THE URBAN DISTRICT COUNCIL
OF HOYLAKE AND WEST KIRBY

Official Inspection

of

GLOVER-WEST VERTICAL RETORT INSTALLATION

at

HOYLAKE
GAS WORKS

on

Wednesday, 14th December, 1927

W. S. J. ENGLISH, Esq.,
Chairman, Finance Committee.

RODERICK WILLIAMS, Esq.,
Law Clerk.

GEO. DOLEMAN, Esq.,
Chairman, Electricity Committee.

FRED. BANKS, Esq., J.P.,
Chairman of the Council.

ARTHUR VALON, Esq., M. Inst. C.E.,
Consulting Engineer.

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Gas and Water Manager.

THOS. REDFERN, Esq.,
Clerk to the Council.

THE URBAN DISTRICT COUNCIL OF HOYLAKE AND WEST KIRBY

GAS DEPARTMENT

Official Inspection of Gas Works

Wednesday, 14th December, 1927

MEMBERS OF THE COUNCIL:

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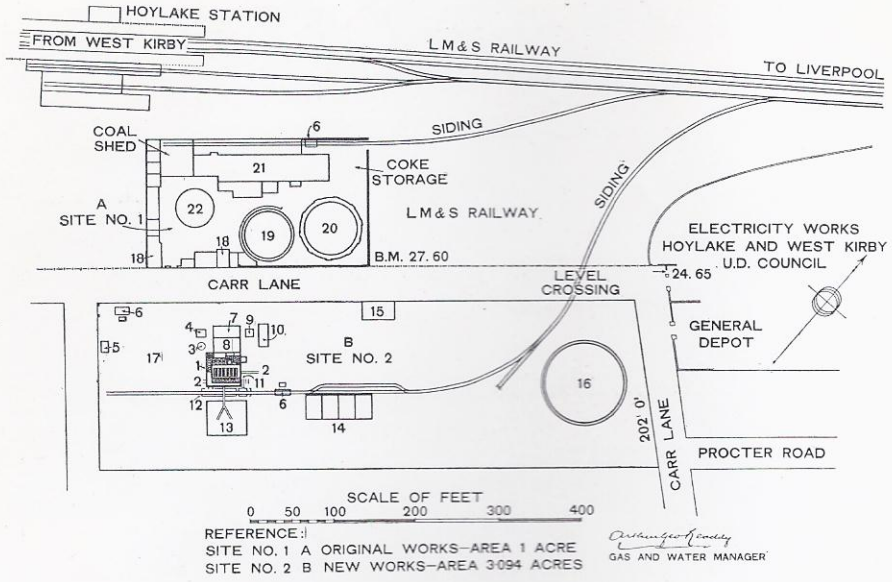
MEMBERS OF THE GAS AND WATER COMMITTEE:

FRED. BANKS, Esq., J.P., Chairman,

And the members above marked *, together with W. Briscoe, Esq., and L. Cooper, Esq., as representatives of the Rural Area.



Plan of Hoylake and West Kirby Gas Works.

KEY.

1. Glover-West Installation of Vertical Retorts.
2. Coke Shoots.
3. Cyclone Tar Extractor.
4. Water Condenser.
5. Water Tank.
6. Weigh Machines.
7. Boiler House.
8. Exhausters.
9. Livesey Washer.
10. Rotary Washer.
11. Elevator.
12. Wagon Tipper.
13. Coal Store.
14. Purifiers.
15. Station Meter.
16. No. 3 Holder.
17. Reserve for Extension.
18. Shops and Offices.
19. No. 1 Holder.
20. No. 2 Holder.
21. Horizontal Retort House.
22. Tar Well.

