May 20, 1930. R. H. CROZIER 1,759,821

PROCESS OF AND APPARATUS FOR DESTRUCTIVE DISTILLATION

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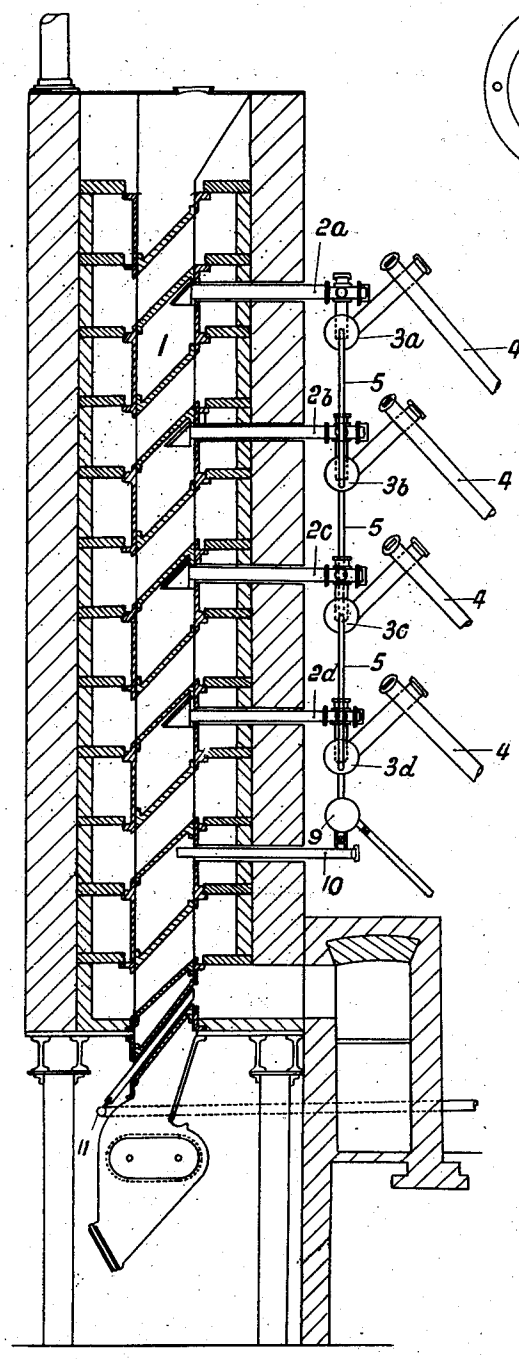

FIG. 1.

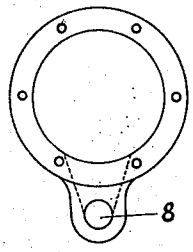

FIG. 3.

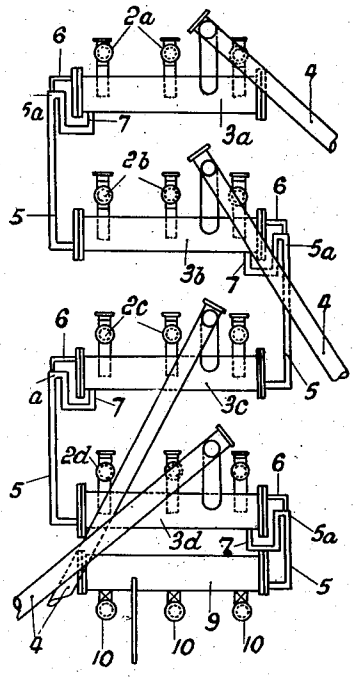

FIG. 2.

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PROCESS OF AND APPARATUS FOR DESTRUCTIVE DISTILLATION

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This invention relates to a method of and means for extracting and cracking heavy oils from coal, shale or the like for the recovery therefrom of oils of lower boiling point.

