

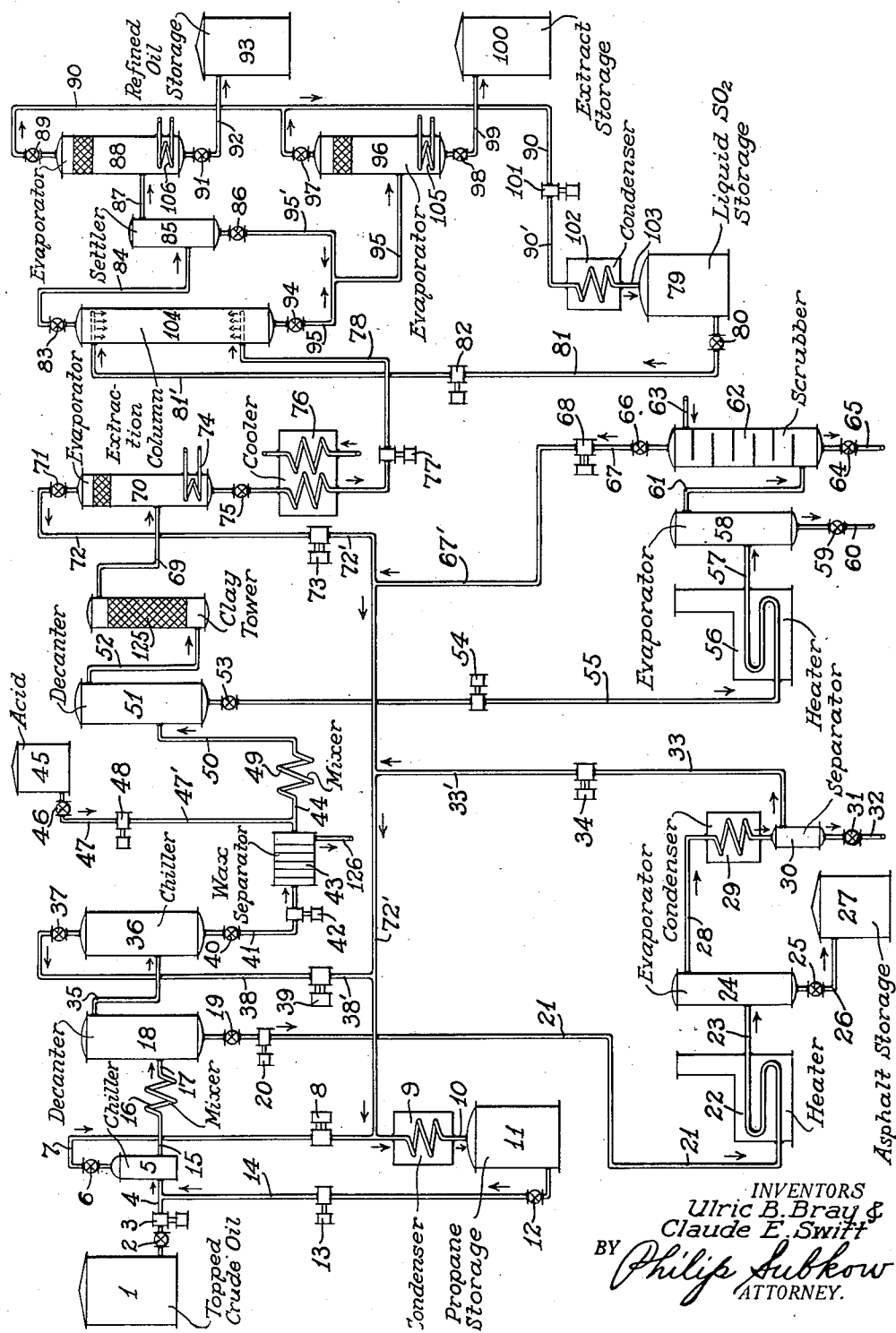
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U. B. BRAY ET AL

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PROCESS FOR TREATING OILS

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PROCESS FOR TREATING OILS

Ulric B. Bray, Palos Verdes Estates, and Claude E. Swift, Glendale, Calif., assignors to Union Oil Company of California, Los Angeles, Calif., a corporation of California

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9 Claims. (Cl. 196—13)

This invention relates to a process for treating petroleum to produce lubricating oil and is a division of our copending application Serial No. 555,017, filed August 4th, 1931. More particularly, the invention relates to the separation of asphalt from oil.