THE HOYLAKE AND WEST KIRBY GAS UNDERTAKING

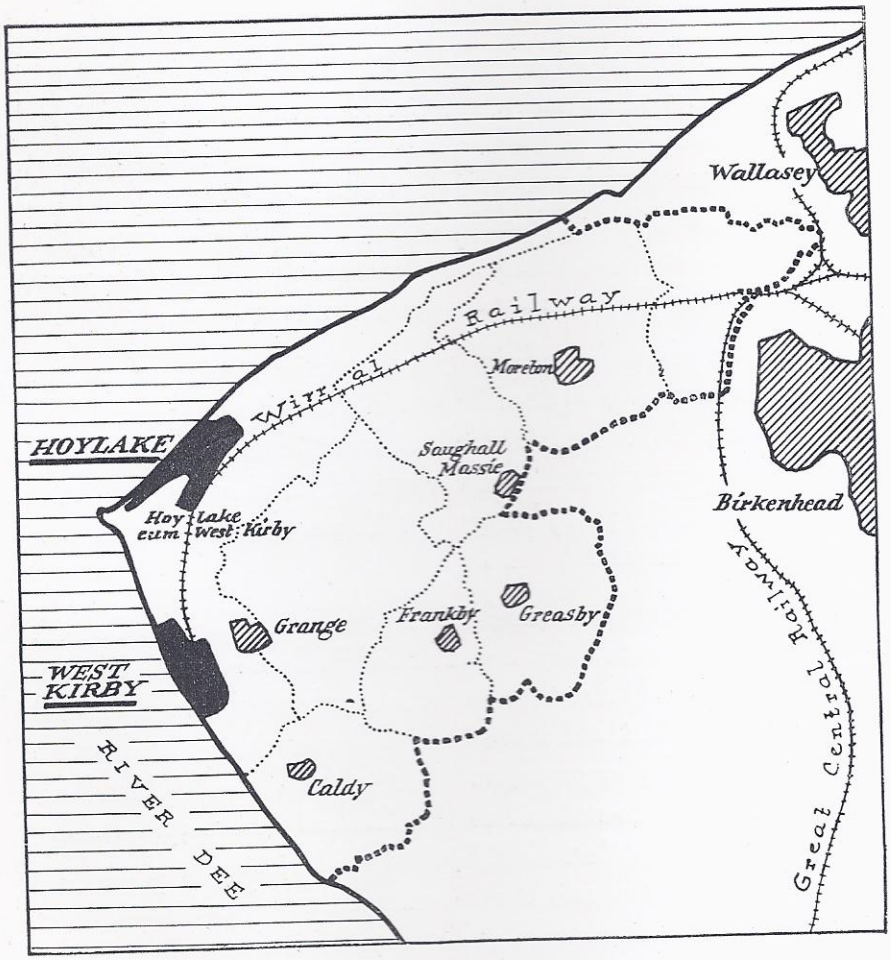
GAS was first supplied in this district by the Hoylake and West Kirby Gas and Water Co., Ltd., in 1880. The original works was built on the north-east side of Carr Lane, Hoylake, and in the year 1885 just over three million cubic feet of gas was sold to 125 customers. By 1915 these figures had risen to 67½ million cubic feet of gas, sold to 3,319 customers, when the Company acquired the No. 2 site on the south side of Carr Lane.

The price of gas for lighting purposes in 1880 was 6s. 6d. per 1,000 cubic feet. This fell to 3s. 4d. in the period from October, 1912, to June, 1915. In 1923 the provisions of the Gas Regulation Act of 1920 were adopted and the system of charging by therm was introduced, the price being 11·11d. per therm to consumers using ordinary meters.

