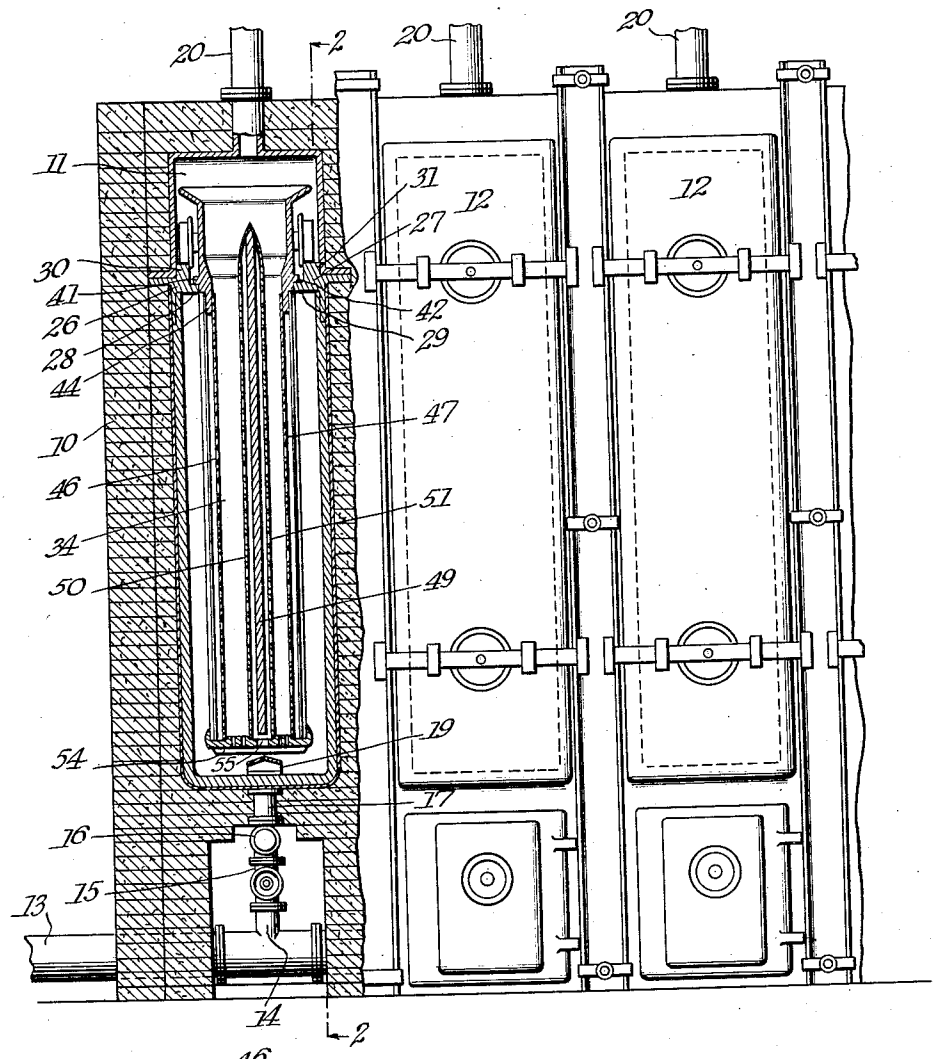
Oct. 25, 1932. J. E. LOUTTIT ET AL 1,884,017

PROCESS OF DISTILLATION OF COAL

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Fig. 1.



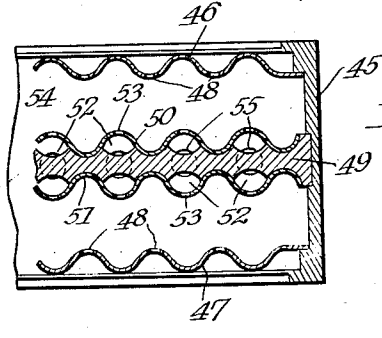


Fig. 4.

Inventor

James E. Louttit.

Elmer H. Records.

