Sept. 20, 1932. C. AB-DER-HALDEN 1,878,581

RETORT WITH REVOLVING HEARTH

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Fig. 1

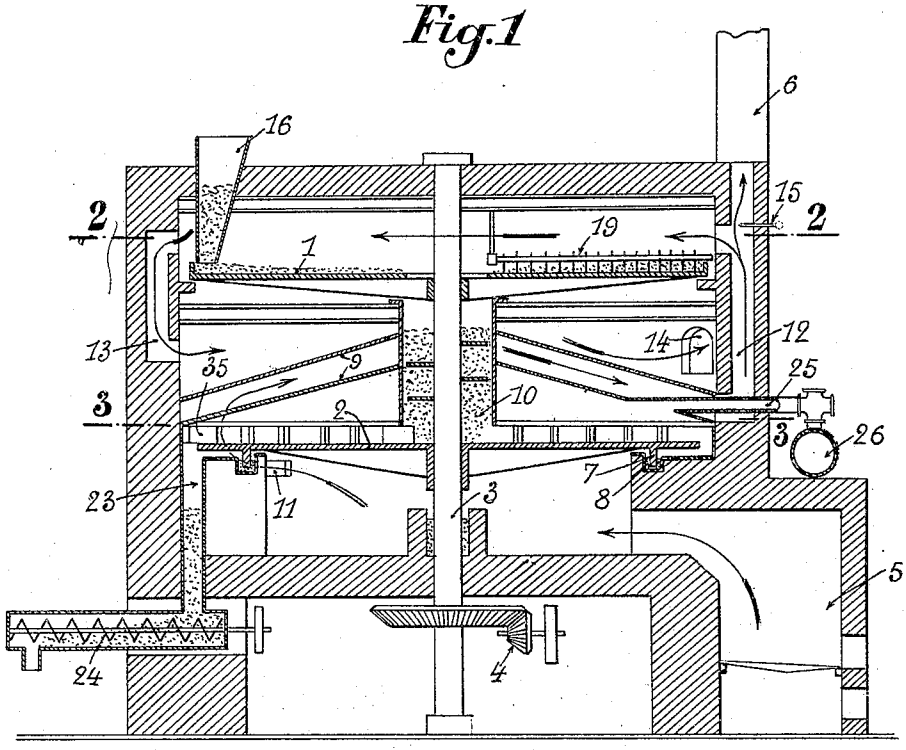


Fig. 2

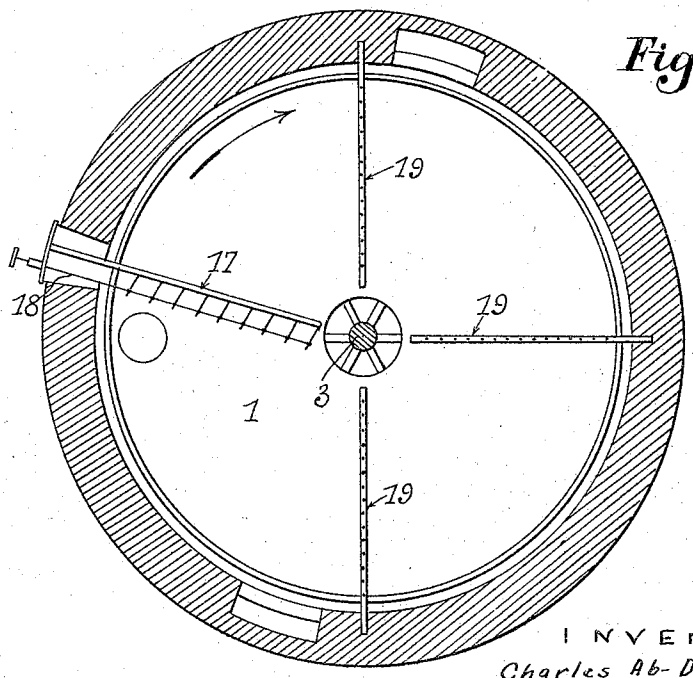


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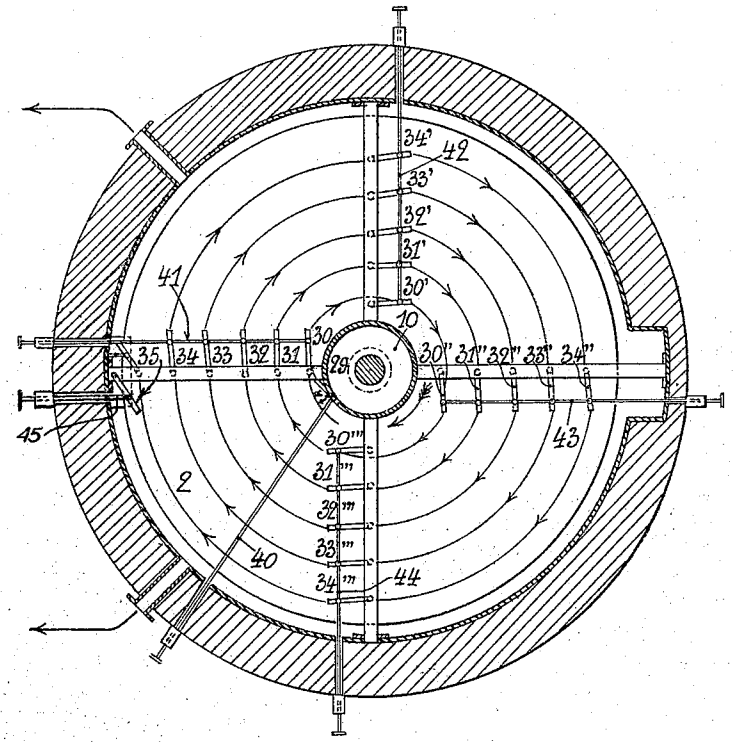
*Fig. 3*

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# UNITED STATES PATENT OFFICE

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## RETORT WITH REVOLVING HEARTH

Application filed May 18, 1928, Serial No. 278,669, and in France April 17, 1928.

The invention relates to retorts with revolving hearth and more particularly to revolving hearths of retorts for the continuous carbonization of carbonaceous materials at low temperature.

It has already been proposed to provide retorts of this kind, in which the material is moved upon the revolving hearth plate by means of radially arranged vanes or plates of variable inclination, by which the material is moved radially on said hearth, provision being made of a set of stationary rakes which stir the material during its travel upon the hearth.

Experience has shown that with such a device the thickness of the layer of material to be carbonized increases from the centre to the periphery of the hearth. This is chiefly detrimental in the case of the carbonization at low temperature, since the speed of carbonization much depends upon the thickness of the layer of material to be carbonized. Moreover, some kinds of fuels have a tendency to cake and, for a given thickness of the layer, the material is converted into a conglomerate which opposes the circulation of said material upon the hearth.

