July 3, 1934. A. J. A. HERENG 1,964,878

PROCESS AND APPARATUS FOR THE LOW TEMPERATURE DISTILLATION OF SOLID FUELS

Filed May 28, 1931 4 Sheets-Sheet 1

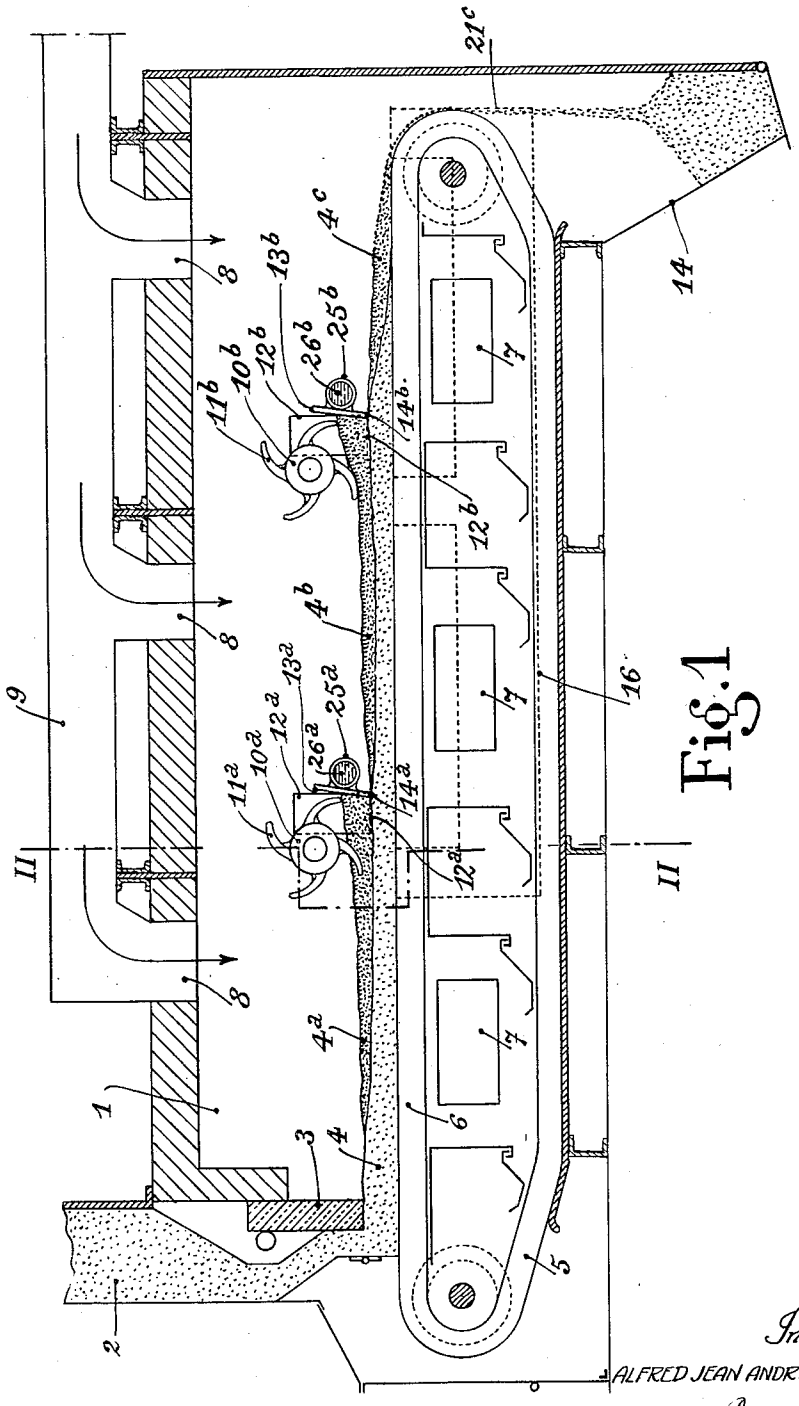


Fig. 1

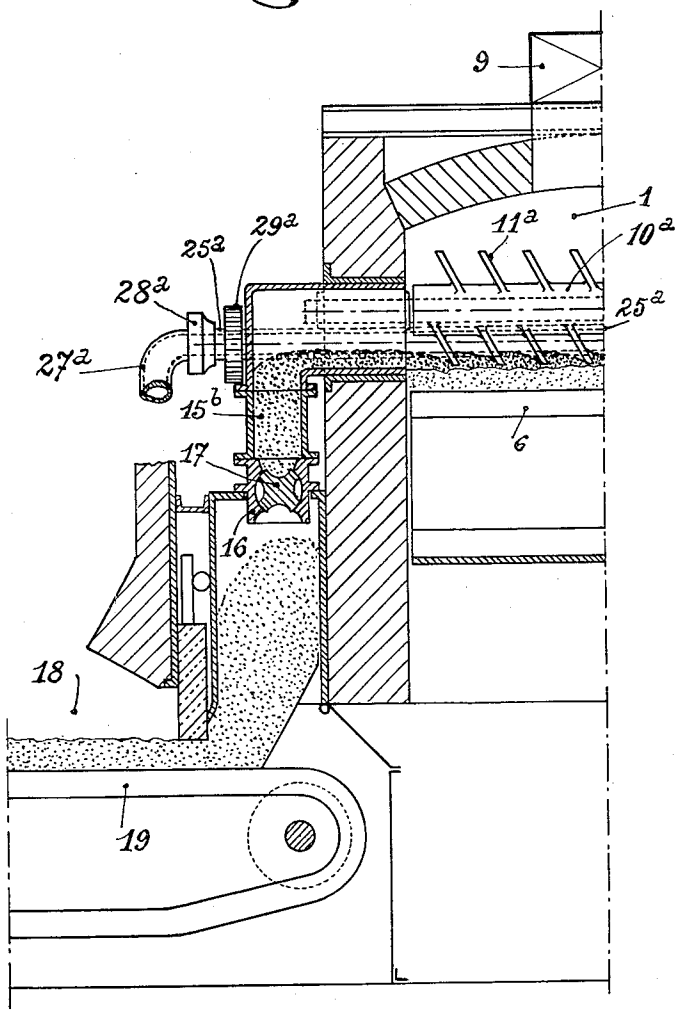
Inventor:
