

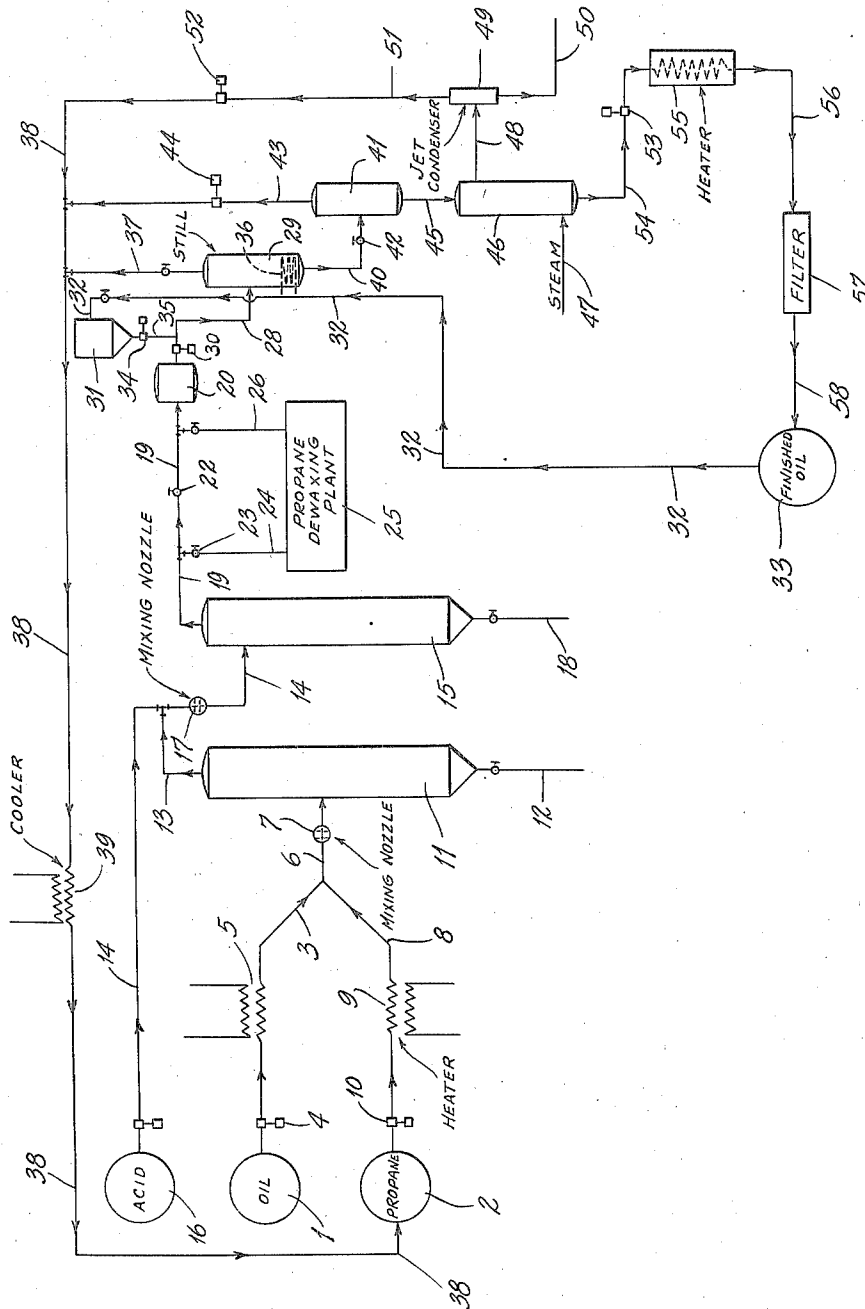
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D. B. MAPES ET AL

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# PROCESS OF MANUFACTURING LUBRICATING OILS

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INVENTORS:  
D. B. MAPES,  
E. M. DONS,

By Albert J. McCauley

ATTORNEY.

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PROCESS OF MANUFACTURING  
LUBRICATING OILS

Dwight B. Mapes and Eddie M. Dons, Tulsa, Okla.,  
assignors to Mid-Continent Petroleum Corpo-  
ration, Tulsa, Okla., a corporation of Delaware

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4 Claims. (Cl. 196—34)

This invention relates to processes of manufac-  
turing lubricating oils, and more particularly to a  
process wherein a solvent, preferably a normally  
gaseous solvent, is employed during the refining  
of an oil.

