in which no attempt is made to treat the tars in the fire, and it has been out of proportion to any economy effected.

"It is very improbable that any plant will thoroughly fix the tar in a gas producer at any temperature, which can be practically and economically used in such apparatus.

"The down draught producer has been tried at various times during the last score of years, and although this sometimes destroys the tars, it also destroys other valuable properties of gas producers, which puts it out of court as a practical apparatus. In my opinion it is far better and easier to wash out the tar from the simple gas produced, and to

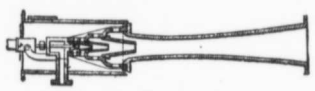

Fig. 5—The Koerting Blower.

utilize this tar in some other way, either as a fuel or as a by-product. It has been proved that it is possible to so clean the gas and that the valves of an engine are no more affected by the gas thus cleaned than by ordinary town's gas.

"It is possible by attention to certain details of design and structure to make producers of such small sizes for utilizing the commonest slack or dross fuel for the production of a uniform power gas."*

Such a producer as spoken of in the foregoing paragraph, has been designed and built by Crossley Bros., Openshaw, England, and this seems to be the only firm who have been successful in solving this problem in the way indicated.

Of the inverted combustion style of generator little need be said as this principle is only partially successful, and has many disadvantages.

Since the generator and its accessories and the gas holder are the features in which there is the chief dissimilarity between the pressure and the suction plants, these will be described in detail for each type of producer, while the features which are similar to the two types will be considered only in connection with the suction plant.

The Generator.†

The generator or producer consists of a retort made of refractory clay, vertically mounted, and cylindrical or conical in form. This retort is protected on its exterior by a metal jacket with an intermediate layer of sand which serves to reduce the heat lost by radiation.

The fuel is charged through the top of the retort, which is provided with a double closure in order to prevent the entrance of air during the charging operation. Different styles of charging hoppers, as they are called, are illustrated and described later.

The producer rests on a grid arranged at the base of the retort, upon which grid the ashes fall. The outlet of the injector pipe opens into the ash-pit, and this injector constantly supplies a mixture of steam and air. The mixture is generally superheated in passing through a coil arranged in the fire-box of the boiler, in the generator, or in the outlet for the burnt gases. Sometimes the air is subjected to preliminary heating by recouperating in some way the waste heat of the apparatus.

The chief features in the arrangement of generators which have received the attention of manufacturers, are the following: good distribution of the fuel in charging; easy descent of fuel; reduction of the destructive action of the clinkers on the walls; means for cleaning the grate without interfering with the generation of the gas; and prevention of leakage. Many devi es have been employed to fulfil these requisites.

A perfect distribution fuel during charging is attained chiefly by the form of the hopper, and of its gate, which is generally conical. In most apparatus, the gate opens towards the interior of the generator, and the inclination of its walls causes a uniform scattering of the fuel in the retort. It is all the more necessary to disperse the fuel in this manner when the cross-section of the retort is small compared with its height.

The facility of the fuel's descent is dependent largely upon the nature and size of the coal employed. Porous coal gives better results than dense and compact coal. It is, therefore, preferable to employ screened coal free from dust, in pieces each the size of a hazel nut. The various styles of cross-section given the interior of generators, including as they do cylindrical forms, truncated at the summit or the base, partially truncated at the base and the like, would lead to the conclusion that this question of fuel descent is not of the importance some writers would have us believe. Still, it must be considered that if the fuel drops slowly, its prolonged detention within the walls of the hopper, and its transformation into fusible slag may result in a disintegration of the refractory lining of the furnace.

The quantity of the steam, injected, greater or less, according to the nature of the fuel, renders it possible to obtain fusiable slags and consequently to prevent grave injury to the retort.

Cleanliness is most important so far as the operation of the generator is concerned. It should be possible to scrape the generator during operation without changing the composition of the gas. Mechanical cleaners with movable grates or revolving beds have the merit of causing the ashes to drop without interfering with the operation of the apparatus. The same meritorious feature is characteristic of ash-pits having water-sealed joints.

A generator should be provided in its upper part with openings through which a poker can easily be introduced in order to shake up the fuel and dislodge the clinkers which tend to form, and which cause the principal defects in operation, particularly with fuels that tend to swell, cake and adhere to the furnace walls when heated. Many producers, moreover, are provided with lateral openings, having mica panes, through which the progress of combustion can be observed.

Air and Steam Blast.

In the Dowson system of producing the air and steam blast a steam boiler of 75 pounds pressure is required. This method of blowing, which is rather complicated, has the disadvantage of varying on feed with the pressure of the steam in the boiler, which necessarily varies somewhat. This is one reason why some manufacturers have designed plants in which fans and blowers are employed to produce the draft; but the chief reason is the desire to utilize the otherwise waste heat from the gas to vaporize the water, in which case the steam cannot be produced under pressure.

The blowers employed when steam under pressure is used, are of different designs, but they are nearly all based on the Koerting blower, shown in Fig. 5. The blower consists essentially of a tube through which the steam is supplied under pressure and a cylindro-conical blast pipe. As it escapes under pressure the steam is caught in the blast pipe, and draws with it a certain quantity of air, which can be regulated.

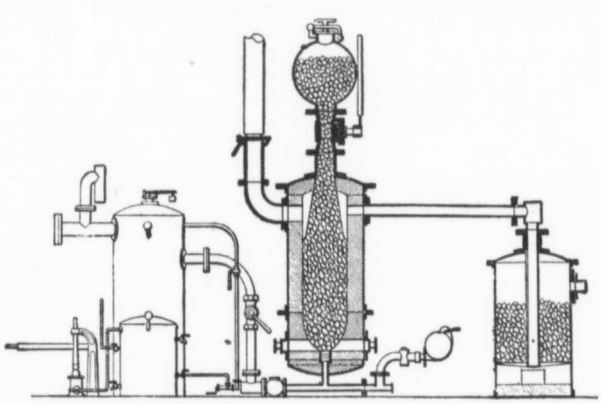

Fig. 6—The Gardie Producer.

Where the steam boiler is not used mechanical blowers are employed to produce the required blast. These are usually of the rotary type, but sometimes centrifugal fans are employed. In some producer installations the air blast is supplied under 70 to 90 pounds per square inch pressure. The Gardie producer shown in Fig. 6 is an example of this type of producer.

Washing and Purifying of Gas.

Ordinary methods of washing and purifying

*Thomas Rigby (connected with Crossley Bros. Ltd.,) in paper presented to Manchester Association of Engineers in 1905 on "Power Gas Plants."

†The authority for the detail description in this section is "Gas Engines and Producer Gas Plants" by R. E. Mathot.