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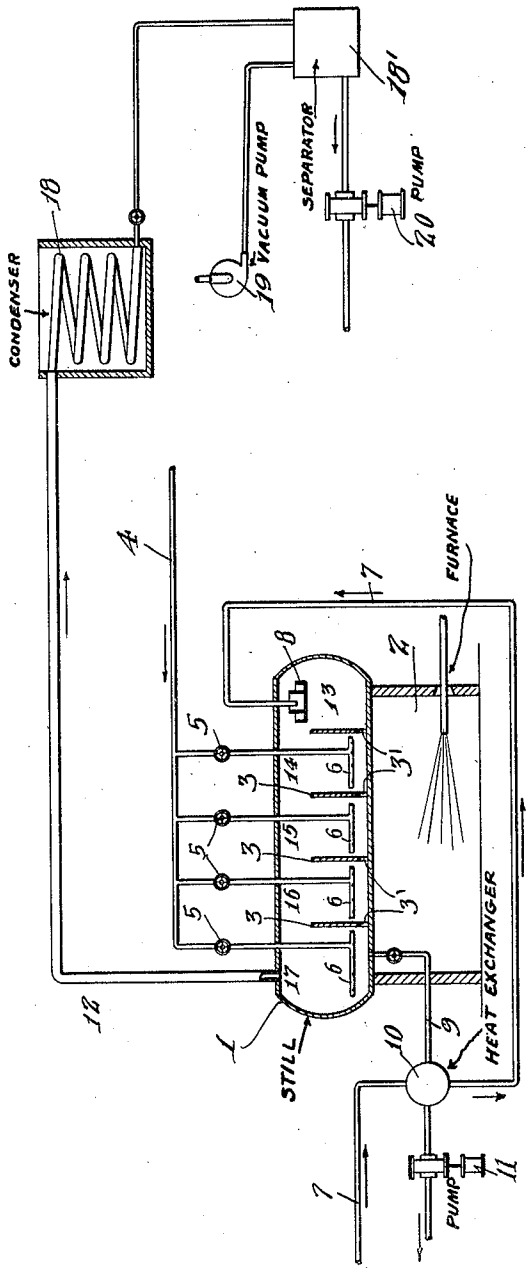

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PROCESS OF DISTILLING PETROLEUM OIL.

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This invention relates to the distillation of petroleum oils and in particular to the distillation of those high boiling point fractions of pertoleum, desirable as distillates and whose boiling temperatures are so high as to make their distillation without accompanying destructive distillation, or cracking, impractical by ordinary means.

The fact that many petroleum oils have boiling temperatures higher than the temperatures at which some portions of these same oils break down or crack, has long been a source of trouble to refiners. Because of this fact the yield of desirable heavy distillates has been reduced and additional rerunning of distillates made necessary.

The breaking down by cracking of a part of the oil, not only reduces the yield of the most desirable high boiling point distillates, such as cylinder stock, but a part of the heavier of the cracked fractions commingle with the natural distillates and change to a certain extent the characteristics of the recovered distillates.

The detrimental effects of cracking are made particularly evident in the production of high grade lubricating oils, where, because of the high temperatures required for their distillation, cracking is most apparent and from which distillates the lighter cracked products must be removed by rerunning.

In attempting to prevent cracking by the reduction of still temperatures open steam is almost universally used during the distillation of the heavier products. The partial pressure effect of the steam is to permit a continual vaporization of the oil at a temperature below its boiling point at the pressure employed. Resort has also been made to distillation in partial vacuum, both with and without steam. In all cases, however, the final and highest boiling point fractions have been removed from the reduced residuum in the absence of the vapors of the lighter fractions, these having been distilled off. That is, fractional distillation is the universal practice, whether the process is continuous or batch, and whether or not distillation is carried on in a single still or a number of stills operating in series.

In the customary processes of distilling petroleum oil from its residuum, the different boiling point oils are removed in the order of their vaporizing temperature. Accordingly, the highest boiling oils are left in the residuum to be separately distilled therefrom. Such highest boiling petroleum oils are generally the most readily decomposed or cracked oils obtained from the crude.

If, in place of separately vaporizing the higher boiling point oils, the higher boiling point oils are vaporized simultaneously with the vaporization of a more readily vaporized oil, the temperature at which the higher boiling point oils can be vaporized is materially reduced. The reduction of the vaporizing temperature of the higher boiling point oils is due to the influence of the lower boiling point oils. The vapors of the lower boiling point oils being commingled with those of the higher boiling point oils assist the vaporization of such higher boiling point oils by their partial pressure effect on the oil undergoing treatment.

