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DISTILLATION OF HEAVY OILS, OIL RESIDUES, AND BITUMENS.

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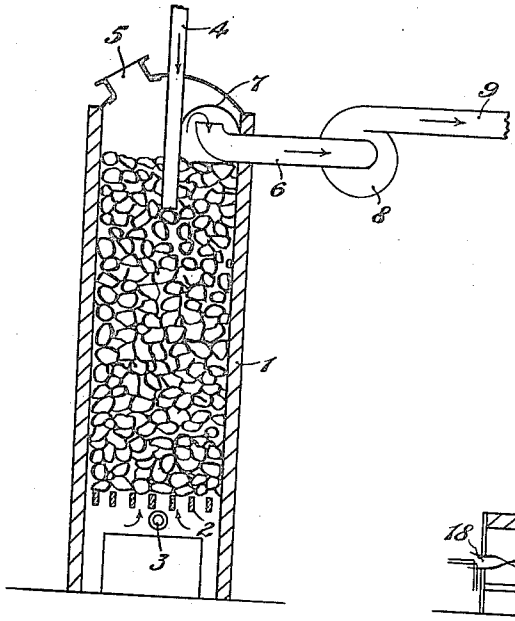


FIG. 1.

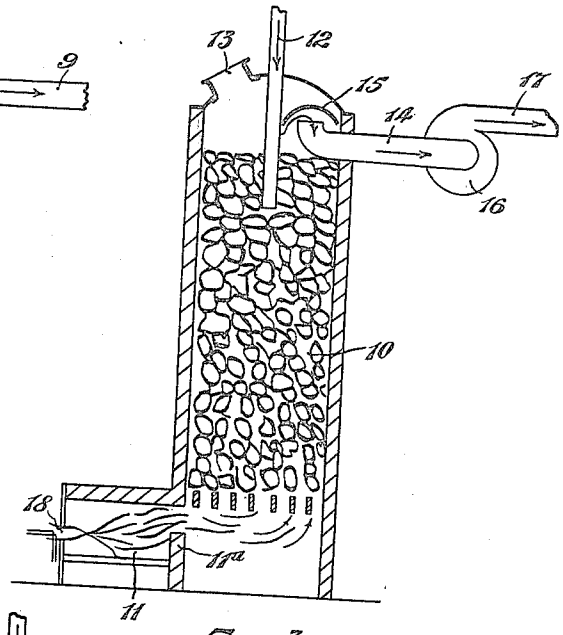


FIG. 3.

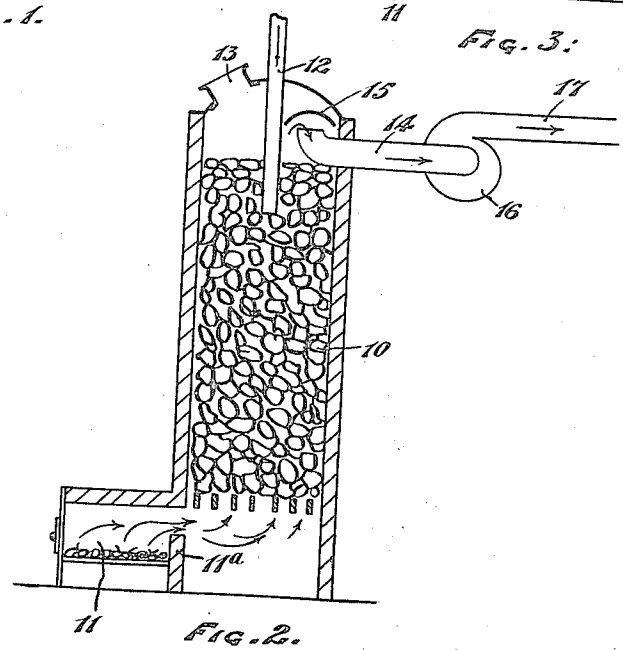


FIG. 2.

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UNITED STATES PATENT OFFICE.

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DISTILLATION OF HEAVY OILS, OIL RESIDUES, AND BITUMENS.

1,247,671. Specification of Letters Patent. Patented Nov. 27, 1917.

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To all whom it may concern:

Be it known that I, WILLIAM AUGUSTUS HALL, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in the Distillation of Heavy Oils, Oil Residues, and Bitumens, of which the following is a specification.

My present invention relates to an improved process of distilling bituminous oils.

