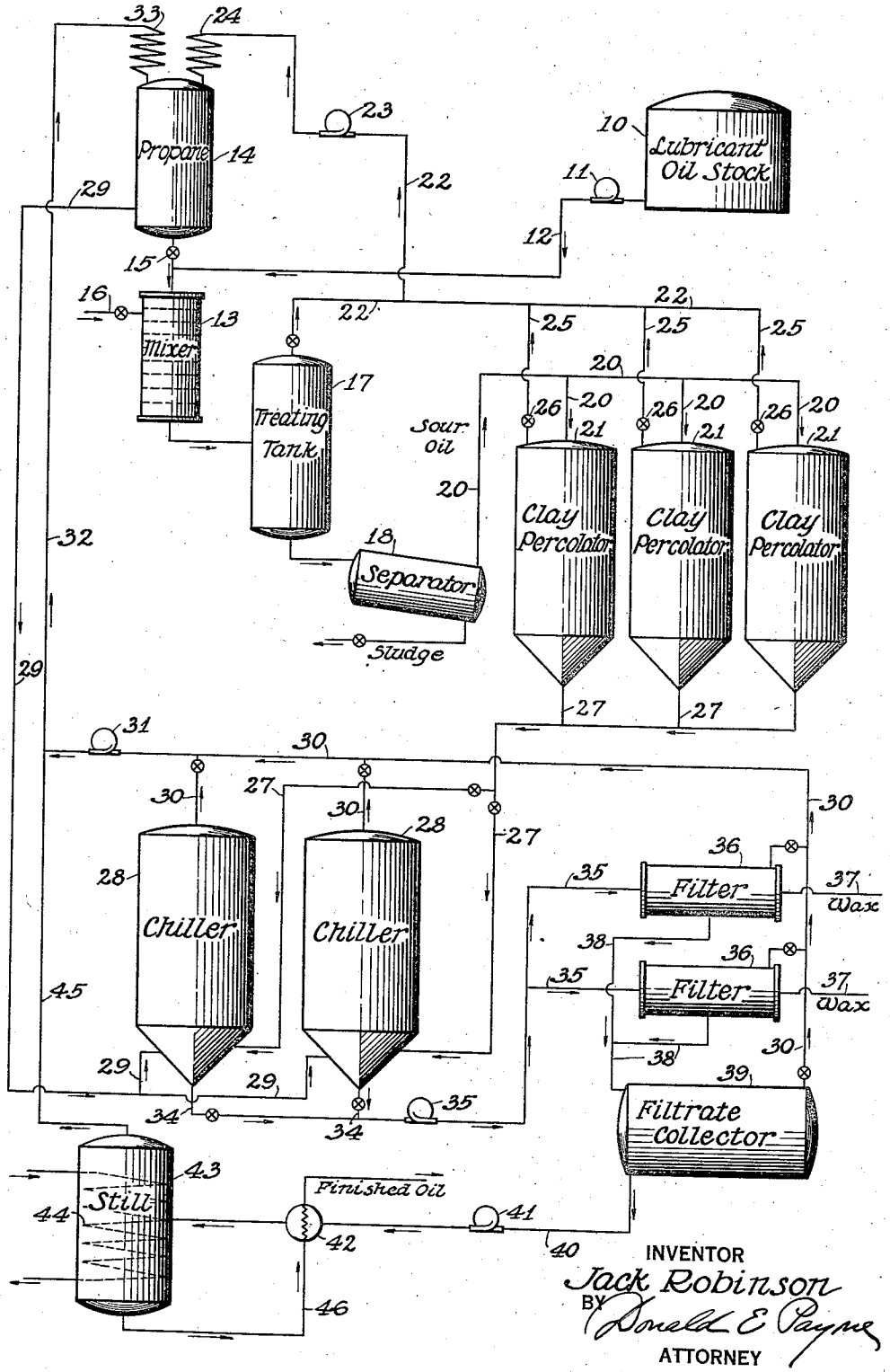
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OIL REFINING

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OIL REFINING

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3 Claims. (Cl. 196—147)

This invention relates to oil refining and it refers more particularly to a system and method of finishing lubricating oils in the presence of diluents, such as propane or butane.

