mills, already great, will grow into an industry, lending additional strength to Geelong, employing hundreds of operatives and producing goods at a working cost diminishing proportionately to increasing output, with consequent reductions in the selling price to the public.


EXCELSIOR MILLS
CARDING.
COMBING.
PANORAMIC VIEW OF BUILDINGS.
SPINNING
GODFREY HIRST PROP LTD.
Geelong, Vic.
MANUFACTURERS OF
FLANNELS, BLANKETS,
Tweeds & Serges.
Tel 1181. Geelong.
WEAVING

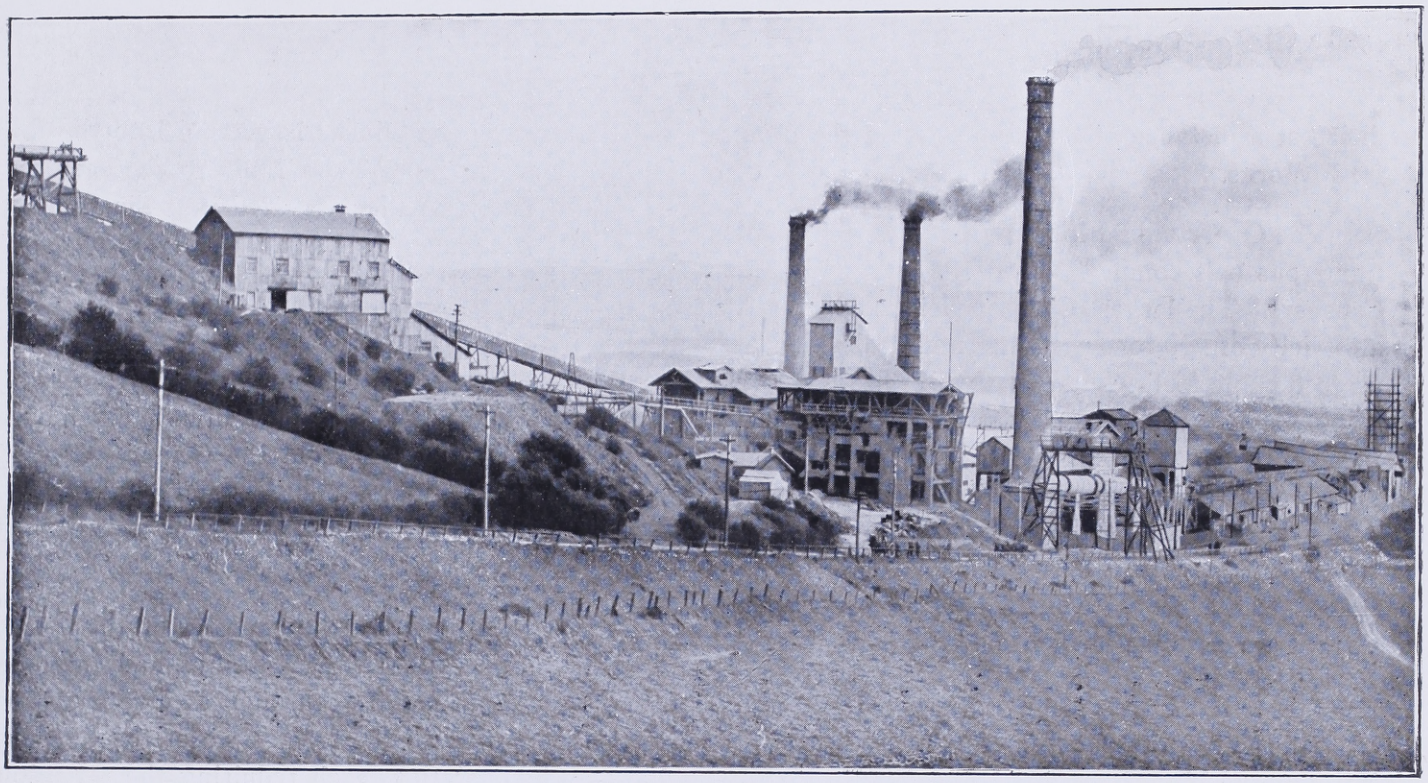
The plant of the Barwon Mill consisted of five sets. The new owners added another set, and devoted the mills to the production of flannels, blankets, and tweeds. The Excelsior No. 1 Mill was burnt down in 1912. Fortunately, it was rebuilt in the year before the war which made the replacement of sets practically impossible. The Victorian and Excelsior No. 2 Mill, at the start of the new control, had ten sets. Messrs. Godfrey Hirst & Co. brought the plant subsequently up to 11 sets for woollens and four sets for worsteds. Throughout the more prosperous period between Federation and the outbreak of war, the proprietors were constantly seeking to improve the plant of the mills and to keep apace with modern progress.

The failure of the Victorian and the Barwon Mills under the old companies affords striking testimony of the difficulties encountered by the founders of the woollen manufacture in this State. The prejudice against Australian goods meant an uphill fight. Messrs. Godfrey Hirst & Co. broke down this prejudice gradually by the quality of their goods, and with the inter-State trade opened by Federation, they entered on more prosperous times. The directors prepared plans in 1920 for doubling No. 1 Mill, but the prices of the plant, when cabled from England, proved so excessive that the extension had to be held over. As a comparison, after the fire in 1912, a set of carding engines could be set up for £960; and when quoted in 1920 the price was £5,000, with delivery in two years' time. Such advances apply to all classes of machinery in the trade. Wool scouring and drying machines are manufactured locally by James Dyson, of South Geelong, while J. C. Brown has turned out some winding machines, but the inability to secure such plant as must be imported prevented the extension, which would have inevitably cheapened production. At this period the mills employed 350 hands, whose wages totalled £35,000. The value of buildings and plant represented £70,000, while they consumed 716,000 lbs. of scoured wool, valued at £95,000, per annum.

During the world's struggle for justice and right, the mills worked strenuously, helping to clothe the Australian forces. This continuous work, though on straight cut lines, meant working the plant to breaking point, which now necessitates heavy expenditure on overhaul and replacement, before expansion is practicable.

Whatever may seem the merits of the woollen trade during these years, the Australian manufacturer, faced to-day with demand for new plant, obtainable only at enormous prices, does not reap, by any means, the full benefit to which he is entitled after the years of struggle and pioneering work. It is the policy of the Federal Government to get as much wool made up in Australia as possible, but as the management says:—How can the Government expect this to be brought about when manufacturers have not got the money to enlarge their undertakings, after the Government has taken away so much in taxation? In spite of these difficulties large and extensive additions to plant and buildings are taking place, at a cost of £7,000. The mill is now equipped with 21 sets, the value of the buildings and plant being £160,000. To-day the mills employ 400 hands, whose wages amount to £50,000 per year, and to give these people constant employment 870,000 lbs. of scoured wool, and 162,000 lbs. of cotton, valued at £118,000 are consumed annually. The mill, during the war, manufactured for the Government 2,704,176 yards of cloth.

