Oct. 22, 1940. U. B. BRAY 2,218,516

METHOD FOR PRODUCING LUBRICATING OIL

Filed Oct. 6, 1930 2 Sheets-Sheet 1

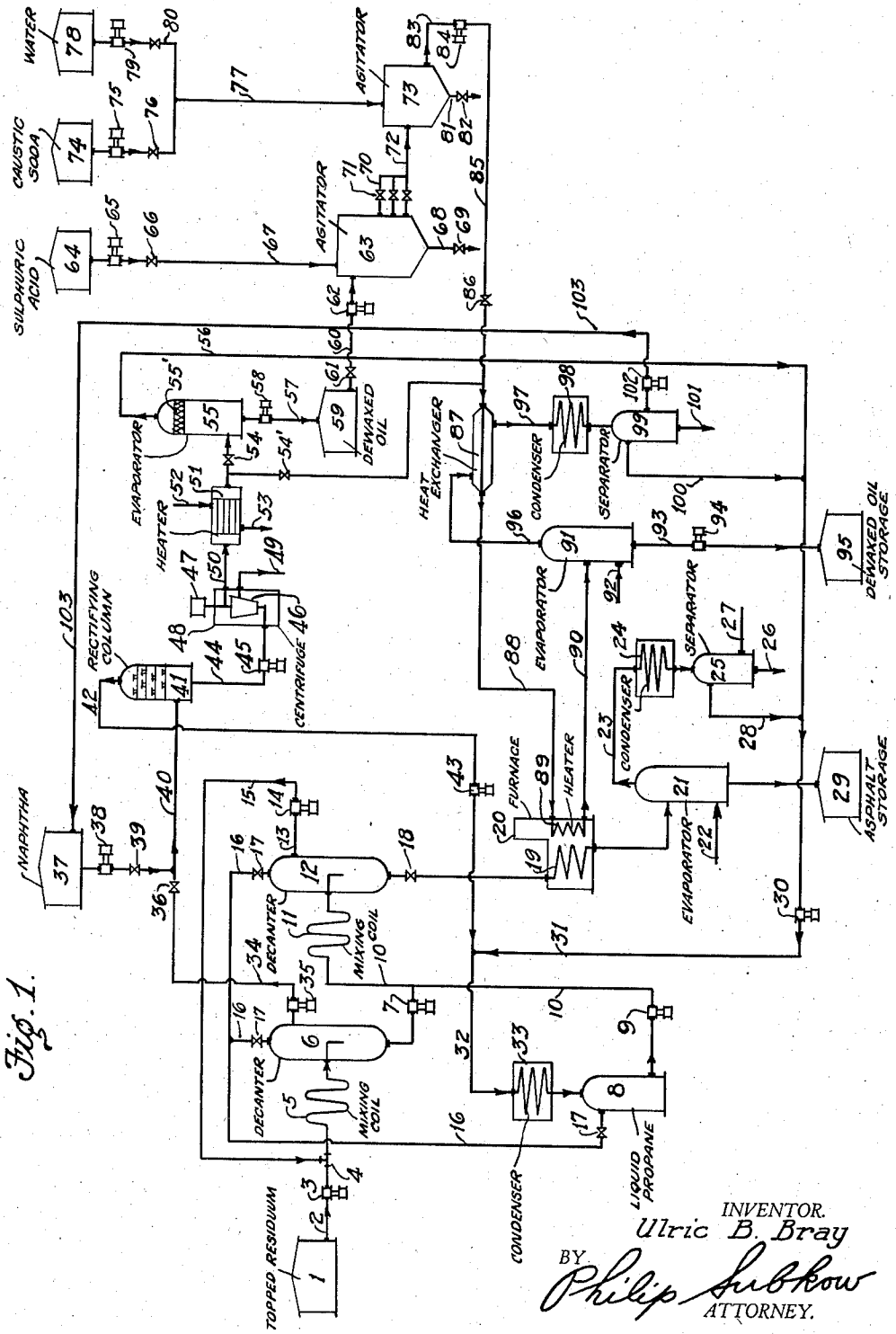


Fig. 1.

