May 23, 1933. A. J. A. HERENG 1,909,956

PROCESS OF COAL DISTILLATION

Filed Dec. 11, 1928 4 Sheets-Sheet 1

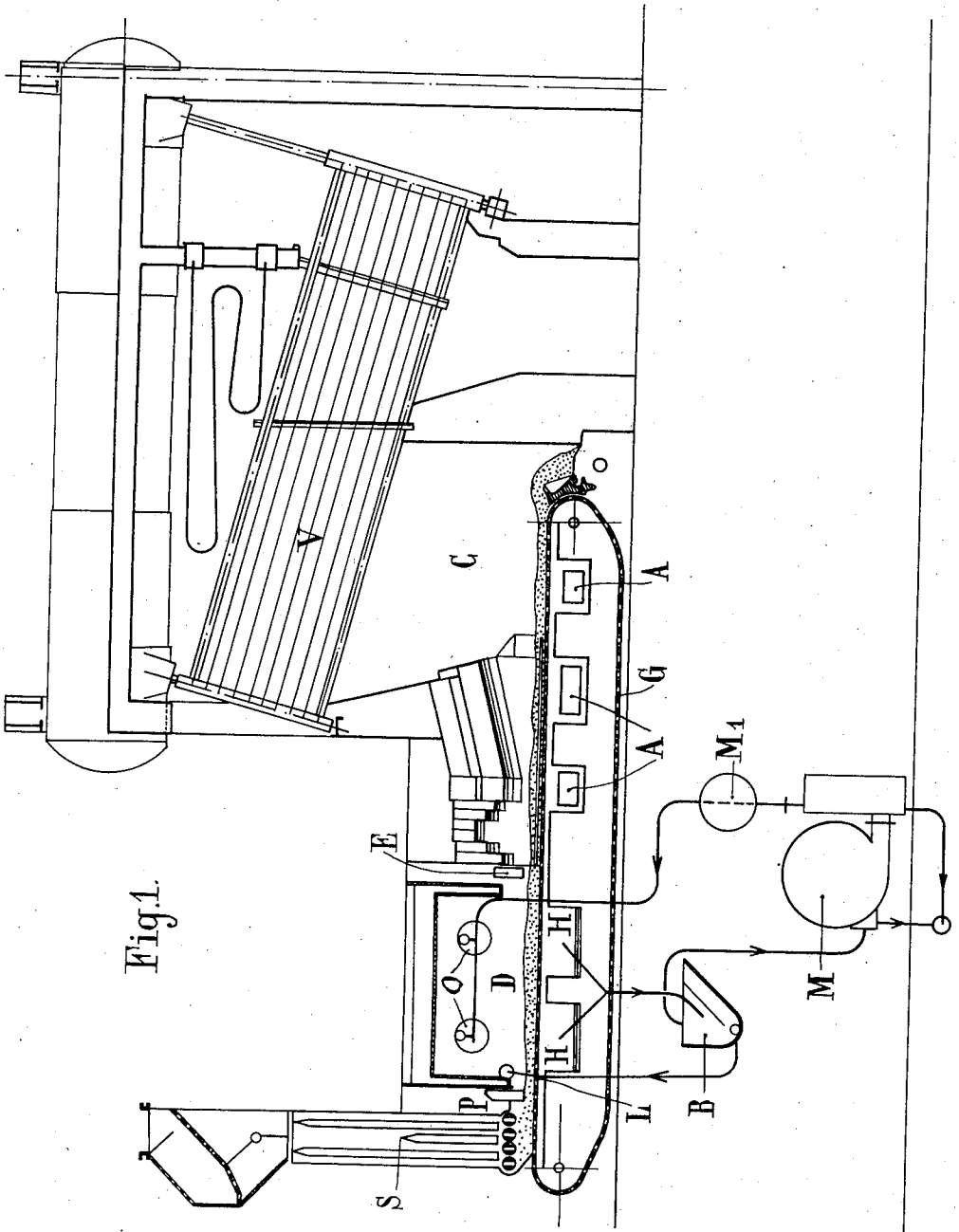


Fig.1.

