

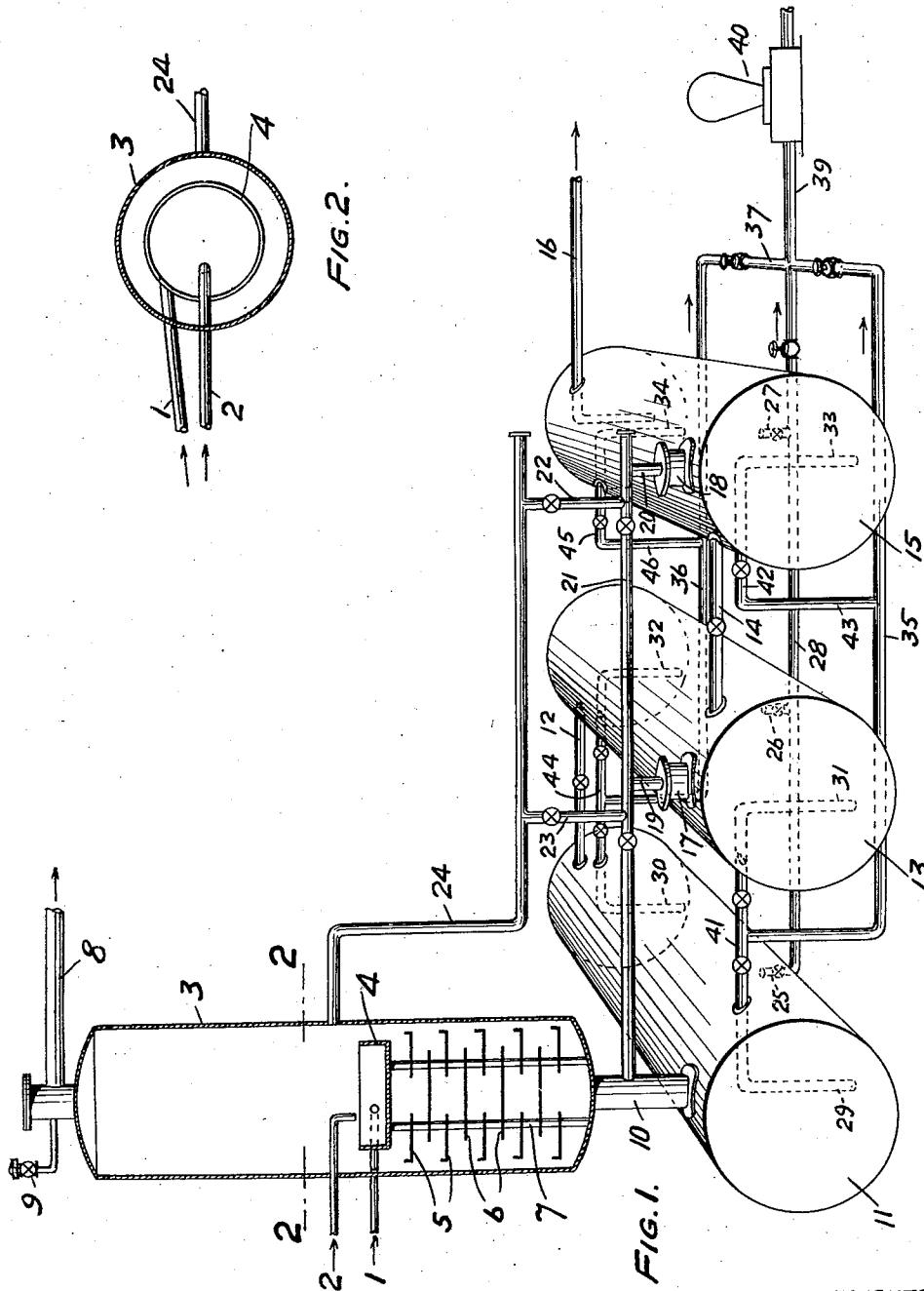
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PROCESS OF PREPARING STOCK FOR DISTILLATION OF LUBRICATING OIL

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PROCESS OF PREPARING STOCK FOR
DISTILLATION OF LUBRICATING OIL

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9 Claims. (Cl. 196—41)

The present invention relates to a process for chemically treating topped crude oil to prepare it for distillation into its various lubricating fractions.

5 In the distillation of lubricating oils from topped crude oil it is of the utmost importance to free the stock charged to the lubricating oil still from any impurities which may be therein contained and which are the results of cracking or oxidiz-
10 ing a portion of the crude while topping the same. Such cracked or oxidized compounds, if permitted to remain in the charging stock, will ultimately vaporize with the lubricating oil fractions during distillation, thereby making such lubricating oils
15 unfit for sale without extensive chemical treatment, as the cracked or oxidized compounds greatly impair the color, odor, etc., of the distilled oil. It is also of the greatest importance to remove any water, whether naturally present
20 in the crude or added thereto in processes for treating it to prepare it for distillation.