ALFRED JEAN ANDRE. HERENG
BY
HIS ATTORNEY

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Fig. 2



Inventor:
ALFRED JEAN ANDRÉ HERENG

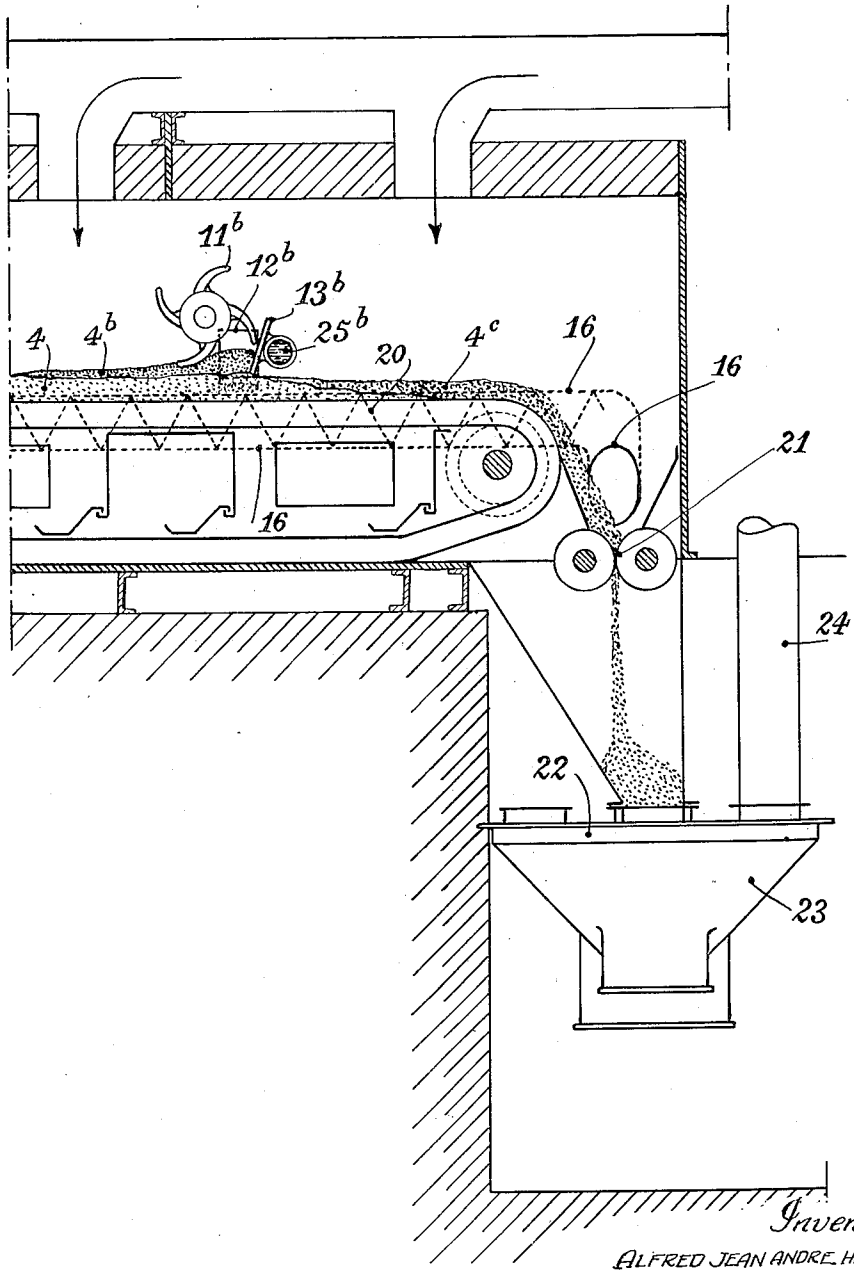
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HIS ATTORNEY