In the refining of hydrocarbon oils, solvents  
are frequently employed to improve the quality  
of the oils. For example, a lubricating oil stock  
may be effectively treated with propane to de-  
sludge and dewax the oil.

However, many of these solvents including  
propane are relatively difficult to recover from an  
oil, especially when the oil is in an acid condition,  
without impairing the color of the oil.

An object of our invention, therefore, is to pro-  
vide a process of effectively recovering propane  
from an oil without impairing the color of the  
oil.

A further object is to provide an efficient proc-  
ess of treating a solution of oil, propane and acid,  
and to recover the solvent, and at the same time  
neutralize and decolorize the oil in a simple man-  
ner, which eliminates a number of the steps heret-  
ofore employed in carrying out the operations.

With the foregoing and other objects in view,  
the invention comprises the novel method herein-  
after more specifically described and shown in the  
accompanying drawing, which illustrates one  
form of the invention. However, it is to be under-  
stood that the invention comprehends changes,  
variations and modifications which come within  
the scope of the claims hereunto appended.

The drawing is a diagrammatical view of a sys-  
tem adapted for use in carrying out the invention.

To illustrate one form of the invention, we will  
describe a continuous system that may be em-  
ployed in the treatment of a lubricating oil with a  
normally gaseous solvent, such as propane, but it  
will be understood that the invention is not limited  
to this specific combination.

1 designates a storage tank for the oil to be  
treated, and 2 indicates a source of liquid propane  
which may be under a pressure of about 100 to 180  
pounds. The oil conductor 3 is provided with a  
pump 4 which is operated continuously to force  
the oil through a heater 5, and then into a mixing  
line 6 including a mixing nozzle 7.

8 designates a propane conductor leading from  
the propane tank 2 to the mixing line 6 and in-  
cluding a heater 9 and a pump 10 whereby the  
liquid propane is constantly discharged to said  
mixing line.

The volume of propane may be about two or  
three times the volume of oil.

The heaters 5 and 9 enable the oil and propane

to enter the mixing line 6 at the desired temper-  
ature, which may be between 80° F. and 120° F.

After the continuous streams of oil and propane  
are united in the line 6, they are thoroughly mixed  
at the nozzle 7 to provide a propane solution,  
which is discharged into a settling chamber 11.  
The asphaltic sludge resulting from the settling  
in said chamber 11 is discharged through a pipe  
12 at the bottom of the chamber, while the other  
constituents of the solution slowly rise to the top  
of said chamber and pass out through a pipe 13  
connected to a pipe 14 which leads to a second  
settling chamber 15.

Sulfuric acid from a source of supply 16, is con-  
stantly pumped through the pipe 14, which in-  
cludes a mixing nozzle 17, and the resultant mix-  
ture is discharged into the settling chamber 15.  
The acid sludge slowly settles to the bottom of  
said chamber 15, where it is discharged through  
a pipe 18, while the remaining constituents of the  
oil and propane solution constantly pass out of  
the top of said chamber 15, through a conductor  
19.

The acid-treated solution of propane and oil  
in the conductor 19 may pass directly to a receiver  
20, or by closing a valve 22 in the conductor 19,  
and opening a valve 23 in line 24 the solution may  
be diverted to a propane dewaxing plant 25, where  
the pressure is reduced to evaporate propane and  
thereby chill the stock to a low temperature, such  
as -40° F., which permits free removal of the wax  
by filtration. After separation from the wax, the  
resultant solution of propane and oil may be dis-  
charged from the dewaxing plant through a line  
26 connected to the conductor 19 leading to the  
receiver 20.

It will now be understood that the solution of  
propane and oil can be very advantageously em-  
ployed in successive continuous operations wherein  
the propane is first employed in the chamber 11  
to remove asphaltic sludge, again employed in the  
chamber 15 to aid in the acid treatment, and  
thereafter employed as a refrigerant and diluent  
for the dewaxing operation in 25. This progres-  
sive unitary method, using the same propane for  
the successive operations of desludging and de-  
waxing, eliminates a number of expensive steps  
ordinarily employed to obtain less satisfactory  
results.

Furthermore, the propane remaining in the  
treated oil continues to perform an important  
function in the operation of decolorizing the oil,  
and we will also show just how to eventually dis-  
till the propane from the acid-containing oil,  
without causing objectionable oxidation which

would result in the production of dark colored tarry substances in the still.