The object of my invention is to provide a more efficient, more economical and a more rapid method of freeing lubricating oils from objectionable components or impurities. A further object is to improve the finishing of lubricating oils with clay by the presence of a diluent which has the combined effect of throwing the asphaltines out of solution, lowering the viscosity, and increasing the adsorptive efficiency of the clay. A further object is to provide a system wherein the temperature in various parts of an oil finishing system may be easily regulated and maintained at a low value. Other objects will be understood from the following detailed description.

In practicing my invention I employ, as a diluent, a liquefied hydrocarbon gas such as propane or butane. I have found that the use of this diluent gives increased yields per ton of clay in percolation, and that an improved oil is produced thereby. At the same time the temperature and viscosity can be readily controlled and, by maintaining a suitable pressure on the system, the diluent may be carried with the oil and utilized in other steps of the finishing process. The diluent is particularly useful in regulating the temperature of the treating step, in producing the refrigeration for the dewaxing step, and expediting the filtration of wax crystals; it will therefore be seen that my use of this diluent in the claying or percolation of the oil ties in with the other steps of the oil treatment to make a new and improved oil refining process.

The accompanying drawing, which forms a part of this specification, illustrates diagrammatically the plan of my improved system.

My invention is applicable to the refining of any lubricating oil, and it is particularly useful in refining oils which are contaminated by asphaltic, resinous or other impurities or coloring matters. In my specific example I will refer to the finishing of a heavy wax-bearing Mid-Continent lubricating oil having a viscosity of about 83 seconds Saybolt at 210° F. My preferred diluent is a mixture of butane and propane having a vapor pressure at 100° F. of about 100–150 lbs. per square inch. It should be understood that any of the liquefied hydrocarbon gases or mixtures thereof may be used. With those hydrocarbons difficult to liquefy, the apparatus employed must withstand higher pressures than when the more easily liquefied hydrocarbons, such as butane, are employed. The expression "propane" in the following specification and claims is hereby defined to mean commercial propane or mixtures of propane with butane, having a vapor pressure at 100° F. of about 50–200 pounds.

The lubricant oil stock from storage tank 10 is forced by pump 11 through pipe 12 to mixer 13 at a pressure of about 50–200 pounds, depending upon the vapor pressure of the propane. Propane from pressure storage tank 14 is introduced by pipe 15 into pipe 12 and thence into the mixer 13. Treating acid, preferably 96% sulfuric acid, in amounts of about one pound per gallon of oil stock, is introduced into the mixer through pipe 16. The mixer itself may consist of a cylindrical drum provided with suitable perforated platen or baffles, the structure of which forms no part of the present invention. The temperature in the mixer is preferably about 75–90° F. and it may be regulated by the use of suitable heating or cooling coils.

The mixture of acid, oil and propane is then introduced into treating tank 17, where sufficient time is allowed for the reaction, and the sour oil is separated from the sludge in separator 18, the sludge being withdrawn through pipe 19. Sour oil from the separator 18 is conveyed by pipes 20 to clay contacting or percolating filters 21.

It is desirable that the temperature in the separator be kept within clearly defined limits, preferably about 70–90°, and I accomplish this function by withdrawing vapors through pipe 22, pump 23, and condenser 24, and returning the propane back to storage tank 14. The cooling in the acid treating chamber is thus effected by the vaporization of a portion of the diluent.

Percolating filters 21 may be of the conventional type wherein filter clay, such as fuller's earth, Attapulgus clay, Florida earth, etc., from 30 to 60 mesh is supported by screens and filter elements in large cylindrical chambers, each of which is provided with a hopper bottom. The chambers are adapted to withstand pressure upwards of 200 pounds and the upper part of each chamber is connected by conduits 25 through a pressure release valve 26 to vapor line 22.

I have discovered that the use of liquefied hydrocarbon gases as diluents in claying processes has important unexpected advantages. The liquefied gases seem to have a tendency to throw out asphaltines, asphaltic bodies, resins, and other coloring matters and impurities from solution and to thereby assist in the adsorption of these undesirable components by the clay. Of course,

the propane has a marked effect in reducing the viscosity of the oil which, in turn, brings about a marked increase in filter rates, avoiding harmful and destructive temperatures. Another feature which is not easily explained is that a larger amount of oil may be treated with a given amount of clay when propane is used as a diluent or, in other words, the propane gives an increased yield of finished oil per ton of clay.

