PATENT SPECIFICATION

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499,018

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COMPLETE SPECIFICATION

Production of Gas by the Distillation or Gasification of Fuels of Varying Lump Size

We, DIDIER-WERKE AKTIENGESELLSCHAFT, a Company organised according to the Laws of Germany, of Westfälische Strasse 90, Berlin-Wilmersdorf, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to improvements in the continuous production of gas by the distillation or gasification of fuels of varying lump sizes. The invention is especially suitable for the continuous production of gas mixtures of definite composition, for example a synthesis gas employed as the initial gas in the production of hydrocarbons by synthetic processes, which gas contains hydrogen and carbon monoxide, usually in the ratio of two parts of hydrogen to one part of carbon monoxide. When generating such a synthesis gas from solid fuels it is obviously desirable to conduct the process in such a manner that the proportional composition of the gas generated does not vary from time to time.

One of the objects of the present invention is therefore to produce continuously a gas of uniform composition, more particularly a synthesis gas, by the known process in which the gases resulting from the distillation of solid fuels are led, either alone or together with other additional gases or vapours (for example, steam) through the incandescent coke residue resulting from the distillation of the fuel, whereby the initial gases are converted into the desired gas mixture.

The low grade fuels generally used for the production of synthesis gas (for example, brown coal or non-caking hard coals which may have a comparatively low content of volatiles) could hitherto only be used if they had a certain minimum lump size, because if the individual pieces of fuel were of too small a size, the resistance to the gases passing therethrough was too great, which resulted either in the gases taking too long a time to pass through the conversion zone in the retort, where undesired reactions took place, or, on the other hand, caused too high a pressure in the retort which led to a leakage of gas through the retort walls, or into the pre-drying chamber for the fuel usually provided above the inlet to the retort proper. In consequence, the fine components of the fuel (that is to say, usually particles under about 5 mm. lump size) had to be separated and this small sized fuel, unless briquetted and charged into the retorts in such form, could not be used for the generation of gas in known types of synthesis gas generating apparatus.

The present invention renders it possible to use small sized fuel also, and it is only necessary therefore to separate the dusty components from the fuel.

According to the present invention, a method for the continuous distillation or gasification of fuels of different lump sizes in retorts is characterised in this, that the different sizes of fuel are located in separated columns each of substantially uniform lump size situated side by side in the retort, and that the gas generated in the column or columns of small sized fuel passes in admixture with steam which is introduced into the small sized fuel, through the highly heated fuel of large lump size to a gas offtake situated in that part of the retort containing the large sized fuel.

The invention further comprises a retort for carrying out the process of the present invention, comprising a continuously-operating externally-heated vertical retort subdivided by a partition wall or walls containing apertures for the passage of the gas, into two or more sections, which sections receive the columns of fuel separated according to lump size, with a gas offtake or offtakes situated in the section of the retort which contains the largest sized fuel, below the level of the lowest aperture in the division wall or walls.

According to further subsidiary features of the present invention, the apertures in the division wall or walls can

[*Price* 1/-]

be regulated to control the passage of gas therethrough, and the division wall or walls may be continued below the level of the gas offtake, one or more apertures being provided in the part of each division wall below the gas offtake.

The columns of fuel which are situated side-by-side in the retort in accordance with the present invention, each consist of fuel of approximately similar lump size, but relatively to one another the columns of fuel exhibit a considerable difference in the average size of the lumps. The average sizes of the fuel in the column adjacent to the gas offtake and from which the gases are withdrawn is so chosen as to provide sufficient voids between the lumps to permit the evacuation of the gases from the retort without the employment of excessive suction or the generation of excessive pressures. For example, the size of the large-sized fuel may be 10—30 mm. diameter, whilst the small sized fuel is 2—10 mm. diameter. The dusty components which are previously separated from the fuel are the components in the range from 2—0 mm. diameter.

In one preferred embodiment of the present invention the interior of the retort is divided into two sections by a partition wall which contains a plurality of apertures. One section of the retort is charged with small sized fuel, and the other section with larged sized fuel, the gases from the section containing small sized fuel passing through the apertures in the partition wall into the column of large sized fuel. This arrangement has the advantage that distinct separation of the two columns of fuel is obtained, and further that the transition zone of the gases from the one fuel column into the other is accurately defined. The zones of gas formation and conversion can thereby be subjected to a greater degree of control and the gas flow through the retort can be regulated properly. As the resistance to gas flow is naturally greater in the small sized fuel, the gases are impelled to take a shorter path into the column of large sized fuel.