Broadly, the improved process consists in mixing heavy bitiuminous oil with (or absorbing the same in) an amount of coke or like porous combustible material at least equal in weight to the amount of oil, subjecting the material thereby produced to direct contact with hot gases of a non-oxidizing character and condensing the volatile matter evolved by the reaction. Preferably, the heat necessary for effecting this distillation of the bituminous oil is obtained by the combustion of a portion of the coke itself the oil being brought into contact with the coke and the distillation being effected at a point above the combustion zone where the products of combustion have acquired a non-oxidizing character.

It may be found in some cases desirable to burn coke or coal separately in an auxiliary furnace attached to a coke column, whereby the hot products of combustion from the external furnace are drawn up through the coke column supplied with oil at the zone where the gases have become non-oxidizing. Another method which may be practised economically in certain conditions involves the internal application of the heat in the shape of hot products of combustion from the burning of oil or gas in an auxiliary furnace attached to or in the bottom of or underneath the coke column, such latter method being particularly suitable on the oil fields, or where natural gas is cheaply obtained.

In performing the process in the preferred way I use a form of gas producer, provided with a much higher column than is common in gas producers. This column is charged with coke of a suitable size; the higher the column, the larger may be the coke. The coke is burned at the bottom of the column by the admission of air, but, as there is a very short combustion or oxidizing zone and a very tall column above of coke heated by the hot products of combustion from the oxidizing zone, at a certain point above the oxidizing zone non-oxidizing or even reducing conditions are reached, and at or above that point the oil is admitted in such manner that it spreads in liquid state over and through the entire mass of coke at the zone of its admission or is absorbed by the said coke, the same being a highly porous material. The feeding of oil and coke is so adjusted that there is never more oil than coke, in the zone of distillation, since coke will not absorb more than about its weight of oil. The hot gas arising from the hot lower zone is rendered non-oxidizing in character by the large amount of coke through which it passes before reaching the oil. The distillation progresses without separation of the light from heavy vapors, according to the boiling points of the different fractions, the oil vapors being accompanied by producer gas, largely composed of carbon monoxid, hydrogen and nitrogen. These gases are removed in the ordinary manner common in the production of producer gas, carrying with them all of the oil vapors, and the gas and vapors are then passed through a condenser in which the oil vapors are condensed while the producer gas and other fixed gases which remain uncondensed are collected in a gasholder, the gas in which may be used for heating a retort in which the distillation may be carried out or for power purposes.

Fresh coke may be admitted from time to time in the ordinary manner in which it is admitted in gas producers, but it must be borne in mind that there is always a considerable addition of coke (from 15 to 25% of the weight of oil) which is formed from the coking of the bitumen and which burns at the bottom of the zone as the charge drops down. Hence, much smaller additions of extraneous coke are required than would otherwise be the case, and with very bituminous oils no further additions of coke may be necessary other than the original charge. The combustion must be regulated to prevent too high a temperature being reached at the zone at which the oil is distilled. The temperature at this zone should not exceed about 490° C. or 500° C.

It is of course necessary to produce a slight draft on the vapors, in order that there may be no back pressure in the furnace which would tend to drive the oil or its vapors down into the oxidizing zone.

This draft can readily be produced by an exhaust fan. Water or steam may be admitted at or about the grate level in the combustion zone, the same as is frequently done in some styles of coke-burning furnaces and gas producers.

In practising the process in the other ways mentioned, coke is charged into a column connected with a furnace from which the hot gases are passed up through the column, the oil being supplied in the same way as above described. When the operation is properly conducted, it is clear that the oxygen content of any air passing through the coke column will be converted into CO or CO_2 before it reaches the zone at which the oil is distilled. In this case, of course, the coke in that zone is not consumed.

The improved process has the advantage that very large cupolas can be used, insuring great capacity and a comparatively low plant cost per gallon run through. It insures an internal application of the heat at the exact point where it is required, without liability of overheating the walls of the cupola, which may be lined with fire brick to prevent loss by radiation, and the destruction of the cupola.

Apparatus for performing the process is shown diagrammatically in the accompanying drawings in which Figure 1 is a vertical section of a form of apparatus for use in connection with the preferred method of performing the process by partial combustion of the coke, while Figs. 2 and 3 show in vertical section forms suitable for use where an auxiliary furnace is used for supplying the necessary hot gases.

Referring to Fig. 1, 1 denotes conventionally a gas producer charged with coke, 2 a grate on which the coke is burned, 3 an air and steam supply pipe, 4 the pipe leading the oil into the coke, 5 the coke supply chute, 6 a pipe for leading the volatile matter and the products from the producer, 7 a baffle over the inlet end of the pipe for preventing ingress of coke, 8 a fan for inducing the flow of the vapors and gases from the producer, 9 the pipe for leading the vapors and gases to a condenser and separator not shown. The condensate, assuming that a heavy bituminous oil is being treated, will be materially lighter than the oil introduced, since the heavy, bituminous matters do not distil, but are charred in the lower part of the distillation zone, being there (or lower down) converted partly into coke, and partly into light vapors, which distil.

