fuel, the outer (11) forming a water or air-tight jacket. The body is mounted on a novel ash and clinker extractor, which allows the attendant to withdraw the spent fuel at will, without disturbing the process of gas making, thus ensuring continuous work.

The working is as follows:—Non-bituminous fuel is supplied through hopper (2) to the proper height in chamber (6), and is ignited at the top; a few drops of water are allowed to enter chamber (11), which are converted into steam and become thoroughly saturated with the air. A hand fan is now operated, forcing the air through opening (3) into chamber (11), where it becomes saturated with the steam; through opening (4) in hollow sleeve (5); on to and down through the fuel in chamber (6); passing out of passage (19) up the vent pipe to the atmosphere.

The fan is operated until a sufficient depth of incandescent fuel is obtained to generate the gas, when vent cock and hollow sleeve (5) being shut off and hopper door (7) opened, the generator works open to the atmosphere. The engine now continues the gas making in exactly the same manner, with the exception that the air is drawn through the fuel by the suction stroke of the piston instead of being forced through by the fan.

Lignite coal is now added and the hollow sleeves (9) (of which there are a number set at different planes) are turned so that the opening (10) corresponds with pipes (7), which permits air and steam to be drawn down pipes (7) through hollow sleeves (9) and into chamber (6), thus setting up a further combustion zone. The volatile matter contained in the fuel commences to distil, and the products of distillation—gas, tarry matter, and the like—are drawn down through the superheated zone, where the tar is taken up and converted into a fixed gas; the chemical action, therefore, being the distillation of volatile matter and the formation of carbon dioxide at the top of the fire. Then lower down in the superheated zone the volatile matter is converted into a fixed gas and the steam decomposed, liberating the hydrogen, while the carbon dioxide takes up another part of carbon, forming carbon monoxide.

The ash and clinker extractor, which is an important feature of the Cambridge gas producer, is simply a large hollow cock, one end of which is open, but has a door (16) mounted to prevent ingress of air in the wall of the plug (15). A grate (13) is formed, also an opening (14). The fuel rests on grate (13) and any fuel small enough falls into the plug.

To extract clinker, etc., turn plug by operating hand wheel (18), so that opening (14) corresponds with the opening in the generator. The spent fuel will then fall into and fill the plug till the blank part shuts off the opening to the generator. Open door (16), take out the spent fuel, shut the door, and turn the grate to its original position.

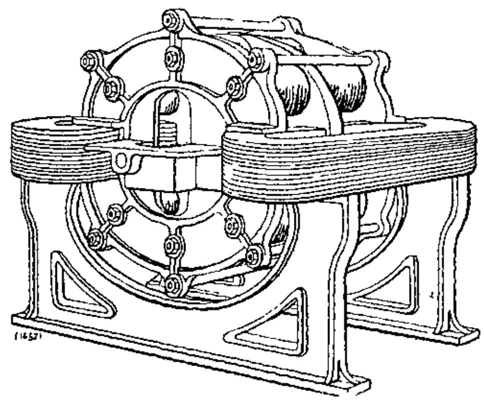
The fact of being able to extract the clinker while keeping the fire in good order should be of very great benefit when the generator is required to run continuously, as in electric power stations, marine engines, etc.

Messrs. Booth and MacDonald are at present erecting a 25 b.h.p. plant for pottery works at Christchurch, and are also building a 75 b.h.p. generator to replace their old type generator for the driving of their main workshop.

