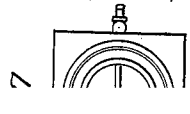
Dec. 18, 1923.

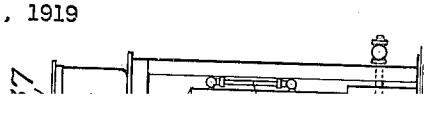
1,478,102

E. M. CLARK ET AL

ART OF TREATING OILS

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UNITED STATES PATENT OFFICE.

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ART OF TREATING OILS.

Application filed December 26, 1919. Serial No. 347,308.

To all whom it may concern:

Be it known that EDGAR M. CLARK, NATHANIEL E. LOOMIS, and JAMES R. CARRINGER, citizens of the United States, residing at 19 Stoneleigh Road, Westfield, New Jersey, 589 Jefferson Ave., Elizabeth, New Jersey, and 15 Beechwood Place, Hillside, New Jersey, respectively, in the county of Union and State of New Jersey, have invented a new and useful Improvement in Art of Treating Oils, of which the following is a specification.

The present invention relates to the treatment of petroleum oils, and more particularly to the treatment of heavy oils having a high viscosity, for the purpose of breaking down their viscosity and for such other purposes as will more fully hereinafter appear.

In petroleum oil refining, oils are frequently encountered, both crudes and residues, which by reason of their high gravity and rapid coking, are not amenable to economic distillation and, by reason of their high viscosity, may not be utilized efficiently as fuel oils. In accordance with the present invention, the viscosity of such oil products may be markedly reduced in many cases without substantial change in gravity and the treated oil may thereupon be utilized as fuel oil, fluxes or for other purposes.

In the accompanying drawings there is illustrated a specific form of apparatus which may be utilized in carrying out the invention. In the drawings,

Figure 1 is a plan view of the system of apparatus utilized, and

Fig. 2 is a side elevation thereof.

Referring more particularly to the drawings, the numeral 10 indicates a pump utilized for maintaining the oil under pressure as it passes through the system of apparatus. The oil to be treated, for example, a heavy residue or crude, is drawn in through the pipe 11 and discharged through the pipe 12 containing a check valve 13 into a preheating device 14, shown as a drum set in a gas fired furnace 15. In the preheating device the temperature of the oil is raised to a point insufficient to cause a percepticle coking of the oil being treated, for example, 400—500° F. From the preheating device 14 the oil passes through pipe 16 containing check valve 17 to the tube 18 leading into the converting coil 21. A small amount of steam under pressure may be admitted into the pipe 18 through pipe 19 containing check valve 20 to avoid coking in the converting coil. The converting coil may, for convenience in cleaning, be formed of a plurality of straight longitudinal pipes 21 set in a suitable furnace 22, and extending for a short distance outside of the furnace at their ends. The longitudinal pipes of the coils may be connected by cross pipes 23 and removable end caps 24 may likewise be provided for the removal of coke and for cleaning the tube.

The oil is forced through the coil under a pressure at least sufficient to maintain it, substantially entirely in the liquid phase while being heated to the necessary conversion temperature for the reduction of its viscosity, for example, 700 to 800° F., and passes from the coil through the pipe 25 provided with a pressure gauge 26 into the cooler 27, where it may be partially or entirely cooled. The period for which the oil is subjected to the conversion temperature is insufficient to permit the formation of substantial amounts of light boiling point hydrocarbons therein.

From the cooler 27 the oil passes through pipe 28 containing expansion valve 29 into a receptacle or drum 30. The pressure on the oil is reduced by its passage through the expansion valve 29, but a slight pressure, for example, ten pounds, may be maintained on the oil in the drum 30 to facilitate its removal therefrom. The drum 30 is provided with a pressure gauge 31 and its upper portion commuicates through a pipe 32 containing an expansion valve 33 with the condenser 34. The lower portion of the drum 30 communicates through pipe 35 containing expansion valve 36 with the cooler 37, from which the cooled oil passes into the receiving drum 38 provided with a suitable gauge 39 and a discharge pipe 40.

The portion of the apparatus wherein the oil is maintained under pressure is substantially free of spaces or pockets wherein vapor may accumulate. The cooled oil from drum 30 may be subjected to distillation for the removal of its lighter constituents which lower the flash point excessively, or the temperature to which the oil is cooled may

be regulated so that the light hydrocarbons which will excessively reduce the flash point of the oil will be distilled off after the pressure on the oil is reduced, passing off with the steam through the pipe 32.