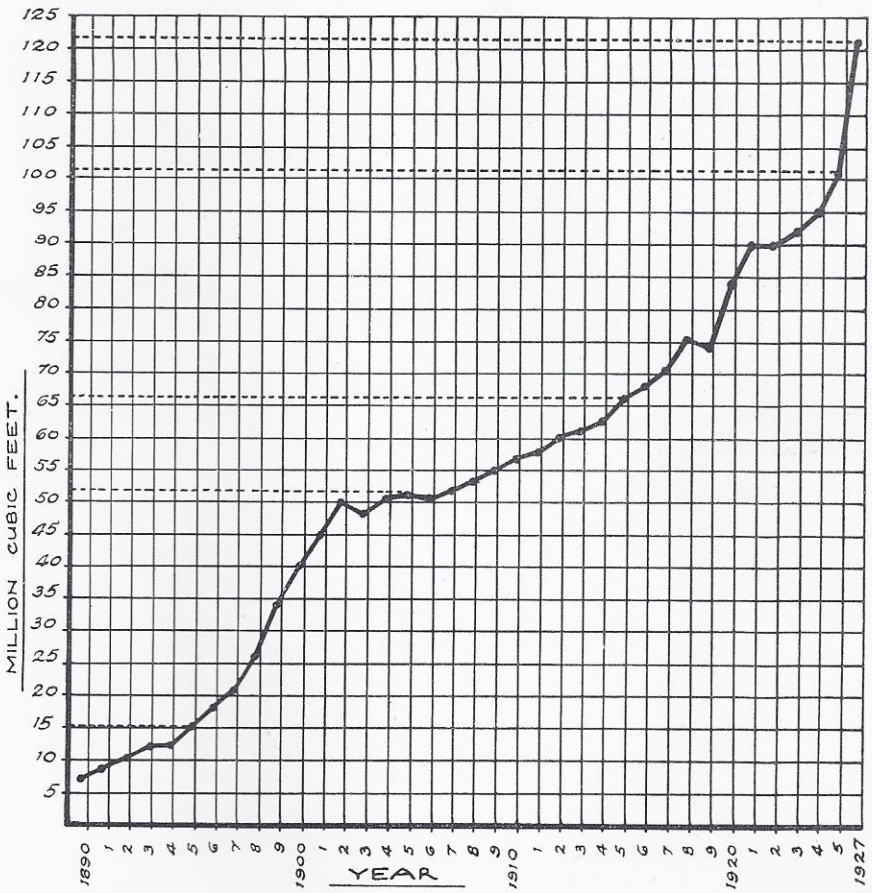
The undertaking was transferred to the Urban District Council of Hoylake and West Kirby, by an Act of Parliament passed in the session of 1925. By this time the annual sale of gas had exceeded 102 million cubic feet, and an extension of gas-making plant became a matter of pressing importance. Mr. Arthur Valon, M.Inst.C.E., who had acted as consultant to the Council before and during the transfer of the undertaking, advised the installation of modern carbonizing apparatus and the rearrangement of the plant, concentrating the manufacture of gas on the No. 2 site.

The area supplied by the undertaking is shown on the map on page 6, and the growth of the undertaking is indicated by the graph reproduced on page 7.

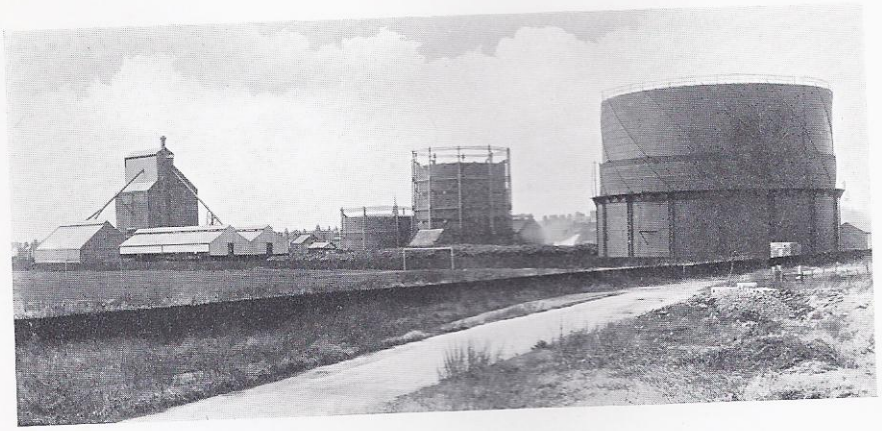
URBAN DISTRICT COUNCIL OF HOYLAKE & WEST KIRBY



Map showing Authorized Area of Gas Supply.



Graph showing Growth of Annual Gas Consumption.



General View of the Hoylake and West Kirby Gas Works, showing the Glover-West Vertical Retort Installation.

THE GLOVER-WEST SYSTEM OF CONTINUOUS CARBONIZATION IN VERTICAL RETORTS

THE system of carbonization to be adopted in the new works was very carefully considered by the Gas Committee and the Council, with the assistance of their consulting engineer, Mr. Arthur Valon, M.Inst.C.E., and their manager, Mr. A. G. Readdy, F.C.I.S. Economy of gas production, reliability of service, facility and flexibility of operation were, of course, paramount considerations. That the Glover-West system of continuous carbonization in vertical retorts fulfilled these conditions was shown by the fact that it had been adopted by over 200 undertakings at home and abroad. But, in a district rapidly becoming a residential suburb of Liverpool and Birkenhead, it was clear that the same features which had led to its adoption at Southport, Blackpool, Colwyn Bay, Leamington, and many other seaside resorts and inland spas would be of importance to Hoylake. The Glover-West system of vertical retorts would not injure in any way the amenities of the property in which it stood.

