Dec. 3, 1929. P. PLANTINGA 1,738,202

PROCESS OF AND APPARATUS FOR CARBONIZING MATERIAL CONTAINING OIL, FAT, TAR, OR THE LIKE

Filed April 26, 1924

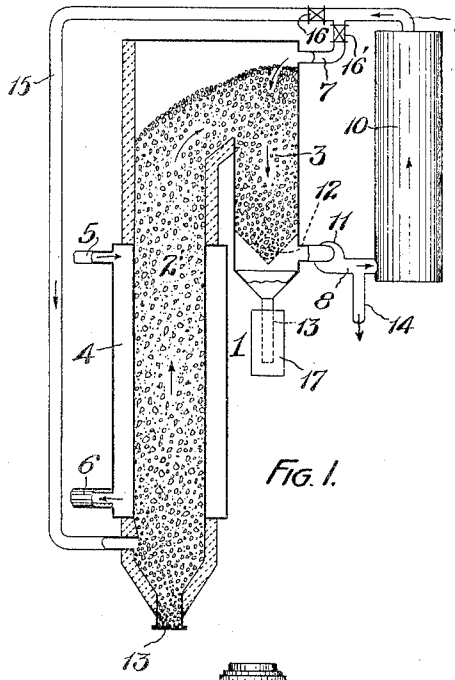


FIG. 1.

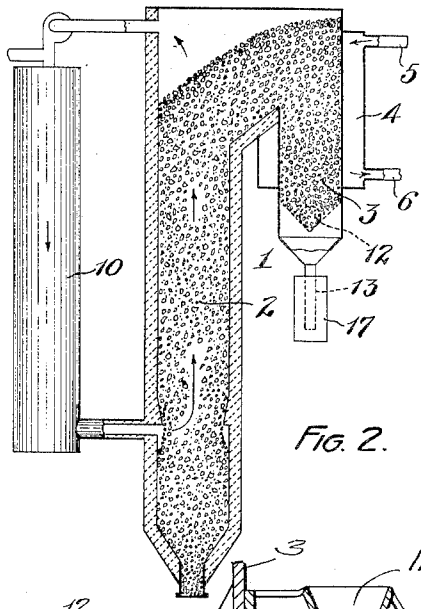


FIG. 2.

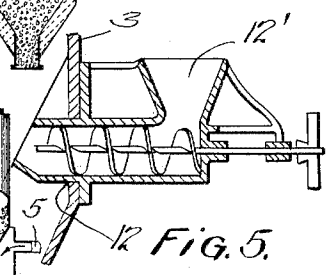


FIG. 5.

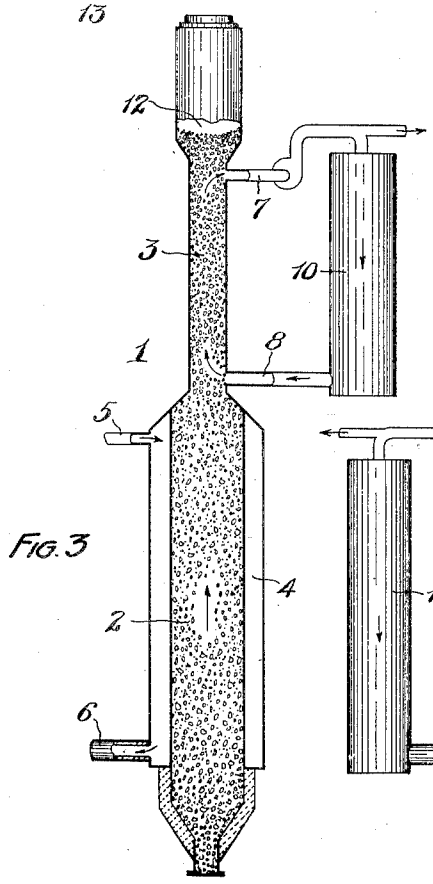


FIG. 3

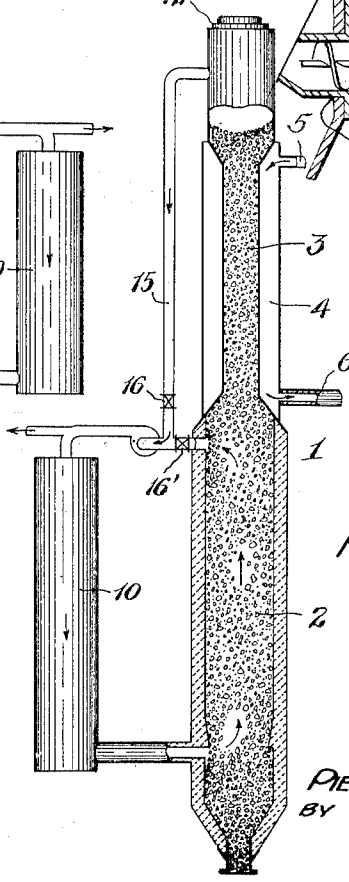


FIG. 4.