By Cushman, Darby & Darby

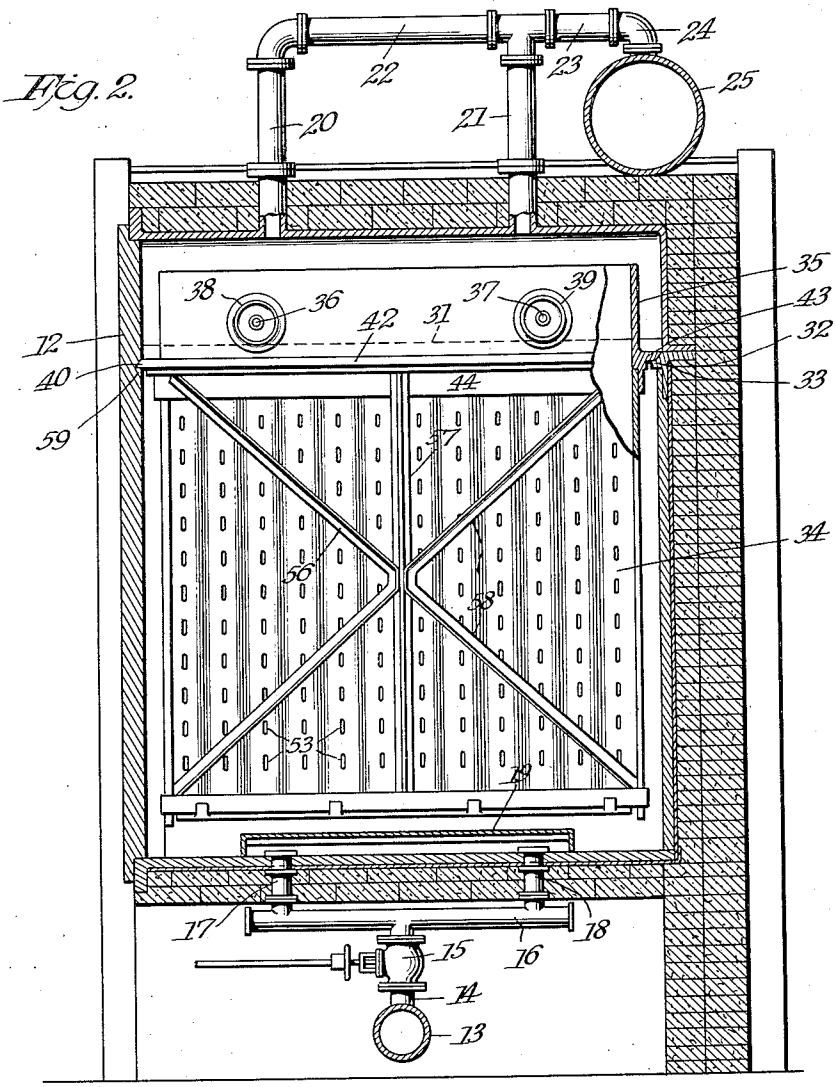
Attorneys

Oct. 25, 1932. J. E. LOUTTIT ET AL 1,884,017

PROCESS OF DISTILLATION OF COAL

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Fig. 2.



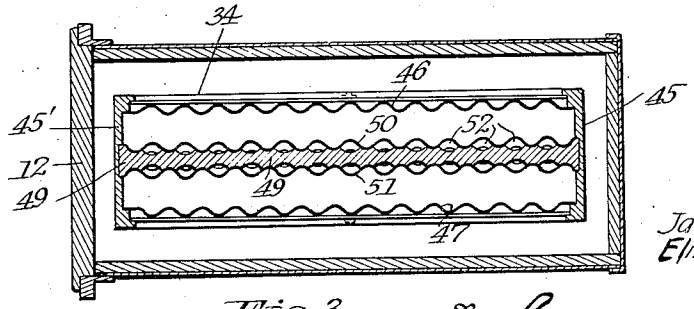


Fig. 3.

Inventor

James E. Louttit.
Elmer H. Records.