The position and number of the apertures in the partition wall are chosen according to the type of fuel to be treated, or the type of gas to be produced. Preferably, the size of the various apertures in the partition wall can be adjusted, and thus the height of the transition zone from one fuel column to another, and the amount of gas passing therethrough, can be regulated as required. Further, by such an arrangement the suction can be regulated to suit changes in the sizes of the fuels.

If the retort is preceded by a preheating or predrying chamber for the fuel, the partition wall in the retort is preferably extended into the preheating chamber, if desired, over the full height thereof, whereby a distinct separation of the columns of different lump sizes is effected throughout the height of the apparatus.

The invention is described with reference to the accompanying drawings, in which retorts suitable for the production of synthesis gas are illustrated. In the drawings:—

Figure 1 shows a vertical section through one embodiment in which the retort contains two fuel columns,

Figure 2 shows in vertical section a modification in which the retort contains three fuel columns, and

Figure 3 is a part section perpendicular to the plane of Figure 2 on the line A—A thereof.

Referring to Figure 1, the retort proper is indicated at 1, and above the retort is a predrying chamber 2. The retort 1 is divided by a vertical partition wall 3 into two sections 4 and 5 respectively. The partition wall 3 is continued upwards by the part 6 throughout the height of the predrying chamber 2. Two charging openings 7 and 8 are provided at the inlet to the predrying chamber, through which charging openings the fuel, separated according to lump size, is introduced. Small sized fuel is charged through the charging opening 8 into the section 9 of the predrier, from whence the fuel passes into section 5 of the retort. Large sized lump fuel is charged through the charging opening 7 and, after passing through the section 10 of the predrier, enters the section 4 of the retort. In the arrangement illustrated the partition wall 3 is continued by the portion 11 down to the base of the retort immediately above the outlet for the residue of the fuel, but the part of the partition wall 11 below the gas offtake 14 may be omitted if desired. The apertures in the partition wall 3 may be adjustable in size in the same manner as is described hereinafter with reference to Figures 2 and 3.

The retort 1 is externally heated. The gases formed by the distillation of the small sized fuel in the upper part of section 5 of the retort flow downwards through the incandescent residue of the fuel, which is already partly degasified, and which at a lower level is completely degasified. Steam is introduced into the reaction zone of the column of fuel through the openings 12 in the steam supply duct 13. For the sake of

simplicity, the steam supply 13 is shown as a pipe in the retort. The gases resulting from the distillation of the fuel, in reaction with the steam introduced as just described, are converted in the reaction zone by the contact with the incandescent fuel residue into the desired gas, for example, synthesis gas.

The gases then pass horizontally through the apertures in the partition wall 3 into section 4 of the retort, and there commingle with the distillation gases originating in the upper part of this section. Steam can also be introduced into this section of the retort, which steam, in conjunction with the incandescent residue of the fuel, effects the conversion of the distillation gases originating in section 4, and also completes the conversion of any incompletely converted gases from section 5 of the retort. Advantageously, the total gases then pass together some distance through the slowly descending incandescent fuel beneath the lowest aperture in the partition wall, and the gases are then led off through the gas offtake 14 in the chamber wall 15, which forms a boundary wall of section 4 of the retort. The pressure resulting from the heating of the fuel in the retort suffices to force the gases through section 5 of the retort into section 4, and also to impel the gases through the gas offtake 14, but if, in any case, the pressure so generated is insufficient on account of the smallness of the fuel employed, the use of a comparatively small suction on the gas offtake will suffice to conduct the gases along the path described.

On account of the partly-horizontally directed flow of the gases within the reaction zone of the retort, the path of the gases through this zone is extended as compared with retorts in which the gases flow only vertically; it is thereby possible to make the height of the retort less than would be necessary if the gas stream were led only in a vertical direction.

Figures 2 and 3 show a modification in which the retort, externally heated by the heating flues 16, is divided into three sections 17 and 18 by two partition walls 19.

The division walls 19 contain apertures 21. The dampers 20, which also contain a series of apertures corresponding to those in the division walls 19, are adjustable in position relatively to the apertures in the division walls. The two outer sections 17 of the retort are charged with small sized fuel, and the middle section 18 with large sized fuel. The fuel may be preheated in a pheating chamber as described with reference to Figure 1, which preheating device is subdivided into sections 17*a* and 18*a* corresponding to the sections of the retort. The gas offtake from the chamber 18 may be of the type described and claimed in our co-pending British Patent Application No. 8225/38 (Serial No. 494,896), and is formed by a horizontal duct 25 having a roof-shaped top, which duct communicates at one end with the gas outlet 25*a*.