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PROCESS AND APPARATUS FOR THE LOW TEMPERATURE DISTILLATION OF SOLID FUELS

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Fig.3



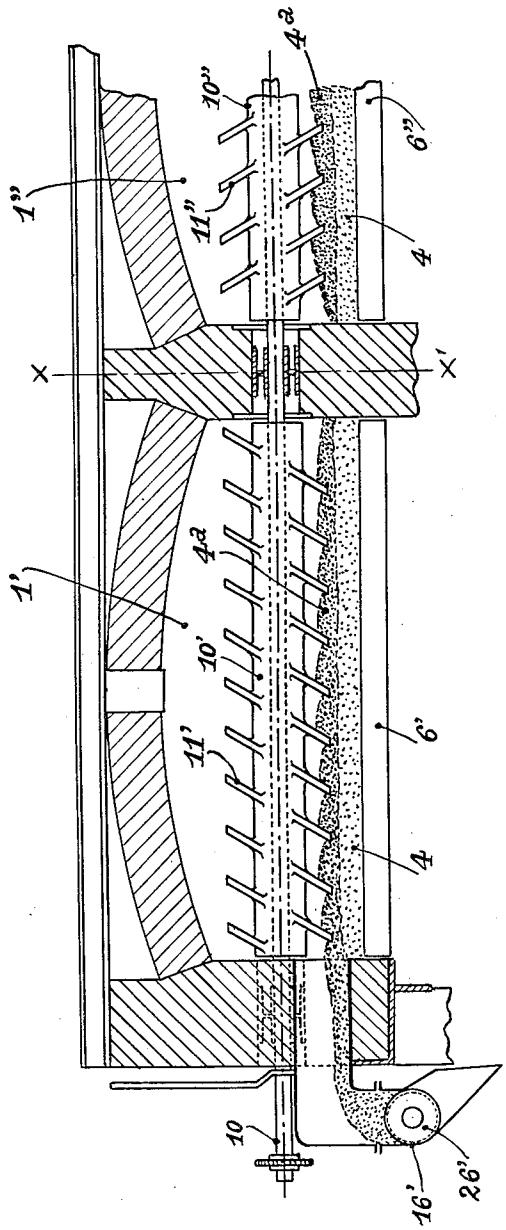
Inventor.
ALFRED JEAN ANDRE HERENG
By
HIS ATTORNEY

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PROCESS AND APPARATUS FOR THE LOW TEMPERATURE DISTILLATION OF SOLID FUELS

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Fig. 4



Inventor:
ALFRED JEAN ANDRE. HERENG
By Pannerlinck
HIS ATTORNEY

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UNITED STATES PATENT OFFICE

1,964,878

PROCESS AND APPARATUS FOR THE LOW-TEMPERATURE DISTILLATION OF SOLID FUELS

Alfred Jean Andre Hereng, Paris, France

Application May 28, 1931, Serial No. 540,609
In France May 30, 1930

7 Claims. (Cl. 202—9)

The present invention relates to the low-temperature distillation of solid fuels spread out in a sheet in a heated chamber, upon a horizontal conveyor which is permeable to gases, the lower face of the said sheet being subjected to suction so as to draw through the layer of fuel the gaseous products resulting from the distillation.