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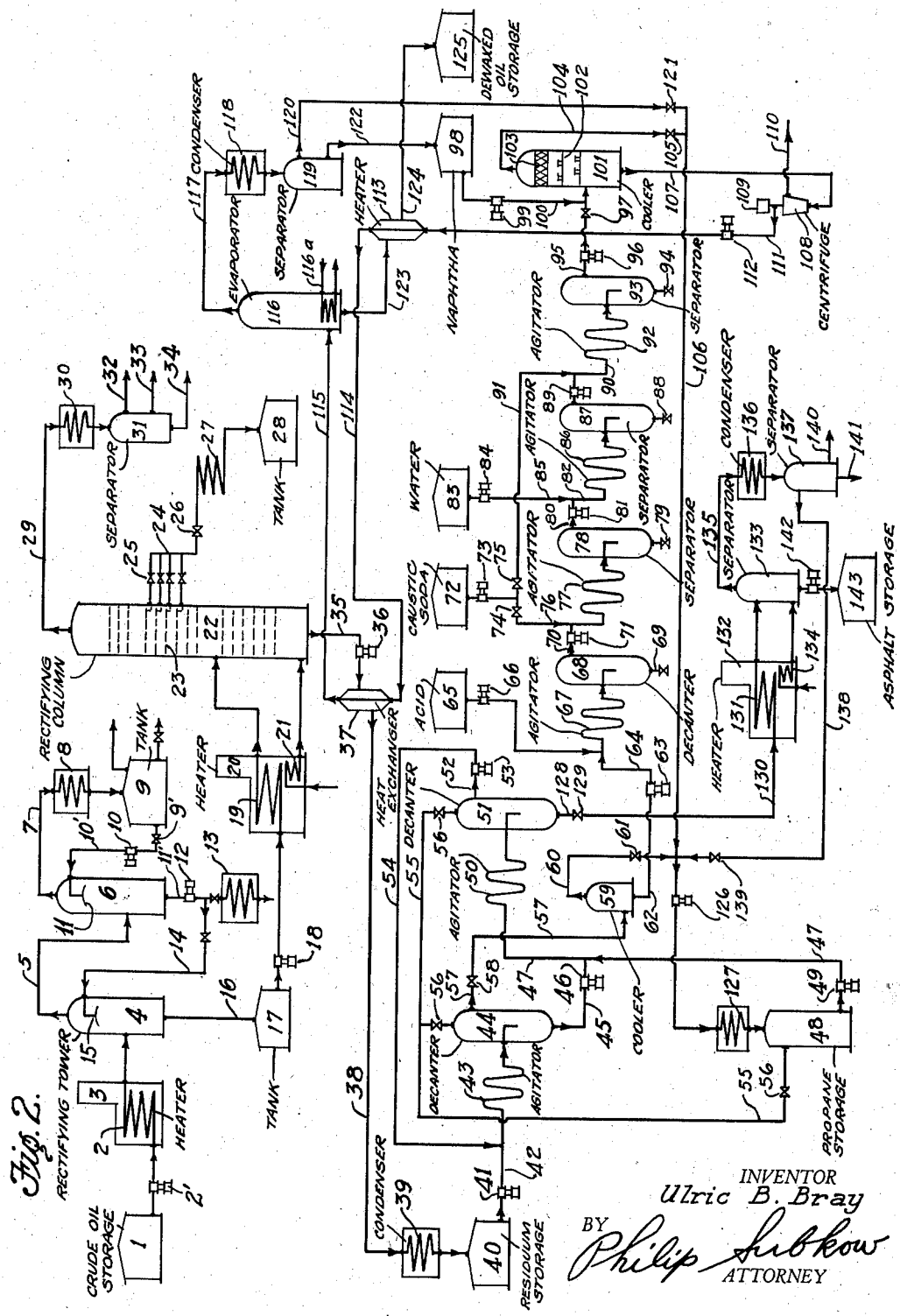


Fig. 2.

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UNITED STATES PATENT OFFICE

2,218,516

METHOD FOR PRODUCING LUBRICATING OIL

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Application October 6, 1930, Serial No. 486,724

15 Claims. (Cl. 196—13)

This invention relates to the production of lubricating oils from crude oils containing asphalt and wax. Subject matter disclosed herein but not claimed is claimed in the following co-pending applications and patents: Serial No. 466,189, filed July 7, 1930, claiming dewaxing with a liquefied normally gaseous hydrocarbon; Serial No. 705,910, filed January 9, 1934, a division of Serial No. 466,189, claiming a process and apparatus for dewaxing with a liquefied normally gaseous hydrocarbon under controlled pressures with or without alternate chilling and centrifuging; Serial No. 749,649, filed October 23, 1934, a division of Serial No. 466,189, claiming dewaxing with butane with or without heating of the wax-bearing oil with butane to effect solution prior to chilling; Patent No. 1,944,491, claiming separation of asphalt and wax from oils containing them; Patent No. 1,949,989, claiming separation of asphalt from oils by treatment with liquefied normally gaseous hydrocarbon with or without washing of precipitated asphalt with fresh solvent; Patent No. 2,006,098, claiming chemical treatment of oils dissolved in a liquefied normally gaseous hydrocarbon solvent; Patent No. 2,031,204, claiming deasphalting and/or dewaxing with a liquefied volatile solvent and with a heavier solvent material; and Patent No. 2,081,731, claiming distillation of oils to remove light fractions, substantial deasphalting of the residue, and the subsequent distillation of the partially deasphalted residue to produce a lubricating oil distillate.

It has been discovered that superior lubricating oils and asphalts can be obtained from crude oil by causing separation of the lubricating oil from the asphalt at temperatures below that at which deleterious changes are induced in the oil.

It has been found that if oil containing asphalt is heated in the presence of the asphalt, the latter catalyzes certain reactions in the oil which result in the destruction of those characteristics of the lubricating oils which are most desirable.

