13. Growth of the Gas Industry in Victoria.

BY R. J. BENNIE, B.C.E., B.MECH.E.
Metropolitan Gas Company, Melbourne.

The early history of the inception of the gas industry in Victoria bears a striking resemblance to the history of its origin in England. In 1792 a Scotsman, William Murdoch, who was an engineer employed by James Watt, the inventor of the steam engine, constructed a small gas plant and lit up his home in Redruth, a village of Cornwall. Six years later Murdoch erected a much larger plant with which he illuminated Messrs. Boulton & Watt's engine works at Soho, Birmingham.

During the period in which the experiments and demonstrations of Murdoch were attracting much attention, a German named Frederick Albert Winsor began an active propaganda in London, and as a result of his persistent efforts the first project for the supply of gas to the community from a central gasworks was put into operation in 1807, and the public supply of gas was fairly launched on the stream of progress.

In Victoria, as far back as 1845, George South, an enterprising blacksmith of Fitzroy, attempted to make gas and sell it compressed into containers. This venture did not succeed on account of lack of confidence in the strength of the containers. Five years later, however, William Overton, a confectioner, arranged with South to erect on his premises in Swanston Street, a small plant consisting of a cast iron retort and a gasholder. With this Overton illuminated his confectionery shop and the adjoining baker's shop which he also conducted. Great crowds flocked to see the new lighting, and soon neighboring business people approached Overton with a view to his extending the supply of gas to their premises. Overton considered this to be impracticable, but he suggested that a company should be formed for the public supply of gas. Accordingly, a prospectus was drawn up, and a public meeting was convened by the mayor of Melbourne to be held in the Mechanic's Institute on 28th August, 1850, at which a company was inaugurated.

The first gas works in Melbourne were erected on a marshy flat between Collins Street and Little Flinders Street West, and pipes were laid to supply gas to the south-western part of the town. In 1853 an Act of Incorporation was passed under the name of *The Melbourne Gas and Coke Act*, and on 1st September, 1854, the foundation stone was laid of a new works on a site on the Yarra bank now occupied by the present West Melbourne gas works. These works were opened on 3rd January, 1856. The coal carbonized was imported from Scotland and the price of the gas was 25s. per thousand cubic feet.

A second company, for the supply of gas to the north-eastern portion of the town, was promoted by the Rev. John Allen, who was the first Secretary of the former company, and on the 22nd August, 1860 an Act was passed incorporating "The Collingwood Fitzroy and District Gas and Coke Company, Limited." Subsequently, a third company was incorporated to supply "Emerald Hill," as South Melbourne was then called.

Each of the companies mentioned had its own works situated within its supply area, on the sites of the present gas works. In due time, as the area of supply increased, separate companies were supplying opposite sides of the same street. It was, therefore, realized that it would be to the mutual advantage of the companies and the gas consumers if the three undertakings were merged, with the attendant advantages of a common administration and a unified distribution system. This culminated in *The Metropolitan Gas Company's Act*, 1878 authorizing the amalgamation which took place on 1st January of that year under the chairmanship of Mr. John Benn.

At various times other smaller companies were founded to supply the suburbs and country districts. One of these, the Brunswick Gas Works Company, Limited, was taken over by the Metropolitan Gas Company in 1904. The Geelong, Ballarat and Bendigo companies are all operating under special Acts passed many years ago. In the nineties and later, many smaller suburban and country gas undertakings were brought under a central administration by the foundation of the Colonial Gas Association—thus providing them with expert guidance and financial support which they could not have obtained by any other means. A similar fusion occurred more recently, with the advent of the Gas Supply Company, Limited.

For those who are unfamiliar with the process of gas manufacture, the following brief outline of the various operations will be of interest.

The coal is heated in enclosed retorts by external combustion of producer gas. The gas evolved from the coal is led through condensers to remove the tar and much of the ammoniacal liquor. It is then passed through washers where it is brought into intimate contact with water to dissolve out the last traces of ammonia and tar oils. Following this, it passes through beds of hydrated oxide of iron, a natural earth which removes the sulphuretted hydrogen. Finally, the excess moisture in the gas is removed by washing it with a strong cool solution of calcium chloride, after which it is ready for storage and distribution.

In the early days of the industry, the coal was shovelled into horizontal cast iron retorts, about six or eight feet in length, which were closed at the further end. Later, a special scoop was devised consisting of a long semi-circular trough; this was filled with coal and inserted in the retort, rotated one-half turn and withdrawn, leaving a full charge of coal behind evenly distributed along the retort. This operation was quickly effected and little gas was lost while charging. The pressure of the gas generated in the retort was utilized to force the gas through the crude washing devices used in those days, and the pressure in the gasholder of only a few inches of water-gauge was considered sufficient to transmit the gas through the mains to the consumers.