Steam inlets 28 are provided to the upper parts of the sections 17 containing the small sized fuel, as described with reference to Figure 1. By adjusting the positions of the dampers 20, the size of the apertures in the division walls can be regulated as desired, and hence the gas flow from the small sized fuel into the large sized fuel can be regulated. If desired, the dampers 20 can be arranged to close certain of the apertures in the division walls to a greater or less extent than other apertures. The division walls 19 are continued below the gas offtake 25. Apertures 27 may be provided in these continuations of the division wall, especially if the charge in this region is steamed for the production of watergas. The residue of the fuel is removed by extractor mechanism below each section of the retort. The arrangement of Figure 2 renders it possible, with a minimum path for the gases in the sections containing the small sized fuel, to deal with a considerable quantity of such fuel per retort.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method for the continuous distillation or gasification of fuels of different lump sizes in retorts, characterised in this, that the different sizes of fuel are located in separated columns each of substantially uniform lump size situated side by side in the retort, and that the gas generated in the column or columns of small sized fuel passes in admixture with steam which is introduced into the small sized fuel, through the highly heated fuel of large lump size to a gas offtake situated in that part of the retort containing the large sized fuel.

2. A retort for carrying out the method of Claim 1, comprising a continuously-operating, externally-heated, vertical retort subdivided by a vertical partition wall or walls containing apertures for the passage of the gas, into two or more sections, which sections receive the columns of fuel separated according to lump size, with a gas off-

take or offtakes situated in the section of the retort which contains the largest sized fuel, below the level of the lowest aperture in the division wall or walls.

3. Retort as claimed in Claim 2, in which the apertures in the division wall or walls can be regulated to control the passage of gas therethrough.

4. Retort as claimed in Claim 2 or 3, in which the division wall or walls is or are continued below the level of the gas offtake, and one or more apertures are provided in the part of each division wall below the gas offtake.

5. Retort as claimed in Claim 2, 3 or 4, in which steam inlets are provided in the section or sections of the retort containing the small sized fuel.

6. Retort as claimed in Claim 2, 3, 4 or 5, in which a preheating chamber is provided for preheating the fuel prior to its entry into the retort, and the preheating chamber is subdivided by a partition wall or walls into sections corresponding to the sections of the retort.

7. Retort for the production of synthesis gas by the method claimed in Claim 1, comprising a continuously-operating, externally-heated, vertical retort subdivided into either two or three sections by a vertical partition wall or walls provided with apertures over part of their height at an intermediate level of the retort, one section, or the two outer sections of the retort receiving small sized fuel and the remaining section of the retort receiving large sized fuel, with a gas offtake from the section containing the larged sized fuel arranged below the level of the lowest aperture in the partition wall or walls, and steam inlets to the section or sections of the retort containing small sized fuel.

8. A method for the distillation or gasification of fuels of different lump sizes, substantially as described with reference to either Figure 1 or Figure 2 of the accompanying drawings.

9. A retort for carrying out the method of Claim 1, substantially as described with reference to Figure 1 of the accompanying drawings.

Dated this 11th day of July, 1938.
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Fig. 1.

