

G. W. WALLACE.
 PROCESS FOR CARBONIZING CARBONACEOUS MATERIALS.
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1,358,663.

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Fig. 1.

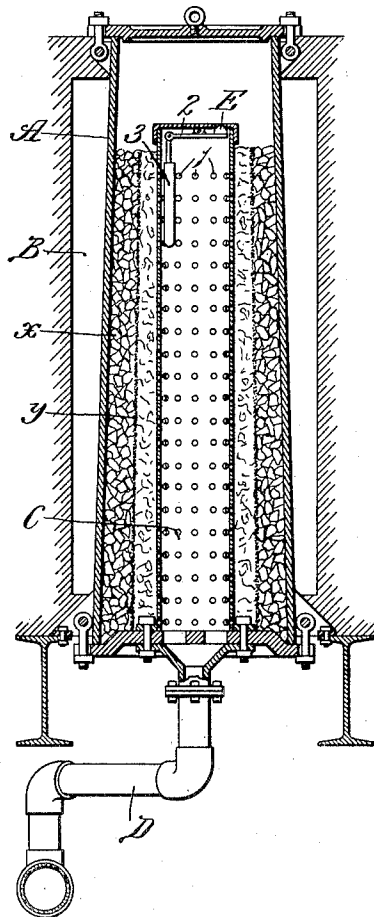


Fig. 2.

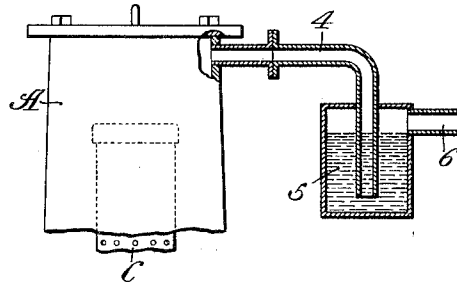
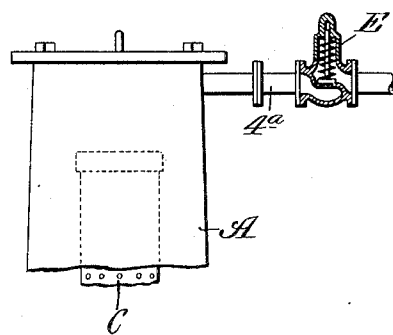


Fig. 3.



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PROCESS FOR CARBONIZING CARBONACEOUS MATERIALS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GEORGE W. WALLACE, a citizen of the United States, residing at East St. Louis, Illinois, have invented a certain new and useful Improvement in Processes for Carbonizing Carbonaceous Materials, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to the carbonization or distillation of carbonaceous materials, more particularly, the production of oil and coke from coal.

In my prior U. S. Patent No. 1,283,001, dated October 29, 1918, I have described a process for distilling, carbonizing or vaporizing carbonaceous materials such as coals, lignites, oils and shales, which process consists in heating carbonaceous material in a closed chamber or retort and subjecting said material to such treatment that the evolved gases, vapors and liquids are removed before they can undergo secondary decomposition. This is effected by causing the evolved gases, vapors and liquids to escape from the chamber by traveling through the coolest portion of the material in the chamber into a take-off duct and thence immediately escape from said chamber through a suction pipe that communicates with one end of said take-off duct. The heat is applied externally to the side wall of the chamber or retort that holds the material, and consequently, the material therein, if fusible, becomes coked progressively, as the heat penetrates through said material, the heat causing the material to fuse into a putty-like, impervious mass, and thereafter turn into coke. As the process proceeds the coking zone, represented by the fused material, moves inwardly progressively, toward the center take-off duct, thus leaving a body of coke in the zone outside of the coking zone, or, in other words, in the space between the heated walls of the retort and the fused mass of material that is being converted into coke.

In using the process above referred to for the carbonization of coal, manufacture of coke and production of oil from bituminous substances which fuse upon being subjected to a high temperature, I have discovered that in some instances gases continue to evolve from the material that has passed through the coking stage and that said

gases produce a back pressure in the outer zone lying beyond the coking zone. If this back pressure becomes relatively high the gases that are evolved in the outer zone are forced through the coking zone, thereby producing fissures or cracks in the fused mass in the coking zone. These fissures or cracks, when first formed, are very slight, but as the material continues to shrink as the coking operation proceeds, they open up or become wider, thereby causing the coke that is produced by the process to be fragile and in the form of small pieces. Moreover, the back pressure that is sometimes produced in the zone outside of the coking zone seems to increase the time required to carbonize or distil the material in the retort.

The main object of my present invention is to provide a process for distilling, carbonizing or vaporizing solid carbonaceous materials that has the good features and characteristics of the process described in my prior patent above referred to, namely, prevents the evolved gases, vapors and liquids from undergoing secondary decomposition, and which insures the production of a good grade of coke, when coal is the carbonaceous material distilled, even though gases are evolved in the zone outside of the coking zone.