INVENTOR:

Alfred Jean André Hereng

BY

ATTORNEY

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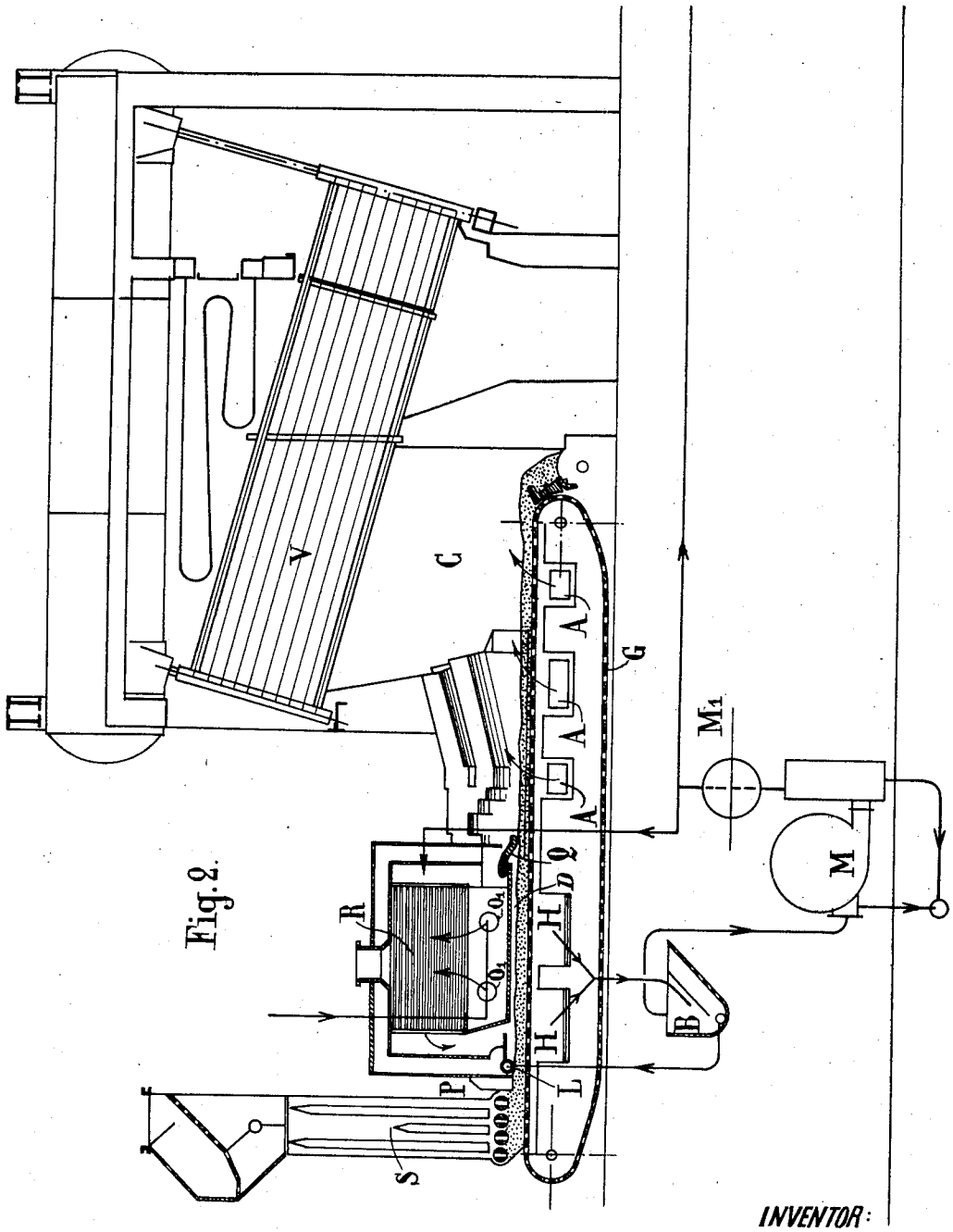


Fig. 2.