It has been found advisable to cause the separation of asphalt from the oil by means of volatile solvents which are capable of dissolving the oil and any wax and which do not dissolve the asphalt. Such solvents are light petroleum fractions, such as casinghead gasoline and naphtha and also petroleum fractions normally vaporous at ordinary temperatures and pressures. Other solvents which may be used are alcohol, ether, mixtures of alcohol and ether, acetone, etc. I prefer to use as my volatile solvent a petroleum fraction obtained by the rectification of natural gasoline. The fractions are composed in the main of propane and isobutane. A typical analysis of such a fraction is 6.72% ethane, 72.2% propane and 19.91% isobutane and 1.17% normal butane. It will be understood, however, that these merely illustrate the type of fraction used and the composition may vary. This fraction will hereinafter be referred to as propane for purposes of simplicity.

In order to cause the extraction with this liquid fraction, the solution is maintained at a pressure sufficient to maintain the propane liquid at ordinary temperatures. The fraction above described is liquid at ordinary temperatures at about 125 lbs. The extraction of the oil from the asphalt at such pressures results in an asphalt substantially free of oil and a solution of oil in the liquid petroleum fraction. This solution contains substantially all the wax present in the crude oil.

It has also been found that oil containing asphalt and impurities such as wax may be first freed from the asphalt by a primary extraction with a light solvent such as the solvent described above and that the impurities such as wax may then be removed at a suitable temperature by the aid of a heavier solvent such as naphtha in which the wax is substantially insoluble at the low temperature employed. By heavier solvent I mean one of higher boiling point than the light solvent previously described.

Advantage is taken of the high volatility of the light solvent to cause a cooling of the oil upon a release of pressure to produce the separation of the contained wax. A further advantage in cooling the oil in this manner is to bring the oil to a proper temperature for acid treatment. By acid treatment I intend to include treatment with acid followed by the step of neutralization and/or clay treatment.

If a large proportion of the propane is removed from the solution after the asphalt has been separated, the remaining solution becomes too viscous and not of sufficiently low specific gravity to permit satisfactory behavior in the dewaxing operation which is conveniently accomplished in a centrifuge. Difficulties are also encountered in chemically treating oils of high viscosity. My invention avoids these difficulties by mixing the oil with naphtha before dewaxing to reduce the viscosity and place the oil in proper condition for dewaxing. The reduced viscosity is also advantageous in chemical treatment of the oil. If naphtha is expanded at very low pressure into the oil prior to dewaxing, it may also have a cooling effect similar to that caused by the expansion of

the propane. By naphtha, I mean those petroleum fractions which vary from kerosene to light fractions of gasoline, preferably a gasoline-like fraction having a specific gravity of about 55° A. P. I. and a boiling range of about 200–300° F. Instead of naphtha I may use other solvents or diluents, for instance, benzol, alcohols such as methyl, ethyl, propyl, butyl alcohol or mixtures of the same, ketones such as acetone or di-ethyl ketone, chlorinated light hydrocarbons such as dichlorethylene, trichlorethylene or the like, or mixtures of benzol with acetone or other ketones, or mixtures of benzol and butanol or other alcohols.

In addition to the power which the naphtha has of reducing the viscosity of the asphalt-free oil, it also is used as an extracting medium for wax or other material whose presence is deleterious in a finished, high grade lubricating oil. The naphtha if used in sufficient quantities acts as a solvent for the oil during the removal of the wax or other impurities in a manner similar to the action of the propane solution during the removal of the asphalt. By regulating the quantity substantially oil free wax may be precipitated. In comparing their volatility and specific gravity, the propane is considered to be the light solvent and the naphtha is the heavier solvent. An advantage in using both light and heavy solvents resides in the fact that the dewaxing may take place in the presence of the heavier solvent after the lighter, more volatile solvent has been evaporated with a consequent decrease in the temperature of the wax containing oil.

It is therefore an object of my invention to produce lubricating oil from oil containing asphalt and impurities by extracting the lubricating oil first with a light solvent such as propane to precipitate the asphalt and then extracting the oil from the impurities such as wax with a heavier solvent such as naphtha.

It is a further object to produce lubricating oil from the oil described above by maintaining pressure on the oil and light solvent during the extraction of the asphalt and to extract the impurities such as wax from the asphalt free oil by means of a heavier solvent under reduced pressure.

It is furthermore an object of my invention to produce lubricating oil from oil containing asphalt and wax by mixing this oil with a solvent in which the lubricating oil fractions and wax are soluble, but in which the asphalt is insoluble, and subsequently separating the wax from the lubricating oil fractions in the presence of naphtha.

It is a further object of this invention to mix the naphtha with the oil either in the presence of substantially all the propane used to precipitate the asphalt, or in the presence of only a portion of said propane, or the naphtha may be added after substantially all the propane has been separated from the oil and wax.

It is a further object of this invention to produce lubricating oil from oil containing asphalt and wax by precipitating the asphalt with a solvent for the oil and wax and to chemically treat the oil either before or after removal of the wax from the oil, and either before or after the addition of naphtha to the oil and wax.