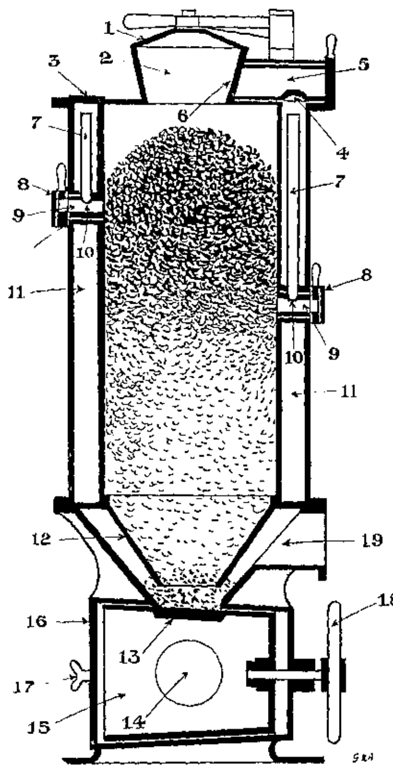
The First Dynamo.

A Gulf of 50 Years.

This is the dynamo patented in 1854 by Soeren Hjorth, and manufactured by Malcolm and Campbell in Liverpool in 1856, and was presented to the Polytechnic School in 1857. It was the first generator in which the current of the electro-magnets is taken from the main current developed by the machine itself, and where the principle of mutual excitation between current and electro-magnets is clearly demonstrated and utilised in practice, although the inventor considered it necessary to use permanent magnets as well. It was not till about ten years later that it was found that the use of permanent magnets could be done away with.



The First Dynamo.



"Cambridge" Gas-Producer.

The illustration shows a diagram of the Hjorth machine as it was built.

Electricity and Steam.

Railway Traction of the Future.

The application of electric traction to steam railroads continues to show gratifying results. Although no figures have been made public as to its economy, the electrical operation of the suburban tracks and terminals of the New York Central and New Haven lines has been carried on throughout the year with unbroken success. The New York Central electric zone is being extended to White Plains, and the New Haven Company are building a mile of experimental overhead line beyond Stamford, preparatory to the extension of the system to New Haven. The latter company have also ordered two experimental freight locomotives, and it is the intention to operate the whole line from New York to New Haven, a distance of nearly eighty miles, with electric traction both for freight and passenger-service. The Pennsylvania Railroad Company are having fifty locomotives of 4,000 maximum horse-power built for the operation of their tunnels and terminals in New York city. An important improvement in these engines is the removal of the motor from the axle and placing it above the frame, with a view to raising the centre of gravity and reducing the stresses on the track and roadbed. Mention should be made here of a most important enlargement of the capacity of central power stations by the introduction of low-pressure turbines between the low-pressure cylinders and the condensers, in such power stations as are now operated by reciprocating engines. In the 59th Street power station of the New York subways the maximum output of 8,000 kilowatts of the big cross-compound engines has been increased to 16,000 kilowatts by interposing a Curtiss turbine in this manner.

Progress of Steel-Concrete.

Interlocking Steel and Concrete Pile Construction for Sea Walls and Foundation Work.

(*Engineering News.*)

A new system of interlocking pile construction has been used recently in Chicago for protective work and jetties on the lake shore and for the foundations of buildings. The construction is such that the completed work forms a solid and continuous wall. The process consists in sinking steel tubes by jetting and loading, and then filling them with concrete. Each tube or cylinder has on one side a hollow vertical rib and on the other side a hollow vertical socket, both of dovetail form; the rib of one pile enters the groove of the other and the piles are thus locked together. As the rib and grooves are hollow and form a part of the tube, the separate concrete piles in the tubes are locked together, and do not depend upon the steel shell to lock the piles together. For land work, the cylinders are open at the bottom, and the faces of the rib and groove are open (the sides being tied together by transverse strips). With this arrangement the concrete filling forms a monolithic mass (above the surface of the ground), and may have horizontal and diagonal reinforcing rods embedded within it. This arrangement is used also in water where there is no danger of scouring. In this case, the tube does not displace the material, and the concrete filling does not extend below the bottom of the lake or river. For work in the water, and exposed to the action of waves and currents, the tube has a closed flat bottom and closed faces to the rib and groove, so that the concrete filling forms a separate pile, interlocking with the adjacent piles, and reinforced by vertical rods as may be required.