Another object is to provide a novel apparatus for distilling, carbonizing or vaporizing solid carbonaceous material.

To this end I have devised a process which consists in heating carbonaceous material in a closed chamber or retort, withdrawing under reduced pressure the gases, vapors and liquids evolved from the material in the coking zone and causing said gases, vapors and liquids to travel through the coolest portion of the material in the chamber into a take-off duct through which they immediately escape from the apparatus, and preventing a back pressure from being created in the zone outside of the coking zone of sufficient force to cause the gases in said outer zone to break through and disrupt the fused material in the coking zone at the critical time in the process at which any disturbance of the coking material will have a permanent effect on the structure of the coke produced by the process. I have also devised an apparatus for practising my process, which apparatus consists of a closed chamber or retort, a perforated take-off duct arranged inside of said chamber and con-

nected at one end to a suction-producing device and means that provides an exit for the relatively small amount of gases that are evolved in the zone outside of the coking zone.

Figure 1 of the drawings is a vertical sectional view of an apparatus that can be used in practicing my present process; and

Figs. 2 and 3 are side elevational views, partly in section, illustrating other means that can be used for preventing pressure from building up in the zone outside of the coking zone.

The apparatus shown in Fig. 1 comprises a closed chamber or retort A that is adapted to contain carbonaceous material, means for heating the side wall of said chamber, such, for example, as a combustion chamber B to which products of combustion are supplied, a perforated take-off duct C arranged preferably at the center of the chamber A and having its lower end communicating with an eduction pipe D which is connected with a suction-producing device (not shown) and a valve E at the upper end of the take-off duct C that opens automatically under certain conditions, and thus prevents pressure from building up in the retort sufficiently to disrupt the fused material in the coking zone.

When heat is applied to the walls of the chamber A the material in said chamber will become coked progressively as the heat penetrates inwardly through said material, the heat causing said material to first fuse into a putty-like, impervious mass and then turn into coke. The gases, vapors and liquids that are evolved from the material during the coking operation are drawn into the take-off duct C through the perforations therein, and thence travel downwardly through said take-off duct to the eduction pipe D through which they are conveyed away from the apparatus. In view of the fact that the take-off duct is arranged at the center of the chamber A at the coolest part of the body of material in said chamber, and as said take-off duct communicates at one end with a suction-producing device, the gases, vapors and liquids that are evolved from the material which is passing through the coking stage travel through the coolest portion of the material in the chamber A during the operation of escaping from said chamber, thus causing a reduction in the temperature of the gases, vapors and liquids below the initial temperature of formation, and consequently, preventing any further breaking down of the hydrocarbon molecules. Owing to the fact that the liquids are immediately conducted out of the apparatus through a take-off duct which is so formed that no liquids can collect and remain therein, there is no possibility of the liquids condensing, revaporizing or becoming cracked or mixed with the material in

the chamber A that surrounds the take-off duct.

In the event that a back pressure is created in the zone x outside of the coking zone represented by the mass of fused material y that is being converted into coke, the valve E in the upper end of the take-off duct C will open automatically before said back pressure reaches such a degree that it will cause the gases evolved in the zone x to be forced through the fused material y in the coking zone, thereby automatically relieving the pressure in the portion of the chamber A between the side wall of said chamber and the fused material in the coking zone y . Consequently, the coke that is produced by my present process will be firm and in the form of large pieces, as it is impossible for sufficient back pressure to be developed in the chamber A to cause the gases that are evolved in the zone x to be forced through the coking zone, and thus produce fissures or cracks in the fused material y at the critical time at which any disturbance of the coking mass will have a permanent affect on the structure of the coke. The percentage of gases that are evolved in the outer zone x is relatively small,—never in excess of five per cent. of the total gases and vapors evolved from the material in the chamber A. When the relief valve E is arranged in the upper end of the take-off duct, as herein shown, there is no loss of gases, as the gases which escape through the port controlled by said relief valve enter the take-off duct C. In all other respects my present process is the same as the process described in my prior U. S. patent above referred to, as it insures the removal of the major portion of the evolved gases, liquids and vapors in such a manner that they pass through the coolest zone in the chamber A in escaping therefrom and are immediately removed from the apparatus before secondary decomposition can occur, namely, before the hydrocarbon molecules in the gases can break down and before the liquids can condense, revaporize, become cracked or mixed with the material in the chamber A that surrounds the take-off duct.

In the apparatus shown in Fig. 1 the means for relieving the pressure that develops in the zone outside of the coking zone consists of a valve E that is arranged in the upper end of the take-off duct, as previously described, said valve being carried by a pivotally mounted device 2 that is equipped with a weight 3 which normally holds the valve E seated. Various other means can be used, however, for relieving the pressure in the chamber A, and therefore, I have illustrated in Fig. 2 of the drawings an apparatus in which the chamber A is provided adjacent its upper end with a discharge pipe 4 that passes through a water seal 5 which is provided at its upper end with an outlet

pipe 6. In such an apparatus the relatively small amount of gases that are evolved in the outer zone X escape from the upper end of the chamber A through the discharge pipe 4. In Fig. 3 of the drawings I have shown still another way of relieving the pressure in the chamber A, the apparatus shown in Fig. 3 being provided with a spring-actuated relief valve E' that is arranged in a discharge pipe 4^a which leads from the upper end of the chamber A, said valve E' being normally seated, but being capable of opening automatically so as to relieve the pressure in the chamber A in the manner previously described.