The invention has for its object to avoid these defects and to provide a device by which the material will be distributed with a uniform thickness throughout the hearth. The invention has also for its object to provide a device by which the speed of circulation of the material from the centre to the periphery of the hearth, or vice-versa, may be controlled and accurately adjusted. A further object of the invention consists in providing a retort with revolving hearth especially designed for the carbonization of solid fuels having a tendency to agglomerate and, for this purpose, the material which travels upon the hearth is separated by a spiral furrow, instead of forming a continuous layer, thus preventing the material from caking.

Further features and advantages of the invention will be specified in the following description with reference to the appended drawings which shows, by way of example, an embodiment of the invention in the case of a retort having two revolving hearths, one of which serves for drying the fuel and the other for the carbonization.

In the drawings:

Fig. 1 is an axial section of the retort.

Fig. 2 is a section along the line 2—2 of Fig. 1, and

Fig. 3 is a section along the line 3—3 of Fig. 1.

As shown in the drawings, the retort comprises two revolving hearth plates 1 and 2 secured to a common vertical shaft 3, which latter may be driven in rotation by means of a suitable gearing 4.

The revolving hearth 1, which is designed for the drying of the material, is rotatable within a chamber adapted to be passed through by the hot gases from a combustion chamber 5, and connected with a stack 6.