It has been shown by experience that the distillation of fuel does not always take place in a uniform manner throughout the mass of the fuel under treatment. The upper part of the traveling sheet of fuel will first distill and a crust of semi-coke will form, the permeability of which depends on the agglomerating nature of the fuel. The distillation of the upper part of the mass may be delayed, or it can only take place by superheating the fuel before it leaves the distilling chamber.

The present invention relates to means and devices whereby all such drawbacks will be eliminated in whatever degree they may occur.

For this purpose, in accordance with the present invention, when the fuel has passed through a part of its course in the distilling chamber, the compact crust of the completely distilled fuel formed at the upper part of the sheet of fuel is automatically broken up within the chamber. Preferably, this broken-up layer is immediately removed from the distilling chamber. Thus the subjacent part of the fuel mass which is charged with substances adapted for distillation, and which is still permeable to gases, is laid bare. The upper layer of this subjacent part is then distilled in turn; it is broken up and removed from the distilling chamber after the volatile substances it contains have been distilled, and it is converted into semi-coke. The same operation takes place n times until the sheet of fuel reaches the end of the distilling chamber. Only a thin horizontal layer of fuel adapted for distillation throughout its whole mass will be left on the conveyor during the last part of its travel in the distilling chamber.

The chief advantages of my process are as follows:

1. Reduction of the time required for the distillation of a given mass of fuel, this reduction being due to the fact that the fuel permeable to the heating gases and to the gases of distillation, is brought into contact with such gases in $n+1$ sections of the distilling chamber, or throughout the length of said chamber, instead of a fraction

$$\frac{1}{n+1}$$

of this length.

2. Superheating as now employed to effect the distillation of the fuel throughout the whole thickness of the mass under treatment, is eliminated.

3. The production of condensable hydrocarbons resulting from distillation effected at a low and uniform temperature, since the fuel has not been superheated at any point in the distilling chamber.

4. An increase in the heating power of the resulting gas, by virtue of the large amount of methane in this gas, due to the low temperature of the distillation.

The present invention covers, in addition to the aforesaid process and means, the use of said process and means in combination with the processes and means specified in the applicant's prior application for patent Serial No. 325,188.

The invention includes apparatus suitable for use in carrying out the process. This apparatus may include:

1. Rotary crust-breaking and removing devices or scrapers, which break up the crust of agglomerated fuel formed in the upper part of the layer of fuel, and transport the broken pieces of the crust out of the distilling chamber substantially at right angles to the direction of travel of the endless conveyor. Each of the crust-removing devices or scrapers consists of helical paddles or blades mounted on a common shaft mounted above the sheet of fuel and substantially at right angles to the latter.

2. The combination with each crust-breaking and removing device of a stop plate which is parallel to said shaft carrying the helical paddles and is mounted above the distilled fuel and in front of the broken-up crust of the distilled fuel, thus preventing such broken pieces from being transported by the endless conveyor, and assuring the displacement of such pieces at right angles to the direction of travel of the endless conveyor.

3. A device for the vertical adjustment of each stop plate.

4. A leakless collecting chamber adapted to receive the partial masses of the semi-coke in the broken state as delivered by the said scrapers. The collecting chamber may be provided with the following devices:

(a) A hopper for the supply of an apparatus which is combined with the distilling chamber.

(b) Or a general conveyor for all the semi-coke produced in the distilling chamber.

(c) Or both of these devices.

The accompanying drawings which are given by way of example and in no wise limit the scope of the invention diagrammatically illustrate the distilling apparatus.

In these drawings:

Fig. 1 is a longitudinal section through the distilling apparatus which is provided with crust-breaking and removing devices.

Fig. 2 is a section on line II—II of Fig. 1.

Fig. 3 is a partial longitudinal section showing

an apparatus similar to the one shown in Figure 1 and whose collecting chamber is provided with a conveyor delivering the semi-coke into a cleaning device.

Fig. 4 is a detail view in vertical cross section of part of a distilling apparatus comprising two chambers forming a pair, the section being taken on the longitudinal axis of an apparatus serving for the transverse removal of the distilled fuel.

