SESSION 1911-1912

President: The Most Hon. The Marquis of Graham, C.B., C.V.O.

Visit to the Gas Light and Coke Co.'s Works at Beckton.

Saturday, May 27, 1911.

On Saturday, May 27, the Institute of Marine Engineers paid a visit to the works of the Gas Light and Coke Company at Beckton. The first gas company ever established, it appropriately claims precedence also in owning the largest gas works in the world. An impression of their extent may be obtained when it is stated that they cover 270 acres of ground, and communication is established between the different parts of the works by means of a network of railways with a total length of 40 miles, with twelve signal boxes and thirty-two locomotives. There are fourteen retort houses, each with its own complete set of purifying apparatus, and each forming in itself a gas works of no mean size. There are nine gas-holders in all—one of them having a capacity of 8,000,000 cubic ft.—but comparatively little of the gas is stored, 30 to 60 million cubic ft. being pumped to London during the twenty-four hours. The total capacity is 75,000,000 ft., including 13,000,000 ft. of carburetted water gas.

Before proceeding to the gas making plant, the visitors were shown round the constructional, and repairing shops. There are seventy-two Lancashire and Babcock boilers used on the works, the furnaces including the "Beckton," a special forced draught type constructed on the works for burning coke "breeze." The forge, which is a building of fairly large size, contains thirty fires and three steam hammers.

The largest retort house at present in use is 510 ft. long and

FIGURE 1.

100 ft. wide. It contains 440 retorts and will produce, when fully at work, 8½ million cubic ft. per day. The retorts, consisting of fireclay tubes 20 ft. in length, are arranged in beds of ten, surrounding a central combustion chamber, the hot gases from the furnaces beneath being conveyed round the retorts and returned to the bottom tunnel, through which they are conveyed to the central stack. The heating of the retort settings is on the "gaseous" system of firing, i.e. the fuel—coke—is first converted to a combustible gas by the primary air supply, and this producer gas is burnt in the combustion chamber with a secondary supply of air which has been previously heated up by the waste gases. By this means an intense heat is obtained, the temperature in the combustion chamber being above 2,500° F.

Vertical iron pipes at the mouths of the retorts carry the crude gas distilled from the coal to the top of the retort beds and into a rectangular hydraulic main running along the length of the beds. The water in this main acts as a valve or seal preventing the gas returning through the vertical pipe when the retorts are opened for discharging and filling. From the hydraulic main the gas is withdrawn by exhausters ; the coal being thus distilled with an absence of pressure the gas is more readily given off. The gas is then conveyed through condensers, of which there are two types used, the vertical and horizontal, the purpose of the apparatus being to condense—by the free circulation of air and water spray round the pipes of the horizontal type and by water in the case of the verticals—the tar and ammonia left in the gas. These products are then run off into the storage tanks and the cooled gas, which still contains a considerable amount of ammonia, carbonic acid and sulphuretted hydrogen, is passed through the washers or scrubbers. These are circular iron towers, about 60 ft. in height, filled with wooden grids. Weak ammoniacal liquor or clean water percolates through the interstices of the grids, meeting the ascending gas and removing therefrom the whole of the remaining ammonia, carbonic acid and sulphuretted hydrogen being also absorbed to some extent. The same functions are on some sections performed by the more up-to-date rotary washer, the gas, in these, passing through a number of wheels or balls, which present a very large wetted surface to the gas.

The gas next passes through sets of eight purifiers, where it is divided into several streams, each stream passing through