By Cushman, Darby & Cushman

Attorneys

Oct. 25, 1932. J. E. LOUTTIT ET AL 1,884,017

PROCESS OF DISTILLATION OF COAL

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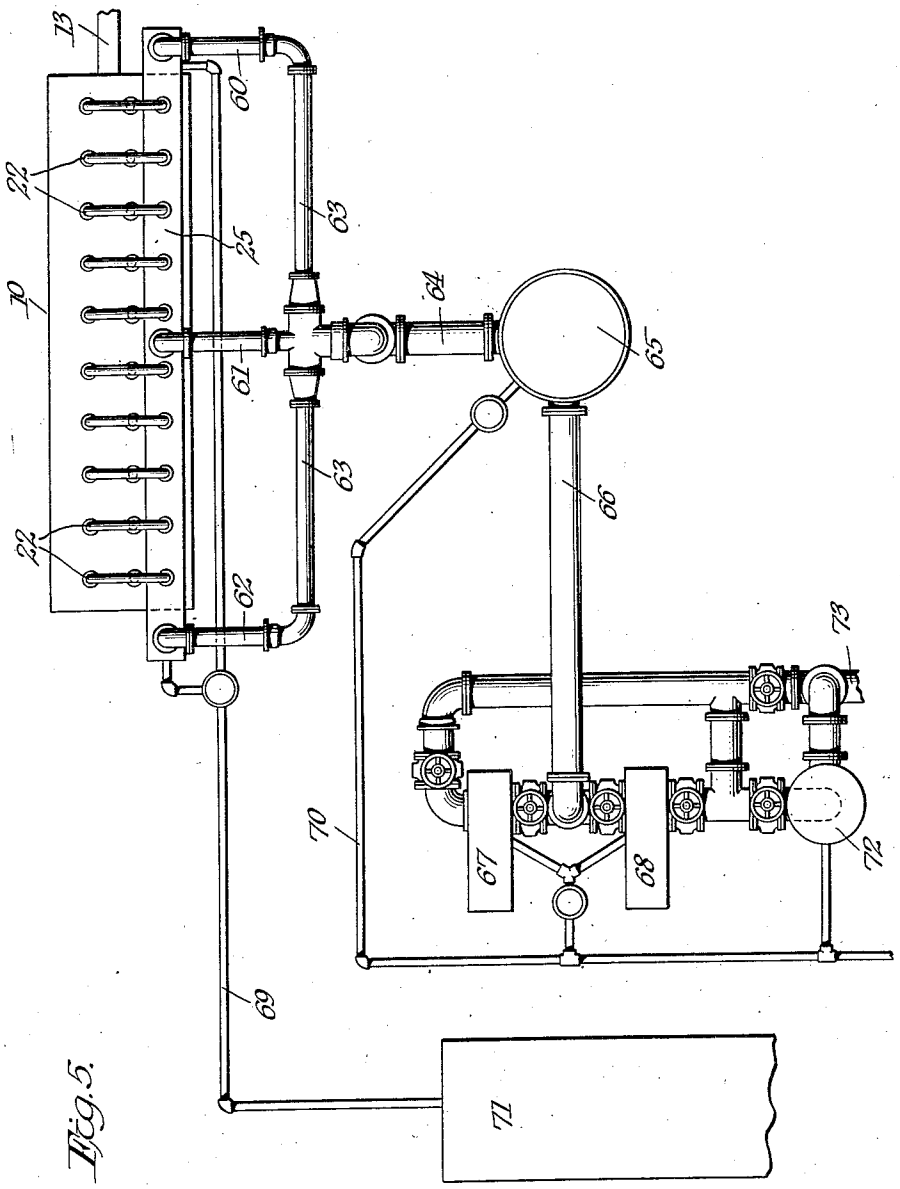


Fig. 5.

Inventor

James E. Louttit
Elmer H. Records

By Coleman, Bryant & Darby

Attorneys

Patented Oct. 25, 1932

1,884,017

UNITED STATES PATENT OFFICE

JAMES E. LOUTTIT AND ELMER H. RECORDS, OF SPOKANE, WASHINGTON

PROCESS OF DISTILLATION OF COAL

Application filed January 14, 1929. Serial No. 332,327.

The present invention relates to a process for the destructive distillation of coal and similar carbonaceous substances, wherein superheated steam is utilized as the sole heating medium. The invention also relates to certain improvements in retorts and removable charge containers therefor particularly designed for the efficient practice of our improved process.

The use of superheated steam as the heating agent in carbonization processes, is, of course, not new in itself, and the present invention is concerned only with certain improvements in the general method which lead to vastly superior results than hitherto obtainable. Prior distillation systems utilizing superheated steam as the sole heating agents have possessed certain inherent defects which have been a bar to efficient operation. According to certain prior processes, superheated steam is passed through a large mass of coal, or is passed in a continuous circuit through a number of comparatively small separately confined masses. The unavoidable and inefficient result in each instance, is that the first formed gases undergo secondary reactions in their subsequent passage through the coal mass or masses, such reactions affecting adversely the ultimate quantity of the gaseous products. In another instance, of which we are aware, the superheated steam is passed indiscriminately into contact with coal confined in a battery of containers of relatively small dimensions, but here also the same secondary reactions occur and, furthermore, in this latter instance, the lack of suitable directing means for the steam enables more or less of it to pass directly to the condenser without coming into direct contact with the coal at all.

