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O. HUBMANN

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APPARATUS FOR DISTILLING COMBUSTIBLE MATERIALS

Filed July 12, 1926

Fig. 1.

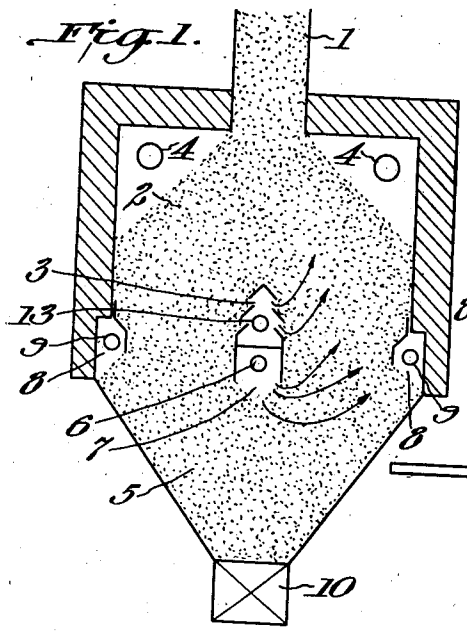


Fig. 3.

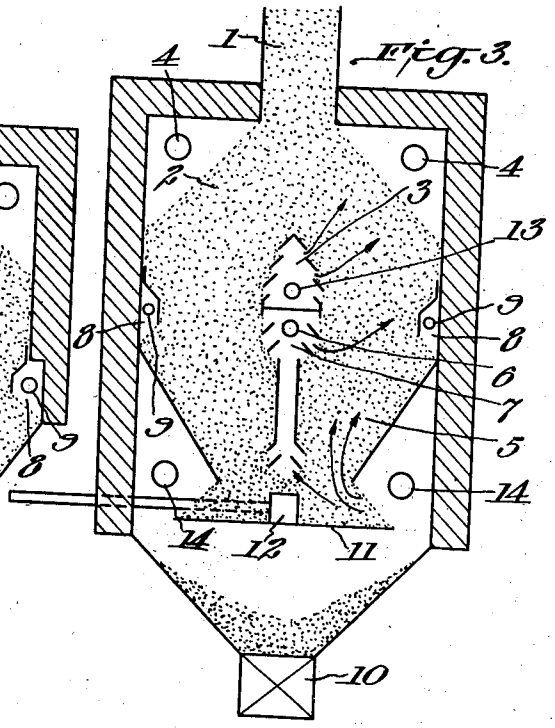
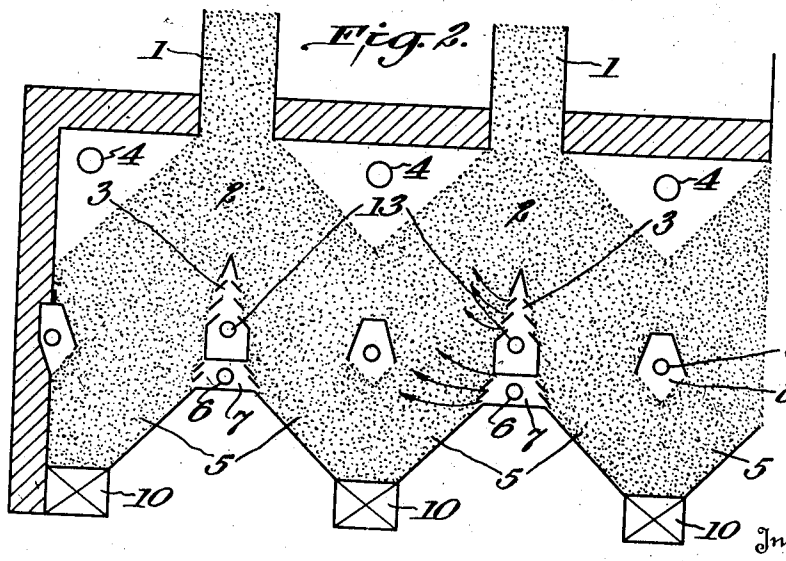


Fig. 2.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR DISTILLING COMBUSTIBLE MATERIALS.

Application filed July 12, 1926, Serial No. 121,967, and in Germany October 23, 1924.

The invention relates to the distillation of combustible materials such as brown coal or other coal rich in bitumens, and more particularly to a method wherein the distilling is effected by passing hot gas through the material and wherein the coke produced is cooled by the passage of gas therethrough.