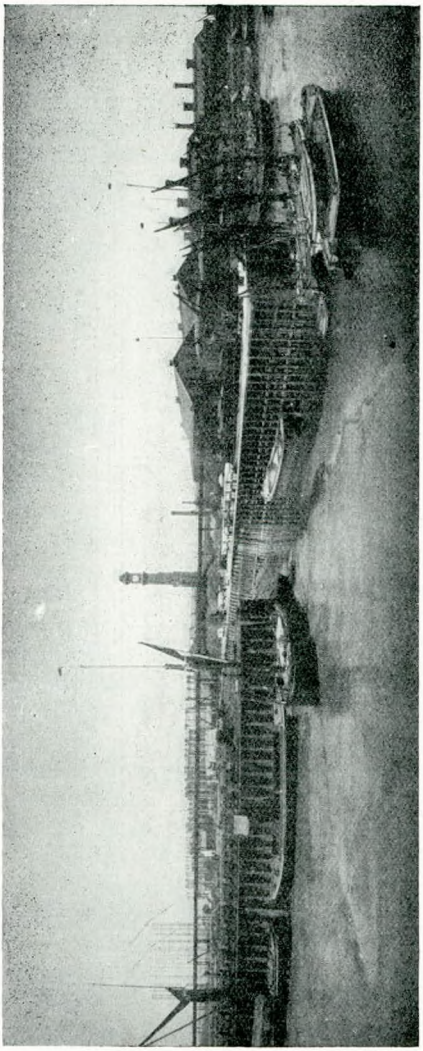

FIGURE 2.

two or more boxes in series and finally through two catch boxes. In general these purifiers are charged with hydrated oxide of iron, arranged in layers on wooden grids. In some cases "Weldon mud," i.e. manganese dioxide, is used instead of oxide of iron. In passing through these purifiers the gas is freed from the impurity, sulphuretted hydrogen. In some cases, some of the boxes are charged with slaked lime, the gas passing through these before the oxide boxes. The function of the lime is to remove the carbonic acid and more particularly to reduce the sulphur compounds other than sulphuretted hydrogen.

After leaving the purifiers the gas is passed through the large station gas-meters before being conveyed to the gas-holders, where it is stored for use as required. It is pumped through to London along cast-iron mains of 4 ft. diameter at a pressure of 48 in. (of water) by means of fourteen large gas-exhausters, on the Beale Donkin rotary plan, eight of which have a capacity of 250,000 cubic ft. per hour each, and six with a capacity of 350,000 ft. each.

Considerable interest was shown in the apparatus for filling and emptying the retorts. Three types are used at Beckton, the West, driven by compressed air; the Arrol-Foulis, by hydraulic power, and the electrically-driven Fiddes-Aldridge. The last-named apparatus fills and discharges at one operation. It consists of a series of boxes linked into the form of a chain which winds on to a large wheel. By means of a shoot fed by overhead hoppers, coal is shot into the line of boxes as they enter the retort. The front end of the first box is fitted with an arrangement which pushes the hot coke out at the other end of the retort, and when the boxes have traversed the length of the retort a series of feathering plates forming the ends of the boxes, enables the boxes to be withdrawn leaving the coal deposited in the retort. The hot coke is caught on a conveyer; part of it to be used to feed the furnaces and the remainder to be taken away for commercial use.

The coal is allowed to remain in the retort for six to eight hours at a uniform heat of over 2,000° F. The wear and tear upon the retorts is naturally very heavy and they are renewed about every four years.

After looking over the works the party was taken by rail to one of the piers, a structure built on cast-iron cylinders and projecting about 150 yards from the shore, and with a river

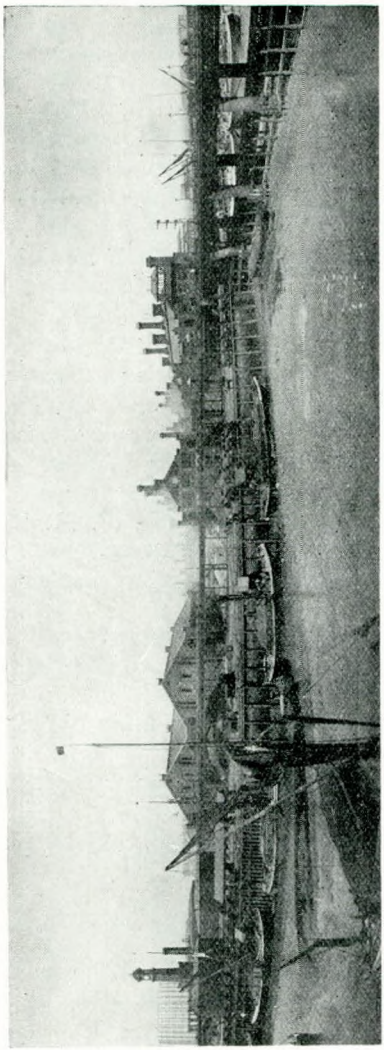

FIGURE 3.

frontage of 800 ft. There are five berths, each giving accommodation to the largest size of steam collier, the unloading being effected by means of twelve large hydraulic cranes. The average consumption of coal at the works is about one million tons per annum, each ton giving from 11,000 to 12,000 cubic ft. of gas.