A contract was therefore placed with Messrs. West's Gas Improvement Co., Ltd., of Manchester, for the installation of 12 Glover-West vertical retorts of the 33-inch New Model design, complete with all necessary foundations, buildings, coal- and coke-handling plants, and waste-heat recovery plant. The nominal daily capacity of this plant is 666,000 cubic feet of gas at a calorific value of 500 B.Th.U.'s when carbonizing good quality gas coals.

FOUNDATIONS. The design and construction of the foundations for the new installation were confided to Messrs. West's Rotinoff Piling and Construction Co., Ltd. Pre-cast ferro-concrete piles, 14 in. square for the retort bench and 12 in. square for the lighter loads, were driven to an average depth of 45 ft. through the glacial drift which overlays the new red sandstone at this point. Spanning between the groups of piles, caps and beams in ferro-concrete were arranged

to form bases for the stanchions and brickwork of the retort bench and retort house.

The loads on the coal-store foundations being of much less magnitude, a reinforced concrete raft was laid for the floor, with beams to take the roof stanchions. On excavating for the coal breaker and receiving hopper pits, the clay was found to be sufficiently strong to take the distribution load without the addition of reinforced concrete.

THE GLOVER-WEST VERTICAL RETORT. In the Glover-West vertical retort the principle of continuous carbonization, after twenty years' development, has reached a very high pitch of perfection. The details of the system have been fully described in the technical press and textbooks, and only a brief account of the salient points will be given here.

In the first place the retort is not, as in the older intermittent systems, periodically filled and emptied. The retorts are placed vertically, coal passes in at the top of each retort under its own gravity, and at a speed which is regulated by the continuous withdrawal of the residual coke from the bottom of the retort. The coke is cooled within the retort before leaving it. The cloud of smoke and steam, resulting from the periodical charging and discharging and the water-quenching of incandescent coke of intermittently operated retorts or ovens, is thus entirely obviated.

The following is a general description of the Glover-West system of continuous carbonization in vertical retorts.

Coal is supplied to the coal-feed hopper above each retort and slowly and continuously descends through the retort to the coke-receiving chamber below. The coal passing through the heated retort becomes completely carbonized, and the residual coke is extracted by means of a mechanically operated extractor at the base of the retort.

The speed of the coke extractor determines the rate at which the coal passes through the retort. The speed of each extractor can be varied to meet any requirements.

The coke discharged by the coke extractor is received and temporarily stored in a coke-receiving chamber, from which it is periodically discharged to the coke-handling apparatus.