The Excelsior Mills, housed in a great pile of buildings by the Barwon River, and working strenuously to-day to meet the Australian demand for Australian woollen goods, represent in themselves two pioneering enterprises which were a failure through the old Australian prejudice and through the want of capital out of earnings, which caused stagnation, and finally actual ruin. The limitation of prices to-day, and the consequent restriction of capital, which would be the stimulus to the industry, means that a development of infinite importance to the Victorian people and to Geelong must be deferred. Over the Company's heads is held the British manufactured article of only 25 per cent. British labour, imported into Australia at a lower cost than the same article can be produced in Australia, thus restricting the capital which alone can bring about expansion.



Partial View of Works—Capacity 2,500 Tons Cement Weekly.

Australian Portland Cement Company.

FEW industries have expanded with such rapidity, and few have undergone such changes in their individual processes, as the manufacture of Portland Cement. The advance towards perfection and the increase in economical production have been so great, that it is difficult to convey in this brief treatise a reasonable impression of the great strides that have been made. The annual output in U.S.A., in 1890, was 50,000 tons; to-day it is over 9,000,000 tons per annum. During the same period the output in Great Britain has expanded from 1,000,000 to over 3,000,000 tons, and in Germany from 1,500,000 to over 6,000,000 tons yearly.

During the past ten years Australia has established its relative importance in production. The pioneer factory was that of the Australian Portland Cement Co., established in 1890 with an annual output of 7,500 tons. To-day the combined capacity of the nine works in Australia is 600,000 tons per annum. A further plant of 30,000 tons capacity will shortly be operating in N.S.W.

The greatest consumption of cement in any country has not exceeded one half-barrel per capita per annum. On this basis the existing works can supply the total requirements of Australia for some years to come. Plans for considerable additions to the Fyansford plant have been prepared in readiness for any greater demand that may arise.

The increased consumption of cement has been due to the recognition of its suitability and ultimate economy in buildings, roads, bridges, and other structures. Reinforced concrete is now largely replacing all other methods of construction. The main highways and city streets of the world are being built with concrete, either entirely or in conjunction with bitumen; and, until the same system is adopted here, the costs of all our road transport will be unduly high and country development retarded.

The raw materials, consisting of Carbonate of Lime, Silica, and Alumina, are available in abun-

dance at a distance of three miles from the Fyansford Works.

The Quarry plant includes three steam shovels, numerous belt conveyors, and very large Gyratory Crushers. The largest Crusher weighs 90 tons, has a capacity of 200 tons per hour, and deals with rock up to 8 cubic feet. The Storage Bin has a capacity of 7,000 tons, and from it the stone, now reduced in size, to about 2½ inches, is automatically conveyed, and fed into the aerial ropeway buckets for conveyance to the Works. The Ropeway is electrically driven, and has a capacity of 100 tons per hour. There are 172 buckets, each holding 10¾ cwt. of stone. One bucket is delivered every eighteen seconds.

At the Works the Ropeway deposits its load into storage bins, from which it is fed to the Raw Grinding Mills. As the "wet" or "slurry" system is adopted (as opposed to that of the dry system) sufficient water to produce the desired consistency is added at this point.

In the Ball and Tube Mills, the largest of which contain 26 tons of Steel Balls, the material is reduced to a degree of fineness so that not more than 10% is retained on a sieve of 32,400 meshes to the square inch.

The ground material is next conveyed to the Slurry Mixing Silos, where careful chemical adjustments are made. One big advantage of the wet system is that the perfect mixing of all constituents enables a practically perfect chemical accuracy to be obtained in these adjustments.

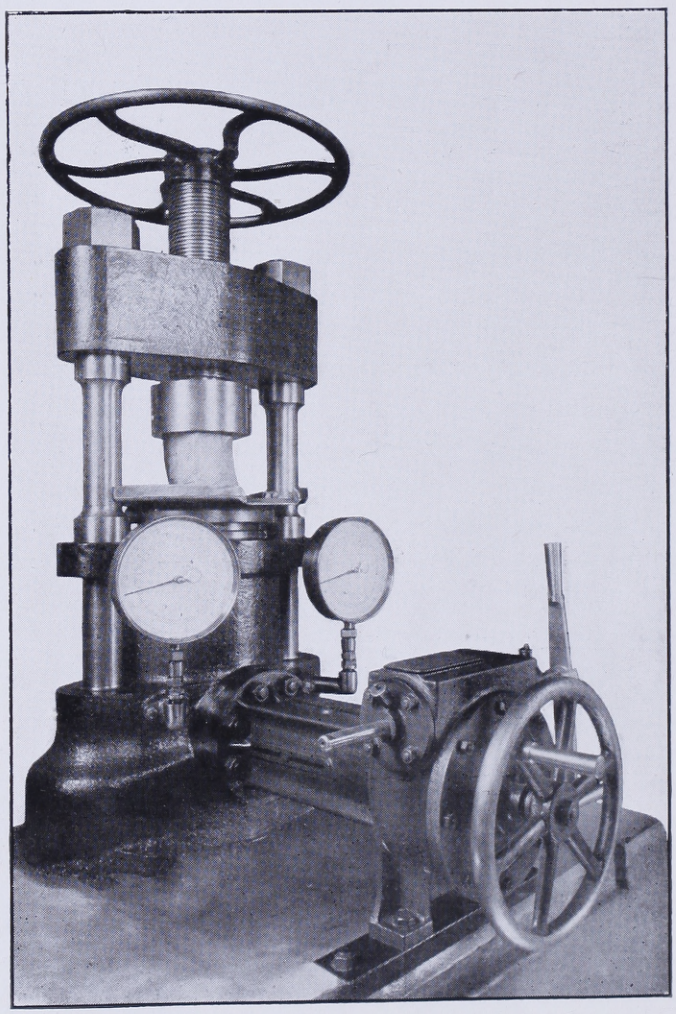
The Slurry is next run into a Storage Basin with a capacity of 1,500 tons, where it is kept continuously agitated, and from which it is pumped into the three Rotary Kilns. The largest of these is 200 feet long, 9 feet diameter, and weighs 500 tons.

The firing is by powdered coal from the lower end of the Kiln at a temperature of 1,400 to 1,500 degrees Centigrade, which converts the slurry into clinker. The latter discharges into Coolers, from which it is automatically conveyed to the Clinker Silos.