At a later period it was found that, if fireclay retorts were used, the higher temperature to which the coal could be raised would cause more gas to be evolved, and the residue of coke left in the retorts was a cleaner material. At the same time a form of rotary pump known as an " exhauster " was devised to help remove the gases and drive them on their way, and thus reduce the large quantity of gas lost in the retort house. Various improvements were made in other departments. The waste ammonia condensate liquors were mixed with lime-water, and the ammonia distilled over into sulphuric acid, thus making sulphate of ammonia—used as a fertilizer and as a raw material for the manufacture of ammonia compounds. The tar, which at West Melbourne works was originally run down a bore and lost beneath the swamp, was later conserved and, after proper treatment, used as a road surfacing material.

In more recent times the length of the fireclay retorts was gradually increased to about twenty feet and special mechanical devices were employed which pushed the coke out at the further end, and recharged the retort by projecting the coal into it, leaving an even layer throughout. A later development was the introduction of the inclined retort, and still later the intermittently-operated vertical retort, in both of which systems the force of gravity was utilized for charging and discharging purposes. The latest form of retort, however, is the continuous vertical type, in which the coke is continuously removed from the base, allowing the coal to enter at the top and descend slowly by gravity through the necessary air tight valves. This is commercially by far the most economical carbonizing system; it was introduced into Melbourne in 1916.

At West Melbourne the coal was originally brought into the works in drays. In the 'eighties mechanical coal reception plant was installed, consisting of hydraulic cranes equipped with tipping tubs which were manually filled in the ship's hold; and the coal was transported to the stores and retort houses by a light overhead railway. The most modern type of plant has recently been installed, however, comprising electrically-operated grabs by which the coal is unloaded from vessels at the wharf, whence it is taken by rubber belt conveyors into the works.

Another method of gas manufacture which has lately become very prominent is the production of carburetted water gas. The plant generally employed for this purpose consists of a generator, carburetter and super-heater, together with auxiliary plant, such as scrubber, condenser, waste heat boiler, etc. Coke is placed in the generator and heated to incandescence by blowing air through it, the waste products passing through and heating in turn checker brickwork in the carburetter and the super-heater, and thence through a waste heat boiler to a chimney stack. The valves are then changed over and steam is blown through the bed of incandescent coke, when hydrogen and carbon monoxide are formed. While these gases are passing through the checker brick chambers, oil is sprayed in and " cracked," thus producing a permanent enriching gas.

After leaving the dehydrator, the gas passes to the storage holders through the works meters—which latter were formerly very bulky: A drum was half submerged on its horizontal axis, and divided into spiral compartments; the gas, passing through, revolved the drum and worked a counting train. A more compact form is now in vogue, which is a very lightly and accurately constructed Roots blower driven by the gas passing through it. Other works meters are based upon Venturi's principle, the hot wire anemometer, etc. The gas is now sent on its way, by centrifugal gas pumps, to the outlying storages, and to the consumers, and its course is controlled by various pressure governing devices. The consumer's meter is a double bellows, driven by the gas; the movement of its diaphragms actuate slide valves which control the admission and exhaust of the gas to the bellows.

There are forty-one gas undertakings in Victoria, and they supply approximately 270,000 consumers. Formerly gas was almost exclusively sold at a flat rate in which the price did not vary. Later a step rate method was adopted, under which a specified price was paid for the entire amount of gas consumed in a given period and the rate charge depends on the step in which the consumption falls. The block rate, however, under which a constant price is charged for gas consumed in the first block and lower prices for gas consumed in succeeding blocks, has recently been adopted.

The total gas storage capacity in the metropolis is about thirty million cubic feet, of which more than twenty millions belong to the Metropolitan Gas Company. This company pioneered the electric welding of very large structures. In 1923, a new floating bell for a gas holder of three million cubic feet capacity was entirely welded. This was followed in rapid succession by six others, bringing the total welded storage capacity up to thirteen millions. In addition, two welded holders are now under construction. All the structural work of this company is now welded, and the total to date exceeds 20,000 tons.

As evidence of the continued prosperity of the industry in Melbourne it may be mentioned that gas is used by over 90% of the entire population in the metropolitan area. It is also interesting to note that out of a total of 507 cafes in the metropolitan area no fewer than 490 use gas for cooking requirements.

The use of gas for industrial purposes is rapidly expanding and should receive considerable impetus by the introduction of the block rate method of charging for gas, to which reference has already been made. The application of gas to industry has been very successful in Birmingham where 25% of the total output of gas is now used for this purpose.

Although in Melbourne gas for street lighting has been largely superseded by electricity, it may be surprising to many to learn that 80% of the street lighting in Great Britain is still done by gas, including Westminster which is recognized as the best illuminated city in the World.

The gas industry is essentially one for providing heat in a convenient form and at the same time conserving the valuable by-products of the coal. The heat content in the products of a large gas works is well over 75% of that in the coal.

In conclusion, some idea of the vastness of this industry in Victoria may be gleaned from the fact that over 300,000 tons of coal are carbonized per annum. This produces 5,500 million cubic feet of gas in which the energy is greater than that contained in the entire electricity output of the State, and in addition, the remaining coke residue, about 180,000 tons, contains more than twice the State's electric energy.