Another object of this invention is to produce lubricating oil from oil containing asphalt and wax by mixing a volatile solvent therewith under pressure to precipitate the asphalt and dissolve the lubricating oil fractions and wax, separate the precipitated wax under pressure, and taking advantage of the highly volatile characteristics of the solvent by releasing the pressure and allowing the solvent to vaporize and consequently cool the oil and wax, thereby precipitating the latter, and to separate the wax from the oil in the presence of naphtha.

Another object of the invention is to produce lubricating oil in the manner described above and to make further use of the volatility of the solvent by partially releasing the pressure on the oil, solvent and wax subsequent to the removal of the precipitated asphalt under pressure, whereby the oil, wax and the solvent which remain in the liquid form are sufficiently cooled to be at the desired temperature for chemical treatment, and after chemical treatment, making use of the volatility of the remaining solvent by further releasing the pressure and precipitating the wax due to the consequent cooling.

The process will be more adequately understood by reference to the drawings which show preferred schematic arrangements of the apparatus to carry out the process described herein.

Fig. 1 is a schematic arrangement of apparatus in which the oil is first made asphalt free and then is dewaxed in the presence of naphtha and chemically treated in the substantial absence of solvent.

Fig. 2 is a schematic arrangement of apparatus in which the oil is first made asphalt free and then is dewaxed in the presence of naphtha and chemically treated in the presence of substantial quantities of solvent.

Referring more particularly to Fig. 1, topped residuum obtained by distilling crude oil at a temperature preferably not over 600–625° F. to remove all fractions up to and including all or a portion of the light lubricating oil, is taken from tank 1 and is passed through line 2 to pump 3 and to T 4 where it meets a propane solution of lubricating oil coming through line 15. The propane and residuum pass through the turbulence or mixing coil 5 and then into decanter 6. The asphalt in the residuum is precipitated by the propane and settles to the bottom of decanter 6 in the form of a slurry which is passed through pump 7 and line 10 where it is mixed with propane from storage 8 via pump 9 and line 10. The mixture then is passed into mixing coil 11 and into decanter 12. Decanters 6 and 12 and propane storage 8 are maintained at the same pressure by means of equilibrium lines 16 controlled by valves 17. The pressures in 6, 12 and 8 are sufficient to maintain the solvent in liquid state at ordinary temperatures. For the solvent given above, this is about 125 lbs. per square inch.

The clear overflow from decanter 12, consisting of liquid propane in which is dissolved a small amount of lubricating oil, is passed through line 13, pump 14 to line 15 to T 4 where it is mixed with the incoming topped residuum and passes through turbulence coil 5 into decanter 6, as described above. The asphalt slurry from decanter 12 is drawn off through the pressure release valve 18 and flashed through coil 19 in furnace 20. Sufficient heat is supplied to cause vaporization of the propane and to melt the asphalt. The heated mixture of asphalt and propane is now sent into evaporator 21 where superheated steam is introduced via 22 in order to complete the evaporation of the propane and to reduce the asphalt to satisfactory flash and fire specifications. The overhead from evapo-

rator 21 is sent through line 23 to condenser 24 and then to separator 25. The condensed light oils are removed through 27 and condensed water through 26. The uncondensed propane from the separator is sent through line 28 to propane compressor 30. The compressed propane is sent through line 31 to line 32 to condenser 33 where it is liquefied and passes into propane storage 8. The reduced asphalt is sent to asphalt storage 29. The pressure in 21 is about atmospheric, although it may be higher if desired.

The overflow from decanter 6, consisting of a more concentrated solution of lubricating oil and propane is passed through pump 35 and line 34 through pressure reduction valve 36 where it meets naphtha from tank 37 passing through pump 38 and valve 39. In the operation of cooling chamber 41, if a very large portion of the propane is evaporated, the remaining solution would be too viscous and not of sufficiently low specific gravity to permit satisfactory behavior in the dewaxing operation. Therefore, a suitable quantity of naphtha is added in line 40 to the incoming propane solution. The addition of the naphtha also reduces the loss of propane in the centrifuging operation if the centrifuge is not gas tight in construction.

It is desired to release the pressure upon the propane solution so that propane will evaporate from the solution and thereby sufficiently lower the temperature of the remaining solution to permit a satisfactory dewaxing operation. The propane solution passing through pressure reduction valve 36 goes through line 40 into cooling chamber 41 which is in effect a rectifying column held at a predetermined pressure corresponding to the desired dewaxing temperature. As the propane evaporates the temperature of the remaining solution falls to that in which the vapor pressure will correspond to that being maintained in the cooling chamber by propane compressor 43. The propane vapors pass out through line 42 to compressor 43. The conditions in rectifying column 41 are maintained by the proper manipulation of valve 36 and by controlling the suction of compressor 43 so that only the solvent is removed and the lubricating oil and naphtha are retained as bottoms. By reducing the pressure to substantially atmospheric a temperature of —40° F. can be obtained. Substantially all the propane may be removed from the solution in rectifying column 41 or only the necessary quantity may be allowed to vaporize therefrom in order to provide for sufficient cooling to dewax the oil. If desired, the vapors rising in the column 41 may be washed by the addition of naphtha into the top thereof. The compressed vapors leaving compressor 43 pass through line 32 to condenser 33 where the vapors are liquefied and passed into liquid propane storage 8.