In these figures, the same reference numerals relate to like parts.

Referring to Figure 1, 1 is the distilling chamber, which is provided with the following elements: a hopper 2 for the supply of fine coal to be distilled, a gate 3 for regulating the height of the layer of fuel 4 in the distilling chamber; a movable endless grate 5 whose upper part 6 serves to transport the fuel and also forms a support which is permeable to the gases of distillation; suction chests 7 used for the withdrawal of such gases and positioned below the grate; conduits 8 for the heating gas issuing from a channel 9.

Above the layer 4 of the fuel spread on the upper part 6 of said permeable conveyor are situated rotary scrapers, two being employed in the present case. Each scraper is placed across the path followed by the fuel through the distilling chamber; each scraper has a shaft (10^a for the first and 10^b for the second), and helical paddles (11^a for the first and 11^b for the second). The paddles cut up the crust of the agglomerated fuel, and at the same time they convey it across the chamber to a lateral outlet (12^a for the first scraper and 12^b for the second). Each scraper is combined with a stop plate (13^a for the first and 13^b for the second), adapted to arrest the agglomerated fuel which has moved past the paddles. The lower edges (13^a—14^b) of each stop plate are smooth or toothed. For coal which agglomerates readily, the lower edge of each plate is toothed.

The lower end of each stop plate is at such height that the layer of coal which comes into contact with the plate will consist of coal which is completely distilled, and hence this mass will be stopped. The crust 4^a which is formed in the first part of the distilling chamber 1 is not sufficiently permeable to the gases and its thickness increases with the distance from its entrance into the chamber. This crust is broken up and removed from the chamber by the scraper 10^a—11^a and the stop plate 13^a. The part of the fuel which moves past this scraper and plate is always in the state of fine coal and is hence permeable to the gases. This part of the fuel is thus laid bare and as it continues to travel through the distilling chamber, a crust 4^b will form thereon whose thickness increases down to the succeeding scraper 10^b. This scraper breaks up and removes the crust 4^b, while the stop plate 13^b arrests the parts of this crust which have escaped the action of the paddles 11^b and pushes them back on the latter.

The part of the fuel which rests directly upon the movable grate will reach the end of the distilling chamber. A crust 4^c like 4^a—4^b is formed on the last section of the coal and allowed to drop into the lower container 14.

Suitable conduits 15^b (Fig. 2) lead the fuel collected by each rotary scraper into a leakless collecting conduit 16, which may consist of a leakless rotary feeding device 17 by which the fuel is discharged into a chamber which is distinct from the distilling chamber, e. g., into a furnace 18 provided with a movable grate 19 (Fig. 2).

The collecting conduit 16 may be provided with a conveyor 20 (Fig. 3) consisting for example of a worm for moving the semi-coke to a given point, e. g., into a crusher 21 (Fig. 3) of a suitable type. This consists of two crushing drums and a dust-collector 22. The stones, slate and other impurities drop into a container 23, and the ground and purified semi-coke is drawn by a stream of air into a conduit 24.

In Figure 4, the distilling apparatus comprises two chambers 1'—1'' placed side by side, these being symmetrical with reference to the axis x—x'. The scrapers are combined in pairs and have a common shaft 10' provided with helical paddles 11'—11''. The padles 11' deliver the fuel which they collect into a collecting chamber 16', and the paddles 11'' deliver their fuel into a like chamber which is symmetrical with the chamber 16' with reference to the axis x—x', and is not shown in the figure.

As above stated, each stop plate may be provided with a device for regulating the thickness of the layer of fuel upon which it acts. Such a device consists of a pivoting tube secured to the said stop plate, i. e. a tube 25^a for the plate 12^a and a tube 25^b for the plate 12^b. Said tube serves for the circulation of a cooling fluid (26^a—26^b) such as water. Each tube such as 25^a is connected with piping 27^a; a stuffing-box 28^a and a gear wheel 29^a (or the like) serve to rotate the tube 25^a on its axis, thus regulating the height of the lower edge 14^a of the stop plate 13^a.

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

1. The process of continuous low temperature destructive distillation of coal comprising the following steps: moving the coal from one point to another in a substantially continuous layer, subjecting the moving layer of coal to destructive distillation thereby causing destructive distillation and partial agglomeration of one side of said layer, supplying the heat for the distillation by circulating hot gases obtained from the distillation of the coal through said layer from one side thereof to the other throughout the length and width of said layer within a zone between said points, and removing from the layer within the longitudinal limits of said zone the agglomerated and distilled coal.

