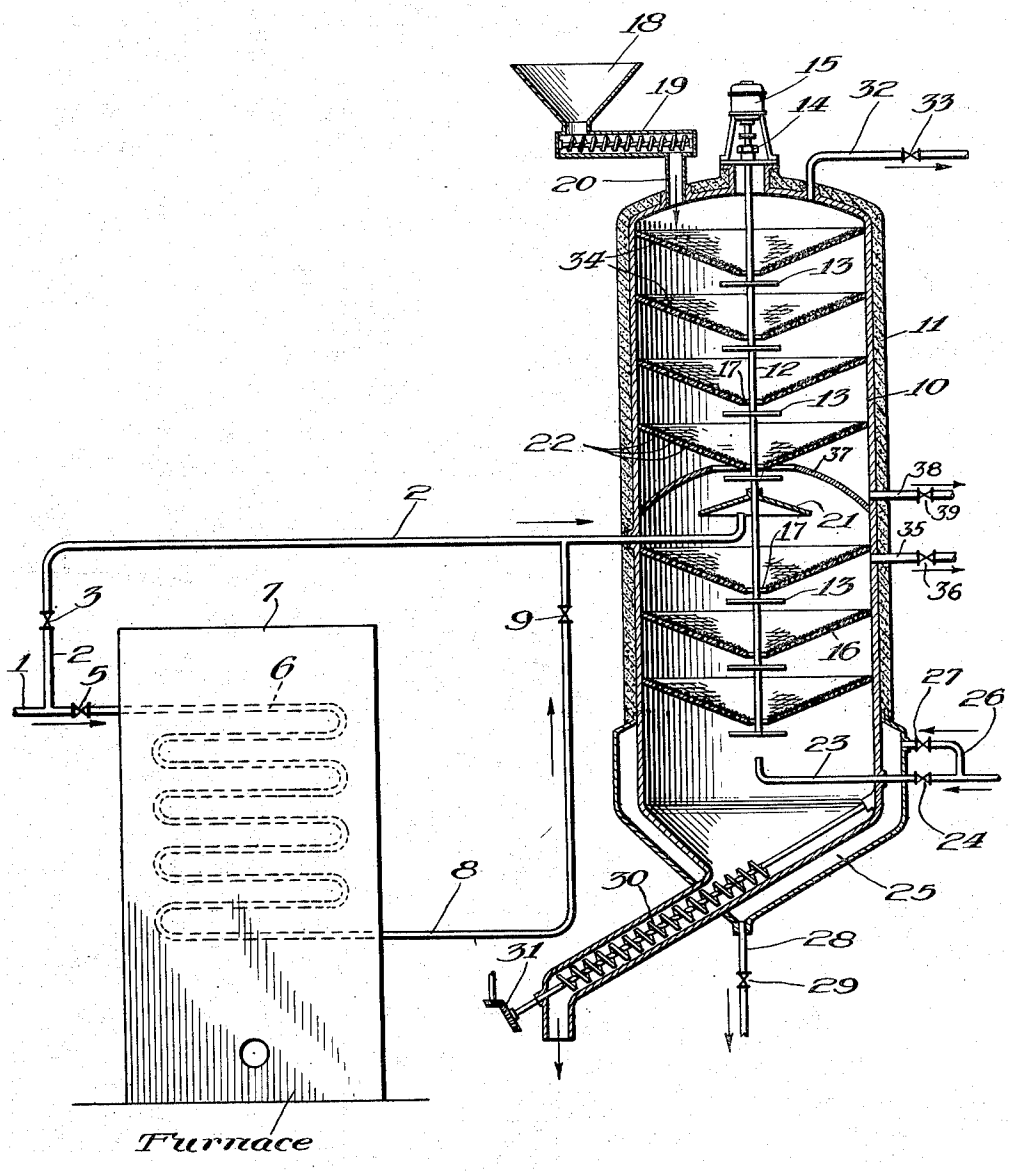
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TREATMENT OF HYDROCARBON OILS

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TREATMENT OF HYDROCARBON OILS

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This invention relates to the treatment of hydrocarbon oils and particularly refers to the treatment of oils such as distillates, lubricating oils and the like, with adsorbent materials such as clay or other adsorbent earths, to improve the quality of the oil.

The principles of the present invention are applicable to the treatment of many oils, and in the present embodiment are particularly directed to the treatment of distillates such as straight run or cracked products containing motor fuel, end point distillates, either cracked or straight run, such as gasoline, kerosene, naphtha and the like, and lubricating oils.