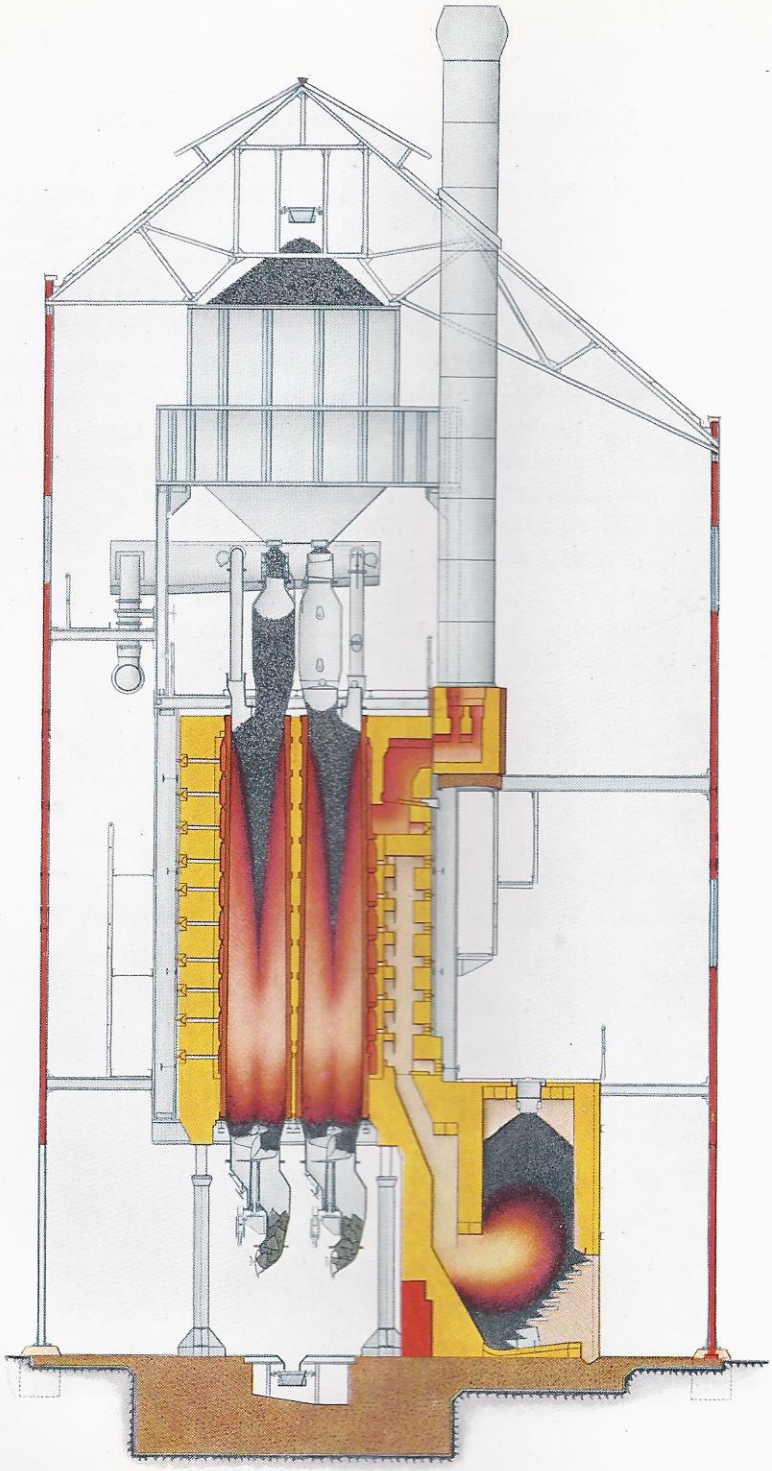
The retort setting and the method of heating the retort may be described briefly as follows :—

The retorts are surrounded by superimposed combustion chambers separately heated and controlled. The products of combustion make their exit from the combustion chambers and, travelling upwards, enter the upper chambers and circulate round the tops of the retorts, after which they pass away to the chimney.

The secondary-air supply, for the completion of combustion, is suitably heated before entering the combustion chambers.

As the coal passes continuously down the retorts the heat gradually penetrates towards the centre, the speed of coke extraction being so regulated that complete carbonization is effected towards the base of the retort, thus forming a taper " core " of coal, as shown in the illustration on page 12.

Steam is admitted in adjusted quantity at the base of the retort, forming any desired proportion of water-gas by reacting with the residual coke.



Cross-Section of a Standard Retort House with Glover-West Vertical Retorts arranged in units of two retorts.

SPECIAL FEATURES OF THE GLOVER-WEST SYSTEM

THE continued success of the Glover-West system of continuous carbonization in vertical retorts is conclusively demonstrated by the fact that there are over 200 installations of Glover-West vertical retorts in operation, carbonizing all known varieties of gas-making coals in this country and abroad.

The chief points which distinguish the Glover-West system are :—

(*a*) The particular method of heating the retort.
(*b*) The elliptical shape of the retort.
(*c*) The special feature in the design of the retort, by which the heat of the residual coke is utilized for raising the temperature of the steam at the base of the retort to such an extent that the practice of steaming does not materially affect the throughput of the retort.

METHOD OF HEATING. In the Glover-West system the combustion chambers are arranged horizontally across the lines of the retorts, each combustion chamber being provided with its own fuel-gas nostrils, separately controlled, with sight-holes for the inspection of the interior of each chamber. The temperature can, therefore, be readily distributed over the vertical length of the retort to suit the class of coal which is being carbonized ; the maximum may be in the upper chambers or in the lower, or the temperature may be evenly distributed over the whole length of the retort.