The revolving hearth 2, which serves for the carbonization, is rotatable in a chamber heated from the outside by the combustion gases from the combustion chamber 5, and carries on its under face a circular flange 7, which engages an annular groove 8 filled with a suitable material, the latter being fluid enough to allow the rotation of the hearth, although being sufficiently compact, in order to constitute a gas-tight joint between the chambers above and below the hearth.

The material to be carbonized passes from the revolving hearth 1 to the revolving hearth 2 through a chimney or hopper 10, which extends through a double cover 9 and ends at a small distance above the hearth 2.

The combustion gases proceeding from the combustion chamber 5 are circulated in the direction shown by the arrows in Fig. 1. Said gases first pass through the chamber below the hearth 2, then flow through suitable flues 11 into the space comprised between the two covers 9, thence through a flue 12 into the space above the hearth 1. Said gases then pass through a flue 13 into the chamber below the hearth 1 whence they are discharged into the stack 6 through a flue 14. The flue 12 is provided with a valve or register 15 by which the amount of hot gases passing above the drying hearth 1 may be adjusted at will.

The material to be carbonized is fed to the retort by means of a hopper 16 and drops

upon the hearth 1. A set of vanes or plates 17 (Fig. 2), inclined upon the diameter of the hearth, causes the material upon the hearth to travel radially toward the centre of the hearth. Said plates are pivoted to their support and the angle which they form with respect to the direction of rotation may be changed at will by means of a control rod 18, which may be operated from the outside. Moreover, a set of stationary rakes 19 stir the material which travels upon the hearth and break down the portions of the mass of material which may have agglomerated.

The material then drops through the vertical chimney 10 upon the lower hearth 2 which is provided with a set of plates arranged as will be hereinafter described. A stationary plate 35 is so disposed as to take off the desired amount of carbonized material and to cause it to drop through a discharge chimney or chute 23 into a screw conveyor 24, disposed at the lower end thereof.

The volatile products distilled off during the carbonization are discharged through a tube 25 secured to the cover 9 and opening into a gas collector 26.

It will be noted that the portion of the material to be dried which rests upon the upper hearth 1, and which is moved by one of the plates or vanes, forms a small heap which is broken down when passing under the rakes; however said heap preserves substantially the same position upon the hearth. When the latter has turned through a complete revolution, the material engages behind the same plate or vane and a further radial displacement is only possible, provided that a further amount of material is added to said heap and increases its width to a sufficient extent in order that its natural slope reach the following plate or vane.

Consequently, the thickness of the material to be carbonized increases from the centre of the carbonization hearth toward the periphery. As above stated, this is chiefly detrimental in the case of low temperature carbonization, where the speed of the operation depends to a large extent upon the thickness of the layer of material. On the other hand, some caking fuels, for a given thickness, form a conglomerate which opposes the movement on the hearth.

These defects are obviated by the provision, in combination with the hearth 2, of the plate or vane arrangement according to the invention, in which the plates are disposed along two diameters of the hearth at least and form a spiral curve in such manner that the material which is moved by one of said plates toward the centre or the periphery is brought into the path of the successive plate and engages the latter. Moreover, the plates form determined angles with the tangents to the spiral, and said angles may be adjusted according to the desired rate of discharge of the material from the hearth.

In the embodiment shown in the drawings, the material to be carbonized, which is delivered from the central hopper 10, is spread over the hearth 2 by the delivering plate or vane 29 in an amount which is determined by the angle $\alpha$ formed by said plate and the direction of rotation; said angle may be adjusted from the outside by means of a control rod 40. Every portion of the material spread over the hearth by the plate 29 is moved radially by the plates 30, 30′, 30″, 30‴ successively, and is thus brought behind the plate 31. As before, this portion of material is progressively moved toward the periphery by the successive plates 31′, 31″, 31‴, etc.; until it reaches the outer plate 35, by which it is taken off and drops into the chute 23. The several plates 30, 31, etc.; are pivoted to their support and their angle may be adjusted from the outside by means of rods 41, 42, 43, 44. Similarly, the angle of plate 35 may be adjusted by means of a rod 45.