The principles of the invention as adapted to the treatment of a cracked distillate of motor fuel boiling range are shown in the attached diagrammatic drawing, which will serve to more clearly illustrate the features and novelty of the invention, although it should be understood that the invention is not limited to the use of the apparatus illustrated nor to the treatment of any specific type of oil. The invention is, rather, directed to an improved method and means of continuously treating hydrocarbon oils with adsorbent materials by dispersing said adsorbent material throughout the body of the oil, preferably maintained in a vaporized state, said dispersion being effected by means of one or a plurality of rapidly rotating discs.

In the single diagrammatic drawing a side sectional elevational view is shown of suitable apparatus for carrying out my invention.

Referring now to the drawing, the distillate to be treated, which in this case may fall within the boiling range of commercial motor fuel, may be supplied directly from the fractionator of a cracking system, not shown, through lines 1 and 2 and valve 3, to treater 4. All or any desired portion of the distillate vapors may, however, be directed through valve 5 in line 1 to heating element 6, disposed within any suitable furnace setting 7, to increase their temperature to any desired degree, passing from heating element 6 through line 8 and valve 9 to line 2, and thence to treater 4. In case the distillate to be treated is supplied from storage or elsewhere in a liquid state it is preferably directed through heating element 6 in the manner hereinbefore described to effect its complete or substantial vaporization before it is introduced into treater 4.

Treater 4 may comprise a cylindrical shell 10, preferably insulated as indicated at 11. Shaft 12 extending throughout any desired portion of the treater, has a plurality of discs 13 mounted thereon and extends through the upper head of treater 4, through a suitable stuffing box 14 and, during the operation of the process, is driven at a relatively high rate of speed by any suitable means such as an electric motor 15. Perforated baffles or deflectors 16 may be conical in shape and extend from the shell 10 of the treater to its central portion, terminating in openings 17 through which shaft 12 extends.

The treating agent, in this case adsorbent clay, may be introduced into the treater from hopper 18 by means of helical conveyor 19 and through line 20. A bed of the treating material may be maintained within conveyor 19 and hopper 18 to serve as a seal, preventing the escape of vapors from the zone of treatment or, especially when it is desirable to operate under a substantial super-atmospheric pressure, any other well known means of introducing the treating material and, at the same time, preventing the escape of vapors may be employed.

The adsorbent clay may be introduced into the upper portion of treater 4 to the uppermost of the baffles 16, which directs said material to the central portion of the uppermost disc 13. Said disc may be rapidly rotated and may hurl the clay, in a finely dispersed state, into the body of vapors passing through the treater. The finely dispersed clay may be collected upon the next lower baffle 16 and may be directed to another rapidly rotating disc 13 where it is again dispersed. A deflector 16 and a rapidly rotating disc 13, arranged as illustrated, comprise one treating stage or step and any desired number of said stages or steps may be employed, depending upon the material undergoing treatment and the results desired.

The vapors to be treated, entering treater 4 through line 2, are preferably discharged beneath a deflector 21, which may distribute the vapors and prevent clay from lodging within line 2 and restricting the flow of vapors. The vapors may pass upward through the several treating stages, in each of which they are intimately commingled with the adsorbent clay as it is dispersed throughout their mass, as hereinbefore described, by means of rapidly rotating discs 13.

Baffles 16 may be provided with perforations 22 and with screens 24 of somewhat smaller mesh than the size of the adsorbent clay. The slope of the baffles may be greater than the angle of repose of the adsorbent clay and may be of sufficient magnitude to allow the clay, together with any adsorbed oil and reflux condensate to flow downwardly over the upper surface of the baffles

to the rapidly rotating disc of the next lower step and thus continuously downwardly through the zone of treatment substantially countercurrent to the vapors undergoing treatment.

By means of the action of the discs 13 the vapors may be contacted in the succeeding treating stages with the adsorbent material in a finely dispersed form and by means of the perforated baffles 16 the vapors undergoing treatment may successively be contacted with moving beds of the adsorbent treating agent. In this manner positive contact is effected between the hydrocarbon vapors and the treating agent insuring efficient treatment regulated in extent by the number of treating stages employed, the speed of rotation of discs 13, the relative sizes of the various component parts of the treating zone, the temperature of the vapors, and the pressure conditions maintained within the treater. It is evident that these variables render the treating process very flexible and insure the efficient treatment of oils which vary widely in characteristics, also a wide variety of treating agents is permitted, such as, for example, adsorbent clay, diatomaceous earths, fuller's earth, bentonite and similar materials.