INVENTOR:

Alfred Jean André Hereng

BY Louis Bouillette

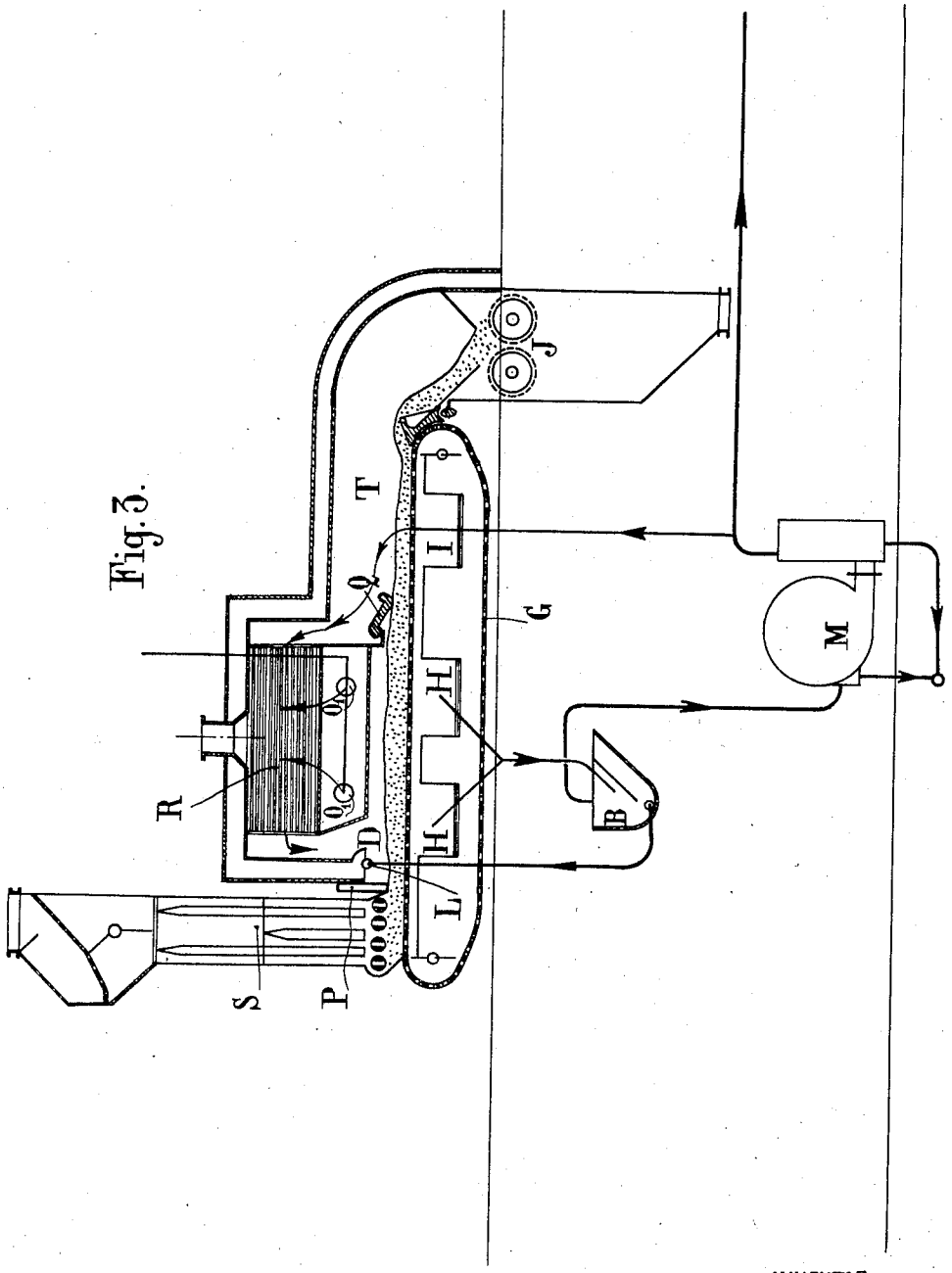
ATTORNEY

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Fig. 3.