As some crudes are received from the wells they contain, among other impurities, sodium, magnesium, and other chlorides. Some of these
25 chlorides are removed in solution when the water originally contained in the crude is settled out, but a small proportion of them will remain in the crude. When the topped crude is subse-
30 quently treated with alkali solution to remove cracked and oxidation products, the alkali used is a commercial form containing impurities in the form of chlorides. If the topped crude is not
35 thoroughly dehydrated after the alkali treatment, serious harm is likely to result, as the water to-
40 gether with the naturally present and added chlorides react, at the temperatures required to distill lubricating oils, to form hydrochloric acid. This acid is extremely corrosive to the metal
45 of the stills and for this reason all water must be removed, for without it the chlorides cannot form hydrochloric acid and have no deleterious action on the stills. It is necessary to treat the topped
50 crude with an aqueous solution of alkali in order to get a complete mixture and contact between the oil and alkali. If alkali in solid or com-
minuted form is added to the oil, a complete mixture cannot be effected and the alkali settles out onto the heating surfaces of the stills, thereby in
55 a short time impairing heat exchange to such an extent that the stills must be shut down for cleaning.

A patent issued to me November 24, 1931, No. 1,833,691, and Patent No. 1,903,407 issued April 4, 1933, are both directed to processes for dehydrat-
ing, topping, and then treating crude oil with an

alkali solution in order to prepare the crude oil for distillation of the various lubricating fractions contained therein. The present application is di-
rected more specifically to an improved method for treating the topped crude with sodium hydrox-
ide or other alkali solution.

An object of the present invention is to provide a process for treating the topped crude or mazoot by thoroughly mixing the same with so-
10 dium hydroxide solution to convert some of the cracked or oxidation products present into com-
plex high boiling compounds, mainly soaps, which will not vaporize at subsequent distillation
15 temperatures and to precipitate other cracked or oxidation products as sodium salts.

Another object is to remove water, which is introduced as a solvent for the sodium hydroxide,
from the mazoot before distillation of the con-
tained lubricating fractions.

A further object is to remove from the alkali
20 treated crude all decomposition products which are precipitated by the alkali treatment and sub-
sequent dehydration.

The process set forth herein may be carried out in any suitable apparatus but I have found
25 that the specific apparatus shown herein gives the best results.

In the drawing:

Fig. 1 is a front elevation with a section of the
tower cut away;

Fig. 2 is a section of the tower on line 2—2 of
Fig. 1.

The heated topped crude or mazoot is con-
tinuously pumped to the mixing and evaporat-
ing tower 3 through line 1. The crude, of which
35 this mazoot is a residuum, is first subjected to treatment and distillation as described in said
Pew Patent No. 1,833,691; that is, it is first freed of its contained salt water by heating and set-
tling under pressure after which it is further
40 heated in a pipe still, and the lighter constitu-
ents, such as gasoline, kerosene, and gas oil, vaporized in a distillation tower. The bottoms
from this distillation tower, which comprise the mazoot to be treated by the present invention,
45 leave the distillation tower and are pumped to the apparatus herein described at a temperature
of 500° to 575° F.

The heated mazoot continuously enters the
mixing pan 4 in tower 3, tangentially thereof, so
50 as to give it a whirling motion and is therein mixed, for example, with 1% of 38 Bé. sodium hydroxide solution, which is pumped through line
2 and forced downwardly into the whirling mazoot. As the mazoot-soda mixture overflows
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from the pan 4 it cascades over the series of traps 5 and 6, which are supported on the up-rights 7. These up-rights 7 also support the pan 4. As the mazoot-soda mixture cascades over the trays 5 and 6 the water, which acted as solvent for the caustic soda, is vaporized, and some light oil fractions may also be vaporized with the water. Due to the high temperature of the mazoot (500°-575° F.), the tower 3 may be maintained under a pressure above or below atmospheric or may be maintained at atmospheric pressure. However, since it is usually desired to evaporate as much of the water (soda solvent) and as little oil as possible in the tower, the best working pressure can be determined from these factors. The water and oil vapors pass upwardly through the tower 3 and then through line 8 to a condenser and separator (not shown). Safety valve 9 is provided at the top of the tower to prevent the pressure from rising above any predetermined point.

The soda-treated mazoot passes downwardly from the bottom of the tower through throat 10 to one end of a settling chamber 11 through which it flows to the opposite end whence it passes through cross-over line 12 to one end of settling chamber 13. At the opposite end, settling chamber 13 is connected to a third settling chamber 15 by cross-over 14. After flowing through chamber 15 the treated mazoot passes out of the system through line 16.