It is an object of our invention to separate asphalt from oil by means of a solvent at an elevated temperature. A further object of our invention is to separate the asphalt from oil by means of liquefied normally gaseous hydrocarbon solvents, such as liquid propane, at temperatures above ordinary room or normal temperatures and under superatmospheric pressure.

It is another object of our invention to separate the asphalt from oils at temperatures above 75° F. and more particularly at temperatures of approximately 120° F.

Another object of our invention is to separate wax from oils containing the same subsequent to de-asphaltizing the oil at elevated temperatures. To separate the wax, we prefer to vaporize a portion of the solvent under reduced pressure. This will chill the oil and cause the wax to precipitate from solution.

A further object of our invention is to treat the oil with chemicals, such as sulphuric acid and clay, in the presence of a solvent subsequent to deasphaltizing at elevated temperatures and also to separate the oil into paraffinoid and non-paraffinoid fractions by means of a selective solvent, such as liquid sulphur dioxide.

It is another object to effect the separation or extraction of the oil subsequent to deasphaltizing either in the presence or substantial absence of a diluent as liquid propane.

Other objects and features of our invention will be understood by referring to the drawing which represents a schematic arrangement of one form of apparatus in which our process may be carried out.

Referring more particularly to the drawing, crude oil from which all of the gasoline, kerosene and gas oil has been removed in tank 1 is withdrawn through valve 2 and sent by means of pump 3 to line 4 where it meets a stream of solvent coming from storage tank 11 through valve 12 pump 13 and line 14. A solvent is chosen which is capable of dissolving the oil and wax but which does not dissolve the asphalt. As solvents, we may employ light petroleum fractions, such as naphtha, casinghead gasoline and petroleum fractions normally vaporous at ordinary temperature and pressure. Other solvents which may be used are

alcohol, ether, mixtures of alcohol and ether, acetone, etc. We prefer to use as our solvent a liquefied normally gaseous hydrocarbon such as a petroleum fraction obtained by the rectification of natural gasoline. Such solvents comprise methane, ethane, propane, butane or mixtures thereof. A typical analysis of such a fraction is 6.72% ethane, 72.2% propane, 19.91% isobutane and 1.17% normal butane. This fraction is liquid at ordinary temperatures at a pressure of about 125 lbs. per square inch.

The mixture of topped crude and liquefied normally gaseous hydrocarbon solvent, such as liquid propane under pressure, passes into chiller 5 where the mass is cooled by allowing a portion of the liquid propane to vaporize under reduced pressure through valve 6 into line 7. The vaporized propane in line 7 is compressed by compressor 8 and sent to condenser 9 where it is liquefied and passes by means of line 10 to propane storage tank 11. The cooled mass of topped crude and liquid propane in chiller 5 passes by means of line 15 to agitator 16 where it is thoroughly mixed, after which it passes by means of line 17 to decanter 18 where the asphalt settles out.

The asphalt in decanter 18 is removed through valve 19 and sent by pump 20 through line 21 to heater 22 where the temperature of the mass is raised sufficiently to vaporize all of the propane and moisture present. The heated mass then passes by means of line 23 into separator 24 where the asphalt separates out and is removed through valve 25 and line 26 to storage tank 27. The mixture of water vapor and propane passes from separator 24 through line 28 to condenser 29 where the water vapor is condensed. The mixture of water and propane vapor passes from condenser 29 to separator 30 where the water is separated out and is removed through valve 31 and line 32. The propane vapor in separator 30 passes by means of line 33 to compressor 34 where it is compressed and sent by means of lines 33' and 72' to condenser 9 where it is liquefied and passes through line 10 to storage tank 11.

The propane solution of oil in decanter 18 is withdrawn through line 35 and passes into chiller 36 where the temperature of the mass is lowered to a point sufficient to cause thorough wax precipitation by allowing a portion of the propane present in chiller 36 to vaporize under reduced pressure through valve 37 into line 38. The propane vapor in line 38 is compressed by compressor 39 and sent through lines 38' and 72'

to condenser 9 where it is liquefied and passes by means of line 10 to storage tank 11.

The cooled mass in chiller 36 is withdrawn through valve 40 and line 41 whereafter it is sent by pump 42 to a dewaxing stage 43 which may consist in centrifuging, filtering and cold settling the chilled mass to remove the wax which is withdrawn via line 126. The dewaxed oil dissolved in liquid propane emerges from dewaxing stage 43 into line 44 where it is mixed with sulphuric acid coming from tank 45 through valve 46, line 47, pump 48 and line 47'. The mixture of oil and acid then passes into agitator 49 where it is thoroughly mixed, after which it passes into decanter 51 where the sludge is allowed to settle out.