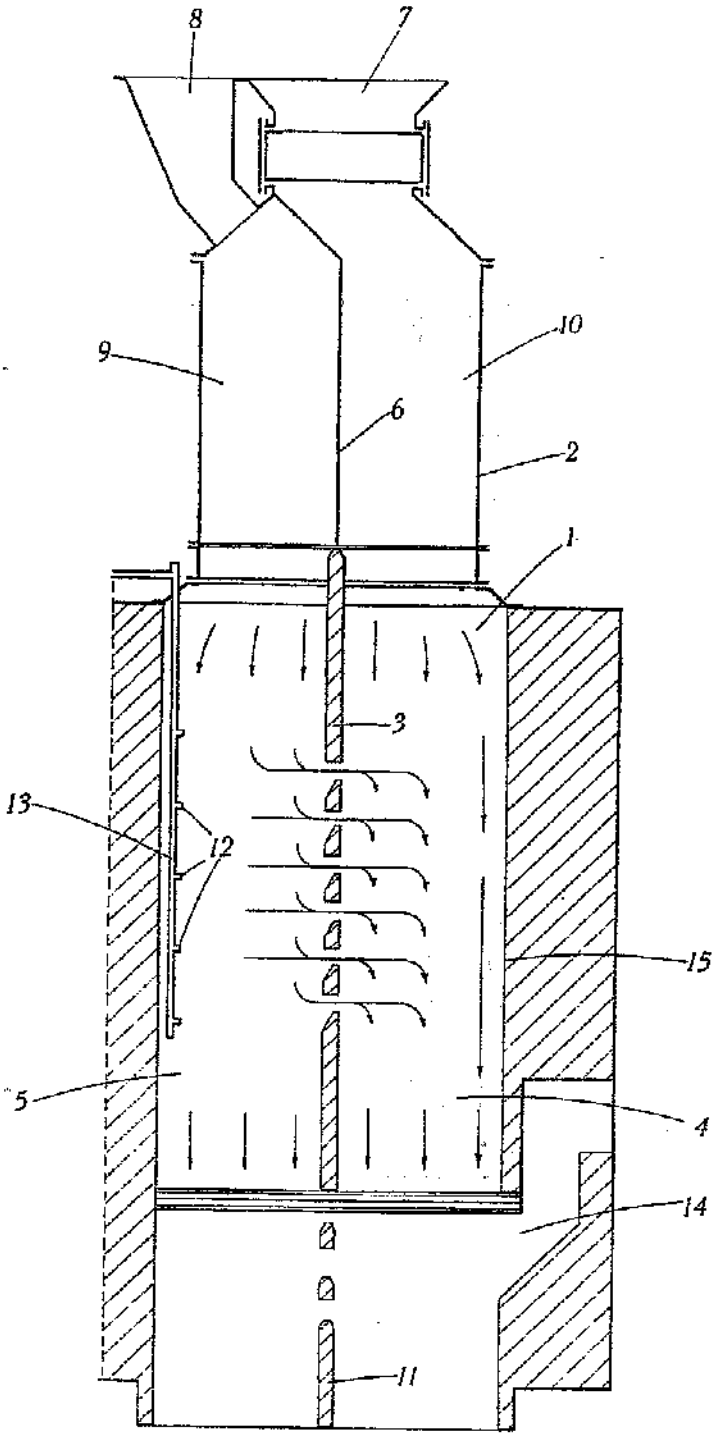


Fig. 2.

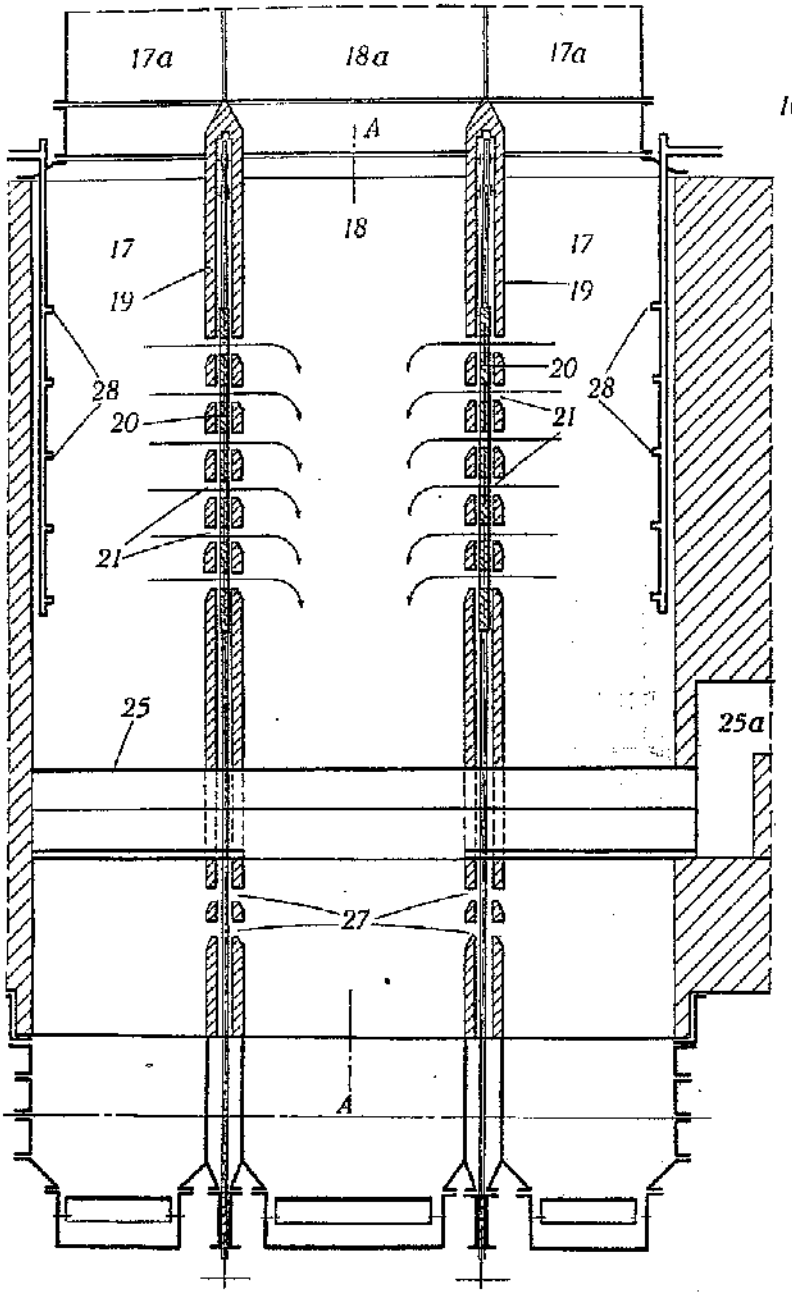
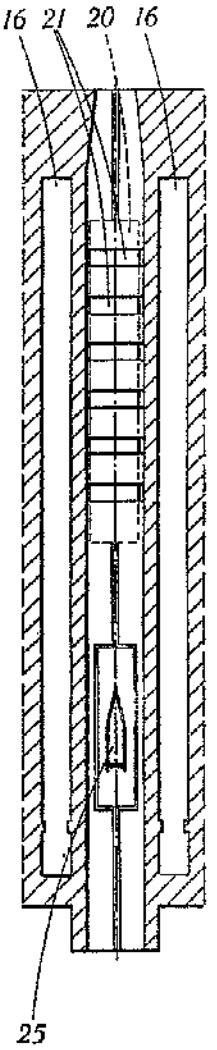