Extended experiments and careful checking of results have convinced us that efficient operation can only be secured when the process is so carried out as to avoid secondary reactions in the evolved gases, and when the entire volume of the supplied steam is passed quickly and under relatively low pressure in contact with all the constituent elements of the coal body. Consequently, according to our improved process, a given quantity of coal is sub-divided into small confined masses preferably in the form of vertically disposed mutually isolated layers. Superheated steam at a temperature of 700° F., or over and at a pressure of from one to five pounds per square inch above atmospheric pressure is conducted in a separate current to each of the confined masses, so that each of the latter receives fresh steam directly from the source of suply, and the entire volume of the supplied steam is brought into contact with all of the constituent elements of the masses. The steam is passed quickly through each of the masses, and emerges therefrom in separate paths to be conducted directly to an initial point of treatment. Since we find low operating pressure to be a desideratum, and since, at the same time, rapid passage of the steam through the confined masses is a feature of importance, we preferably provide suction means in the outlet line for drawing the steam through the coal masses.

The superheated steam in its passage through the coal masses, combines in part with some of the distilled tar and hydrocarbon vapors to form an industrial gas of extremely high calorific intensity, the ultimate gas being generally similar to a mechanical mixture of coal gas and water gas, but having a specifically different analysis. The residues are in the form of a smokeless fuel commonly known as "coalite", which is easily ignited and burns slowly under light draft. It contains a high percentage of carbon with sufficient of the volatile hydrocarbons left in to give it the burning quantities mentioned. Of course, the process may be carried to a point of complete volatilization, but it is preferably stopped at such a point as to yield a residue having the characteristics mentioned above.

The volatilization of the lighter oils and hydrocarbons and the volatilization of the heavier oils and products are secured at their various temperatures in one operation.

A particular advantage is that fuels such as lignite and low grade bituminous coal can be very profitably treated in accordance with the present process. In all cases, a particularly large yield of valuable fuel gas is se-

cured as well as the valuable coalite residue and the tar by-products. In all instances, our improved process is particularly economical in time and labor requirements. It may be carried out in from thirty minutes to three hours, depending upon the type of coal to be carbonized.

We have illustrated in the accompanying drawings improved apparatus for carrying out the described process, and in these drawings.

Figure 1 is a side elevation of a portion of a retort comprising a series of retort chambers, one of the chambers being shown in vertical section.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a horizontal section through one of the retort chambers.

Figure 4 is an enlarged view of a portion of the removable charge container shown in Figure 3, and

Figure 5 is a top plan view of the retort end of a complete installation.

The retort-generator may suitably comprise a brick structure 10 provided with a series of retort chambers as at 11, these chambers being of substantial height and depth, but of relatively small width and provided with front openings adapted to be closed by doors 12. A pipe 13 is connected directly with a source of superheated steam supply and extends beneath all of the chambers 11. Beneath each chamber a branch pipe 14 is connected into pipe 13, this branch being adapted to supply superheated steam to the superposed chamber through control valve 15, distributor head 16 and branches 17 and 18. Preferably, a baffle 19 is arranged at the bottom of the chamber in position to break the force of and divert the incoming steam. Each chamber is preferably equipped with a plurality of outlets as at 20 and 21, Figure 2, these being connected by means of pipe lengths 22, 25 and elbow 24 with a header 25.

Adjacent the upper end of each chamber, castings 26 and 27 are supported by the chamber walls, these castings running from the front to the rear of the chamber and presenting flanges 28 and 29 and guide-rail portions 30 and 31. The rear wall of the chamber has set therein a casting 32, Figure 2, which presents a flange 33 in directly interposed relation to the inner ends of flanges 28 and 29.

The reference numeral 34 designates as a whole a removable charge container, one being adapted to be positioned within each chamber 11. This container consists of an upper portion 35 preferably of cast iron and having imperforate walls. On each side of this upper portion, are mounted a pair of stub axles as at 36 and 37, Figure 2, on which flanged wheels 38 and 39 are rotatable. These sets of wheels are designed to run on guide-rails 30 and 31, above described, and thereby to support the container in the chamber. At a suitable distance below the stub axles, the front, side, and rear walls are provided with flanges as at 40, 41, 42 and 43, flanges 41 and 42 being adapted to overlie flanges 28 and 29, and flange 43 being adapted to overlie flange 33 so as to form a seal between the charge container and the side and rear walls of the retort chamber. Preferably, guide-rails 30 and 31 are substantially horizontally disposed, while flanges 28, 29, 41 and 42 are slightly upwardly inclined from the front to the rear of the chamber.