A large quantity of oil is used in the manufacture of carburetted water gas, of which the Beckton works was the pioneer in the United Kingdom. By means of this plant gas can be obtained of high illuminating power.

The coal testing plant, which is really a miniature gas works, proved of great interest. Samples of twenty tons are tested at a time. A rough indication of the quality of the gas being made is shown by means of the photometer, an instrument by which the length of the jet of flame is measured by its pressure. The final test of illuminating power is determined against a standard flame on a " bar " or " table " photometer.

After partaking of refreshments kindly provided by the Company, a vote of thanks was accorded, on the proposal of Mr. W. McLaren, seconded by Mr. F. M. Timpson, to the Company and to Messrs. Solomon, Rainey, Hunter and Wheeler, under whose guidance the inspection was made.

Reception and Concert

AT THE

ROYAL BOTANIC SOCIETY'S GARDENS, REGENT'S PARK, W.

On *Friday, June* 30, 1911.

On Friday evening, June 30, about 200 members and friends assembled in the Royal Botanic Society's Gardens, Regent's Park, W., when a Reception was held by the President, the Most Hon. the Marquis of Graham, C.B., C.V.O., accompanied by the Marchioness of Graham.

The former part of the evening, from 7 till 8, was spent in looking through the large conservatories and gardens, during

which time a programme of music was rendered by the Salerno Orchestra, under the direction of Mr. Clive Parsons.

On the arrival of the President, the Members of Council were introduced by Mr. J. T. Milton (Chairman of Council) at a preliminary Reception, and a bouquet was presented to the Marchioness by Miss Nellie Adamson, daughter of the Hon. Secretary.

The Reception was then held in the large Conservatory, and from 8.30 to 10 a Concert was held in the large Hall. The opening selection was "The Doge's March," from *The Merchant of Venice*, and the programme included songs, "Annie Laurie," and "My Ain Folk," by Miss Esther Yunson; "Three Fishers went Sailing" and "A Song of Thanksgiving," by Miss Janie Blake; violin, 'cello and pianoforte trio, "Peer Gynt Suite" and Bohn's "Op 330," by the Misses Crichlow; songs, "The Lowland Sea" and "Rose of my Heart," by Mr. D'Arcy Woollven; and humorous selections, "Water Scenes" and "A Humorous Pianoration," by Mr. Selwyn Driver.

A very interesting ceremony then took place, the High Commissioner for New Zealand, the Hon. Sir William Hall-Jones, K.C.M.G., presenting, on behalf of the Marine Engineers of New Zealand, the Gold Emblem to Mr. Frank Reddaway, J.P., of Manchester. The High Commissioner explained that the Emblem was presented in view of the gift to the Australasian Institute of a beautiful statue of "Industry" by Mr. Reddaway, which had been placed in the entrance hall of the new building at Wellington.

The President expressed the thanks of the Members to Sir William for his courtesy in coming to make the presentation at great personal inconvenience, and Mr. A. E. Battle (Member of Council) as a New Zealander and also a member of the Institute in London, supported the vote of thanks, which was heartily accorded.

The visitors then dispersed, after having spent a very pleasant evening.

Visit to the Bow Electric Generating Station

of the Charing Cross, West End, and City Electricity Supply Co., Ltd.,

Saturday, July 15, 1911.

On Saturday, July 15, the Institute of Marine Engineers paid a visit to the Bow generating station of the Charing Cross, West End, and City Electricity Supply Company, Ltd. The works, which have been constructed within the last ten years, cover an area of about eight acres, and are situated adjoining the Great Eastern Railway line near Stratford. The buildings comprise the engine-room, 300 ft. long by 75 ft. wide, with a boiler-house of similar dimensions parallel to it.

