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APPARATUS FOR REFINING HYDROCARBON OIL

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This invention relates to oil refining apparatus and is directed specifically to apparatus employed in decolorizing and deodorizing cracked hydrocarbon distillates.

5 In the treatment of such distillates for the purpose of removing color-imparting and gum-forming compounds, certain systems employ finely divided contact or catalytic materials such as fuller's earth, or materials
10 having the properties of fuller's earth. Fuller's earth particularly has been found to possess the property of polymerizing the undesirable compounds so that the desirable fractions or compounds may be separately re-
15 moved from the treating system devoid of impurities which render the products unsuitable as a commercial motor fuel.

Heretofore in the operation of these systems an empirical quantity of fuller's earth in
20 finely divided form has been introduced into the flowing body of oil under treatment, this quantity depending largely upon the judgment or skill of the attendant. As a result of this method lack of uniformity in the char-
25 acter of the end product has resulted, and it is a primary object of the present invention to provide automatic feeding means by which the quantity of fuller's earth introduced into the system will be exactly proportioned and
30 regulated in accordance with the quantity of oil flowing through the system for treatment.

In such systems oil adapted for treatment is forced through a pipe line by a pump, and it is another object of the present inven-
35 tion to provide means, operated from the piston rod, valve gear or other positively operated part of the pump for the purpose of effecting the operation of a clay feeding hopper, by which regulatable amounts of clay
40 are introduced into the body of oil adapted for treatment.

With these and other objects in view which will appear as the description proceeds, the invention consists in the novel features of
45 construction, combinations of elements and arrangements of parts hereinafter to be fully described and pointed out in the appended claims.

In the accompanying drawing:

50 Figure 1 is a diagrammatic view, partly in

vertical section, of the apparatus employed in carrying out the present invention,

Figure 2 is a horizontal sectional view on the line 2—2 of Figure 1,

Figure 3 is a horizontal sectional view on the line 3—3 of Figure 1.

Referring more particularly to the drawing, the numeral 1 designates an oil supply line through which liquid oil adapted for purification purposes is passed. This liquid
30 oil is preferably a distillate obtained from cracking apparatus, possessing a high percentage of unsaturate compounds, of undesirable color and possessing usually a relatively high gum content. Such a distillate is
35 obtained commonly from high temperature vapor phase cracking systems although, of course, other systems may produce distillates having somewhat similar characteristics.

The oil is introduced into a tank 2, the
40 line 1 being provided with an automatic flow actuated valve 3, which is responsive to the liquid level in the priming tank for the purpose of controlling the admission of the distillate into said tank. A pipe line 4 leads
45 from the bottom of the tank to the inlet side of a pump 5, which in this instance has been shown as of the usual steam actuated variety. The outlet side of the pump 5 is connected by
50 a pipe line 6 to a pipe still or other heater 7 in which the oil is heated and vaporized while in contact with fuller's earth. Following release from the pipe still the oil in a
55 vaporized form is admitted under reduced pressure into a separating tower 8. In this tower there takes place a separation of the desirable and undesirable fractions, the polymerized undesirable fractions in liquid
60 form, mixed with the clay treating material being removed from the bottom of the tower, while the purified desired fractions are led from the top of the tower in vapor form. The desired fractions are subsequently con-
65 densed and are then in condition for use as motor fuel.

70 The fuller's earth or other equivalent treating material is introduced into the top of the priming tank 2 for admixture with the oil under treatment. This is accomplished by means of a clay receiving hopper or maga-
75 80 85 90 95 100

zine 9. The bottom of the hopper is provided with a wheel 10 formed to include a plurality of circularly arranged clay receiving pockets or openings 11 which are disposed near the perimeter of the wheel. The wheel is revolved by a vertical shaft 12 connected axially therewith, the said shaft being journaled within a bearing 13 formed in the bottom of the hopper 9. The openings 11 are positioned so that when the wheel is rotated the said openings are successively presented to a vertical discharge pipe 14, the upper end of which enters the bottom of the hopper. In this manner the contents of the openings 11 are discharged successively into and through the pipe 14 and thence into the tank 2 since the lower end of the pipe 14 enters the top of the tank 2. A shelf or lip 15 projects over that portion of the wheel 10 which is in registration with the pipe 14. This enables the quantity of clay carried in the openings 11 only to be discharged into the tank 2, preventing the materials above the wheel from entering the pipe 14 and thereby insuring a regulated delivery of a uniform quantity of clay into the mixing tank 2.