Due to the above arrangement of the plates, the distribution of the material is made uniform throughout the surface of the hearth. Furthermore, the material to be carbonized, instead of being spread in a continuous layer, forms on the hearth plate a substantially spiral heap, the external surface of which allows the ready separation of the gases. Finally, the material to be carbonized describes a directly controllable number of revolutions. The speed of rotation being known, it is possible to determine with a great accuracy the duration of the operation.

The device above described is particularly adapted for the carbonization of caking coals whose carbonization would be practically impossible with a plate arrangement as described with reference to the drying hearth 1.

Obviously, the invention is not strictly limited to its use in carbonization retorts and it may be employed in all cases where it is desirable to distribute the material to be treated at a uniform thickness, to increase to a maximum the surface of contact of the material with the atmosphere of the retort, and to accurately control the time during which the material remains upon the hearth.

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

1. In a retort, a revolvable hearth plate, means for rotating said hearth plate about a vertical axis, a stationary support above said hearth plate, a number of vanes for guiding the material to be treated pivoted on said support and having their lower edges adjacent said hearth plate and adapted to assume different angular positions with relation to a radial direction from the center of said hearth plate, and rods pivoted on all of the vanes and extending through the retort

on the outside of said retort, whereby the angular position of said vanes may be regulated from stationary points on the outside of the retort during the rotation of said hearth plate.

2. In a retort, a revolvable hearth plate, means for rotating said hearth plate about a vertical axis, stationary supports in radial directions above said hearth plate, a number of studs on said supports disposed perpendicularly to said hearth plate and along a spiral line on said hearth plate, whereby said studs are at different distances from the center of said hearth plate, vanes for guiding the material to be treated pivoted on said studs and having their lower edges adjacent said hearth plate and disposed angularly with relation to a radial direction from the center of said hearth plate.

3. In a retort, a revolvable hearth plate, means for roating said hearth plate about a vertical axis, a feeding hopper for the material to be treated having its lower end near and above said hearth plate, a discharge conduit for said material under said hearth plate, said feeding hopper and said discharge conduit being disposed the one near the centre of the hearth plate, and the other near the periphery of said hearth plate, a stationary support above said hearth plate, vanes for guiding the material carried on said support and having their lower edges adjacent said hearth plate and disposed angularly with relation to a radial direction from the center of said hearth plate and at different distances from the center of said hearth plate, whereby said material is moved radially on said hearth plate, a stationary pivot disposed near said discharge conduit and above said hearth plate, a delivering plate pivoted on said pivot, extending until over that one of the surfaces of said hearth plate swept by said vanes which is nearest said discharge conduit, and adapted to assume different angular positions with relation to the radius of said hearth plate passing through said pivot, and means for varying the angular position of said delivering plate, whereby the amount of material delivered from said hearth plate into said discharge conduit may be regulated.

4. In a retort, a revolvable hearth plate, means for rotating said hearth plate about a vertical axis, stationary supports in radial directions above said hearth plate, vanes for guiding the material to be treated carried on said supports and having their lower edges adjacent said hearth plate and disposed angularly with relation to a radial direction and at different distances from the center of said hearth plate with their inner ends directed towards the center of said hearth plate and their outer ends directed towards the periphery of the hearth plate, each of said vanes having its inner end at least as near this center of the hearth plate as the outer end of the vane which is the next nearer said center and its outer end at least as far from this center as the inner end of the vane which is the next farther from this center.

5. In a retort, a revolvable hearth plate, means for rotating said hearth plate about a vertical axis, a stationary support above said hearth plate, vanes for guiding the material carried on said support and having their lower edges adjacent said hearth plate and disposed angularly with relation to a radial direction and at different distances from the center of said hearth plate, whereby said material is moved radially on said hearth plate, a feeding hopper for the material to be treated having its lower end near and above said hearth plate and offset out of the surfaces of the hearth swept by said vanes, a stationary pivot disposed near said lower end of said hopper, a control plate pivoted on said pivot, extending until over that one of the surfaces of said hearth plate swept by said vanes which is nearest said hopper, and adapted to assume different angular positions with relation to the radius of said hearth plate passing through said pivot, and means for varying the angular position of said control plate, whereby the amount of material supplied from said hopper to said hearth plate may be regulated.

In testimony whereof I have signed my name to this specification.

CHARLES AB-DER-HALDEN.