The cooled mixture from the bottom of rectifying column 41 is carried through line 44 to pump 45 from which it is sent to centrifuge 46. The centrifuge is operated by motor 47 which is positioned outside a gas tight insulated chamber 48 which contains centrifuge 46. Wax is discharged from the centrifuge through line 49. The discharged wax may be worked up in any suitable manner for the recovery of propane, naphtha and oil. The dewaxed oil is discharged through line 50 and is passed into heater 51. The heater 51 may consist of any convenient equipment which will impart heat to the cold oil passing through line 50, such as a heated coil set in a furnace or heat exchanger. As shown it is a steam heater, steam entering at 52 and leaving at 53. The dewaxed oil solution leaving heater 51 may be sent by either of two courses.

If it is desired to acid and alkali treat the dewaxed lubricating oil stock while in naphtha solution, the oil is passed through valve 54 to evaporator 55. In evaporator 55 practically all of the remaining propane is removed from the solution, passed through mist extractor 55', through line 56 to propane compressor 30, where it is compressed and sent through line 31 and line 32 to condenser 33 where it is liquefied and passed into propane storage 8. The column 55 is operated to keep the naphtha in the oil by the proper manipulation of valve 54 and by controlling the suction of propane compressor 30. This is merely a simple rectifying step. Rectifying plates may be provided to assist in this operation as will be understood by those skilled in the art.

The naphtha solution from the bottom of evaporator 55 passes through pump 58, line 57 to dewaxed naphtha solution storage 59. From 59 the dewaxed naphtha solution passes through valve 61, pump 62, via line 60 to agitator 63 where it is treated with sulfuric acid from tank 64, pumped by 65 through valve 66 in line 67. The acid treated oil is decanted from the sludge through the valves 71 and lines 70 and run into agitator 73 through line 72. The acid sludge is withdrawn through line 68 controlled by valve 69. In 73 it is first treated with water passing from 78 via pump 79 and valve 80 through line 77. The water is withdrawn through 81 controlled by valve 82. The oil is then treated with caustic soda passing from 74 via pump 75 and valved line 76 to line 77. The spent caustic is withdrawn through 81. The alkali treated oil is then washed with water as previously described. The treated naphtha solution is carried from agitator 73 by line 83. The treated naphtha solution passes through line 83, pump 84, line 85, valve 86 to heat interchanger 87.

If it is not desired to perform the acid and alkali treatment in the presence of the naphtha, the oil leaving heater 51 is passed through valve 54' to heat interchanger 87, valves 54 and 86 being closed and valve 54' open. Oil leaving 87, where its temperature is raised somewhat, is sent through line 88 to coil 89 in furnace 20 where its temperature is raised still further before being introduced into evaporator 91 through line 90. Steam is introduced via 92 in evaporator 91 to aid in the flashing of the naphtha and residual propane and to reduce the remaining oil to satisfactory flash and fire specifications. The oil remaining in the bottom of evaporator 91 is drawn off through line 93 and sent to dewaxed oil storage 95 via pump 94. If the oil has not been chemically treated in naphtha solution, it may now be treated free from naphtha.

The treated naphtha solution travels from heat interchanger 87 in the same path described above in order to be freed of naphtha and residual propane.

The overhead from evaporator 91 is passed through 96 and heat exchanger 87 into line 97 and is further condensed in condenser 98 from which it passes into separator 99. The naphtha condensate is sent by pump 102 through line 103 to naphtha storage 37. Any uncondensed propane in separator 99 passes through line 100 to propane compressor 30. The compressed propane passes through line 31 and 32 to condenser 33 where it liquefies and passes to propane stor-

age 8. The condensed steam is withdrawn through 101.

Referring more particularly to Fig. 2, this embodiment relates to the aforesaid process in which a modification is made whereby the chemical treatment takes place in the presence of substantial quantities of the solvent which is in solution with the oil and wax.

The crude oil to be used as a source of lubricating oil is taken from a crude oil storage tank 1 and sent by pump 2' through coil 2 in furnace 3, whence it is sent to evaporating column 4. The vapors passing through line 5 consist of gas oil, kerosene and gasoline vapors which go to dephlegmator 6 where they are fractionated into gasoline overhead and kerosene and gas oil bottoms. These may be rerun or handled in any conventional manner. The vapors passing through 7 are condensed in condenser 8 and the condensate, i. e., gasoline, is collected in 9. A part thereof may be returned by pump 10 through line 10' controlled by valve 9' to distributor 11 to act as a reflux. The dephlegmator bottoms are removed through 11' by pump 12 and are cooled in 13. They consist of gas oil and kerosene. Part thereof is returned as a wash via line 14 and spray 15.