Afterwards the clinker is ground into the finished cement in huge Tube Mills to the required degree of fineness; then elevated into the Cement Silos, where it is again submitted to severe physical and chemical tests to comply with British Standard Specification.

After storage, the cement is conveyed to the Bagging Department at the Railway Terminus, situated about 600 feet from the Cement Storage Silos, being carried on a Rubber Band at a speed of about 300 feet to the minute, which carries approximately 5 lbs. of cement to the foot.

The bagging is done by means of the Bates Bagger, which automatically weighs and fills the bags, the cement entering through a valve provided in the top corner of the bag. Two of these machines are in operation, each requiring the attention



Compressing Machine for Crushing Test up to 150 tons.

General View of Limestone Quarry.

Showing Bin (7,000 Tons Capacity) and Aerial Ropeway, Loading Station on left, and 3 Steam Shovels in background.

of one man. The combined output is one ton of cement per minute. The bags, when filled, fall from the machine on to Belt Conveyors, and are transported direct into the Railway trucks; the average daily output is 7,000 bags.

Coal plays a very important part in the manufacture of cement, about 10 cwt. being required for each ton of cement produced. The consumption at Fyansford is about 1,000 tons weekly.

The coal, which is carried by rail, is dumped from trucks into a 5,000 ton bin, at the Railway Terminus, from where it is conveyed to the Coal Dryer and Pulverisers. After being ground it is pumped by means of the Fuller Kinyon Pump to the Rotary Kilns and Powerhouse, a distance of 1,200 feet, through a 4 inch pipe, where it is used for firing the Kilns and Boilers.

The Company's private siding, which is connected with North Geelong, and is three miles in length, was provided by the Railway Department, on the Company's guarantee of supplying a minimum of 50,000 tons of freight per annum. Last year freight was paid on 150,000 tons, showing the value of the industry to the Department.

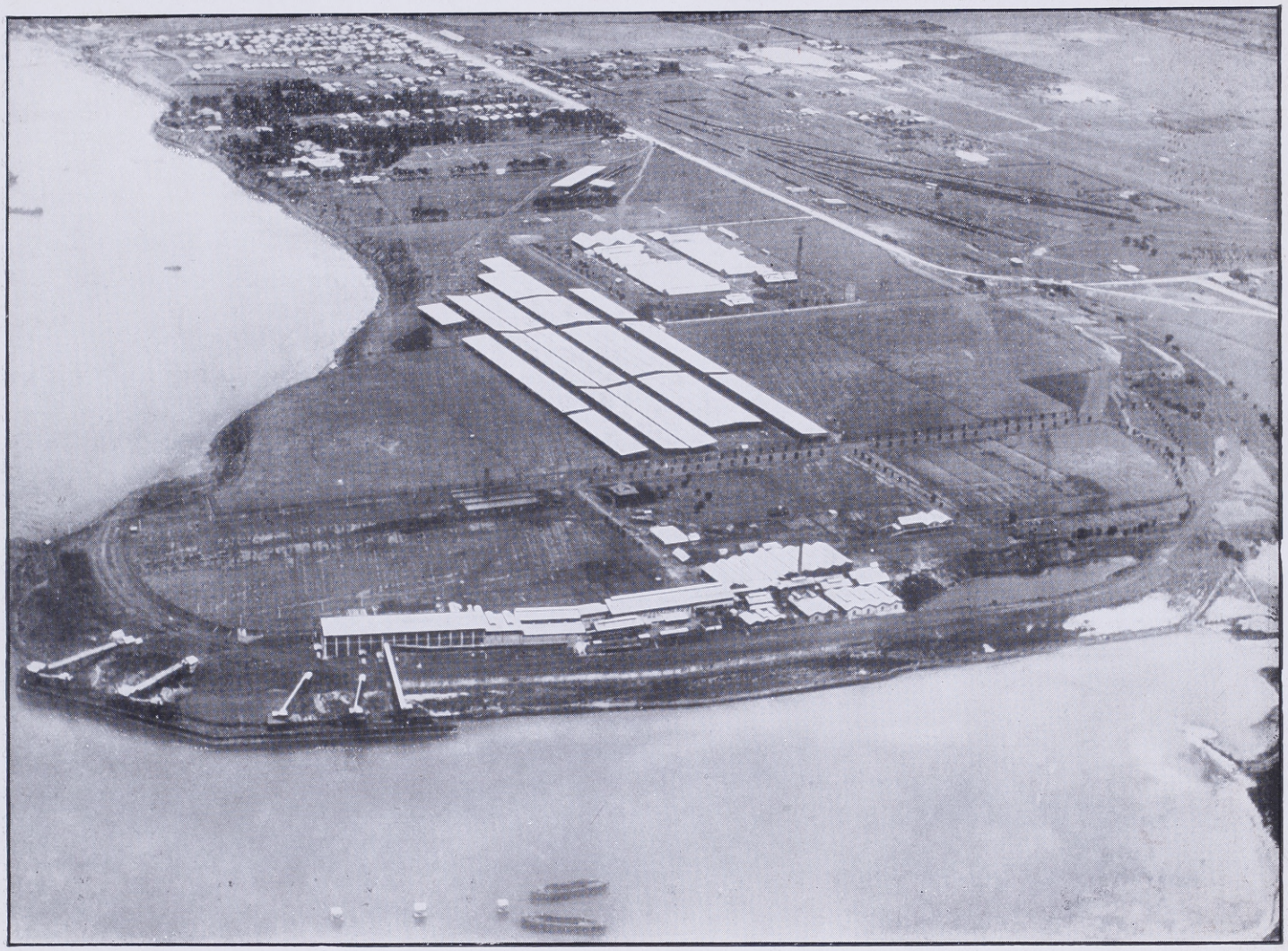
The works give employment to about 450 men, of which about 150 are engaged at the Quarries. As cement manufacture is known as a "continuous process," the works run without intermission seven days per week, right through. The average weekly Pay Roll is £2,000 per week.

Further extension to the Plant has been decided upon to enable the Company to meet the increasing demand for its product, which is recognised as comparing favourably in quality with the best imported brands.

The whole plant, including the Quarry machinery, is driven electrically from the Company's Powerhouse, which has a capacity of 2,000 K.W.s., and which is augmented by 750 K.W.s. from the Melbourne Electric Supply Company, Geelong. The respective plants work in parallel, and the annual power consumption exceeds 11,000,000 units.

For distributing the power, over one hundred Motors, ranging from 1—450 H.P., are in use. Several of the largest size possess rather unusual features, being of exceptionally low speeds, and being direct-coupled to Mills.

The huge amount of repairs incidental to cement manufacture necessitates a very extensive Engineering Department. This consists of Machine Shop and Iron and Brass Foundry. The output from the Iron Foundry amounts to two tons of castings per week.