When the distillation of petroleum oil is conducted continuously, and at greatly reduced pressure and perferably with the use of steam, and the highest boiling point oils vaporized from the residuum simultaneously with the vaporization of a material quantity of substantially lower boiling point oils, the temperature at which the highest boiling point oils may be vaporized is so reduced that decomposition of such high boiling oils is substantially prevented.

The objects and advantages of this invention will be more readily understood from a description of an apparatus and a process embodying the invention as practiced in such an apparatus, it being understood that such apparatus and process so hereinafter described is given only as an example of a practical embodiment of the invention.

In the drawings, 1 represents a still set over a furnace 2. Preferably the still is provided with baffles 3, with small openings 3′ at the bottom, which extend across the still 1, which baffles separate the still into a plurality of semi-separate compartments indicated at 13, 14, 15, 16 and 17 respectively. 7 indicates the feed line to the still which preferably passes through a tar heat exchanger 10, communicates with the still at one of end compartments 13, and discharges the feed oil into a drip pan 8 therein. The still

is provided with a residuum drawoff line 9 which preferably communicates with the end compartment 17, which compartment is at the opposite end of a still 1 to which the feed line 7 communicates. Said line 9 preferably leads through the heat exchanger 10, hence through a pump 11 to storage. 12 indicates the vapor line of the still which preferably communicates with the end compartment 17. Said vapor line 12 leads through a condenser 18 to a separator 18' to which vacuum pump 19 is connected. From the separator 18' by means of the pump 20 the condensate may be transferred as desired to suitable storage, etc. 4 indicates a steam line leading from a source of steam (not shown) and connected through valves 5 to spray lines 6 in the various compartments of the still.

When vaporizing the highest boiling point and most readily decomposed or cracked oils, the oil, as fed into the still through the line 7, comprises not only the highest boiling point and most readily decomposed or cracked oil, but the feed oil includes also a substantial quantity of materially lower boiling point oils, which oils act to influence and assist the vaporization of such high boiling point and readily decomposed oil from the residuum. The vaporization within the still of any oil of lower boiling point than such high boiling point oil will reduce the vaporizing temperature of such high boiling point oil. Thus, for carrying forth the invention so as to utilize the maximum advantage of the influence of low boiling point petroleum vapors, all the vapors of a crude oil should be evolved simultaneously with the relatively higher boiling point vapors. However, as later described, since the vaporization of the oil fed into the still is at greatly reduced pressure, as an aid to the vaporization of the readily decomposed oil, we prefer, because of the difficulty of condensing the lowest boiling point constituents at the reduced pressure, to first separately distill some of the lighter fractions from the crude.

For convenience the numerous constituents of petroleum may be classified as: motor fuels, lamp oils, gas oils, viscous or lubricating distillates, and the residuum. The motor fuels are the lighter or lower boiling point fractions of petroleum. The lamp oils are the next heavier or higher boiling point fractions. The gas oils are those fractions of petroleum obtained between the lamp oils and the lubricating distillates. The gas oils are generally too heavy to be employed as a burning fuel for lamps and not sufficiently viscous for use as lubricants. The viscous or lubricating distillates are the highest boiling point fractions normally distilled from the oil and are used as lubricating oils or as charging stocks for cracking processes. The residuum of the oil is the residue left after the separation of the other constituents named and will vary in character with the nature of the oil treated.

Even when operating at greatly reduced pressure and with the use of steam, some of the higher boiling point viscous or lubricating oils are decomposed when vaporizing the same from their residuum unless such vaporization is effected in the pressure of the vapors of lower boiling point oil. When separating certain oils from their residuum I prefer to include in the feed oil to the still substantially all the lubricating constituents with the residuum. How much lower boiling point oils should be distilled with the readily decomposed oil will depend on the apparatus available, and the amount and boiling temperature of the higher boiling point oils which are to be vaporized. With a familar grade of California oil the feed oil is normally reduced to a gravity between 14° and 17° Baumé before being fed into the still. Equivalent feed oil from other crudes may have a materially different gravity. In some cases, however, it is advisable to employ the additional influence of lower boiling point oils, such as the gas oil or even lower boiling point oils.

By operation of the pump 19, the pressure in the still 1 is maintained as low as practically possible, preferably a vacuum in excess of 24 inches of mercury or less than 2.9 pounds per square inch absolute pressure should be maintained. Preferably steam is used to assist the vaporization of the oils in the still 1 and the oils in the still are maintained at a temperature sufficiently low to prevent any substantial amount of cracking.