The producer-gas is at a temperature of about 1,150° F. before its admission to the combustion chambers. The secondary air rises in the outer wall of the setting adjacent to the internal passage of the products of combustion, thus fulfilling the double function of regeneration and insulation. It is raised to approximately the same temperature as the fuel-gas by utilizing the radiant heat of the walls of the setting.

THE ELLIPTICAL SHAPE OF THE RETORT. The elliptical design of the Glover-West retort secures a natural rigidity from the arch-like shape of the retort walls. No stays are required. The whole superficial area of the sides of the retort is in immediate contact with the flame of combustion, and loss of heat from absorption by excessive brickwork is avoided.

The ends of the retort in plan are in the form of a curve continuous with that of the sides, so that there are no sharp corners across which the charge might "bridge" or "arch over," and the coal passes evenly down the retort without sticking or hanging-up.

Graphite or scurf forming in the retort remains in close contact with the curved retort walls and does not flake away. Stoppages from this cause are entirely obviated in this design of retort.

THE NEW MODEL RETORT. The Glover-West New Model retort has been definitely designed to take full advantage of the practice of steaming the charge. It consists of the original standard retort superimposed upon a chamber specially designed to present an enlarged area of incandescent coke to the incoming steam at the base of the retort, so that the steam is superheated to a temperature approaching the point of dissociation before it actually enters the retort proper.

By this means the whole of the available heat from the combustion chambers is utilized solely for the purpose of carbonizing the charge of coal, while the sensible heat of the newly formed water-gas is available for the purpose of internally heating the core of coal in the retort.

PRODUCER. The producer is built with the setting, and is of the step-grate type. The grate is left open to the atmosphere, and the ingress of primary air is controlled solely by the demands of the setting and the pull of the chimney dampers. By this means the supply of producer-gas to the combustion chambers is kept constant in quantity and quality. As a consequence the heating of the setting is kept absolutely uniform and the fuel consumption is kept down.

The producer is open to inspection at all times. There is no clinkering in the usual sense of the word; it is merely necessary to keep the fire reasonably clean.

Recent improvements in the design have been in the direction of a very substantial increase in net grate area, ensuring a slow speed of travel of air and gases through the fuel bed and an internal temperature low enough practically to eliminate the formation of clinker. Further, the disposition of the grate in relation to the flare bed is such that the zone of maximum temperature is kept low in the fuel bed, and the minimum distance through the fuel occurs from the middle of the grate, thus avoiding a short circuit between the top of the grate and the flare bed and the formation of clinker in a position above the lintel, where it is difficult to dislodge it.

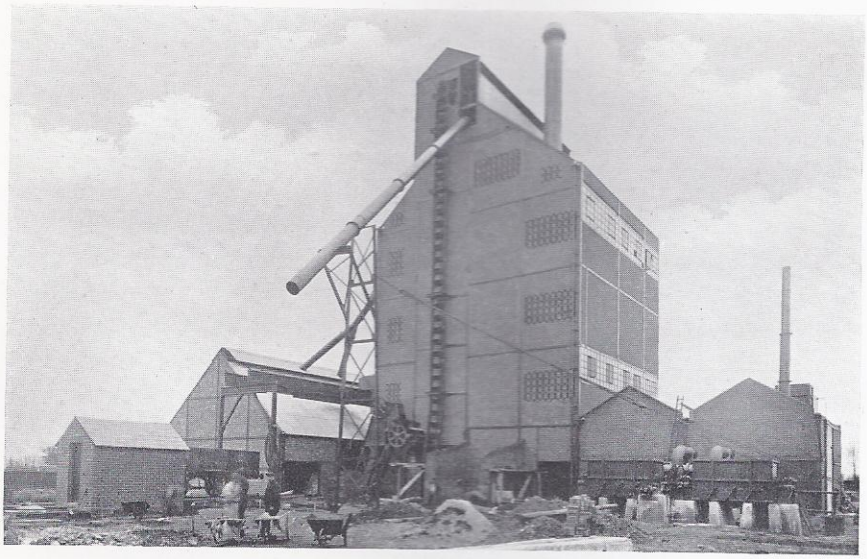
COAL- AND COKE-HANDLING PLANT. Coal is brought to the carbonizing plant in railway wagons upon a siding from the L.M. & S. Railway. The wagons are tipped by overhead electrically driven apparatus arranged so that the contents of the wagons may be discharged from either end. The coal is received in a steel hopper placed below the railway. From the hopper it is raised by a fixed-bucket elevator and delivered to a West coal-breaker of the two-roll type, in which it is reduced to a size suitable for the carbonizing plant.