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UNITED STATES PATENT OFFICE

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PROCESS OF AND APPARATUS FOR CARBONIZING MATERIAL CONTAINING OIL, FAT, TAR, OR THE LIKE

Application filed April 26, 1924. Serial No. 709,077.

My invention relates to methods of and means for carbonizing material such as coal, shale, garbage, lignite, or similar substances, containing oil, tar, fats, or the like. The object of the invention is to provide a method and apparatus for such treatment whereby these contained substances may be recovered in the form of liquids or gas, or both, in an economical and efficient manner.

The said invention consists of a method and apparatus hereinafter fully described and particularly pointed out in the claims.

More specifically, my present invention consists of a modification of the invention shown, described and claimed in my pending application, Serial No. 700,965, filed March 21, 1924.

The annexed drawing and the following description set forth in detail certain means embodying my invention, embodying that part of my invention relating to the apparatus, the disclosed means, however, constituting but one of the various mechanical forms in which the principle of said part of the invention may be employed.

In the said annexed drawing:

Figure 1 represents diagrammatically, an apparatus for practicing my invention.

Fig. 2 represents, also diagrammatically, a modified form of said apparatus.

Similarly, Figs. 3 and 4 represent still further modifications.

Fig. 5 is a vertical section through a material charging device which may conveniently be employed with my invention; in this figure the device is shown associated with that form of my invention represented in Fig. 1.

The apparatus illustrated by Fig. 1 consists of a chamber 1 for carbonizing the material to be treated, having a main portion 2, which conveniently may be called a carbonizing chamber, and an offset portion 3, which may conveniently be called an auxiliary chamber, the apparatus having the general construction of an apparatus shown, described and claimed in my above-mentioned pending application.

The main portion 2 of the chamber is surrounded by a heating chamber 4 which may be connected with any suitable source of heat (not shown) as for example, a current of hot air, through an inlet 5 and an outlet 6.

The top and bottom of the interior of the offset portion 3 is connected by means of ducts 7 and 8 respectively, with a heater 10, by means of which and a suitable blower 11, a heated gas may be circulated through the offset portion and the material therein. A suitable charging opening 12 is provided in the portion 3 for the introduction of the material in any suitable and well known manner, for example, by means of the charging device 12′ shown in Fig. 5, and a suitable outlet 13 is provided at the bottom of the portion 2 for the withdrawal of the residuum after the material has been treated. The charging device shown in Fig. 5, which is a vertical section through opening 12 and chamber 3 of Fig. 1, is merely illustrative of one of several suitable forms of charging device which may be employed with my invention.

A suitable gas outlet 14 is provided in the duct 8 for taking off the gas produced.

In operating the above described apparatus, the material in the portion 2 of the chamber is heated by means of the exterior heating chamber 4 to the degree required to distill the material therein and volatilize the volatilizable substances carried thereby. A flow of gas is thus induced which travels upwardly through the portion 2, then downwardly through the offset portion 3, and then again to the heater, the excess gas being taken off through the gas outlet 14. In the chamber 3, the products distilled from the carbonizable material are liquefied and the newly introduced material is heated during its passage towards the carbonizing chamber 2.

The above described apparatus may be modified by providing an auxiliary duct 15 provided with a valve 16 and connected at one end with the duct 7 (which is provided with a valve 16′) and at the other end with the bottom part 2 of the chamber 1. By opening the valve 16, and then closing valve 16′, the gas, in addition to circulating through the portion 3, also circulates through the entire chamber 1, as will be understood. Both valves may be opened, so that part of the

heated gas may pass through the portion 3 and part through the entire chamber.

In Fig. 2 I have illustrated a modification of the above described apparatus, wherein the offset portion 3 is provided with the exterior heating chamber 4 and the main portion 2 connected interiorly with the heater 10. In this case, the process is similar to that first described excepting that the parts 2 and 3 are respectively interiorly and exteriorly heated instead of exteriorly and interiorly respectively.

In Fig. 3 I have shown a further modification wherein the entire chamber is upright, the part 3 being above the part 2 as shown. The heater 10 is connected with the upper and lower ends of part 3 and the part 2 provided with the heating chamber 4 as is the case of the device illustrated by Fig. 1, and the material being fed into the apparatus at the top charging opening 12. In this case the process would be the same described in connection with Fig. 1.

In Fig. 4, I have shown a modification of the apparatus of Fig. 3, such modification being similar to that effected by the apparatus of Fig. 2 over that of Fig. 1. In this case, therefore, the lower part 2 is connected with the heater 10 and interiorly heated, and the upper part 3 provided with the heating chamber 4.

The last described device may be modified as in the case of the apparatus of Fig. 1, by providing the auxiliary duct 15 and the valves 16 and 16′ so that gas may be caused to circulate entirely through the whole chamber 1 in addition to circulating specifically through the part 2, or only through the lower chamber portion.

In the forms of apparatus shown in Figs. 1 and 2, a suitable receptacle 17 is provided below the chamber portion 3 into which the outlet 13 discharges, and which receives the liquids formed by condensation in said chamber portion 3, all as described in my said above mentioned pending application.