The engine-room was first visited. It contains two 6,000 h.p. Sulzer vertical 3-cylinder engines, each driving a 4,000 kw. Lahmeyer generator, four Sulzer-Lahmeyer 1,600 kw. sets, and two Belliss-Lahmeyer 800 kw. sets. The capacity is therefore 16,000 kw. The system is 3-phase, working at a pressure of 10,000 volts (without transformers), and the periodicity is 50 cycles per second.

The 6,000 h.p. engines are compound, the high-pressure cylinder being in the centre with a low-pressure cylinder on each side, driving on to cranks, which are equally divided. The diameter of the high-pressure cylinder is $50\frac{1}{4}$ in.; the low-pressure cylinders are each 70 in. diam., and the stroke is 51 in. The over-all height of the engine is 33 ft. 4 in., weight 450 tons, speed 83 revs. per minute, and the steam pressure 160 lb. The oil is supplied under pressure from a tank above the cylinders. Each of the engines is fitted with feed-water heaters.

The 1,600 kw. engines are of the compound horizontal type, with cylinders of 34 in. and 61 in. diam. and 59 in. stroke. The valves are of the 4-seated pattern. The pistons are supported by bearings outside the cylinders. The exhaust steam, after leaving the low-pressure cylinder, is led to an oil separator, where it is divided and taken to two jet condensers, one on each side of the engine. The air pumps are situated underneath the condensers, and are driven from the crank pins of the high and low pressure engines respectively. The water is delivered by these air pumps into the steel hot-wells, from which it is

pumped by motor-driven centrifugal pumps into the cooling towers. The vacuum obtained is about 25 in. The Belliss engines have separate condensers driven electrically.

The 4,000 kw. generators are probably the largest in this country. The total weight of each is 197 tons, the outside diameter of the stator frame is 29 ft. 2 in., the width of the iron core is 2 ft. 2 in. There are 72 poles on each rotor, circular in shape, made of solid wrought iron, and bolted to the wheel, so that they can be dismantled without altering the position of the stator. The winding is of flat copper, with the edge wound. The diameter of the flywheel, including the poles, is 25 ft., and the speed 85 revs. per minute. The 800 kw. machines, driven by high-speed engines, are run in parallel with the larger generators driven by the slow-speed engines.

At one side of the engine-room is the large main switchboard. It is arranged in two separate sections to comply with the London County Council requirements for theatres to be supplied with two distinct services. These two sections, however, can be connected by an emergency switch. The resistances for the fields of the machines are situated on the engine-room floor ; in the gallery above is the controlling gear, and above that again are the high-tension switches. Each machine has its own complete set, switch lever, ammeter, watt-meter, volt-meter, etc.

In the boiler-house, which was next visited, are 21 Hornsby water-tube boilers, eight of which are fitted with chain grates for mechanical stoking. There are two kinds of boilers in use, the horizontal and the "Upright," the latter having an over-all length of 27 ft., width 18 ft. 9 in., heating surface 10,850 sq. ft., and grate area of 168 sq. ft. The normal evaporation is 33,000 lb. per hour. One pair of "Upright" boilers has been steamed at the rate of 100,000 lb. per hour. The dimensions of the horizontal type are considerably less. Each boiler is fitted with its own superheater, by which a temperature of about 380° is obtained. Coal is supplied by feeders from an overhead bunker, extending the length of the building, and having a capacity of 10,000 tons.

The pump-room, adjoining the boiler-house, was then inspected. It contains six slow-speed direct-acting pumps of the Woodeson type, made by Messrs. Clarke, Chapman & Co., Ltd.—two with a capacity of 10,000 gallons each per hour and four of 5,000 gallons each ; also two Blake pumps of 10,000

gallons and 15,000 gallons respectively. The water is obtained from two artesian wells 400 ft. deep, and discharged into a large reservoir below the pump-room. It is then pumped to a tank at the top of the building, from which it is distributed by gravity wherever required.

The party concluded the visit with an inspection of the cooling towers, which are a conspicuous feature of the works. There are 15 of these steel erections, each 30 ft. diam. up to a height of about 38 ft. They afterwards narrow down, and finish off with a circular shell of about half the diameter of the lower one, the height to the top of the structure being about 85 ft. The circulating water is pumped to the top of the cone, and is allowed to trickle down over a series of louvres into a reservoir below the tower, from which it is drawn for use in the jet condensers.