The broken coal falls to the buckets of a line of West's lip-bucket conveyor-elevator which encircles the retort house. In this conveyor the broken coal is elevated and distributed in the overhead coal-storage bunkers, which, with a capacity equal to forty-eight hours' supply of coal to the retorts, are placed above the retort bench, with openings in direct communication to the several coal valves above each individual retort.

Coke is discharged from the retorts direct to the buckets of the same conveyor and elevated and delivered to the coke-storage hopper placed at the end of the retort house, with shoots for the supply of railway wagons or the producer feeding buggy. Shoots are also arranged so that coal can be discharged from the top strand of the conveyor into the coal store, and so that coke can be discharged and stored in the yard.

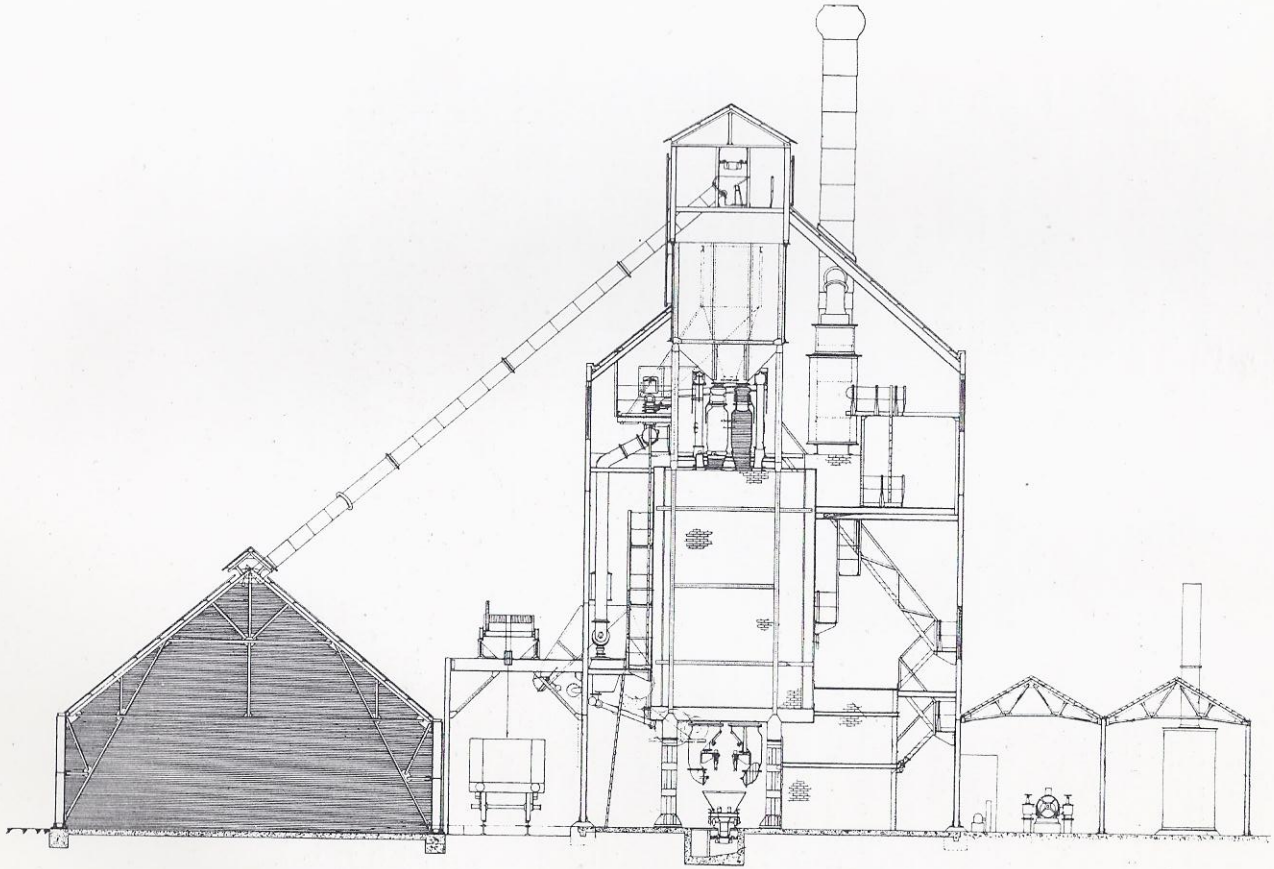
BUILDINGS. The retort house is of the steel-framed, brick-panelled design usual in installations of Glover-West vertical retorts. The coal store is a self-braced steel structure, with 4½ in. and 9 in. brick filling, designed to withstand the pressure of the coal. The boiler and exhauster houses are built of brick with steel roof structures, and the whole is designed to harmonize with the remainder of the gasworks buildings.