Aerial View of Corio Quay.

The Port of Geelong.

THE port of Geelong is that portion of Port Phillip west of a line drawn in a northerly direction from the northern extremity of the eastern boundary of the Township of Portarlington, to the southern or right bank of Little River at the debouchment of such river into Port Phillip.

The Port of Geelong is commonly divided into two portions, "Corio Bay," or the "Inner Harbor," and the "Outer Harbor."

The dividing line, a natural obstruction across the eastern limit of Corio Bay, is known as the Bar. It protects the Bay on the east, the only open portion, so rendering it for all shipping purposes a land-locked harbor.

The area of the Port is about 5,411 acres, with varying natural depths of water ranging from 18 to 33 feet. About 2,563 acres have a depth of at least 30 feet at O.L.W.

It may be said to be bounded by the Municipalities of the City of Geelong, the Town of Geelong West, and the Shires of Bellarine, South Barwon, and Corio. In the Shire of Bellarine, on the southern shore of the Port, the Township of Portarlington is situated, the foreshore of which is within the authority of the Trust. A Pier at the Township, controlled by the Trust, is in daily communication with Melbourne, Portarlington, and Geelong by steamboat.

Corio Bay, the present shipping centre of the Port, and Geelong itself from earliest days and until recent years, have been retarded in progress by the existence of the Bar, which prevented vessels of any considerable draft entering the Port. A Channel, known as "Hopetoun Channel," was commenced in 1882, and formally opened on 20th December, 1893, by the Governor of Victoria, Lord Hopetoun, whose name it bears.

Further dredging was intermittently pursued after the opening, until in 1905 an official depth of 23 at O.L.W., and navigable width of 130 feet, was reported, the length being 2,200 yards.

Owing to the increasing size of vessels, the Channel had before 1905 been found too small, and

Corio Quay—Wheat Loading. Unloading Trucks.

further deepening was continually urged, but, as had been the case from 1854, it was always found difficult to induce any Government to expend money in improving the Port.

In 1905, the question of providing for the deepening and widening of the Channel and generally providing for the improvement of the Port, was taken in hand by the Hon. Thos. Bent, at that time Premier of the State, and a Bill with that intent was introduced to Parliament, and, after considerable opposition, passed on the 12th Dec., 1905. The Act incorporated the Geelong Harbor Trust.

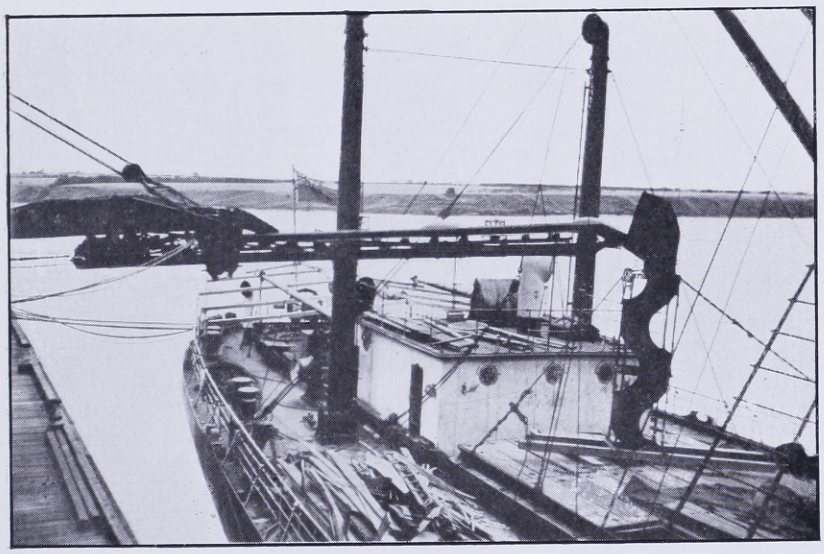
The Port of Geelong, as before described, with a considerable area of waste lands of the Crown, then of little value and practically non-productive, was vested in three Commissioners, to whom was committed the control and improvement of the Port and waste lands.

The first Commissioners appointed by the Government were Mr. G. F. Holden (now Chairman of the Melbourne Harbor Trust), Mr. E. H. Lascelles, known as the discoverer of the value of the Mallee lands of the State, and Mr. A. P. McMillan. The latter two are dead. The present Commissioners are Mr. Robert Purnell (Chairman), Mr. Edward Bechervaise, and the Hon. Robt. McGregor. M.L.A.

The Act gave the Commissioners authority to borrow moneys to a limited extent for the improvement of the Port and waste lands, and from time to time subsequent Acts were passed further extending the borrowing powers of the Commissioners,and also authorising the Treasurer of the State to take up Loan Debentures of the Trust. Unfortunately, no means were provided for meeting the necessarily increasing call upon Revenue for Interest on Loan Money, the expenditure of which was bound to be unproductive for many years. To quote words recently uttered by a Cabinet Minister, "The Commissioners were given an impossible task." The result now is a considerable liability to the Government, and a statement openly made by the present Treasurer of the State that it is the intention of the Government to destroy local control by amalgamating the Port of Geelong with the Port of Melbourne.

From the centralising influence of the Metropolis, Geelong has always suffered, and it is to be regretted that residents of Geelong, who know little of the past history of the Port, are openly advocating the proposed retrograde movement.

In 1906 Geelong and District entered upon a prosperity from which there has been no looking back. Municipal valuations have nearly doubled, and population increased. The gross Revenue of the Trust itself has increased from £13,440 in 1906, to £54,233 in 1922.



Corio Quay—Wheat Loading. Conveyor to Ship's Hold.

The Port, commanding as it does the whole of the Western and most of the North Western portions of Victoria (and, as soon as the projected Railways into New South Wales are constructed, and brought into service, a considerable portion of Riverina), has before it a magnificent, future which the suggested amalgamation must seriously retard if not wholly destroy.

Dredging, since the constitution of the Trust, has increased the depth of water in Hopetoun Channel to 25 feet at O.L.W., and navigable width 220 feet.

Further dredging in the Channel and Fairway will be undertaken as soon as funds are available, the intention being to obtain as soon as possible an uniform depth in the approaches to the Bay, and a berthing depth at the Piers and Wharves within Corio Bay of 29 feet.

The following may be mentioned as activities of the Trust which have added materially to the advancement of the City and Municipalities, viz.:—

(1) The laying down of railway lines at Corio Quay giving direct communication with trunk lines of the railway system of the State, and therefore to all portions of the State, and to other States of the Commonwealth.

(2) The construction of new berths at Corio Quay, on the North Western foreshore of the Bay, and the installation there of the most complete and economical system of shipping frozen produce and grain.