The acid-treated solution of propane and oil, which may be either dewaxed, or undewaxed, is forced through the line 28 by pump 30 to a high pressure still 29. Before the solution of oil and propane in line 28 is discharged into the still 29, a finely divided earth, such as 200 mesh or finer fuller's earth, or other suitable contact clay, is preferably mixed with the solution. This comminuted clay is merely an illustration of a suitable material for neutralizing and decolorizing the oil.

As an illustration of one manner of introducing a finely divided earth into the solution, we have shown a mixing tank 31, wherein contact clay is mixed with a portion of finished oil, entering the tank 31 through a line 32 which is connected to an oil storage tank 33. The clay slurry formed in the mixing tank 31 is forced by a pump 34 through a conductor 35 into the solution of oil and propane flowing through the conductor 28.

The resultant mixture of clay, oil and propane passing into the still 29 from the conductor 28 may be heated to a temperature of about 225° F. to 250° F., by means of a steam coil 36. The propane evaporated in the still 29 is discharged through a conductor 37, to a return line 38. The propane in line 38, after being condensed in cooler 39, is returned to the propane storage tank 2. The pressure on the mixture in still 29 is preferably approximately equal to the vapor pressure in the propane storage tank 2. However, if desired, a pump may be employed in line 38 to return the propane to the storage tank 2.

The oil and clay mixture containing some propane is discharged from the still 29 through a conductor 40 leading to a flash chamber 41, where the pressure on the mixture is released to about atmospheric pressure. The valve 42 in the conductor 40 may be regulated to give the desired drop in pressure on the mixture entering the chamber 41. The propane vaporized in the chamber 41 is discharged through a pipe 43 and passes through a compressor 44 to the return line 38.

The oil and clay mixture passes from the chamber 41 through a conductor 45 to a stripping chamber 46 where it may be heated to about 325° F. to 350° F., and live steam introduced through pipe 47 into the oil mixture to remove the remaining propane. The steam and vaporized propane in the chamber 46 pass through a conductor 48 to a jet condenser 49 where the steam is condensed and discharged through a pipe 50. The propane gas in the jet condenser 49 is discharged through a line 51, and after passing through a compressor 52 in the line 51 the propane is returned to the storage tank 2 through the return line 38.

The oil and clay in the stripping chamber 46 may be forced by a pump 53 through a line 54 to a heater 55 where it is heated to a high temperature, for example 475° F., to further improve the color of the oil. From the heater 55, the oil passes through a conductor 56 to a filter 57 where the clay is removed from the oil. The oil passes from the filter 57 through a line 58 to the finished oil storage tank 33.

In the foregoing operations, it will be observed that the finely divided earth was added to the acid treated solution of oil and propane before the solution was heated to a high temperature to recover the propane. This is one of the advantageous features of our invention, as it permits the propane to be distilled from the oil, even

while in an acid condition without impairing the color of the oil. In the absence of the finely divided earth, heating the solution of propane and oil in the acid condition, would result in oxidation of the oil and produce dark colored tarry substances, which would darken the oil and form objectionable deposits on the heating surfaces.

Moreover, the heating of the mixture of oil, propane, and clay in the still 29, and stripping chamber 46, not only does not materially darken the oil, but increases the decolorizing efficiency of the clay, and in many instances produces an oil having a very satisfactory color without a further heating of the oil and clay mixture. When the finished oil is to be obtained without an additional heating of the oil, we prefer to recover the propane at a relatively high temperature, such as 350° F. to 375° F., or higher.

When it is desirable to further improve the color of the oil after the recovery of the propane, only a relatively small degree of additional heat will be required in the heater 55, as the oil leaves the stripping chamber 46 at a relatively high temperature.

Our process permits the removal of the propane without employing the steps of neutralizing the oil before removing the propane, and again treating the oil with acid for the contacting operation.

The propane herein referred to is a normally gaseous hydrocarbon, which in commercial practice is usually mixed with various other hydrocarbons, and it is to be understood that the term "propane," as herein used, extends to such mixtures as well as equivalent normally gaseous hydrocarbons, such as ethane, cyclopropane, butane and isobutane.