The bottoms from evaporator 4, consisting of fuel oil or refinery residuum, pass through the run-down line 16 to the hot residuum storage tank 17 which may serve as a surge tank in the continuous operation of the process. The hot residuum from tank 17 is passed through pump 18 which sends the hot residuum through coil 19 in furnace 20 where the residuum is heated to about 625° F. Care is taken at this point not to overheat the residuum because of the danger of injuring the quality of the lubricating oil to be obtained as the final product. The heated residuum passes to fractionating column 22. Steam superheated in coil 21 is introduced in column 22 to aid in the flashing of the volatile oils which are taken off in one or more side streams via lines 24 and as an overhead via line 29. Lines 24 are controlled by valves 25 and the condensate is cooled in 27 and collected in 28, the flow thereinto being controlled by valve 26. If desired, as many tanks as there are side streams may be employed. The side stream distillates may be processed in any suitable manner to produce desirable products.

The overhead from column 22 is removed through line 29, cooled in condenser 30 and sent to receiver 31. Uncondensed vapors are removed therefrom via 32 while condensed oil and water from the steam used in column 22 are removed via lines 33 and 34 respectively. The bottoms from column 22 are run through line 35 by pump 36 to heat exchanger 37 and line 38 to cooler 39 from which they are delivered to the topped residuum tank 40. The operation of coil 19 and column 22 is so regulated as to produce the desired predetermined extent of topping necessary to give the proper viscosity oil in the later extraction of propane.

In the above description of the production of a topped residuum, the foregoing equipment and operations are intended merely to exemplify one of the many ways in which a satisfactory topped residuum can be produced. Many other features of construction and operation such as are known to those skilled in the art may be substituted for or included in the above without departing from my invention. It will be understood that the topping operation here described is equally applicable to the process illustrated in Fig. 1.

The topped residuum from tank 40 is passed by pump 41 through line 42 where it meets a propane solution of lubricating oil coming through line 54. The propane and residuum pass through the turbulence or mixing coil 43 and then into decanter 44. The asphalt in the residuum is precipitated by the propane and settles to the bottom of decanter 44. The precipitated asphalt resembles a slurry and may be drawn off from the bottom of the decanter with sufficient liquid propane to permit pumping.

The asphalt propane slurry is passed through line 45, pump 46 and line 47 where it is mixed with fresh liquid propane from storage 48 sent via pump 49 and line 47. The mixture is then passed into mixing coil 50 and into decanter 51. If it is desired to produce an asphalt containing still less oil or wax, the countercurrent washing with propane may be extended to as many steps as desired. Decanters 44 and 51 and storage 48 are maintained at the same pressure by means of equilibrium lines 55 controlled by valves 56. The pressures in 44, 51 and 48 are sufficient to maintain the solvent in liquid state at ordinary temperatures.

The clear overflow from decanter 51 consisting of liquid propane in which is dissolved a small amount of oil is sent through line 52, pump 53 and line 54 to its connection with line 42 where it is mixed with the incoming topped residuum. The mixed residuum and propane pass through mixing coil 43 and into decanter 44 as described above.

The asphalt slurry from decanter 51 is drawn off through line 128 and pressure release valve 129 and is sent through line 130 to heating coil 131 set in furnace 132. In coil 131 sufficient heat is supplied to cause the vaporization of the propane and to melt the asphalt. The heated mixture of asphalt and propane is now sent into evaporator 133 where superheated steam is introduced via 134 in order to complete the evaporation of the propane and to reduce the asphalt to satisfactory flash and fire specifications. The reduced asphalt is pumped by pump 142 into asphalt storage 143. The overhead from the evaporator 133 is sent through line 135 to a cooler 136 which may be a heat exchanger or simple cooler or a combination of both. The products from the cooler 136 consisting of condensed steam and oil together with uncondensed propane are sent to separator 137. The condensed light oils are removed through 140 and the condensed water leaves through 141. The uncondensed propane is carried by line 138 to pressure regulating valve 139 and line 106 to the propane compressor 126. The compressed gas leaving compressor 126 travels through line 106 to cooler 127 where it liquefies and flows to liquid propane storage tank 48. The pressure in 133 is about atmospheric.

The clear overflow from decanter 44, now consisting of a more concentrated solution of lubricating oil and propane, is next prepared for acid and alkali treatment at reduced temperature. A reduced temperature is very beneficial in the chemical treatment of certain types of oils. In order to lower the temperature of the propane solution, the pressure on the solution is decreased to a value corresponding roughly to the vapor pressure of propane at the desired treating temperature and evaporation of the propane takes place until this temperature is reached, the pressure in the meantime being held constant by au-

tomatic pressure regulating valves. A temperature of about 40° F. is desirable in the following chemical treatment and may be obtained by reducing the pressure on the propane solution to substantially 70 lbs. per square inch.

The propane solution from the top of decanter 44 is therefore passed through line 57 to the pressure release valve 58 and into expansion chamber 59 which is held at a predetermined pressure by means of automatic back pressure regulating valve 61. The propane which has been vaporized in 59, in order to lower the temperature of the remaining oil solution, passes through line 60, valve 61 and line 106 to compressor 126 where the propane vapors are compressed, liquefied and sent to propane storage 48 after cooling in cooler 127.