(3) The construction at Corio Quay of the "Corio Freezing Works and Abattoirs," which are directly connected by rail to the trunk lines of railway already referred to, and to berthing accommodation of the Port at Corio Bay, and also at the Railway Pier on the City foreshore.

(4) The erection at Corio Quay of an Electric Power House, and the installation therein of a Suction Gas Plant for the production of Electric Light and Power for Works established at the Quay, and for the Ship-loading machinery and gear.

(5) The reclamation of a large area of the waste river lands vested in the Trust, and the establishment of Sparrovale Irrigation Farm, in order to show the value and importance to the District of the large area within a short distance of Geelong, which had been considered of little use except for summer grazing.

The Trust has also been instrumental in adding to the importance of Geelong and avenues of employment by directly inducing the establishment of the following industries on lands of the Trust, viz.:—

(1) The establishment by Messrs. Sims Cooper and Coy., at Corio Quay, on land sold to the Company by the Trust, of "The Oriental Scouring Mills."

(2) The establishment by the Cresco Fertilizer Company, at Corio Quay, on land leased to the Company by the Trust, of a large Chemical Manure Manufactory.

(3) At North Geelong the establishment of the Federal Woollen Mills upon lands given by the Trust to the Commonwealth for the purpose. Until recently, the Mills were operated by the Federal Government, but now by a private company trading under the same name.

(4) The establishment, due to the gift by the Trust to the Commonwealth, of Osborne House and lands on the Western foreshore at North Geelong, of a Naval College, afterwards, during the late War, used as a submarine Base.

The above-mentioned activities and utilities of the Trust and the principal Industries influenced by the Trust are again referred to later on.

Corio Quay—Wheat Loading.
Looking Aft, from Vessel's Bridge.

RAILWAY LINES AT CORIO QUAY.

About 4 miles of Railway tracks have been laid down by the Trust for general purposes, and a further two miles and a half by the Railway Department connected with Wheat Storage sites, which are thereby placed in communication with the Corio Quay shipping berths and the Railway Pier at the City.

The lines of the Trust connect the Corio Quay shipping berths and the Wheat Stacking Sites with the trunk railway lines of the State, and with the shipping berths at the Railway Pier. They also connect the Freezing Works and Abattoirs with the same trunk lines, and also directly with the shipping berths at the Quay and the Railway Pier.

The Cresco Fertilizer Works are also connected, by the lines installed by the Trust, with the trunk lines referred to.

The lines laid down by the Trust return no direct Revenue to the Commissioners, but the Victorian Railways collect freight and other charges for their traffic over the lines.

BERTHS AT CORIO QUAY, AND GRAIN AND FROZEN PRODUCE SHIPPING FACILITIES.

Two Berths are available at the Quay for oversea vessels, total length 870 feet, depth of water at present 26 feet at O.L.W.

Grain in bags carried by railway to the Quay is taken from trucks per conveyors to an elevation of 35 feet, and from that elevation is carried by belt conveyors to chutes passing into ship's hold. There are seven belt conveyors, capacity of each 50 tons per hour. Empty trucks are taken by gravitation to sidings.

Frozen produce received at the Quay for shipment is discharged from truck to conveyor to an elevated platform at the wharf's side, and from there discharged into hold by slings.

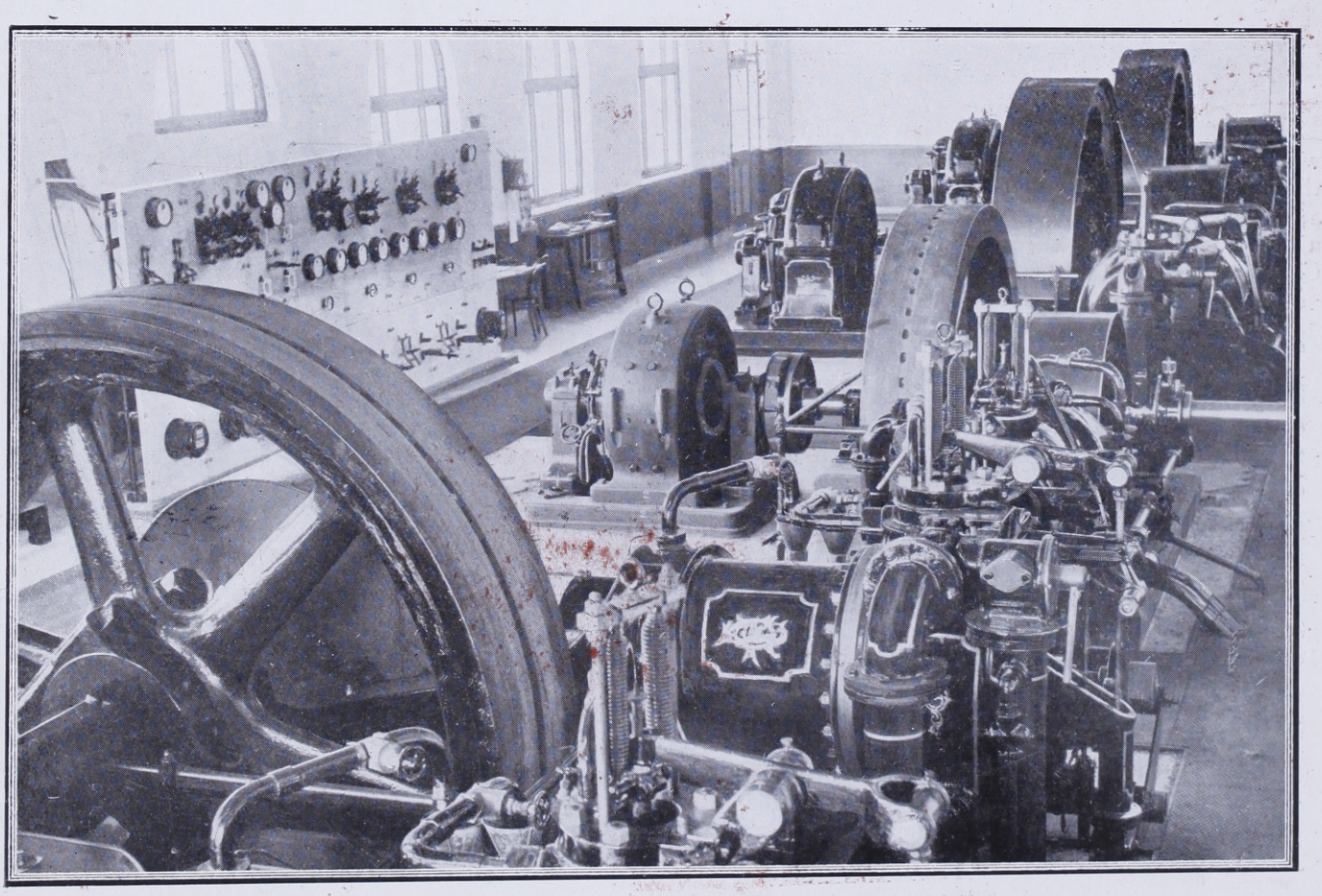
Frozen Meat from the Trust's Works at the Quay is taken by Conveyor direct from the Storage Chambers of the Works to the elevated platform above referred to.