MISCELLANEOUS AND AUXILIARY PLANT. The retort house is amply provided with platforms, staircases and ladders, giving easy access to all parts of the carbonizing and coal- and coke-handling plants. The several units of the breaking, elevating and conveying plant are driven by electric motors



The Glover-West Vertical Retort House, Coal Store, Boiler and Exhauster Houses.

operating on alternating single-phase current, with a periodicity of 50 cycles per second and at 230 volts. A suitable distribution board is placed in the retort house, with connections to the source of supply and control switches, wiring and cabling to the several



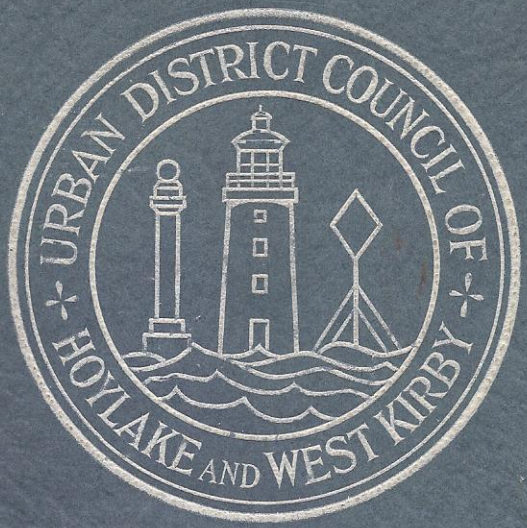
Cross-Section of Glover-West Vertical Retort House, with Coal Store, Wagon Tipper, Boiler and Exhauster Houses.

motors of the installation. The coke extractors are driven through the standard Glover-West reciprocating gear from the main driving shaft of the conveyor motor, with a National gas engine as an alternative.

The carbonizing plant is equipped with exhaust registers to control and record the pressure of gas on the inlet and outlet of the retort-house governor, with two dead-beat pressure indicators as a stand-by. The waste-heat boiler is provided, in addition to the usual boiler fittings, with an automatic feed-water regulator and an alarm device, whereby a steam-whistle is sounded whenever the water level in the boiler varies beyond predetermined limits, with an ample margin of safety. The feed-water pumps and the tar and liquor pump for the service of the foul-gas mains are driven by steam.

The auxiliary plant comprises a new exhauster of 30,000 cubic feet hourly capacity, by Messrs. Bryan Donkin; the exhauster from the No. 1 side, of 15,000 cubic feet hourly capacity, is also to be transferred to the new building; condensers by Messrs. R. & J. Dempster; washer-scrubber by Messrs. Kirkham, Hullett; and Livesey washer and cyclone tar extractor by Messrs. W. & C. Holmes; all of 750,000 cubic feet daily capacity. The mains throughout the works are 15 in. diameter, and were supplied by the Staveley Coal & Iron Co. The sidings were laid by Messrs. R. White & Sons, of Widnes. The works is provided with road weighing-machine for 20 tons load, and a railway machine for 30 tons load. The purifiers, consisting of four boxes each 20 ft. square, together with works station meter, had already been erected on this site in 1923.

The storage capacity consists of No. 1 holder, with two lifts of a capacity of 80,000 cubic feet, erected in 1890; No. 2 holder, with three lifts and a capacity of 200,000 cubic feet, erected in 1898; and a spirally guided holder, with two lifts and 400,000 cubic feet capacity, erected in 1920.



HOYLAKE & WEST KIRBY GAS WORKS 1927