The sludge in decanter 51 is removed through valve 53 and sent by means of pump 54 through line 55 to heater 56 where the temperature of the mass is raised sufficiently to vaporize the propane. The heated mass then passes by means of line 57 to separator 58 where the sludge separates out and is withdrawn through valve 59 and line 60. The propane vapor passes from separator 58 through line 61 to scrubbing tower 62 where it is contacted with liquid caustic soda to remove any sulphur dioxide present. The scrubbed propane passes from tower 62 through valve 66, line 67, compressor 68, lines 67' and 72' to condenser 9 where it is liquefied and passes by means of line 10 to storage tank 11.

The acid treated oil dissolved in propane in decanter 51 passes by means of line 52 to clay tower 125 where any remaining sludge is removed. The propane solution of treated oil then passes from tower 125 by means of line 69 to evaporator 70 where the propane present is vaporized with the aid of steam introduced through closed steam coil 74. The propane vapor passes from evaporator 70 through valve 71 into line 72 thence to compressor 73 where it is compressed and sent by means of line 72' to condenser 9 where it is liquefied and passes by means of line 10 to storage tank 11.

The propane free oil in evaporator 70 is withdrawn through valve 75 and passes through cooler 76 where the temperature is lowered sufficiently for extraction with a selective solvent such as liquid sulphur dioxide which is adapted to separate the oil into paraffinoid and non-paraffinoid fractions. The cooled oil passes from cooler 76 to pump 77 which forces it through line 78 into the lower zone of extraction column 104. Liquid sulphur dioxide from tank 79 is withdrawn through valve 80 into line 81 and is forced by pump 82 through line 81' into the upper zone of extraction column 104. Due to the difference in specific gravity of oil introduced into the lower zone of extraction column 104 and the liquid sulphur dioxide introduced into the upper zone of extraction column 104, these two liquids tend to separate. As the heavy liquid sulphur dioxide passes down through the ascending column of oil it dissolves certain constituents present comprising the non-paraffinoid fractions which are removed in the form of a sulphur dioxide solution through valve 94 into line 95 from which the mixture passes into evaporator 96 where the sulphur dioxide present is removed with the aid of steam introduced into closed steam coil 105 and passes through valve 97 into line 90 and thence to compressor 101 where it is compressed and passes by means of line 90' to condenser 102 where it is liquefied and passes by means of line 103 to sulphur dioxide storage 79. The sulphur dioxide

free oil in evaporator 96 is withdrawn through valve 98 and passes by means of line 99 to storage tank 100.

The ascending column of oil in column 104 from which there has been removed the sulphur dioxide soluble constituents, passes through valve 83 and line 84 into auxiliary settling chamber 85 where any remaining liquid sulphur dioxide settles out. The settled oil from chamber 85 passes through line 87 into evaporator 88 where the sulphur dioxide present is vaporized by aid of steam introduced into closed steam coil 106 and passes through valve 89 to line 90 and thence to compressor 101 where it is liquefied and passes by means of line 103 to sulphur dioxide storage tank 79. The sulphur dioxide free oil in evaporator 88 is withdrawn through valve 91 and sent by means of line 92 to refined oil storage tank 93.

Instead of employing liquid sulphur dioxide as a selective solvent for separating the oil into paraffinoid and non-paraffinoid oils, we may employ as solvent agents which will effect this separation, mixtures of acetone and benzol, aniline or methyl formate. However, liquid sulphur dioxide has been found especially valuable as a solvent to separate the propane extract into oils which exhibit high paraffinicity and into oils which exhibit low paraffinicity. By subjecting the propane extracted oil to the selective solvent action of liquid sulphur dioxide, it is possible to separate this material into oils which have a low temperature viscosity susceptibility and oils which have a high temperature viscosity susceptibility.