INVENTOR:
Alfred Jean André Hereng
BY
ATTORNEY

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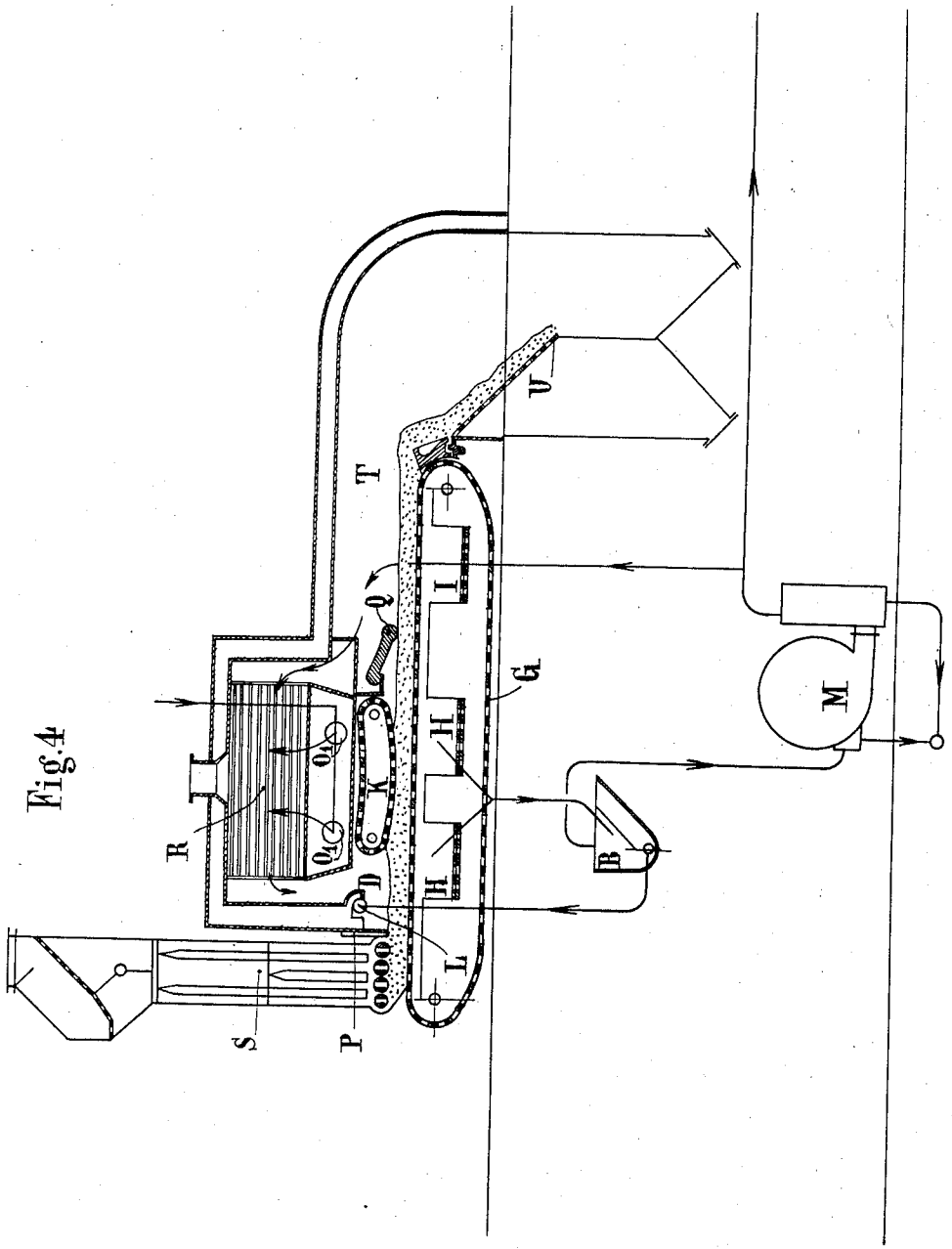