In the construction shown in Figs. 2 and 3, 10 denotes the column charged with coke, 11 the auxiliary furnace, provided with the usual fire bridge 11^a, 12 the oil supply pipe, 13 the coke supply chute for charging the column, 14 the pipe for leading off the volatile matter and spent products of combustion, 15 the baffle over the inlet end of the pipe for preventing ingress of coke, 16 the fan for inducing the flow of the vapors and gases from the producer, 17 the pipe leading to the condenser and separator not shown.

In the construction shown in Fig. 3 there is provided an oil or gas burner 18, and oil or gas used in lieu of solid fuel.

I claim:—

1. A process of producing lighter oils from heavy bituminous oils, consisting in bringing together the heavy bituminous oil in a liquid state and an amount of porous combustible carbonaceous material at least equal in weight to the heavy bituminous oil to be treated and subjecting the mixture to direct contact with hot non-oxidizing gases at a temperature not above 500° C.

2. A process of producing lighter oils from heavy bituminous oils, consisting in feeding the heavy bituminous oil in a liquid state to an amount of porous combustible carbonaceous material at least equal in weight to the heavy oil to be treated, subjecting the mixture to direct contact with hot non-oxidizing gases at a temperature not above 500° C., and separating out and condensing the volatile constituents.

3. A process of producing lighter oils from heavy bituminous oils, consisting in bringing the heavy bituminous unvaporized oil into contact with an amount of porous combustible carbonaceous material at least equal in weight to the heavy oil to be treated and subjecting the mixture to direct contact with hot products of combustion non-oxidizing in character.

4. A process of producing lighter oils from heavy bituminous oils, consisting in burning at its lower end a column of porous combustible carbonaceous material, leading to the column of porous combustible material at a point where the products of combustion passing through the column have acquired a non-oxidizing character, a supply of liquid heavy bituminous oil of a weight about equal to that of the combustible material in the zone of distillation, and maintaining the products of combustion at the point where the mixture of porous combustible material and oil is exposed to direct contact therewith at a temperature not above 500° C.

5. A process of producing lighter oils from heavy bituminous oils, consisting in passing hot gaseous products of combustion through a column of porous combustible carbonaceous material to render the hot gaseous products non-oxidizing in character, and bringing the hot non-oxidizing gas in contact with heavy bituminous oil and in the presence of porous combustible material.

6. A process of producing lighter oils from heavy bituminous oils, consisting in

burning at its lower end a column of coke, leading to the column of coke at a point where the products of combustion from the burning of the coke passing through the column have acquired a non-oxidizing character, a supply of heavy bituminous oil of a weight about equal to that of the coke in the zone of distillation, and maintaining the products of combustion at the point where the mixture of coke and oil is exposed to direct contact with the products of combustion at a temperature not above 500° C.

7. A process of distilling heavy bituminous oil which comprises maintaining the lower end of a relatively tall body of coke at a temperature of at least a red heat, introducing gases thereto, capable of producing combustible gases, and causing the gases to travel upwardly through the said column, maintaining in the upper part of said column a non-oxidizing atmosphere, introducing the heavy oil in a liquid state to the upper part of the coke column, at a point at which the coke is of low enough temperature to absorb the said oil in a liquid state, the weight of coke in this zone being at all times at least substantially equal to the weight of oil, and withdrawing the gases and vapors from the upper part of the column of coke to a condenser.

8. In the distillation of heavy bituminous oil, the improvement which comprises absorbing said oil, in a liquid state, in coke, heating said coke in a non-oxidizing atmosphere to a temperature at which a material amount of the oil will be distilled without being gasified, and passing the vaporized non-gasified oil with the gases comprising the said non-oxidizing atmosphere, to a condenser.

9. In distilling heavy bituminous oil, first absorbing the liquid oil in coke, at a temperature below 500° C., then gradually raising the temperature of the said coke to about 500° C. in a non-oxidizing atmosphere, and leading off the vapors to a condenser, further raising the temperature of the coke and burning the same under conditions capable of generating hot non-oxidizing gases, passing the said gases through the zone in which the above-mentioned distillation is effected.

In testimony whereof I affix my signature.

WILLIAM AUGUSTUS HALL.