I do not wish it to be understood that the process described in my prior U. S. Patent No. 1,283,001, dated October 29, 1918 is inoperative or fails to produce the results described in said patent, for said process works perfectly on oil shale, cannel coal and oil bearing sands. In some instances, however, particularly in the production of oils and coke from coal, the results obtained by my said prior process are not always uniform, and it is the purpose of my present invention to make my prior process more perfect and uniform by providing means for eliminating the possibility of the structure of the coke being affected or the time required to carbonize or distil the material being increased by the gases which are sometimes evolved from the material outside of the coking zone.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A process for distilling, carbonizing or vaporizing solid carbonaceous materials, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, causing the gases, vapors and liquids that are evolved from the material in the coking zone to travel through the coolest portion of the material in said chamber into a take-off duct, immediately removing the gases, vapors and liquids from said take-off duct, and preventing pressure from building up in said chamber sufficiently to disrupt or form fissures in the fused mass in the coking zone.

2. A process for distilling, carbonizing or vaporizing solid carbonaceous materials, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, causing the gases, vapors and liquids that are evolved from the material in the coking zone to travel through the coolest portion of the material in said chamber into a perforated discharge passageway and then escape from said discharge passageway before secondary decomposition can take place and before the liquids can escape from said passageway back into said chamber and mix with the

material therein, and automatically relieving the pressure produced in said chamber by the gases evolved from the material outside of the coking zone.

3. A process for distilling, carbonizing or vaporizing solid carbonaceous materials, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, withdrawing under reduced pressure the gases, vapors and liquids that are evolved from the material in the coking zone, removing said gases, vapors and liquids before they can undergo secondary decomposition in escaping from the chamber, and controlling or governing the pressure that is produced in said chamber between the outer wall thereof and the fused mass of material in the coking zone; for the purpose described.

4. A process for distilling, carbonizing or vaporizing solid carbonaceous materials, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, causing the gases, vapors and liquids that are evolved from the material in the coking zone to travel through the coolest portion of the material in said chamber into a discharge passageway, immediately removing said gases, vapors and liquids from said passageway, and permitting the gases that are evolved from the material outside of the coking zone to escape automatically before the pressure in said chamber becomes great enough to force said gases through the fused material in the coking zone.

5. A process for distilling, carbonizing or vaporizing solid carbonaceous material, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, withdrawing under reduced pressure the gases, vapors and liquids evolved from the material in the coking zone and causing them to travel through the coolest portion of the material in said chamber into a conduit through which they are immediately removed from the apparatus, and preventing the gases that are evolved in the zone outside of the coking zone from breaking through the fused material in the coking zone and thus disrupting or forming fissures in same.

6. A process for distilling, carbonizing or vaporizing solid carbonaceous material, characterized by applying heat externally to a chamber in which solid carbonaceous material is arranged, causing the gases, vapors and liquids evolved from the material in the coking zone to travel through the coolest portion of the material in said chamber into a perforated take-off duct and thence flow downwardly through said take-off duct into a conduit through which they are immediately conducted away from the apparatus, and permitting some of the gases

that are evolved in the zone outside of the coking zone to escape from said chamber from time to time, thereby preventing an abnormal back pressure from being created outside of the coking zone.

7. An apparatus for distilling, carbonizing or vaporizing solid carbonaceous materials, comprising a chamber or retort that is adapted to receive solid carbonaceous material, a perforated take-off duct arranged in said chamber and having its lower end communicating with a suction conduit, and a relief valve arranged adjacent the upper end of said chamber; for the purpose described.

8. An apparatus for distilling, carbonizing or vaporizing solid carbonaceous materials, comprising a chamber or retort that is adapted to receive solid carbonaceous material, means for externally heating said chamber, means for causing the gases, vapors and liquids evolved from the material

in the coking zone to travel through the coolest portion of the material in said chamber and escape from the apparatus before said gases, vapors and liquids can undergo secondary decomposition, and means for preventing pressure from building up in said chamber sufficiently to disrupt or form fissures in the fused mass in the coking zone.

9. An apparatus for distilling, carbonizing or vaporizing solid carbonaceous materials, comprising a chamber or retort that is adapted to receive solid carbonaceous material, a perforated take-off duct that constitutes the sole outlet for the gases, vapors and liquids evolved from the material in the coking zone, the lower end of said take-off duct communicating with a suction conduit, and means for automatically relieving pressure produced in said chamber by the gases evolved from the material outside of the coking zone.

GEORGE W. WALLACE