Fig.4

INVENTOR:
Alfred Jean André Hereng
BY
Louis Pouzeke
ATTORNEY

Patented May 23, 1933 1,909,956

UNITED STATES PATENT OFFICE

ALFRED JEAN ANDRÉ HÉRENG, OF PARIS, FRANCE

PROCESS OF COAL DISTILLATION

Application filed December 11, 1928, Serial No. 325,188, and in France November 8, 1928.

Persons skilled in the art are aware of the interest that attaches to extracting tars from fuels previous to combustion thereof and of the many processes or methods that have been put into operation with a view of obtaining the aforesaid result.

Said methods or processes may be classified in two main groups:

According to the processes of the first group, the coal to be treated is not in contact with the heating fluid and heat is transmitted through a partition.

According to the processes of the second group the coal to be treated is heated internally by the heating fluid.

This invention relates to the second mentioned method, and, according thereto, the fuel to be treated, previously dried and heated up to approximately the softening point, is laid on a travelling grate pervious to fluids, as, for instance, on a power chain grate.

It is a well known fact that the best temperature for obtaining tars by low temperature distillation is included between 300° and 500° C.; in front of and above the metal apron, there is a distillation chamber wherein the fuel is heated up to the above mentioned optimum temperature. Such heating may be ensured by combustion in the compartment of any available fuel, whether gaseous, liquid or solid.

One of the characteristic features of my invention consists in the possibility of heating the fuel to be distilled by means of the gas obtained from the distillation either by burning the same, since it is combustible, or through heating it up to an adequate temperature, say 700° C. Of course radiation from the walls of said distillation chamber cooperates in heating the raw fuel that is laid on the metal grate or conveyor.

On the other hand, the links of the chain are at a sufficiently high temperature, when they come again forwards after a complete revolution, sufficient to cooperate, in the heating of the fuel. Furthermore, said heating has the effect of reducing the amount of dust which passes through the grate coming from the drying device, thereby preventing coal dust from passing through the grate.

Another essential feature of my invention is that the gaseous products of the distillation are drawn under the fuel layer by suction chests wherein a lower pressure is maintained than in the distillation chamber.

I provide, therefore, a fuel layer heated from above, from below, and within its mass, said layer resting on a conveyor pervious to gases, the gaseous products being drawn underneath into suction chests.

The vapor and gaseous products are partly condensable and will give distillation gases having a high calorific power. These are the gases that can be used, as already stated, for heating the fuel in the distillation chamber.

The heavy tars laden with dust withdrawn from the first condensation devices, are returned to the fuel in the distillation chamber; they cooperate in reducing the amount of dust which passes through the grate, they get distilled anew in the fuel layer on contact with the nascent hydrocarbons and the distilled gases are sucked into the lower suction chests as above explained.

Beyond the distillation compartments, there is arranged another compartment, which may be the combustion chamber of a boiler, or a quenching and cooling metal box for the semi-coke; but under this compartment extends the conveyor (that is to say the chain grate) so that the fuel passes automatically from the first to the second compartment without any interference from outside.

As will be readily realized, such a device permits:

(*a*) Either simply extracting the primary tars and tar oils and hydrocarbons such as benzol and toluol and burning the semi-coke and gases.

As a matter of fact, owing solely to the movement of the conveyor, the semi-coke passes from one compartment to the other at a temperature of approximately 500° C. and it is necessary only to draw air through chests located under the conveyor in order readily to cause combustion.

The gases are sent into the second compartment or combustion chamber wherein they co-operate, jointly with the semi-coke, in heating, for instance, a steam generator.