To govern the operation of the wheel 10 a rod 16 is connected with a piston rod 17 of the pump 5. The outer end of the rod 16 is adjustably connected with the lower end of an oscillating bar 18 which is pivotally mounted, as at 19, in approximately the center thereof. It will be seen that when the pump is in operation oscillatory movement of the bar 18 takes place, the length or throw of the movement being rendered regulatable by adjusting the connected positions of the rod 16 with the lower end of the bar 18.

The upper end of the bar 18 is connected with a link 20 which carries a pivoted pawl 21 arranged to engage with ratchet teeth 22 provided in connection with a ratchet wheel 23. This wheel is connected with a lower portion of the shaft 12.

From the foregoing it will be observed that the introduction of fuller's earth into the oil under treatment is synchronized with the quantity of oil passing through the system for treatment, this being effected by operating the clay feeding mechanism from the oil pump or pumps. If the pump is speeded up the inflow of clay is proportionately increased and, conversely, if the throughput of oil is comparatively low, the operation of the pump serves to retard increasingly the input of the treating material. In this manner the system is entirely automatic insofar as the clay feeding operation is concerned. When the desired amount of clay for the particular distillate under treatment has been determined, the motion of the oscillating bar 18 is accordingly adjusted to procure the corresponding feeding rate of the treating material. From that point on the operation is automatic. The system has the advantage of preventing waste

of the treating material or under and over treatment of the distillates. It will be understood that if an amount of fuller's earth is used in excess of the desired quantity, the rate of polymerization is accelerated with corresponding loss in the quantity of the desired fraction recovered, and similarly, if the quantity is under that which is normally needed the purification operation will not be completely carried out and re-running thereof may be necessary.

I, of course, do not limit myself to the precise details of construction described, but reserve the right to employ such modifications and equivalent steps of construction and operation that may be said to fall fairly within the scope of the following claims.

What is claimed is:

1. Apparatus for refining hydrocarbon oils, comprising a mixing vessel, means for introducing hydrocarbon oil to be treated into said vessel, a container for holding a finely divided solid treating material, a conduit connecting the lower portion of said container with said vessel, a rotatable disk positioned in the lower portion of said container and provided with a plurality of circularly disposed open ended pockets of uniform holding capacity, said pockets being positioned to receive said treating material and upon the rotation of said disk to register successively with said conduit to effect the discharge of the contents of said pockets into said conduit and thence by gravity into the oil contained in said vessel, an outlet pipe line for removing the oil-treating material mixture from the lower ends of said vessel, a pump arranged in said pipe line for positively passing the mixture therethrough, said pump being formed to include a reciprocating piston rod, a lever pivotally mounted intermediately of its ends, a link pivotally connecting the piston rod with the lower end of said lever, a rotatable shaft connected with said disk, and pawl and ratchet mechanism connected with said shaft and the upper end of said lever, whereby upon the operation of said pump, intermittent rotating movement is imparted to said disk.

2. In apparatus for refining hydrocarbon oil, a container for the reception of finely divided solid treating material, a conduit connecting the lower portion of said container with said vessel, a rotatable disk positioned in the lower portion of said container and provided with a plurality of circularly disposed open ended pockets of uniform holding capacity, said pockets being positioned to receive said treating material and upon the rotation of said disk to register successively with said conduit to effect the discharge of the contents of said pockets into said conduit and thence by gravity into the oil contained in said vessel, an outlet pipe line for removing the oil-treating material

mixture from the lower ends of said vessel, a pump arranged in said pipe line for positively passing the mixture therethrough, said pump being formed to include a reciprocating piston rod, a lever pivotally mounted intermediately of its ends, a link pivotally connecting the piston rod with the lower end of said lever, a rotatable shaft connected with said disk, and pawl and ratchet mechanism connected with said shaft and the upper end of said lever, whereby upon the operation of said pump, intermittent rotating movement is imparted to said disk.

3. In apparatus for refining hydrocarbon oil with the use of a finely divided solid treating material, a container for the reception of the treating material, a disk rotatably positioned in the lower portion of said container provided with a plurality of circularly disposed open ended pockets of uniform holding capacity formed for the reception of said treating material, a mixing vessel, a restricted conduit uniting the lower portion of said container with said vessel, a stationary baffle positioned in said container immediately over a portion of said disk in vertical registration with the upper end of said conduit, an oil outlet line leading from the lower portion of said vessel, a pump in said outlet line, and means directly operated by the pump for imparting intermittent rotary movement to said disk.

In testimony whereof we affix our signatures.

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