The cooled propane solution in expansion chamber 59 is sent through line 62 by pump 63 to turbulence or mixing coil 67 and thence to decanter 68. Sulfuric acid is introduced from tank 65 by means of pump 66 into line 64. The acid treated oil solution is decanted and the sludge is withdrawn through line 69. The oil is sent by line 70 and pump 71 into turbulence or mixing coil 77 and thence to decanter 78. Water for use in washing the acid treated oil is introduced in line 70 from water storage 72 via pump 73, valve 74 and line 76. The washed oil is then decanted and is removed from decanter 78 via line 80 and pump 81 into line 82. The wash water is removed from decanter 78 through line 79.

Alkali from alkali storage 83 is then admitted to line 82 via pump 84 and line 85. The oil and alkali flow through turbulence coil 86 into decanter 87 from which the alkali sludge is removed via line 88. The decanted oil from 87 is next sent into line 90 by pump 89 and thence into turbulence coil 92. Wash water is also allowed to enter said coil 92 by passage from water storage 72 via pump 73, valve 75, line 91 and line 90. From the turbulence coil 92, the material passes into decanter 93 from which the wash water is removed via 94. Pressure is maintained on the decanters 68, 78, 87 and 93, as above described.

The treated oil solution leaving the treating group by means of line 95 is passed by pump 96 through a second expansion valve 97 where the pressure is released to that corresponding to the dewaxing temperature. This pressure will be substantially atmospheric and its corresponding temperature will be about —35° F. In order to obtain an oil of extremely low cold test and to reduce the danger of loss of propane in the centrifuging operation, practically all of the propane is now evaporated. In order to maintain sufficient fluidity and a proper specific gravity of the solution to be dewaxed by centrifuging, naphtha from tank 98 is added to the propane solution in line 95 via pump 99 and line 100. The mixture of oil, propane and naphtha passes into expansion chamber 101. The evaporation of the propane reduces the temperature of the remaining material to a satisfactory dewaxing temperature. The chilled material then passes through line 107 to centrifuge 108 where the wax is thrown out and carried away by line 110. The centrifuge is driven by motor 109. The wax stream may then be treated in any desired manner for the recovery of naphtha and propane.

The dewaxed oil solution is carried away by line 111 to pump 112. From pump 112 the oil solution is sent to heat exchangers 113 and 37 where the temperature is raised by heat exchange with the bottoms from evaporator 116 and column 22 respectively, before being sent by lines 114 and 115 to evaporator 116. Evaporator 116 may consist of any suitable equipment, but is shown as a simple column heated by steam coil 116a. In this exhausting column, all of the naphtha and any remaining propane are removed so that the oil remaining has proper flash and fire points. The overhead from evaporator 116 passes through line 117 to condenser 118 and then to separator 119. The naphtha recovered in 119 is sent through line 122 to naphtha storage 98, and the uncondensed propane is sent through line 120 to back pressure regulating valve 121 and thence through line 106 to the propane compressor 126 and liquefier 127 to be returned to propane storage 48. The bottoms from evaporator 116 are drawn off through line 123 and are sent to heat exchanger 113 where heat is imparted to the incoming naphtha solution as indicated above. Leaving heat exchanger 113, the bottoms pass through line 124 to tank 125 which is the acid treated dewaxed oil storage tank.

It is to be understood that the above is merely illustrative of preferred embodiments of the invention of which many variations may be made by those skilled in the art without departing from the spirit thereof.

I claim:

1. A method of separating asphalt and wax from oil containing the same which comprises mixing said oil with a solvent, separating the asphalt from the solvent, oil and wax, adding naphtha, separating the solvent from the naphtha, oil and wax at reduced temperature, separating the wax from the oil and naphtha at reduced temperature and subsequently separating the naphtha from the oil.

2. A method of separating asphalt and wax from oil containing the same which comprises mixing said oil with a solvent, separating said asphalt from the solvent, oil and wax, removing part of said solvent before the addition of naphtha, adding naphtha to said solvent solution, separating the remaining solvent from said solution, separating wax from the oil and naphtha and subsequently separating naphtha from the oil.

3. A method of separating asphalt and wax from oil containing the same which comprises mixing said oil with a volatile solvent under superatmospheric pressure sufficient to maintain said solvent liquid, separating said asphalt from the solvent, oil and wax under such pressure, releasing the pressure to partially evaporate the solvent and to cool the oil and precipitate the wax, adding naphtha, separating wax from said oil, naphtha and remaining solvent, further releasing said pressure to separate said remaining solvent from the oil and naphtha and subsequently separating naphtha from the oil.

4. A method of separating asphalt and wax from oil containing the same which comprises mixing said oil with a volatile solvent under superatmospheric pressure sufficient to maintain said solvent liquid, separating said asphalt from the solvent, oil and wax under such pressure, adding naphtha, reducing the temperature and pressure, separating said solvent from the oil, wax and naphtha under reduced pressure, acid treating the oil and separating the naphtha from the oil.