Oils which contain wax may be suitably dewaxed in propane solution either before or after the decolorization process.

Oil which has been neutralized, decolorized and purified by percolation in filters 21 may be introduced through pipes 27 into chillers 28, wherein additional amounts of propane may be added through pipes 29. In the chill chambers I prefer to have at least three or four volumes of propane to one volume of oil. Referigeration is effected by expansion of propane vapors through pipes 30, compressor 31, pipe 32, and condenser 33 to propane receiver 14. I prefer to chill at the rate of about 2° or 3° per minute, the chilling rate being determined by the rate at which propane vapors are removed from the chillers.

When the temperature of the mixture in a chiller has reached about −30° to −40° F. it will be found that the wax has separated out in well defined readily filterable crystals, and the slurry is thereupon passed through pipes 34 and pump 35 to filters 36. These filters are of the closed type and are designed to operate at about −30° to −40° F. The filter structure per se forms no part of the present invention and it will not be described in detail.

Wax is removed from filters by conduits 37 and the filtrate is removed therefrom through pipes 38 to filtrate collector 39. It should be noted that pressure in the filters and the filtrate collector may be regulated by connecting these elements to vapor line 30 through suitable manually operated and/or pressure relief valves.

The filtrate from the collector is passed by pipe 40, pump 41 and heat exchanger 42 into propane still 43, which is heated by suitable steam coil 44. Propane vapors are returned by pipe 45 to line 32, condenser 33 and storage tank 14. The finished oil is withdrawn from the base in still 43 and is passed through pipe 46 and heat exchanger 42.

At intervals it is necessary to interrupt the action of a percolating filter so that the clay may be revivified or replaced. The oil may be washed out of the filters at this time by means of propane and the propane may be entirely volatilized therefrom without the aid of stripping gases or stripping steam. The clay may be revivified by washing with caustic alkali and an alkali metal carbonate, as disclosed in Lowery 1,763,167, or it may be revivified with a solvent mixture, as described in Lemon 1,805,178. In all of such cases the revivifying solution may be washed out of the clay by means of propane even if the clay is revivified by burning (see McConnell 1,479,998). It is desirable to remove oil and diluent from the clay and my improved diluent is especially suitable for this purpose.

It will be noted that the above process is continuous and that the various elements, such as percolation filters, chillers and wax filters, are connected in parallel so that one element may be used while another is being cleaned, repaired or filled. It should also be noted that the above disclosure is directed to those skilled in the art and therefore I have not described in detail the various valves, pumps, pressure regulators, etc., which may be used in the construction of the operating plant.

While I have disclosed a preferred embodiment of my invention it will be understood that I do not limit myself to the details hereinabove set forth except as defined by the following claims.

I claim:

1. The herein disclosed process of decolorizing viscous lubricating oil which comprises heating a mixture of viscous lubricating oil and liquefied normally gaseous hydrocarbon solvent to a temperature corresponding to a solvent vapor pressure in excess of 150 pounds per square inch under pressure sufficient to maintain said solvent in the liquid state and passing the heated mixture through a bed of adsorbent decolorizing clay under sufficient pressure to maintain the heated solution in the liquid state.

2. The herein disclosed process of decolorizing viscous lubricating oil which comprises heating a mixture of viscous lubricating oil and liquefied propane solvent under pressure sufficient to maintain said solvent in the liquid state to a temperature corresponding to a solvent vapor pressure in excess of 150 pounds per square inch and passing the heated mixture through a bed of adsorbent decolorizing clay under sufficient pressure to maintain the heated solution in the liquid state.

3. The process of claim 1, including the further steps of periodically interrupting the passage of the oil solution through the bed of adsorbent decolorizing clay and passing fresh liquefied normally gaseous hydrocarbon solvent under pressure sufficient to maintain the solvent in the liquid state through the bed of adsorbent decolorizing clay during such periods of interrupted flow of oil solution.

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