It will thus be seen that in each of the above mentioned apparatuses, a part of the carbonization takes place in one part of the chamber as a result of the heated gas passing through the materials in such chamber part, which gas imparts its heat to the material by direct contact, and that another part of the carbonization takes place in another part of the chamber as a result of heat conducted to the material in said chamber part from a heating medium applied externally to said part.

In the form of apparatus shown in Figs. 1 and 2, the temperature of the heating medium applied to the offset portion 3 of the chamber may be so regulated as to recover such part as may be desired or all of the gases passing through the material in part 3 as are capable of condensation into a liquid, as will be readily understood by those skilled in the art.

In the form of apparatus shown in Figs. 3 and 4, the temperature of the heating medium applied to part 3 of the chamber may be so regulated that all of the vaporizable material, including those which are capable of condensation into a liquid, pass out of the apparatus, after which all or such part as may be desired of the condensable material may be recovered by any suitable apparatus, as will be understood by those skilled in the art.

What I claim is:

1. In a process of carbonizing solid carbonizable material in a container comprising a carbonizing chamber and a communicating auxiliary chamber so related to the carbonizing chamber that liquids formed in the auxiliary chamber will not run by gravity into the carbonizing chamber, and in which the solid carbonizable material is fed into the auxiliary chamber and in a continuous body therethrough and then into and through the carbonizing chamber, the improvement which comprises, passing a hot gas substantially chemically inert with respect to said carbonizable material through the body of the latter in a direction opposite to the feed thereof, reheating said gas externally of the container alternately to the successive passages of the gas through the container, said gas being circulated in an endless conduit, liquefying in the auxiliary chamber the products distilled from the carbonizable material, causing the liquids formed in the auxiliary chamber to move by gravity toward the material inlet of said auxiliary chamber, collecting and drawing off the liquid from the auxiliary chamber, and applying carbonizing heat to the exterior of one of said chambers.

2. In a process of carbonizing solid carbonizable material in a container comprising a carbonizing chamber and a communicating auxiliary chamber so related to the carbonizing chamber that liquids formed in the auxiliary chamber will not run by gravity into the carbonizing chamber, and in which the solid carbonizable material is fed into the auxiliary chamber and in a continuous body therethrough and then into and through the carbonizing chamber, the improvement which comprises, passing a hot gas substantially chemically inert with respect to said carbonizable material through the body of the latter in a direction opposite to the feed thereof, reheating said gas externally of the container alternately to the successive passages of the gas through the container, said gas being circulated in an endless conduit, bypassing the carbonizing chamber with an additional amount of hot gas derived from said endless conduit, said additional gas being passed through said auxiliary chamber in a direction opposite to the feed of the material therethrough, liquefying in the auxiliary chamber the products distilled from the carbonizable material, causing the liquids

formed in the auxiliary chamber to move by gravity toward the material inlet of the auxiliary chamber, collecting and drawing off the liquid from the auxiliary chamber, and applying carbonizing heat to the exterior of said carbonizing chamber.

3. In a process of carbonizing solid carbonizable material in a container comprising a carbonizing chamber and a communicating auxiliary chamber so related to the carbonizing chamber that liquids formed in the auxiliary chamber will not run by gravity into the carbonizing chamber, and in which the solid carbonizable material is fed into the auxiliary chamber and in a continuous body therethrough and then into and through the carbonizing chamber, the improvement which comprises, passing a hot gas substantially chemically inert with respect to said carbonizable material through the body of the latter in one of said chambers in a direction opposite to the feed of the material therethrough, reheating said gas externally of the container alternately to the successive passages of the gas through said one chamber, said gas being circulated in an endless conduit, liquefying in the auxiliary chamber the products distilled from the carbonizable material, causing the liquids formed in the auxiliary chamber to move by gravity toward the material inlet of the condensing chamber, and applying carbonizing heat to the exterior of that chamber through which the hot gas is not passed.

4. Apparatus for carbonizing solid carbonizable material comprising an imperforate container formed with a carbonizing chamber and a communicating auxiliary chamber so related to the carbonizing chamber that liquids formed in the auxiliary chamber will not run by gravity into the carbonizing chamber; means for feeding solid carbonizable material into the auxiliary chamber and in a continuous body therethrough and then into and through the carbonizing chamber; means for externally heating one of said chambers; means for heating and circulating a gas through the other of said chambers; and means for collecting and drawing off liquids from said auxiliary chamber.

5. Apparatus for carbonizing solid carbonizable material comprising an imperforate container formed with a carbonizing chamber and a communicating auxiliary chamber so related to the carbonizing chamber that liquids formed in the auxiliary chamber will not run by gravity into the carbonizing chamber; means for feeding solid carbonizable material into the auxiliary chamber and in a continuous body therethrough and then into and through the carbonizing chamber; means for externally heating the carbonizing chamber; means for heating and circulating a gas through the container in a direction opposite to the feed of the carbonizable material therethrough; means for bypassing the carbonizing chamber with hot gas; means for passing said last-mentioned hot gas through the auxiliary chamber; and means for collecting and drawing off liquids from the auxiliary chamber.

Signed by me this fourteenth day of April, 1924.

PIERRE PLANTINGA.