As illustrative of the operation of the process for one type of oil without intending to limit our invention, the following is an example:

The topped oil in tank 1, at a temperature approximating 200° F., is mixed with liquid propane and cooled by allowing a portion of the propane present to vaporize until an elevated temperature of about 120° F. is attained, after which the mixture of residual oil and propane is mixed in agitator 16. The thoroughly agitated mass passes into decanter 18 where the propane solution of oil and wax is separated from the undissolved asphalt. This oil dissolved in liquid propane, which is a mixture of paraffinoid and non-paraffinoid oils, is chilled sufficiently to cause the wax present to precipitate out by allowing a further portion of the propane present to vaporize under reduced pressure. The precipitated wax is removed from the solvent solution of oil by such means as cold settling, centrifuging or filter pressing. The oil substantially free of wax and asphalt dissolved in solvent is next treated with sulphuric acid introduced from tank 45. The result of this treatment is to remove further quantities of undesirable bodies present in the oil which tend to give the finished product an increased viscosity temperature susceptibility. After treatment with sulphuric acid, the oil is separated from the solvent and then extracted with liquid sulphur dioxide for the purpose of separating the paraffinoid from the non-paraffinoid constituents.

If desired, the oil may be extracted with liquid sulphur dioxide immediately following the desasphaltizing and dewaxing stages and subsequent to the separation of propane from the asphalt and wax free oil after which the paraffinoid fractions may be commingled with liquid propane and the mixture treated with acid and clay. This procedure has been described in our co-pending application No. 555,017. By performing the acid treatment step in the process subsequent to treatment with liquid sulphur dioxide more

economical and effective results are obtained in that the acid utilized in such treatment is free to act upon those undesirable bodies present in the oil which are not removable by liquid sulphur dioxide. By acid treating the oil prior to extraction with liquid sulphur dioxide, a large portion of the acid is consumed in removing from the oil unsaturated bodies which are easily removable with liquid sulphur dioxide.

10 If desired, the oil may be chemically treated in the presence of the propane subsequent to deasphaltizing after which the propane is separated and the oil extracted with liquid sulphur dioxide, or the deasphaltized oil may be extracted 15 with liquid sulphur dioxide and the paraffinoid fraction chemically treated. These procedures have been described in our copending application Serial No. 555,016.

If desired, the extraction of the deasphaltized 20 oil with liquid sulphur dioxide may be accomplished in the presence of liquid propane as described in our copending application Ser. No. 555,018. In such case the temperature of the deasphaltized oil-propane mixture is further reduced to an extraction temperature by vaporizing 25 propane under reduced pressure. The paraffinoid fraction may then be dewaxed in the presence of liquid propane and then chemically treated also in the presence of liquid propane.

30 The foregoing description is merely illustrative of preferred modes of carrying out our invention and is not to be taken as limiting as many variations may be made within the scope of the following claims by persons skilled in the 35 art without departing from the spirit thereof.

We claim:

1. A process for separating asphalt from oils containing the same which comprises commingling said oil at an elevated temperature of at 40 least 120° F. with a liquefied normally gaseous hydrocarbon solvent and separating said asphalt from said oil and solvent at an elevated temperature.

2. A process for separating asphalt from oils

containing the same which comprises mixing said oil under superatmospheric pressure at an elevated temperature of at least 120° F. in a liquefied normally gaseous hydrocarbon solvent in which oil is soluble and in which asphalt is insoluble and 5 separating said asphalt from said oil and solvent under superatmospheric pressure at an elevated temperature.

3. A process as in claim 2 in which the solvent is liquid propane. 10

4. A process as in claim 2 in which the solvent is liquid propane and the asphalt is separated at an elevated temperature of approximately 120° F.

5. A process for separating asphalt from oils 15 containing the same which comprises mixing said oil under superatmospheric pressure at an elevated temperature in a liquefied normally gaseous hydrocarbon solvent in which oil is soluble and in which asphalt is insoluble, reducing the temperature of the mixture to an elevated temperature of approximately 120° F. and separating 20 asphalt from oil and solvent at said last mentioned elevated temperature.

6. A process as in claim 5 in which the temperature of the mixture is reduced to approximately 120° F. by vaporizing a portion of the solvent under reduced pressure. 25

7. A process as in claim 1 in which the liquefied normally gaseous hydrocarbon solvent comprises propane. 30

8. A process for separating asphalt from oils containing the same which comprises heating said oil to an elevated temperature of at least 120° F., mixing said heated oil while at said 33 temperature with a liquefied normally gaseous hydrocarbon to precipitate asphalt and separating the precipitated asphalt from the oil and liquefied normally gaseous hydrocarbon.

9. A process as in claim 8 in which the liquefied normally gaseous hydrocarbon solvent comprises propane. 40

ULRIC B. BRAY.
CLAUDE E. SWIFT.