As a specific example of the lubricating oil stock to be treated, we will refer to a residual petroleum lubricating oil stock having the following properties: A. P. I. gravity 21.7, a flash point of 510° F., Saybold Universal viscosity of 147 at 210° F., and a cold test of 48° F. Twenty pounds of acid for each barrel of oil may be used in treating an oil of this kind, but, of course, the quantity of acid may be varied as desired.

The ratios of propane to lubricating oil stock mixed at the mixing nozzle 7 may be as high as 8 parts propane to 1 part oil, even 10 to 1 may be used to advantage in some cases, although in most cases we have not used more than 4 parts propane to 1 part oil. The temperature of the mixture at said nozzle 7, may be between 80° F. and 120° F., or higher.

Although it is usually advisable to continuously withdraw the sludge from the settling chambers 11 and 15, it may be withdrawn periodically, or intermittently.

The order of the procedure may be varied without departing from the invention. For example, one may desludge, or deasphaltize, with a propane solution having four or more parts of propane to one part oil, then remove the wax, and thereafter subject the oil in propane solution to the acid treatment. This can be followed by removal of the propane in accordance with our invention. In each case the propane is employed in different kinds of successive operations, and the propane remaining with the oil is eventually removed without objectionable oxidation of the refined oil.

We claim:

1. The method of preventing oxidation in using propane and acid to refine lubricating oils which comprises dissolving a lubricating oil stock in

liquid propane, treating the resultant solution with sulfuric acid and removing the sludge, mixing finely divided neutralizing earth with the solution of acid-oil and propane, distilling the propane from the oil at a temperature low enough to prevent substantial vaporization of the oil but high enough to cause oxidation of acid-containing oil in the presence of propane, said distilling operation being performed in the presence of a quantity of said finely divided earth sufficient to prevent said oxidation in the heated propane solution, thereby preventing the formation of tarry substances during the distillation of the propane, and separating the finely divided earth from the oil.

2. The method of preventing oxidation in using propane and acid to refine lubricating oils which comprises mixing propane and a lubricating oil stock under a pressure high enough to maintain the propane in a substantially liquid condition, treating the solution with sulfuric acid and removing the sludge therefrom, mixing contact clay with oil to form a clay slurry, forcing a stream of the clay slurry into the acid-treated solution of oil and liquid propane, distilling propane from the oil at a temperature low enough to prevent substantial vaporization of the oil but high enough to cause oxidation of acid-containing oil in the presence of propane, said distilling operation being performed in the presence of a quantity of said contact clay sufficient to prevent said oxidation in the heated propane solution, thereby preventing the formation of tarry substances in the solution during the distillation of the propane, and separating the clay from the oil.

3. In the art of refining lubricating oils, the method of using propane and acid for progressive operations which comprises mixing propane and a lubricating oil stock under a pressure high enough to maintain the propane in a substantially liquid condition, treating the propane solution under pressure with sulfuric acid, removing

the acid sludge, mixing contact clay with a relatively small quantity of oil to form a clay slurry, pumping a stream of the clay slurry into the acid-containing solution of oil and liquid propane under pressure to neutralize and decolorize the oil, distilling propane from the oil at a temperature low enough to prevent substantial vaporization of the oil, but high enough to cause oxidation of acid-containing oil in the presence of propane, said distilling operation being performed in the presence of a quantity of said contact clay sufficient to prevent said oxidation in the heated propane solution, thereby preventing the formation of tarry substances in the refined solution during the distillation of the propane, and filtering the clay from the oil.

4. The method of using propane and acid to refine lubricating oils which comprises mixing propane and a lubricating oil stock under a pressure high enough to maintain the propane in a substantially liquid condition, treating the propane solution under pressure with sulfuric acid, removing the acid sludge, mixing contact clay with a relatively small quantity of oil to form a clay slurry, pumping the clay slurry into the acid-containing solution of oil and liquid propane under pressure to neutralize and decolorize the oil, distilling propane from the oil at a temperature low enough to prevent substantial vaporization of the oil, but high enough to cause oxidation of acid-containing oil in the presence of propane, said distilling operation being performed in the presence of a quantity of said contact clay sufficient to prevent said oxidation in the heated propane solution, thereby preventing the formation of tarry substances in the solution during the distillation of the propane, thereafter increasing the temperature of the mixture of oil and clay to obtain the desired color in the oil, and filtering the clay from the oil.

DWIGHT B. MAPES.  
EDDIE M. DONS.