The furnace employed in carrying out the method has a distillation zone and a cooling zone thereunder, the heat transfer in both zones being effected by passage of a stream of non-oxidizing gas through the charge.

Heretofore it has been the practice to employ the cooling gas, which has taken up the heat from the hot coke, for effecting the distillation by raising the temperature of the gas to the necessary degree after its passage through the cooling zone. For this purpose it has been necessary to use certain precautions in order to prevent the insufficiently heated cooling gas from flowing directly from the cooling zone into the distillation zone. To this end gates or dampers have been employed between the coke-cooling zone and the distillation zone, or there has been arranged between the two zones a contracted portion of the shaft, made as long as possible or practicable. In many cases, especially with coarse material, it is necessary to withdraw the cooling gas from the cooling zone as completely as possible and force it back into the distillation zone, since by direct transfer of the insufficiently heated cooling gas, portions of the combustible material in the distillation zone are incompletely distilled. All these means are, if they are to be made to work satisfactorily, attended by technical difficulties and considerable expense.

By the present invention it is possible to obtain a good and uniform distillation of the combustible material and a cooling of the coke in a simple shaft-like furnace in which no dampers are necessary and in which there are no thick separating layers of combustible material between the distillation zone and the cooling zone.

This is attained by introducing the hot distilling gas and at least a portion of the cooling gas stream through the downwardly moving masses of combustible material in the shaft, in the same direction, and by causing the gas streams in their movement to intersect the path of movement of the charge. According to the present improvements, the spaces from which the distilling gas stream and the cooling gas stream enter the charge are disposed close to each other and one below the other, thereby obtaining the advantage of a distilling shaft of small height and reduced heat-losses. The cooling gas is withdrawn from the charge beneath the distillation zone. However, a small portion of the cooling gas can pass over directly into the distillation zone without objectionally affecting the progress of the distillation, since at this point only the upper and hottest layers of the cooling gas can pass into such zone.

The gases employed for cooling can be further used, if desired, after suitable heating for carrying out the distillation. They may however be used for other purposes and the distillation carried out with other gases.

The invention accordingly comprises an essential simplification and improvement of the distillation methods and apparatus heretofore known.

The invention will better be understood by reference to the accompanying drawing, wherein:

Fig. 1 indicates diagrammatically, in vertical section, one form which the distilling apparatus may take;

Fig. 2 is a similar view of a modified form of apparatus wherein a plurality of distillation shafts are combined in one structure; and

Fig. 3 is a similar view of still another modification.

In each of the figures, 1 is the charging opening through which the combustible material is introduced into the distillation shaft, 2 indicates the distillation zone and 5 the cooling zone. The gases for effecting the distillation pass from the space 3 through the grate-like walls into the distillation zone, and outlets 4 are provided for the gases flowing from this zone and out of the distillation shaft. The cooling gas passes out of the lower space 7 into the combustible material. The treated material is discharged through suitable apparatus 10.

In Fig. 1 is shown a distillation shaft in which the spaces for the introduction of the distilling gases and cooling gases are arranged in the middle of the shaft so that the downwardly moving mass of combustible material is divided into two streams. The distilling gases pass from the pipe 13 into the space 3, then pass through both portions

of the combustible material in the direction of the arrows and leave the distillation shaft through the outlets 4, together with the gases resulting from the distillation, and possibly also a small quantity of the cooling gases. The cooling gas enters the space 7 beneath the space 3 by pipe 6, flows through the layers of combustible material which have been distilled in the same direction as the distilling gases, is collected in the outer space 8 and is conducted from the shaft by the conduit 9. As above indicated, this gas can be used for distillation or for other purposes. As the drawing indicates, by the introduction of the distilling and cooling gas streams in accordance with this invention only the upper portions or layers of the cooling gas can mix with the distilling gas. These upper layers of the cooling gas have however correspondingly high temperatures, since in their passage through the charge they come into direct contact with the coke which lies immediately adjacent the inlet for the hot distilling gases and which therefore has their highest temperature. The correspondingly small amount of cooling gas which passes over into the distilling gas stream is so highly heated that it can exert no deleterious effect on the progress of the distillation. Since the introduction of the distilling gas, according to this invention, is most advantageous, an orderly progress of the distillation process is assured.