The distillation is maintained continuously, the feed oil being continuously fed to the still, the desired lubricating fractions being continuously and simultaneously withdrawn through the vapor line 12, and the residuum continuously withdrawn through the line 9 by operation of the pump 11. The distillation of the desired lubricating distillates in one operation or step is obtained by regulating the draw off of residuum so that the oil remains in the still the requisite period of time. The still should be maintained under as nearly constant conditions as possible, thus the temperature of the oil in the still, the quality and quantity of steam, the rate of fire, the degree of vacuum, the rate of feeding the oil and rate of residuum draw off—all should be gaged and maintained constant. By frequent inspection of the residuum draw off and of the distillate the operator may determie whether the desired reduction thereof and vaporization of the lubricating distillates are being accomplished.

The use of the baffles 3 in the still prevent convection currents in the liquid which

might otherwise cause incompletely reduced oil to pass out through the residuum draw-off line.

By vaporizing the lower boiling point lubricating distillates in the same still with the higher boiling point lubricating distillates the temperature at which the higher boiling point distillates may be distilled from the residuum is greatly decreased and decomposition is substantially prevented. If the commingled lubricating distillates thus separated from the residuum are to be used to form lubricating oils, the various grades of lubricating oils may be separated thereafter by fractional distillation, in which case, however, the highest boiling point oils, such as cylinder oil, are withdrawn as the residuum of the fractionating process without being again distilled.

A further advantage of the described process and of the resultant lubricating distillate resides in the value of the produced lubricating distillate as a charging stock for a cracking process. By substantially avoiding cracking in the separation of the lubricating distillate from the residuum or base of the oil, an oil is produced which has a maximum hydrogen content and especially suited for cracking, for the reasons clearly set forth in my Letters Patent No. 1,419,378, granted June 13, 1922.

This process is capable of numerous modifications, and is not, therefore, limited to the particular embodiment described for illustrating the invention, but is of the scope set forth in the accompanying claims.

I claim:

1. A continuous process of distilling petroleum oil to evolve heavy lubricating oil fractions therefrom having a decomposing temperature below their vaporizing temperature when heated under a substantial vacuum and substantially preventing decomposition of such heavy lubricating oil fractions, comprising feeding into a single distilling zone oil containing such heavy lubricating oil fractions and lighter lubricating oil fractions, maintaining the distilling zone at substantially a constant temperature below the decomposing temperature of said heavy fractions and under a reduced pressure to vaporize said heavy fractions in the pressure of the vapors of said lighter fractions, and continuously withdrawing said resulting mixed vapors and residue from the distilling zone in such relation of volume and speed as to cause the vaporization of both said heavy and light lubricating oil fractions.

2. A continuous process of distilling petroleum oil to evolve heavy lubricating oil fractions therefrom having a decomposing temperature below their vaporizing temperature when heated under a substantial vacuum and substantially preventing decomposition of such heavy lubricating oil fractions, comprising feeding into a single distilling zone oil containing such heavy lubricating oil fractions and lighter lubricating oil fractions, maintaining the distilling zone at substantially a constant temperature and below the decomposing temperature of said heavy fractions and under a reduced pressure assisted by the injection of steam to vaporize said heavy fractions in the pressure of the vapors of said lighter fractions, and continuously withdrawing said resulting mixed vapors and residue from the distilling zone in such relation of volume and speed as to cause the vaporization of both said heavy and light lubricating oil fractions.

3. A continuous process of distilling petroleum oil to evolve heavy lubricating oil fractions therefrom having a decomposing temperature below their vaporization temperature when heated under a substantial vacuum and substantially preventing decomposition of such heavy lubricating oil fractions, comprising feeding into a single distilling zone an oil containing the residuum and substantially all the viscous constituents originally present in the crude oil, including cylinder oil stocks and lower boiling point lubricating oil fractions, maintaining the distilling zone at a constant temperature below the decomposing temperature of the said heavy lubricating oil fractions comprising the cylinder oil stock and under a reduced pressure to vaporize said cylinder oil stock in the pressure of the vapors of said lighter lubricating oil fractions, continuously withdrawing the resulting mixed vapors and the residue from the distilling zone in such relation of volume and speed as to cause the vaporization of substantially all the lubricating oil fractions contained in said feed oil.

Signed at Richmond, Calif., this 21st day of March, 1923.

RICHARD WRIGHT HANNA.