5. A process for the production of lubricating oil from an oil containing asphalt and wax which

comprises commingling said oil with liquid propane, separating the asphalt from the propane, oil and wax, adding a heavier solvent to said propane, oil and wax, cooling said oil, propane and heavier solvent sufficiently to precipitate the wax, separating the precipitated wax from the oil, propane and heavier solvent and subsequently separating said propane and said heavier solvent from said dewaxed oil.

6. A process for the production of lubricating oil from an oil containing asphalt and wax which comprises commingling said oil with liquid propane, separating the asphalt from the propane, oil and wax, adding naphtha to said propane, oil and wax, vaporizing a portion of the liquid propane and cooling the oil sufficiently to precipitate the wax, separating the wax from the oil, naphtha and remaining propane, acid treating said oil in the presence of the naphtha and remaining propane and subsequently separating the naphtha and remaining propane from said acid treated oil.

7. A process for the production of lubricating oil from oil containing wax which comprises mixing said oil with a volatile solvent under superatmospheric pressure sufficient to maintain said solvent liquid, adding a wax extracting solvent, releasing the pressure and vaporizing the volatile solvent to cool the oil and precipitate the wax, separating the wax from the oil and wax extracting solvent and subsequently separating the wax extracting solvent from the oil.

8. A process for the production of lubricating oil from oil containing wax which comprises mixing said oil with a volatile solvent under superatmospheric pressure sufficient to maintain said solvent liquid, acid treating said oil and wax under said pressure in the presence of said volatile solvent, alkali treating said acid treated oil and wax under said pressure in the presence of said volatile solvent, adding naphtha under said pressure, releasing the pressure and vaporizing the volatile solvent from the oil, wax and naphtha, separating the wax from the oil and naphtha and subsequently separating the naphtha from the oil.

9. A process for the production of lubricating oil from oil containing wax which comprises mixing said oil with a liquefied normally gaseous hydrocarbon solvent under superatmospheric pressure sufficient to maintain said hydrocarbon solvent liquid, reducing the pressure partially and vaporizing a portion of the solvent to cool the oil, acid treating said cooled oil in the presence of the remaining solvent, adding naphtha while maintaining the cooled oil solvent mixture under said reduced pressure, releasing the pressure and vaporizing the solvent to further cool the oil and precipitate the wax, separating the precipitated wax from the oil and naphtha and separating the naphtha from the oil.

10. A process for the production of lubricating oil from oil containing wax which comprises mixing said oil with a liquefied normally gaseous hydrocarbon solvent and under superatmospheric pressure sufficient to maintain said hydrocarbon solvent liquid, cooling the oil to a temperature insufficient to precipitate substantial quantities of wax by partially reducing the pressure to effect vaporization of a portion of the solvent, acid treating said cooled oil in the presence of the remaining solvent under said partially reduced pressure, adding naphtha under such pressure, releasing the pressure and vaporizing the solvent to further cool the oil and precipitate the wax, separating the precipitated wax from the oil and naphtha and subsequently separating the naphtha from the oil.

11. A process for the production of lubricating oil from oil containing asphalt and wax which comprises mixing said oil with a liquefied normally gaseous hydrocarbon solvent under superatmospheric pressure sufficient to maintain said hydrocarbon solvent liquid to precipitate asphalt, separating the asphalt from the oil solvent solution, reducing the pressure partially and vaporizing a portion of the solvent to cool the oil, acid treating said cooled oil in the presence of the remaining solvent, adding naphtha under such pressure, releasing the pressure and vaporizing the solvent to further cool the oil and precipitate the wax, separating the precipitated wax from the oil and naphtha and separating the naphtha from the oil.

12. A process for the production of lubricating oil from oil containing asphalt and wax which comprises mixing said oil with a liquefied normally gaseous hydrocarbon solvent under superatmospheric pressure sufficient to maintain said hydrocarbon solvent liquid to precipitate asphalt, separating the asphalt from the oil solvent solution, cooling the oil to a temperature insufficient to precipitate substantial quantities of wax by partially reducing the pressure to effect vaporization of a portion of the solvent, acid treating said cooled oil in the presence of the remaining solvent under said partially reduced pressure, adding naphtha under such pressure, releasing the pressure and vaporizing the solvent to further cool the oil and precipitate the wax, separating the precipitated wax from the oil and naphtha and subsequently separating the naphtha from the oil.

13. The process of dewaxing hydrocarbon oils bearing a wax crystallization retarder in the form of coloring material, including the steps of blending a diluent with the hydrocarbon oil, chilling the solution thus formed substantially to a temperature at which the retarding effect of the coloring material is overcome, removing such a portion of the coloring material that the wax crystallization retardation effect of the remainder will not prevent substantially complete wax precipitation on further chilling, sub-chilling the solution to precipitate the wax and separating the wax from the solution.

14. A process according to claim 7 in which the volatile solvent is a liquefied normally gaseous hydrocarbon having a vapor pressure higher than that of butane and lower than that of ethane.

15. A process according to claim 7 in which the volatile solvent consists chiefly of liquid propane.

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