Vapors are formed within the three settling tanks which, if permitted to accumulate within the tanks, would by their pressure lower the level of the liquid within the tanks to a point below the cross-over lines 12 and 14, thereby preventing an even flow of mazoot. For this reason tanks 13 and 15 are provided with domes 17 and 18 respectively, which are connected to pressure equalizing line 21 by pipes 19 and 20 respectively. Any difference in pressure within the three tanks is equalized by the line 21. Connections 22 and 23 are placed between line 21 and vapor line 24, which conveys any vapors generated within the tanks to the top of the tower 3. The provision of vapor line 24 obviates the necessity of the vapor passing into the throat between tower 3 and tank 11 and then up against the downwardly flowing soda treated mazoot. At times the settling mazoot may foam due to the rapid formation of vapors in the settling tanks, in which case the foam passes over pipe 21 to the throat between tower 3 and tank 11 and is beaten down by the falling mazoot.

During the passage of the soda treated mazoot through the settling tanks 11, 13 and 15 certain sodium salts, formed by the action of the caustic soda on the cracked and oxidation compounds present in the topped crude, are precipitated. These sodium salts settle to the bottoms of the tanks and are drawn off at intervals through valved outlets 25, 26 and 27, at the center of the respective tanks. Each of these outlets is connected to a manifold 28, which in turn is connected to pump 40 by line 39. These sodium compounds are of such a nature that they are liable to pack solidly in the bottoms of the tanks 11, 13 and 15 and thereby stop up the outlets 25, 26 and 27. For this reason there are provided two other draw-off pipes in each tank, one draw-off being positioned at each end of the tank. These draw-offs extend downwardly from near the top of the tank to within a few inches of the bottom so that there is no likelihood of their being stopped up by tightly packed sludge.

The draw-offs just described, which are placed in the front of the settling tanks, are numbered 29, 31 and 33. Draw-offs 29 and 31 are connected to pipe 41, which is provided with valves for controlling the flow from each tank. Pipe 41 is connected to pump 40 by lines 35, 37 and 39. The front draw-off 33 in tank 15 is connected to pump 40 by lines 42, 43, 35, 37 and 39. This draw-off is also provided with a valve in line 42 to regulate the outflow of sludge. The rear draw-offs are located directly to the rear of the front draw-offs and are numbered 30, 32 and 34. These draw-offs are also provided with control valves and connecting lines to pump 40. Line 36 corresponds to line 35 in the front draw-off system and connects through lines 37 and 39 to pump 40 while lines 45 and 46 correspond to lines 42 and 43 in the front of the tank. It is readily seen that with the arrangement just described, any one sludge draw-off may be used if more sludge should collect in any one tank than in the others, or all sludge draw-offs may be used at once.

By the foregoing process, the oil is thoroughly dehydrated, thereby preventing the formation of hydrochloric acid, the destructive effects of which have been hereinbefore explained.

It has been specified, herein, by way of an example, that 1% of 38° Bé. caustic soda solution is admixed with the mazoot. The necessary amount of the soda, however, varies with different crudes. The caustic soda is not added to treat the mazoot solely in the step of preparing mazoot for distillation into lubricating oils herein described, but is also added so that there will be a surplus of free alkali left in the oil to react with any cracked or oxidation compounds which may form during the actual distillation. For this reason enough caustic soda is added, in the process herein described, so that about .2% of free alkali remains in the asphalt bottoms after the lubricating fractions have been removed or distilled off. I therefore do not wish to be limited to the addition of 1% of 38° Bé. caustic soda, since the desirable percentage and degree of concentration are variable factors. The free alkali left in the topped crude is so finely divided, due to the intimate mixture possible when it is added in aqueous solution, that it will not settle out onto the heating surfaces of the stills.

It is ordinarily desirable, in tower 3, to vaporize only the solvent (water) of the alkali. However, some light oil fractions are likely to evaporate with the water; and it may be desirable, under some conditions, to vaporize in the tower, in addition to the water, an intermediate or final cut of gas oil or a light fraction of lubricating oil. This can be done without departure from the invention.

The apparatus herein disclosed for carrying out the described process is not herein claimed, the same forming the subject-matter of a divisional application filed June 27, 1933, Serial No. 677,798.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. The process of preparing stock for distillation of lubricating oils, which comprises distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, continuously flowing a stream of the hot

residual oil and also a stream of an alkali solution, into a mixing and dehydrating zone and therein mixing the same and distributing the mixture over a large area under such absolute pressure as to effect, at the temperature of the oil, evaporation of solvent, continuously flowing the dehydrated oil to a zone of settlement and therein settling out sludge, and withdrawing precipitated sludge from the bottom of the settling zone and from a level above the bottom of the settling zone.

