charcoal establishment, the works covering an area of twenty-five acres of ground, and giving employment to 600 men. The coal used is first broken into small pieces by a machine like an anthracite coal These crusher, and is then ready for the retorts. are arranged vertically in sets of four, each being eleven feet in height, and the coal is raised to a platform near their top. Their upper ends, which project above the platform, are each closed by a conical hopper; the opening of the hopper into the retort is closed by a spherical valve, which is suspended in the retort and pulled up against the opening by a chain worked by a counterpoise. This simple contrivance is rendered sufficiently air-tight by a handful of sand being thrown into the hopper. When it is wished to re-charge the retort, the workman fills the hopper with the broken coal, and then depressing the iron chain, lowers the spherical valve, when the contents of the hopper fall into the retort, the opening being immediately closed again and luted by a fresh handful of sand. From the construction of the retort, the coal is gradually heated as it descends to that part of it which passes through the furnace.

The bottoms of the upright retorts pass completely through the furnaces, and are closed below by dipping into shallow pools of water, that form air-tight joints. The advantage of this arrangement is evident; the spent coal from which the oil has been driven off, as it passes through the hot part of the retort gradually descends into the water, and is from time to time raked away below, the coal from above descending as it is removed. Thus the action of these retorts is continuous, and the distillation goes on uninterruptedly both night and day. The waste refuse or spent coal from the retorts consists of about one-half carbon, the remainder being mineral matter. As it is not well adapted for fuel nor utilized in any way, it accumulates in enormous mounds that cover several acres near the works. The vapours which are produced in the retorts are all conducted by iron tubes to the main condensers. These, like the ordinary condensers in coal-gas works consist of a series of iron syphon pipes freely exposed to the air. In passing through these pipes the vapours condense into liquid, a very inconsiderable portion escaping into a gas holder as incondensible gas.

In gas-works, a high temperature resolves the coal into incondensible gas and coal tar, the latter being a liquid heavier than water. In the Paraffine Works a comparatively low temperature, gradually applied, furnishes an inflammable oil lighter than water, with so small a portion of incondensible gas that practically it is of little consideration.

The crude oil produced in the numerous stacks of furnaces by the distillation of the Boghead coal is conveyed by means of iron pipes to a general reservoir : this is a brick tank sunk in the ground, and capable of containing 40,000 gallons. This crude oil is a mixture of various substances, some of which are very volatile, and give off inflammable vapors even at the ordinary temperature of the atmosphere. This tank is perfectly gas-tight, and is thus guarded against fire, while the refined oil is kept in circular iron tanks, each capable of holding 100,000 gallons, and sometimes one million of gallons are kept on the premises. The crude oil as first obtained from the coal is a

dark-coloured thick liquid, containing all the pro-

ducts of its distillation. The first process of purification it undergoes is simple distillation. This is performed in cylindrical iron stills, of enormous size; in these it is distilled to dryness, the superabundant carbon that it contains being left in the form of a shining black coke. As it is necessary to clear out this coke after each distillation, the retorts are made to open at the ends, so as to admit of its removal. This coke is employed as fuel. The vapor arising from these stills is cooled by being conducted along iron pipes passing through large open tanks sunk in the ground. These tanks have a very small stream of water flowing through them.

When the first purification by simple distillation has been effected, the oil is further purified by being acted on by strong oil of vitriol, or sulphuric acid. The Bathgate Works include a complete apparatus for its manufacture : there are furnaces in which large quantities of sulphur are burned : vast leaden chambers, in which the fumes, mixed with those arising from aquafortis, are condensed into the liquid acid; and huge glass evaporating pans bedded in sand, in which the produce is concentrated by heat until it attains the required specific gravity of 1.848. In order to insure an adequate mixture of the paraffine oil and the sulphuric acid required to purify it, both are allowed to flow in the requisite proportions into circular tanks. Each of these contains a revolving stirrer, which throws the whole into great commotion, and causes the inti-mate mixture of the two liquids, spite of their different specific gravities, the acid being double the weight of the oil. This admixture is continued for about four hours, when the combined fluids assume a beautiful opaque green appearance. On being allowed to rest, the impurities which are charred and separated by the action of the oil of vitriol, subside to the bottom in the form of a dense, black, heavy acid tar. As this is not turned to any practical use, it is requisite to get rid of it in some way, as it cannot be allowed to pollute the neighboring streams, and its accumulation would be very inconvenient; it is necessary, therefore, to boil it to dryness, when the solid residue is used as fuel. In order to separate the remaining im-purities and that portion of the sulphuric acid which is left in the parafine oil, it is next subjected to the action of a strong solution of caustic soda. This chemical re-agent is also prepared at theworks, a regular soda factory being in constant operation. This soda is rendered caustic by quicklime: and after having been used to purify the oil, is again worked up and re-used over and over again.

As thus purified, the oil contains four distinct commercial products, which require to be separated from each other in order that each should be made available for useful and economical purposes. To effect this separation, the oil is again distilled. The first elevation of temperature drives over the lighter and more volatile portions ; these are collected separately, and when purified by a subsequent distillation, yield on condensation the fluid known as naptha. This naphtha differs essentially from that obtained from coal tar; the paraffine naptha having a specific gravity of '750, whereas that procured from coal tar has a specific gravity of '850. The paraffine naphtha is of great value as a substitute for turpentine. It is also largely used to those naptha lamps in which the fluid descends down a