Part of the gases may, indeed, be utilized, as already stated, to ensure the heating of the distillation compartment through direct combustion.

(*b*) Or else, extracting, as in the previous case, the primary tars, burning the semi-coke in the combustion chamber, and, instead of sending back into the latter the collected gases, housing them in a gasometer for industrial or domestic use.

In this case, heating of the fuel in the distillation chamber may be ensured by a part of the gases previously heated up to an adequate temperature in a regenerator, so that the gas produced may not be mixed with other gases which are liable to alter the richness thereof.

The regenerator or gas heater may be heated by any routine means (producer gas, etc.) and, especially, by hot gases from the boiler or even by a part of the rich gas produced. The location of the regenerator should be so selected as to minimize radiation losses, for instance, directly above the distillation chamber.

(*c*) Or again, extracting the primary tars, as above indicated, storing the rich gas in a gasometer, and quenching the semi-coke so as to prevent combustion thereof, and utilizing this solid fuel for some ulterior, industrial or domestic use.

The compactness of said semi-coke may be increased in the course of its travel through the distillation chamber by means of a loose chain, resting thereon and suitably weighted, and the slack side of which will ensure compression of the softened fuel down to hardening at the end of distillation, without interfering with the continuous travel of the fuel.

The pressure of said second chain may be adjusted as desired by increasing or decreasing the slack.

(*d*) Or, lastly, extracting the primary tars and rich gases, as above indicated, also the water gas and the air gas by sending the semi-coke on to another chain grate or into a producer whereon or wherein combustion of the semi-coke is effected by the oxygen of steam or by the oxygen of air in accordance with the routine water-gas or producer gas manufacturing methods.

In order to make my invention more clearly understood I have illustrated various embodiments thereof (which will be successively described) in and by drawings appended hereto and wherein the views are shown in elevation with parts in vertical section:

Figure 1 illustrates a device for performing the first mentioned process in which only the primary tars and oils are extracted while the distillation gases partly serve for heating the distillation chamber, the remainder of them being burnt in the boiler.

Figure 2 shows a device for performing the second mentioned process in which the primary tars and oils as well as the produced rich gas are extracted and the semi-coke is burnt, as in the first instance, on the self same chain grate, for example, in a boiler.

Figures 3 and 4 illustrate devices for performing the third mentioned process in which the primary tars and oils, as well as the distillation gas, are extracted and the semi-coke is quenched so as to prevent it from burning and to use it afterwards in a separate apparatus.

In Figure 1 there are shown from left to right, the drying device S, the distillation compartment D, the combustion chamber C and the boiler V. Underneath, the chain grate G.

As will be apparent, the chain grate is the grate with which the boiler would be normally equipped, but it extends forward under the distillation compartment D and the drying device S.

The drying device, indicated as an example, may be constituted by vertical channels wherethrough the raw coal moves down by gravity and heated by combustion gases from the boiler.

Dried and heated, the coal falls down on to the grate whereon the thickness of the layer is regulated by the grate P. The coal travels freely through chamber D, heated up to 600°–650° C. and gets distilled. The semi-coke passes into the combustion chamber C wherein it is burnt by air blown into suction chests A. Screen E permits adjusting the amount of heat that the combustion chamber transmits by radiation to the distillation chamber. Said amount of heat, may, indeed, be sufficient alone to keep the combustion chamber at optimum temperature.

The hydrocarbons obtained by the distillation are detarred and are rid of their oils by the usual means. B is a separator wherein the gases bubble in hot tar. The heavy tars, which settle down, are laden with coal dust; they are sent back, through L, into the distillation chamber D wherein they are freed of dust and redistilled. M is a rotary tar separator, M′ an oil removing column.

The gases, detarred and rid of their oils, are sent to the burners O where complete or partial combustion thereof is caused depending on the extra heat to be provided for the distillation chamber. Excess gases pass under screen E and are burnt in combustion chamber C.