2. The process of preparing stock for distillation of lubricating oils, which comprises distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, continuously flowing a stream of the hot residual oil, and also a stream of an alkali solution, into a mixing and dehydrating zone and therein both mixing the same and distributing the mixture over a large area under such absolute pressure as to effect, at the temperature of the oil, evaporation of solvent, continuously flowing the oil from the tower to a zone of settlement and therein settling out sludge, and removing from the zone of settlement substantially dehydrated and sludge-free oil containing free alkali.

3. The process of preparing stock for distillation of lubricating oil, which comprises distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, continuously flowing a stream of the hot residual oil tangentially, and simultaneously flowing an alkali solution, into a pool of a mixture of oil and alkali solution, whereby the oil and alkali solution are intimately mixed, overflowing the mixture from the pool and at a lower level distributing the oil over large areas under such absolute pressure as to effect evaporation of solvent, and continuously removing residual oil containing free alkali.

4. A process for preparing heated topped crude oil for distillation into its contained lubricating fractions comprising distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, mixing a flowing stream of alkali solution with a flowing stream of said hot residual oil and evaporating solvent of the alkali therefrom by the contained heat of the oil; then passing the alkali treated oil to a settling zone wherein impurities precipitated by the alkali are settled out and further vaporization of alkali solvent takes place, and separately removing settled impurities, vaporized solvent and treated oil.

5. A continuous process for preparing heated topped crude oil for distillation into its contained lubricating fractions comprising distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, flowing such residual oil into a mixing zone; conveying alkali solution into said mixing zone and intimately mixing it with said oil to

precipitate impurities contained therein; flowing the alkali treated oil from said mixing zone to a settling zone and evaporating and removing solvent of the alkali, while so flowing, by the contained heat of the oil; the oil flowing through said settling zone at a greatly reduced speed and therein settling alkali precipitated impurities; and continuously and separately removing evaporated solvent of the alkali and alkali-treated and settled oil from said settling zone.

6. A continuous process for preparing heated topped crude oil for distillation into its contained lubricating fractions comprising distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, flowing such residual oil into a mixing zone; conveying alkali solution into said mixing zone and intimately mixing it with said oil to precipitate impurities contained therein; flowing the alkali-treated oil from said mixing zone to a settling zone and evaporating and removing solvent of the alkali, while so flowing, by the contained heat of the oil; the oil flowing through said settling zone at a greatly reduced speed and therein vaporizing more solvent of the alkali and settling alkali-precipitated impurities; and continuously removing from said settling zone alkali-treated and settled oil and the alkali solvent vapors released therefrom.

7. The process of preparing stock for distillation of lubricating oils, which comprises distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating therefrom a residual oil containing the lubricating fractions which it is desired to subsequently distil, continuously flowing a stream of the hot residual oil, together with an alkali solution, into a zone of mixing and evaporation and therein mixing the same and distributing the mixture over a large area under such absolute pressure as to effect, at the temperature of the oil, evaporation of solvent, continuously flowing the dehydrated oil to a zone of settlement and therein settling out sludge, withdrawing sludge-free oil from the zone of settlement, and conveying vapors from the zone of settlement to the zone of mixing and evaporation.

8. A continuous process for preparing heated topped crude oil for distillation into its contained lubricating fractions comprising distilling from crude petroleum oil low boiling constituents at a temperature approximating but below that at which substantial cracking occurs and thereby separating a residual oil containing the lubricating fractions which it is desired to subsequently distil, intimately mixing with such residual oil an alkali solution adapted to precipitate impurities contained in the oil; then flowing said oil and alkali mixture in a dispersed state to vaporize solvent of the alkali by the contained heat of the oil and removing the evolved solvent vapors; then passing the alkali-treated oil to a series of settling zones wherein impurities precipitated by the alkali are settled out and more alkali solvent vaporizes; removing the solvent vapors from each of said settling zones and equalizing the vapor pressures on said settling zones; removing settled impurities from said settling zones; and continuously removing dehydrated, alkali-treated oil from the final settling zone.

9. The process of preparing stock for distilla-

tion into its contained lubricating fractions comprising distilling from crude petroleum low boiling constituents at a temperature approximating but below that at which substantial cracking occurs, mixing alkali solution with the residual oil, and evaporating therefrom solvent of the alkali by the contained heat of the oil in a plurality of zones in the first of which the oil is distributed

over a large vaporizing surface and in the next of which the oil is conveyed into a slowly flowing body of oil of such considerable depth as to effect settlement of alkali-precipitated impurities, and continuously removing alkali-treated and settled oil from the second zone and alkali solvent vapors from both zones.

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