In accordance with the invention the heat contained in the vapours drawn off at different stages from the retort is utilized to vaporize fractions of boiling point lower than the temperature of the vapours and to concentrate fractions of higher boiling point the fractions of highest boiling point being returned to the residual coke or the like in the retort and cracked in contact therewith. The vapours may be caused to bubble through fractions trapped in the mains and the fractions carried down from main to main through increasing temperatures in contradistinction to bubble towers where the vapours ascend through oils of decreasing temperature. The heaviest fractions are thus concentrated in the lower or lowermost main and are led back into the retort and cracked in contact with the coke or residue from the material being retorted or distilled.

As the result a large portion of the relatively valueless heavy fractions are converted into the more valuable oils of lower boiling point, coke and fixed gas.

It will be appreciated that semi-coke produced in a retort in which cracking is carried out as above described will possess a higher heat value than coke produced by ordinary distillation.

One embodiment of apparatus suitable for carrying the invention into effect is illustrated in the accompanying drawing in which Fig. 1 is a vertical section through a retort fitted with an arrangement for concentrating the heavy fractions at the lower end of the retort and returning such fractions to the retort. Fig. 2 is a side elevation showing the arrangement of the gas mains and bubbling boxes or the like while Fig. 3 shows a detail.

In the embodiment illustrated 1 indicates a retort in which the coal, shale or the like moves downwards continuously and 2^a, 2^b, 2^c, and 2^d the gas mains located at different levels through which the gases and vapours passing off at different temperatures and different levels are drawn off. These gas mains terminate within boxes 3^a, 3^b, 3^c and 3^d provided for collection of the residual fractions, the vapours being caused to bubble through such fractions before passing by the delivery pipes 4 to the condenser (not shown) and serving to vaporize the more volatile fractions contained in the liquid and to concentrate fractions of higher boiling point. Three gas mains are shown at each level. Each of the boxes is suitably lagged or heat insulated in order to ensure that it will be maintained at a definite temperature. Each box is connected with the next lower box by means of a conduit 5 which in the embodiment shown extends upwards at its exit from the higher box in the form of a U-shaped bend 5^a so as to provide a seal for the liquid in such box and ensure the maintenance of the liquid level therein. The upper portion of each bend 5^a is suitably connected by a pipe 6 with the upper part of the associated box so as to permit equalization of pressure and the return of any gases to the box.

In lieu of connecting the conduits 5 with the bottom of each box by way of an elbow 7 the conduit 5 may extend through the end of the box and into a pocket or depression 8 therein as indicated in detail in Fig. 3.

By means of the arrangement described the heaviest fractions are concentrated and accumulate in the boxes and pass downwards by way of the seals to the lowermost box 3^d in which the heaviest fractions are concentrated.

In the embodiment illustrated there is connected to and disposed below the lowermost box 3^d a main 9 connected by way of pipes 10 with the retort, the heavy fractions being thus delivered on to the hot coke at this point.

In the embodiment illustrated there is fitted in the lower end of the retort an inclined flue or a series of flues with a gas burner 11 in each, such burners being supplied with gases from the gas mains or the like associated with the retort. These flues act as bracing members for the retort. The air entering such flues is heated by contact with the flues which are in turn heated by the sensible heat of the moving mass of residual material be-

ing discharged from the retort. The gas produced by the cracking and distilling process may thus be utilized and burnt to the greatest advantage with the heated air heated as described.

I claim:—

1. In an apparatus for destructively distilling carbonizable material the combination of a columnar retort having a charging inlet for charging solid material thereinto and a discharging outlet remote from said charging inlet for discharging solid material therefrom, an elongated reflux fractionating condensation device having a vapor outlet therefor at one end thereof and a residuum outlet therefor at the other end thereof, a series of vapor offtakes for said retort spaced from each other at locations along said retort between said charging inlet and said discharging outlet and communicably connected to said fractionating device at spaced points along the same respectively, the vapor offtake at the location nearest said charging inlet communicating with said fractionating device at the point nearest said vapor outlet and the vapor offtake at the location nearest said discharging outlet being spaced therefrom and communicating with said fractionating device at the point nearest said residuum outlet.