As an illustration of the application of the present invention, the treatment of a heavy Mexican crude oil of 12.5° Bé. gravity, 120° F. flash point, and a viscosity of 809 at 210° F. with a Saybolt viscosimeter may be described. An oil of this character maintained under a pressure of 60 lbs. gauge by the pump is preheated to a temperature of 400 to 500° F. in the preheater 14 and passes through the coil, a small amount of steam or water being injected into the coil with the oil (for example 9% by weight of the oil), the water injected directly being converted into steam within the apparatus. A temperature of 700 to 750° F. is attained by the mixture in the coil. The coil is formed of twelve longitudinal tubes of 2 inch pipe 12 feet long and through which the oil passes at the rate of 40 gallons per hour. From the converting coil the oil passes through the cooler 27, in which it is cooled to a temperature of approximately 30° to 325° F. The oil then passes through the expansion valve 29 into the drum 30, in which a pressure of 10 pounds gauge is maintained. The lighter hydrocarbons of the oil, together with the steam injected into the coil are discharged into the condenser 34. The oil remaining in the separator is discharged through the cooler 37 into the receiving drum 38. The lighter hydrocarbons removed from the oil in the drum 30 amount to approximately 7% of the oil. The converted oil has a gravity of 14.7 Bé. flash point 150° F. and a viscosity of 170 at 210° F. In this case the temperature to which the oil is reduced before relieving the pressure is set at 300 to 325° F. for the purpose of producing a converted oil having a flash point not less than 150° F. By reducing the temperature, for example to 225° F. an oil of a lower flash point may be produced, substantially all of the light hydrocarbons being retained therein while the injected steam will remain in the vapor state and be removed. It is, of course, apparent that the converted oil may be entirely cooled before the pressure is released and the distillation of the steam and lighter vapors therefrom independently effected.

The preheating drum 14 may be dispensed with, a longer period of time being then required for the oil to attain the conversion temperature in passing through the converting coil.

Although the present process has been described in connection with certain details of procedure and apparatus, and as applied to a specific oil, it is to be clearly understood that these details are intended for the purpose of illustration only, and are not to be regarded as limitations upon the scope of the invention, except in so far as included in the accompanying claims.

We claim:

1. The process of breaking down the viscosity of heavy viscous petroleum oils which consists in preheating the oil, forcing the preheated oil through a coil maintained at a higher temperature sufficient to bring the oil to a conversion temperature and cooling the oil before a substantial quantity of low-boiling-point hydrocarbons have been formed therein, a pressure being maintained upon the oil throughout sufficient to hold it substantially entirely in the liquid phase.

2. The process of treating heavy viscous petroleum oil for breaking down its viscosity which consists in preheating the oil to a temperature of 400 to 500° F., forcing the preheated oil through a heated coil whereby the oil is heated to a temperature above 700° F. and cooling the oil before a substantial quantity of low-boiling-point hydrocarbons have been formed therein, a pressure being maintained upon the oil throughout sufficient to hold it substantially entirely in the liquid phase.

3. The process of treating viscous petroleum oil for breaking down its viscosity which comprises preheating oil in a container to a temperature insufficient to cause perceptible coking of the oil, transferring the oil to another container and heating it to a temperature of at least 650° F., cooling the oil before a substantial quantity of low-boiling-point hydrocarbons have been formed therein, and maintaining pressure upon the oil throughout sufficient to hold it substantially entirely in the liquid phase.

4. The process of treating viscous petroleum oil for breaking down its viscosity which comprises preheating said oil to a temperature insufficient to cause preceptible coking of the oil, forcing the preheated oil through a coil maintained at a temperature of at least 650° F., cooling the oil before a substantial quantity of low-boiling-point hydrocarbons have been formed therein and maintaining pressure upon the oil throughout sufficient to hold it substantially entirely in the liquid phase.

5. The process of treating viscous petroleum oil for breaking down its viscosity which consists in preheating said oil to a temperature of 400 to 500° F., injecting steam thereinto in relatively small quantities, heating the mixture to a temperature of at least 650° F. while maintaining a pressure of above 50 lbs. thereupon, thereby retaining the oil substantially entirely in the liquid phase, cooling the mixture while under pressure, reducing the pressure upon the mixture, the temperature to which the mixture is cooled being sufficient to retain the

steam in the vapor state at the reduced pressure, removing the water vapor and cooling the residue.

6. The process of treating heavy viscous crude oil for breaking down its viscosity which consists in applying thereto a pressure of approximately 60 lbs., preheating said oil under such pressure to a temperature of 400 to 500° F., injecting steam thereinto and heating the mixture to a temperature of approximately 750° F. while maintaining said pressure thereupon, cooling said oil to a temperature of 300 to 325° F., reducing the pressure on said oil, removing the vapors formed on reducing the pressure and cooling the residual oil.

7. The process of breaking down the viscosity of heavy viscous petroleum oils which consists in preheating the oil, forcing the preheated oil through a coil maintained at a higher temperature sufficient to bring the oil to a conversion temperature, admixing steam with the oil before its entrance into the coil, and cooling the oil before a substantial quantity of low-boiling point hydrocarbons have been formed therein, a pressure being maintained upon the oil throughout sufficient to hold it substantially entirely in the liquid phase.

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