Handling of both Grain and Meat is reduced to a minimum.

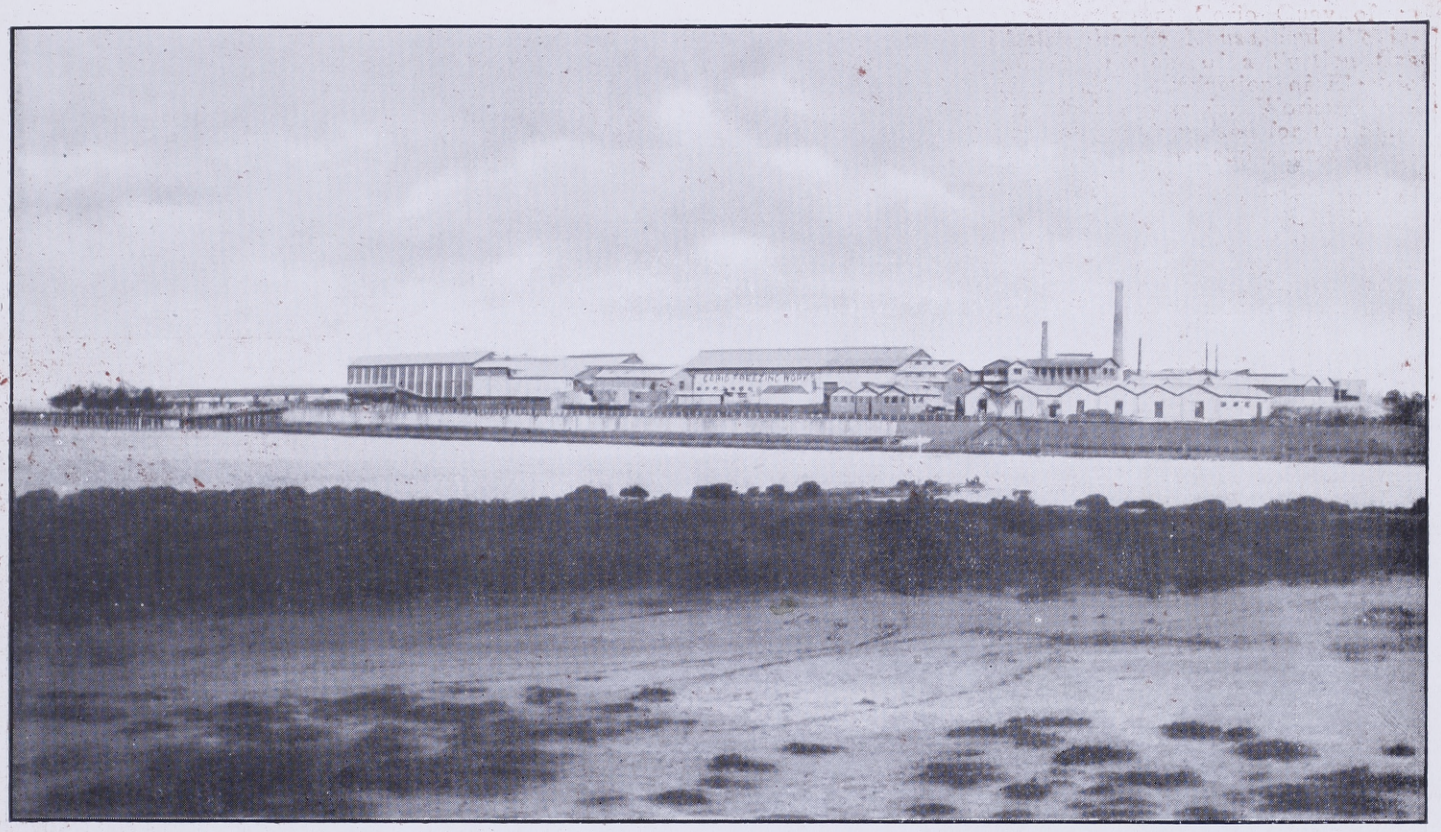
The Conveyors are operated electrically.

THE CORIO FREEZING WORKS AND ABATTOIRS.

These were constructed at Corio Quay by the Trust to meet a want of additional freezing facilities and Cool Storage within the State, and with the promise of the Government of assistance. The initial steps were taken in 1906. Construction was started 2nd February, 1909. The Freezing Machinery was contracted for by the Linde Company in



Portion of Harbor Trust Power House Machinery.



General View of Corio Freezing Works, from Geelong-Melbourne Railway Line

1908. The initial capacity of the Works was:—Freezing and Storage, 231,462 carcases; and slaughtering capacity, 3,000 lambs or sheep per day.

On 3rd November, 1909, the first draft of lambs was treated. The total treated during the season was 39,354.

The first consignment of Frozen Meat was despatched by the S.S. "Rippingham Grange."

The Works were, during the seasons of 1909, 1910, and 1911, operated by the Commissioners. After 1911, the Commissioners, having experienced poor support from producers of stock, who preferred selling their live stock on the hoof rather than to undertake its export at their risk, consulted the Government, which agreed to a proposal to lease the Works, which were accordingly put up to tender. Messrs Sims Cooper & Coy. (Aust.) Limited, for whom the Commissioners had in 1910 and 1911 treated a considerable quantity of lambs and sheep, were the successful tenderers, and they have operated the Works since 1911, using the registered brands of the Commissioners.

The output from the Works, not only of frozen produce, but canned meat, has obtained a well-earned reputation in foreign markets, and, when available, locally.

Large additions to the Works and facilities for treatment of by-products have been made from time to time, either at the suggestion of the Government or at the request of the Operators, so that the Works may be said now to be thoroughly up-to-date. The handling and freezing of carcases after cooling direct from Abattoirs, and shipment direct from Stores to Ship, are advantages not only in conserving the quality of the produce but in economy in handling.

The present capacity of the Works is 300,000 carcases, and the killing capacity equal to 10,000 lambs per day. During the season, October, 1922 to February, 1923, the number of lambs and sheep treated for export was 300,000. This, compared with the number treated during the first season of the Works (39,354), shows the great advance in the Works.

The whole of the produce from stock killed is treated at the Works.

Messrs. Sims Cooper & Co.

Taking lambs as the typical stock treated at the Works, the description illustrates such treatment, from discharge from truck at the Works to shipping for overseas.