2. The process of continuous low temperature destructive distillation of coal comprising the following steps: moving the coal in a substantially continuous layer, subjecting the moving layer of coal to destructive distillation thereby causing destructive distillation and partial agglomeration of one side of said layer, supplying the heat for the distillation by circulating hot gases obtained from the distillation of the coal through said layer from said one side to the other throughout the length and width of said layer by suction applied to the other side of the layer, breaking up and removing from the layer at one point within the longitudinal limits of the layer the crust of agglomerated and distilled coal, and subjecting to destructive distillation past said point the remainder of the coal in said layer.

3. The process of continuous low temperature destructive distillation of coal comprising the following steps: moving the coal in a substantially continuous horizontal layer, subjecting the moving layer of coal to destructive distillation, thereby causing destructive distillation and partial agglomeration of the upper side of said layer, sup-

plying the heat for the distillation by circulating hot gases obtained from the distillation of the coal throughout the length and width of said layer by applying suction to the under side of the layer, and breaking up and removing at a plurality of points within the longitudinal limits of the layer the crust of agglomerated and destructively distilled coal from the layer.

4. In an apparatus for continuous treatment for the low-temperature distillation of coal comprising a distilling chamber, an endless conveyor extending into said chamber, means for moving said conveyor, means for spreading a layer of coal upon said conveyor, a gate at the entrance of the distilling chamber to control the thickness of said layer, a substantially horizontal shaft positioned within and across said chamber above the conveyor and rotatable on its axis, paddles mounted on said shaft and so arranged as to transport solid fuel across the said conveyor, the distilling chamber having a port adjacent said paddles for the discharge of the distilled fuel transported by said paddles.

5. In an apparatus for continuous treatment for the low-temperature distillation of coal comprising a distilling chamber, an endless conveyor permeable to gases extending into said chamber, means for moving said conveyor, means for spreading a layer of coal upon said conveyor, a gate at the entrance of the distilling chamber to control the thickness of said layer, means for passing gas into said chamber and from said chamber through said conveyor, a substantially horizontal shaft positioned within and across said chamber above the conveyor and rotatable on its axis, paddles mounted on the said shaft in the form of a helix and adapted to transport solid fuel across said conveyor, the distilling chamber having a lateral port adjacent the said paddles of the shaft for the discharge of the transported solid fuel, and a stop within said chamber on the opposite side of said shaft from said gate and parallel with said shaft but terminating above the conveyor.

6. In an apparatus for continuous treatment for the low-temperature distillation of coal comprising a distilling chamber, an endless conveyor permeable to gases extending into said chamber, means for moving said conveyor means for spreading a layer of coal upon said conveyor, a gate at the entrance of the distilling chamber to control the thickness of said layer, means for sucking gaseous products into said chamber and from said chamber through said conveyor, substantially horizontal shafts positioned at a plurality of points within and across said chamber, above the conveyor and rotatable on their axes, paddles mounted on each shaft in the form of a helix and adapted to transport solid fuel across the said conveyor, the distilling chamber having a port adjacent the said paddles of each shaft for the dischage of the said solid fuel, a stop within said chamber on the opposite side of said shaft from said gate and parallel with each shaft and terminating above the conveyor, and means for adjusting said stops with respect to said conveyor.

7. In an apparatus for continuous treatment for the low-temperature distillation of coal comprising a distilling chamber, an endless conveyor permeable to gases extending into said chamber, means for moving said conveyor means for spreading a layer of coal upon said conveyor, a gate at the entrance of the distilling chamber to control the thickness of said layer, means for sucking gaseous products into said chamber and from said chamber through said conveyor, a substantially horizontal shaft positioned within and across the chamber above the conveyor and rotatable on its axis, paddles mounted on said shaft in the form of a helix and adapted to transport solid fuel across said conveyor, the distilling chamber having a port adjacent said paddles for the discharge of the solid fuel, a stop within said chamber on the opposite side of said shaft from said gate and parallel with said shaft and terminating above the conveyor, a pivoting shaft fixed to the said stop, and controlling means arranged on the said shaft for adjusting the height of the lower part of said stop with respect to said conveyor.

ALFRED JEAN ANDRE HERENG.