Depending from and rigidly secured to the skirt 44 of element 35 are wall elements which form the lower portion of the charge container. The end walls of this portion may conveniently be in the form of solid plates as at 45 and 45′, but the side walls are provided with perforations. Preferably, the side walls as at 46 and 47, Figure 4, are vertically corrugated, and perforations are provided along the apices of the outwardly concave faces as at 48. A partition plate 49 extends from end to end of the container midway between walls 46 and 47, and is supported by the end walls. The plate 49 is appropriately formed to receive and support vertically corrugated partition walls 50 and 51, so as to provide a number of upwardly extending tubular passages 52. The apices of the outwardly convex surfaces of walls 50 and 51 are provided with series of apertures as at 53. The reference numeral 54, Figures 2 and 4, represents a hinged bottom plate forming the lower end wall of the container, and this wall is provided with a number of apertures 55 lying immediately below tubular passages 52. The side walls 46 and 47 are braced by members 56, 57 and 58, Figure 2. From this figure, it will also be noted that the inner surface of the door 12 is provided with a flange 59 adapted to underlie flange 40 when the door is closed to complete the seal between the container and the chamber walls.

The proportions of the pockets defined in each of the charge containers between the outer walls and the partition walls are such that the coal therein will be confined in what may be termed thin "slab-like" formation. The steam admitted to the chambers through pipes 17 and 18 will quickly pass into the coal masses through the perforations 48 and 53, and thus penetrates the masses in every direction so as to come in contact with each and every one of the coal fragments or particles. Further, the entire volume of the admitted steam is caused to pass into the container by the sealing flanges which have been described. Each retort chamber receives a fresh, undiluted supply of steam direct from the source, and the gases developed in each

container are led directly therefrom to the header 25 without coming in contact with the coal in any other retort chamber. The treatment of the coal in such slab-like masses or layers enables all the constituent elements to be acted upon simultaneously, and avoids the possibility of harmful secondary reactions. In Figure 5, the retort, as a whole and containing a battery of ten chambers or cells, is indicated at 10, and it will be seen from this figure that the header 25 is connected by means of branches 6, 61 and 62 with a collector 63, which, through a main 64, is in connection with a primary condenser 65. The primary condenser 65 is connected by means of a main 66 with exhausters 67 and 68. These exhausters tend to create a vacuum on the outlet side of the retort chambers, and thus diminish the steam pressure within the latter, while, at the same time, accelerating the passage of the steam through the coal masses. This rapid passage of the steam through the material to be treated and the low internal pressure in the retorts have been demonstrated to be important factors in the efficient working of our improved process.

In Figure 5, reference numerals 69 and 70 indicate tar lines, 71 a tar well, and 72 a tar extractor, 73 designating the main leading to the secondary condenser, but since all of these appurtenances are well understood in the art, their complete illustration and description is not required here.

It is to be understood that the above description is intended to be merely illustrative, and by no means restrictive of our invention, and that we do not limit ourselves except as determined in the following claims:

We claim:

1. The process of producing coke and combustible gas from coal, which comprises subdividing the coal into small masses in the form of stationary layers or slabs, confining said slabs in a retort in a mutually isolated arrangement, passing steam as the sole reducing agent directly and rapidly through each of said masses by separate conduit means, and said steam being at a temperature of not less than 700 degrees F. and at a pressure of from 1 to 5 pounds per square inch.

2. The process of distillation and carbonization of coal, which comprises sub-dividing a quantity of carbonizable fragments into small isolated masses, passing superheated steam at a temperature of 700° F. or above, and at a pressure of from 1 to 5 pounds per square inch direct from a source of supply in a separate current through each of said masses, so directing and confining the steam in its passage as to bring its entire volume into contact with the constituent fragments of said masses to complete the carbonization and distillation thereof substantially simultaneously and uniformly, and directly leading off the resultant gases from each of said coked masses to a common point of treatment.

In testimony whereof we have hereunto set our hands.

JAMES E. LOUTTIT.
ELMER H. RECORDS.