Fig. 3.



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499,018 COMPLETE SPECIFICATION

2 SHEETS
SHEET 2

SHEET 1

Fig. 1.

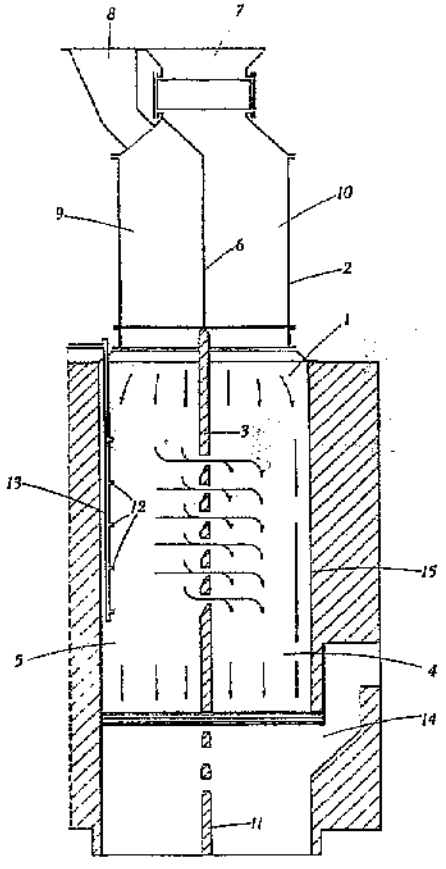


Fig. 2.

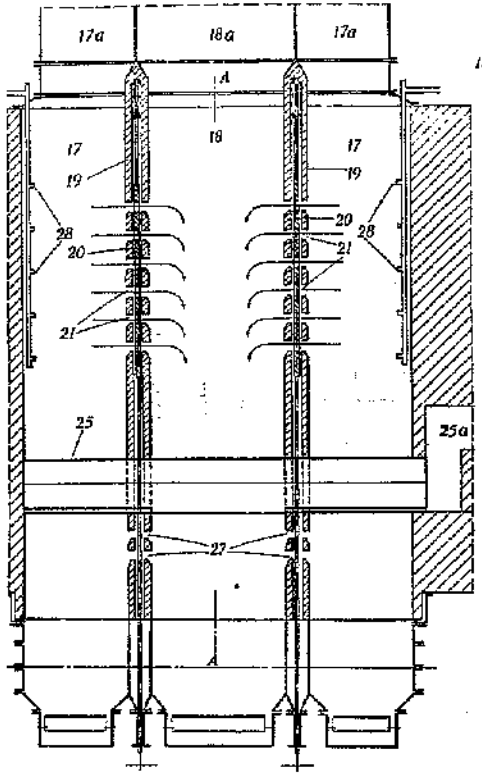
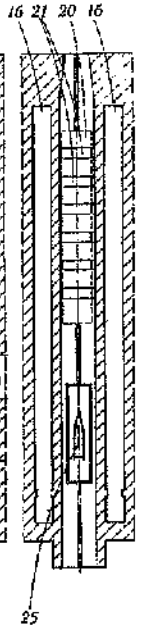


Fig. 3.



[This Drawing is a reproduction of the Original on a reduced scale.]

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