In the embodiment illustrated by Figure 2, where the same reference letters denote the same devices as on Figure 1, a fraction of the collected gases circulates in a closed circuit in order to ensure heating of the distillation chamber D. Said gases go into regenerator R wherein they are heated up to a sufficiently high temperature. They pass into the distillation chamber D and flow through the fuel

layer to which they give up some of their actual heat and they are then drawn into suction chambers H together with the hydrocarbons released by the distilled fuel. A suitably shaped member Q rests on the fuel bed and prevents gases from passing from one compartment into the other compartment.

As shown on said Figure 1, regenerator R is heated by burners O_1 that use either producer gas from an auxiliary generator (not shown), or even coal distillation gas. The regenerator might also be heated by combustion gases from the boiler.

In the device illustrated by Figure 3 it is contemplated to extract semi-coke in pulverized form. On issuing from the condensation apparatus, the cooled distillation gas is led to suction chamber I, passes through the conveyor and the semi-yoke layer which gives up thereto its actual heat and is cooled. The gas thus partly heated goes to regenerator R and goes through the same cycle as in the foregoing cases.

The semi-coke, after having gone through the cooling chamber T, passes into a crusher J wherein it is powdered before complete cooling.

Figure 4 contemplates extraction of the semi-coke in agglomerated form. An adjustably tensioned endless chain K, of same width as the fuel layer, presses down on the latter while this is soft, that is to say in the course of distillation. Said chain is free and taken along by the motion of the fuel so that no relative movement is caused between the layer and the two chains K and G. The hardened semi-coke is next cooled as in chamber T according to the same process as in the previous cases. On leaving grate G, the semi-coke accumulates in hoppers after having passed over a sieve U whereby pea coke is separated.

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

1. The process of low temperature distillation of coal comprising the fololwing steps: arranging the fuel in a substantially continuous layer, heating said layer, and circulating heavy tar containing coal dust through the layer by suction applied to the under side of the layer whereby the coal dust is removed.

2. The process of low temperature distillation of coal comprising the following steps: arranging the coal in a continuously travelling gas pervious and substantially continuous layer, heating said layer, and applying suction to the under side of the layer at a plurality of points while a portion of the gases of distillation and the heavy tar containing coal dust are conducted to the top of the layer whereby the coal dust is removed.

3. The process of low temperature distillation of coal comprising the following steps: arranging the coal in a substantially continuous layer, heating said layer in a distillation chamber, circulating heavy tar containing coal dust through the layer by suction applied to the under side of the layer in the said distillation chamber, and agglomerating the semi-coke in the same chamber whereby the coal dust is removed.

4. The process of low temperature distillation of coal comprising the following steps: arranging the coal in a substantially continuous layer, heating said layer in a distillation chamber, circulating heavy tar containing coal dust through the layer by suction applied to the under side of the layer in the said distillation chamber, and agglomerating the semi-coke in the said chamber by means of a chain loosely hung over the said layer of fuel and pressing on the same whereby the coal dust is removed.

5. The process of low temperature distillation of coal comprising the following steps: arranging the coal in a continuously travelling gas pervious and substantially continuous layer, heating said layer in a distillation chamber, applying suction to the under side of the layer in the said distillation chamber at a plurality of points while a portion of the gases of distillation and the heavy tar containing coal dust are conducted to the top of the layer, and agglomerating the semi-coke in the same chamber whereby the coal dust is removed.

6. The process of low temperature distillation of coal comprising the following steps: arranging the coal in a continuously travelling gas pervious and substantially continuous layer, heating said layer in a distillation chamber, applying suction to the under side of the layer in the said distillation chamber at a plurality of points while a portion of the gases of distillation and the heavy tar containing coal dust are conducted to the top of the layer whereby the coal dust is removed, and agglomerating the semi-coke in the said chamber by means of a chain loosely hung over the layer of coal and pressing on the same at other points towards the end of the travel of the said fuel through the said distillation chamber.

In testimony whereof I affix my signature.

ALFRED JEAN ANDRÉ HÉRENG.