Off the main railway line are two sidings, one on each side of the works. Trucks containing live stock are unloaded at the siding, which is sufficiently large to empty twenty trucks at one time. The lambs are placed in paddocks adjoining until the following day, when they are brought in and are driven up a race to the slaughter house, which is on the second floor. They are here killed, and the carcase placed on a conveyor and taken to the inspection rail. The Killing capacity is 10,000 lambs per

Freezing Works. Interior View of Slaughter House.

day. After inspection the carcase is moved to an automatic weighing machine, where it is graded, weighed, and tagged according to quality. It is then placed on rails in the hanging room, which holds 4,000 carcases, and hangs for four hours to cool. It is then bagged in stockinette, and carried to a freezing chamber by conveyor. There are nineteen freezing chambers, each having a capacity of about 1,000 carcases. Frozen carcases are dropped into Cool Stores below, and stacked ready for shipment. The total storage capacity is 300,000 carcases. For shipment, carcases are placed on a conveyor and thence carried to the ship's side. Last year, 1922, Sims Cooper & Co. loaded many steamers, including the S.S. "Balranald," S.S. "Essex," S.S. "Port Hacking," S.S. "Nestor," S.S. "Borda," and S.S. "Zealandic."

OFFAL. At the time of killing, offal is dropped through a hole alongside the slaughterman, and carried underneath the floor by means of a water chute to the gut room, which is in a central position underneath the slaughter board. In this room the offal is divided into edible and inedible products. The edible products, such as hearts, livers, sweetbreads, and the caul fat, is saved and shipped to England. The caul fat is first made into Premier Jus, from which margarine is made. The inedible offal is sent on to the digester house by means of other water chutes, where it is boiled down for tallow and manure purposes.

SKINS. Skins are conveyed from the slaughter house by means of an endless rope to skin store, or, if they are suitable for Fellmongery purposes, they fall direct on to a lorry, and are conveyed direct to the fellmongery and treated whilst green.

RUNNERS. The runners are saved and cleaned for sausage skins and dried gut, from which such things as surgical strings and tennis racquet strings are manufactured.

MANURE. In this department the Freezing Works again plays a very important part for the agriculturalist or pastoralist. Many hundreds of tons of Fertilizers of the highest standard are manufactured and sold throughout the country, thus putting back into the land that which has been taken out in the course of growing the lambs.

COMPRESSOR ROOM. The current used in the Compressor Room is A.C., and is supplied by the Harbor Trust Commissioners. In this room there are four Compressors, with a total capacity of 430 tons refrigeration, and are driven by Motors having a total H.P. of 650.

Throughout the Freezing Chambers and Stores, two systems of freezing are employed, namely, the Air Battery system and Direct Expansion.

BOILER HOUSE. In this Department two Boilers are installed, sufficiently large to provide necessary steam for the several Departments using it.

In connection with these Works, and in addition to Departments mentioned, are the Preserving Department, where all kinds of Meat are canned, both for local consumption and export; the Cannister Shop, where cans are manufactured for use in the Preserving Department; and the Cask and Box Factory, where casks and boxes are made for use in the tallow and other departments.

ELECTRIC POWER HOUSE.

After careful consideration by the Commissioners, the Power House was erected, and furnished with plant sufficient at the time to provide Power and Light for the Trust's industries, which might be induced there.

A Suction Gas Generating Plant was chosen as the most economical in production.

The first instalment of Machinery consisted of two Suction Gas Generators, with a total capacity of 240 K.W., in two units of 120 K.W. each.

As the calls upon Power increased, the building had to be enlarged, and further units were added to the Suction Gas Plant; and in 1918 and 1920, Steam Plant, which comprised Babcock Boilers and two Turbo Generators, was installed. These additions brought the total capacity of the plant to 1,280 K.W.

The uncertainty of labor and increase in wages and in cost of stores, and also the fact that the Morwell Scheme for production of energy was adopted with the probability of its early connecting with Geelong and working with the Melbourne Electric Supply Company, induced the Commissioners to arrange with that Company for a supply of electric energy in bulk for distribution by the Trust. This involved a change over from D.C. System to A.C., which is at present nearly completed. The whole of the D.C. plant in the Power House is available for sale.

SPARROVALE IRRIGATION FARM.

This is situated upon the Barwon River, and includes about 722 acres of land, which was in its original state subject to flooding, and covered to a great extent with Lignum scrub.

A Levee to keep off flood waters was decided upon in 1912, and taken in hand early in 1913. It was completed in 1915; length 2¾ miles and average height 6 feet.

Extensive underground and surface drainage was carried out, and pumping plant provided, which serves the dual purpose of drainage and pumping water for irrigation.

A considerable area is under Lucerne and Strawberry Clover.