2. In an apparatus for destructively distilling carbonizable material the combination of a columnar retort having a charging inlet for charging solid material thereinto and a discharging outlet remote from said charging inlet for discharging solid material therefrom, an elongated reflux fractionating condensation device having a vapor outlet therefor at one end thereof and a residuum outlet therefor at the other end thereof, a series of vapor offtakes for said retort spaced from each other at locations along said retort between said charging inlet and said discharging outlet and communicably connected to said fractionating device at spaced points along the same respectively, the vapor offtake at the location nearest said charging inlet communicating with said fractionating device at the point nearest said vapor outlet and the vapor offtake at the location nearest said discharging outlet being spaced therefrom and communicating with said fractionating device at the point nearest said residuum outlet, said residuum outlet communicating with said retort at a point between said discharging outlet and said location nearest said discharging outlet.

3. The process of destructive distillation of solid carbonizable material which comprises passing the material along as a column longitudinally thereof, subjecting the material to heat decomposition at progressively increasing temperatures by heating the same to progressively increasing temperatures along the column in the direction of movement thereof, taking off vapors from said material at a plurality of points at increasing temperatures along said column and subjecting the vapors evolved therefrom to reflux fractional condensation in a second column, the vapors from said points at progressively increasing temperatures entering said second column at different points of progressively increasing temperatures respectively, so that vapor taken off from the solid material at the lowest temperature enters said second column at approximately the lowest temperature therein and the vapor taken off from the solid material at the highest temperature enters said second column at approximately the highest temperature therein.

4. The process of destructive distillation of solid carbonizable material which comprises passing the material along as a column longitudinally thereof, subjecting the material to heat decomposition at progressively increasing temperatures by heating the same to progressively increasing temperatures along the column in the direction of movement thereof, taking off vapors from said material at a plurality of points at increasing temperatures along said column and subjecting the vapors evolved therefrom to reflux fractional condensation in a second column, the vapors from said points at progressively increasing temperatures entering said second column at different points of progressively increasing temperatures respectively, so that vapor taken off from the solid material at the lowest temperature enters said second column at approximately the lowest temperature therein and the vapor taken off from the solid material at the highest temperature enters said second column at approximately the highest temperature therein, the final residuum in said second column being conveyed to the column of solid material at approximately the point of highest temperature therein.

5. The process of destructive distillation of solid carbonizable material which comprises passing the material along as a column longitudinally thereof, subjecting the material to heat decomposition at progressively increasing temperatures by heating the same to progressively increasing temperatures along the column in the direction of movement thereof, taking off vapors from said material at a plurality of points at increasing temperatures along said column and subjecting the vapors evolved therefrom to reflux fractional condensation in a second column, the vapors from said points at progressively increasing temperatures entering said second column at different points of progressively increasing temperatures respectively, so that vapor taken off from the solid material at the lowest temperature enters said second column at approximately the lowest temperature therein and the vapor taken off from the solid material at the highest temperature enters said

second column at approximately the highest temperature therein and taking off vapor at a plurality of points along said second column.

6. The process of the destructive distillation of solid carbonizable material which comprises progressively feeding the material into a zone, continuously decomposing the material at progressively increasing temperatures in said zone, simultaneously and separately removing from the material the vapors formed at a plurality of different temperatures, subjecting said vapors to reflux fractional condensation comprising passing the hotter vapors into contact with the condensates from the cooler vapors.

7. The process of the destructive distillation of solid carbonizable material which comprises progressively feeding the material into a zone, continuously decomposing the material at progressively increasing temperatures in said zone, simultaneously and separately removing from the material the vapors formed at a plurality of different temperatures, subjecting said vapors to reflux fractional condensation comprising passing the hotter vapors into contact with the condensates from the cooler vapors and returning the final residuum from said fractional condensation to the solid residue of the destructive distillation for redistillation.

8. The process of the destructive distillation of solid carbonizable material which comprises continuously feeding the material into a zone, continuously decomposing the material at progressively increasing temperatures in said zone, simultaneously and separately removing from the material the vapors formed at a plurality of different temperatures, subjecting said vapors to reflux fractional condensation comprising passing the hotter vapors into contact with the condensates from the cooler vapors, and separately removing vapors at different temperatures, from the material being subjected to said fractional condensation.

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