Stages comprising baffles 16 and discs 13 may, if desired, be provided below the inlet of the vapors to the treating zone. Three such stages are here illustrated, although any desired number may be employed, or this phase of the treatment may, if desired, be eliminated. The purpose of these lower treating stages is to substantially devolatilize the spent treating material and, to assist in this devolatilization, steam, preferably in a superheated state may be introduced as illustrated, through line 23 controlled by valve 24. The treating material may come in contact with the steam in the lower stages of the treating zone in the same manner as it is contacted with hydrocarbon vapors in the upper stages of the treating zone.

Another means of drying and assisting devolatilization of the spent clay comprises a steam jacket 25 which may surround the lower portion of treater 4, steam being introduced through line 26 and valve 27 and exhausted through line 28 controlled by valve 29. The methods here illustrated and described, or any other suitable well known means of substantially drying the clay may be utilized separately or jointly.

The spent treating material may be removed by means of screw conveyor 30 actuated by any suitable means, not illustrated, through gears 31. Conveyor 30 may also furnish a means of maintaining a seal at the point of discharge of the spent treating agent from the treater by maintaining a body of the clay within the conveyor or any other well known means of removing the spent treating material and preventing leakage at this point may be employed.

Hydrocarbons driven from the treating material by the drying and devolatilizing action may be removed as vapors from the treater together with the steam, if used in direct contact, through line 35 and valve 36. These volatilized hydrocarbons may however, be collected as liquid, together with any reflux condensate from the vapors undergoing treatment which are not entrained in the treating material upon deck 37 and may be removed from the treater through line 38 and valve 39.

If steam is used as described in the lower stages of the treater it may be permitted to commingle with the hydrocarbon vapors in the upper stages of the treater assisting in the treatment and often resulting in the production of a sweeter and more stable final product.

The treated vapors may be removed from the upper portion of treater 4 through line 32 controlled by valve 33 and may be passed to any desired further treatment such as fractionation or passed directly, after condensation and cooling, to storage.

The pressures employed within the treating system may range from subatmospheric to substantial superatmospheric pressures of several hundred pounds per square inch. Heating of the oil to be treated, if employed, may be accomplished under any desired pressure conditions. Temperatures employed within the treating zone will depend upon the oil undergoing treatment and the desired results and may range, for example, from a temperature sufficient only to substantially vaporize the oil to temperatures as high as 800° F., or thereabouts. Preferably, the oil is introduced to the treater at a temperature sufficient to maintain its components which boil within the range of the finished product in a vaporized state throughout the treatment, permitting withdrawal of the treated product as vapors.

As a specific example of the operation of the improved process of the present invention, as applied to the treatment of a cracked distillate of motor fuel boiling range, vapors are taken directly from the fractionator of a cracking system at a temperature of about 375° F., and before their introduction into the treater are superheated to a temperature of approximately 500° F. under a superatmospheric pressure of about 60 pounds per square inch. The hot vapors are contacted in successive stages of the treating zone with an adsorbent clay of about 60 mesh under substantially atmospheric pressure and the treated vapors are condensed and cooled without redistillation or further chemical treatment. This treatment produces a sweet, color stable motor fuel of low gum and low sulphur content. The treating loss is often less than 2%, based on the vapors treated, and a ton of clay may treat some 2500 to 3000 barrels of distillate and in some cases as high as 10,000 barrels, depending largely upon the refining required by the raw or untreated vapors.

It is to be understood of course, that the above example is given merely for purposes of illustration and is not intended to serve as a limitation upon my invention.

I claim as my invention:

1. A process of treating hydrocarbon oils to remove objectionable constituents therefrom which comprises introducing said oils into a treating zone in a substantially vaporous state, passing said vapors in a substantially vertical direction upwardly through said zone introducing absorbent material into said zone and centrifugally hurling said material in stages radially from the center of said zone into intimate contact with the vapors and devolitalizing the spent absorbent material before removal from said treating zone.

2. A continuous process of intimately contacting vapors and an absorbent material and devolatilizing spent absorbent material which comprises introducing said vapors into the intermediate portion of an enclosed zone, introducing steam into the lower portion of said zone, introducing absorbent material into the upper portion of said zone, and centrifugally hurling said

material in stages radially from the center of said zone into the ascending vapors and the steam.

3. A continuous process of intimately contacting vapors and an absorbent material and devolatilizing spent absorbent material which comprises introducing said vapors into the intermediate portion of an enclosed zone, introducing steam into the lower portion of said zone, introducing absorbent material into the upper portion of said zone, centrifugally hurling said material radially from the center of the upper portion of said zone into the ascending vapors whereby said material becomes spent and centrifugally hurling said material radially from the center of the lower portion of said zone into the ascending steam whereby said spent material is devolatilized.

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