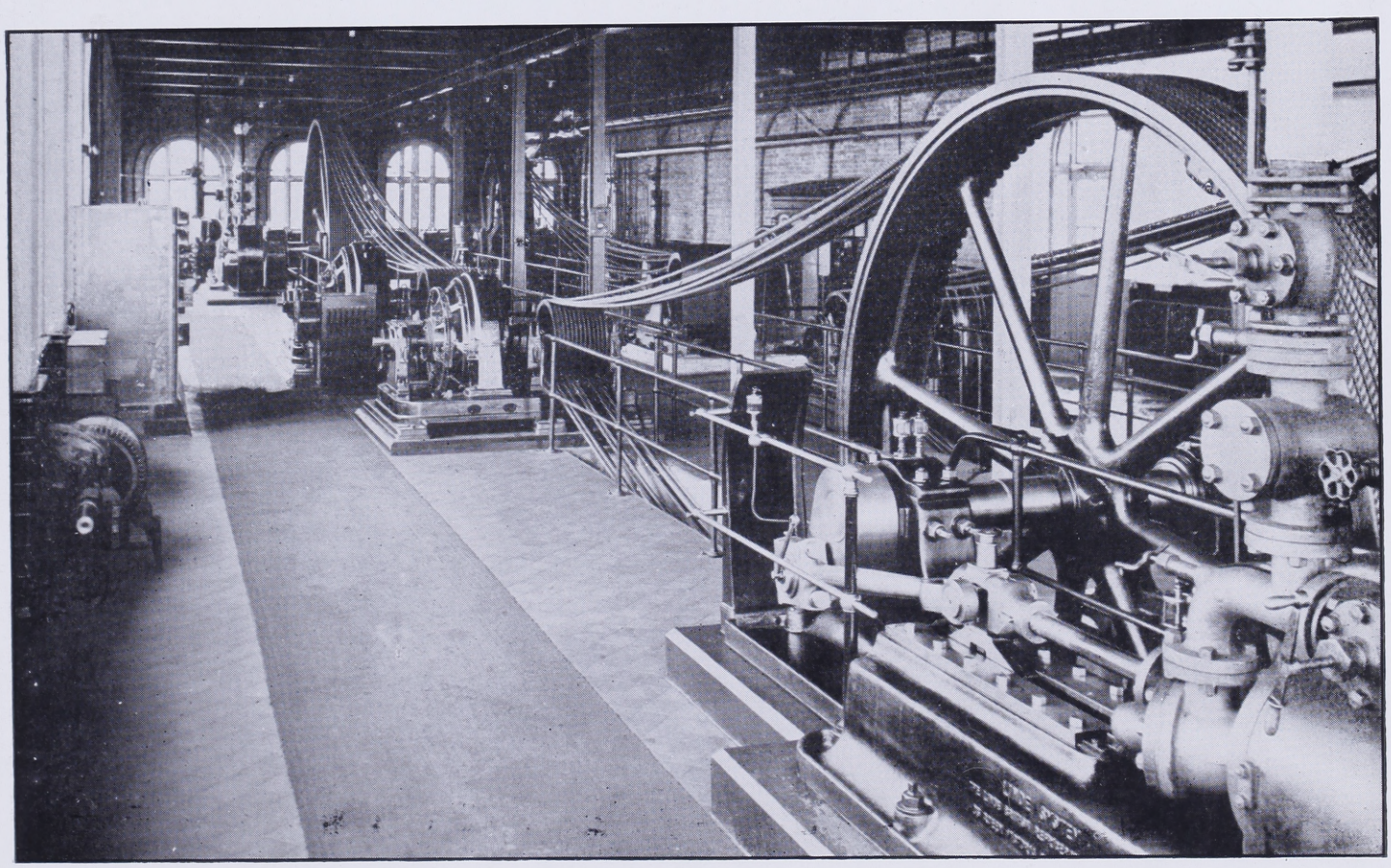
A large Dairy herd is kept, also a pure-bred herd of Ayrshire Cattle, considered one of the best in the State.

The dairy is fully equipped with Refrigerating Machinery, Cool Store, and Milk Cooler.

The intention of the Commissioners in formulating the scheme of reclamation was to prove the value of a portion of the land, with a view to the reclamation ultimately of the whole area of similar land upon the river, and their anticipation of the value of such lands when reclaimed has been fully borne out.

Reclamation will provide small farms of the highest productive character within 5 miles of Geelong.

The farm is under the management of Mr. William Baird, on the share system.



Freezing Works. Ammonia Compressors.

The Returns from Milk and other Produce sold off Sparrovale this year (1923) up to 30th September, total £6,063.

THE ORIENTAL WOOL SCOUR AND SOAP FACTORY.

The extensive premises, the property of Messrs. Sims Cooper & Coy., are situated at Corio Quay on the main Melbourne Road, with access to the waters of Corio Bay, and connected also by siding with the trunk railway lines.

The factory is furnished with modern Wool Scouring, Skin-washing, and Pelt-preparing machinery, as also Soap Making.

The Site occupied was sold by the Harbor Trust Commissioners to the Company.

The Machinery is electrically operated, being supplied by the Harbor Trust Commissioners.

Skins from the Corio Freezing Works are dealt with, and in addition skins from other sources are purchased in large quantities.

The output of Scoured Wool, prepared Skins, Pelts, and Soap, is considerable. The most of the Wool and the Pelts are exported.

Cresco Fertilizers Limited.

This Company, originally formed in Adelaide, South Australia, and carrying on a large business there, negotiated with the Commissioners for a lease of a site at Corio Quay in September, 1922, and commenced construction immediately a lease was agreed upon. The official opening of the Works took place on the 8th June, 1923, with manufactured Chemical Manure in the Storage Shed.

The Company was registered in South Australia in 1913, but their progress, though starting well, was delayed by the war, and it was only after the Armistice that development could be continued. At present the South Australian business represents a big share of the total output of manure, but it is anticipated the Corio Quay Establishment will ultimately supply a good share of this State's requirements, and also supply Tasmanian wants.

Situated adjacent to Corio Bay, and with communication by conveyor to the Wharfage accommodation there, and with railway connection to all parts of Victoria, conditions for handling their heavy tonnage are excellent. This Company endeavours, in manufacturing superphosphate, to supply the best of articles to the user at basic cost. The Shareholders are almost entirely users of Fertilizers. Under such conditions, and with the assured loyalty of Shareholders, an unassailable position is created, which practically nullifies competition. The Company states that in the process of manufacture the old-time custom of breaking down high-grade super to a lower one by the addition of sand has been abandoned, and that it has pioneered a high quality is readily appreciated by the buyers, who were not slow in recognizing the folly of having the bulk of purchases of manures added to by a material practically valueless, and of which, on many Mallee and other farms, there existed naturally an excess. This in itself should commend to users an interest in and a demand for the products of the Company.

The principal raw materials used are carried from wharf to storage shed by conveyors installed by the Company. The installation is such that the transfer is done at a minimum of cost. The storage shed construction is such that the filling of the shed as material is transported is almost automatic.

The Sulphuric Acid used in manufacture of manure is produced at present from American Sulphur, with a guarantee of purity of 99.9%, and under the chamber process. The Phosphate Rock is reduced to a fine powder by the use of various sets of grinding mills. Acid is then added, and, after maturity, the result is the ordinary commercial Superphosphate, which, before being sent out, is finally dressed and screened.

The Rock Phosphate used is imported from the Nauru and Ocean Islands in the Pacific, and is the highest grade of that material in the world. The manufacture of super is carried on throughout the whole year, but five-sixths of it is delivered during about 3 months, consequently it is necessary to have sufficient equipment to handle and load into railway trucks large tonnages daily during the period of delivery. The plants installed and railway sidings enable this to be done at the rate, when necessary, of 1,000 tons per day. Packed in sacks twelve to the ton, some idea is gained of the celerity of handling, as each bag has to be carefully weighed and branded before being trucked. The railway trucks run under a covered verandah, in close proximity to the weighers, and are loaded and safely covered irrespective of weather. This is absolutely necesary, since super needs the same care from the weather as does other similarly soluble goods, sugar for instance. The final history of the super is its distribution on the land by aid of the seed and fertilizer drills, showing the necessity for extreme care in the manufacture and storage of the manure, so that cleaning of the drills is reduced to a minimum and loss of valuable time avoided.

The whole of the Works are operated by electric energy supplied through the Harbor Trust Commissioners.

Wholly set up and printed in Australia by Henry Thacker Pty. Ltd., Ryrie Street, Geelong.

H. Thacker,
Pty, Ltd.,
Printers,
Geelong.