In the modification shown in Fig. 2, several distillation shafts are combined in one structure. The introduction of the distilling and cooling gases, as well as of the combustible material, is the same as above described in connection with Fig. 2, and the only changes are in the form of the gas introducing spaces 3 and 7. Naturally the collecting spaces 8 for the cooling gas and the means for removing the charge must be slightly altered to suit the changed conditions. By unitary assembly of a larger number of distillation shafts, a diminution in the loss of heat is attained.

Fig. 3 shows still another modification in which only a portion of the cooling gases intersects the two halves of the downwardly moving mass of coal. In this case also, that part of the cooling gas which may pass into the distillation zone flows through the hottest coke, and this portion of the gas stream prevents the remainder of the cooling gas, which is of lower temperature, from passing into the distillation zone and interfering with the progress of the distillation. The arrangement for carrying out the process as shown in Fig. 3 differs from those which have been above described in that under the cooling zone is arranged a plate or table 11 on which the masses of combustible material rest. By means of a suitable discharge apparatus, for example the pusher 12, the coke is discharged into the underlying bunker, from which it may be withdrawn by any suitable gate arrangement. The cooling gas is introduced into this bunker by pipes 14. Some of it passes directly from the pipes 14 to the collecting space 8 for the cooling gas. The other portion of the current of cooling gas, which passes through the combustible material in the same direction as the distillation gases, can be introduced entirely through the pipe 6 into the space 7, or in case the pipe 6 is omitted, gas entering through the pipes 14 can be so used, the resistance between the pipes 14 and the space 7 being made smaller by a corresponding downward lengthening of the space 7, as shown. In this case, a portion of the cooling gas introduced through the pipes 14 passes directly through the coke beneath the space 7 into the latter and enters into the column of combustible material, in the same direction as the distillation gases. This branch current can be removed through the pipe 9 or through the pipe 4 of the distillation apparatus. The greater portion of the cooling gas flows, on the contrary, from the conduit 14 to the space 8, is then led off through the outlet 9 and can, after the necessary reheating, again be used for distillation. The conditions of flow are controllable in the conduit 14 and the gas spaces 7 and 8, and by changing the resistance between the inlet 14 and the space 7 may be adjusted as desired. In each of the arrangements shown in the drawings, the inlets for the hot distilling gas and the cooling gas are located on the same side of a column of moving material and the outlet means are at the other side of the column. Obviously other arrangements for the carrying out of the process and other methods of construction or arrangements for introducing the distilling and cooling gases, other forms of the distilling shaft, and other means for removing the gases and for withdrawing the charge may be employed. For example, for the introduction of the distilling and cooling gases, I may use two or more superposed tubes provided on their under sides with exits for the distilling and cooling gases, respectively.

I claim:

1. Apparatus for distilling solid carbonaceous material comprising a shaft-like still having an uninterrupted upper portion, means for introducing the material at the top and withdrawing it from the bottom of the shaft, means for introducing hot distilling gas including inlet means located within the shaft below said upper portion and spaced from the wall of said shaft, means for introducing cooling gas including inlet means located within the shaft below the first named inlet means and likewise spaced from the wall of the shaft, gas outlet means located near the top of the shaft, and addi-

tional gas outlet means located near the side walls at substantially the level of the inlet means for cooling gas, substantially as shown and described.

2. Apparatus for distilling solid carbonaceous material comprising a shaft-like still having an uninterrupted upper portion constituting a distilling zone and a lower portion constituting a cooling zone through which zones a column of material may successively pass, inlet means for hot distilling gas in the lower portion of the distilling zone and inlet means for cold gas below the first-named inlet means, both inlets being located on the same side of the column, outlet means for gas at the upper portion of the distilling zone, and outlet means for withdrawing gas from the cooling zone, both outlets being located at the other side of the column.

3. Apparatus for distilling solid carbonaceous material comprising a shaft-like still having an uninterrupted upper portion constituting a distilling zone and a lower portion constituting a cooling zone through which zones a column of material may successively pass, inlet means for hot distilling gas in the lower portion of the distilling zone and inlet means for cold gas below the first-named inlet means, outlet means for gas at the upper portion of the distilling zone, and outlet means for withdrawing gas from the cooling zone, said inlet and outlet means dividing the column of material into a plurality of streams, the inlet means for distilling gas and cold gas being situated at one side of each stream of material and both of said outlet means at the other side of each of said streams.

In testimony whereof, I affix my signature.

OTTO HUBMANN.