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PRODUCTION OF DAIRY WAX AND LOW POUR POINT LUBRICATING OILS

Filed Aug. 6, 1959 2 Sheets-Sheet 1

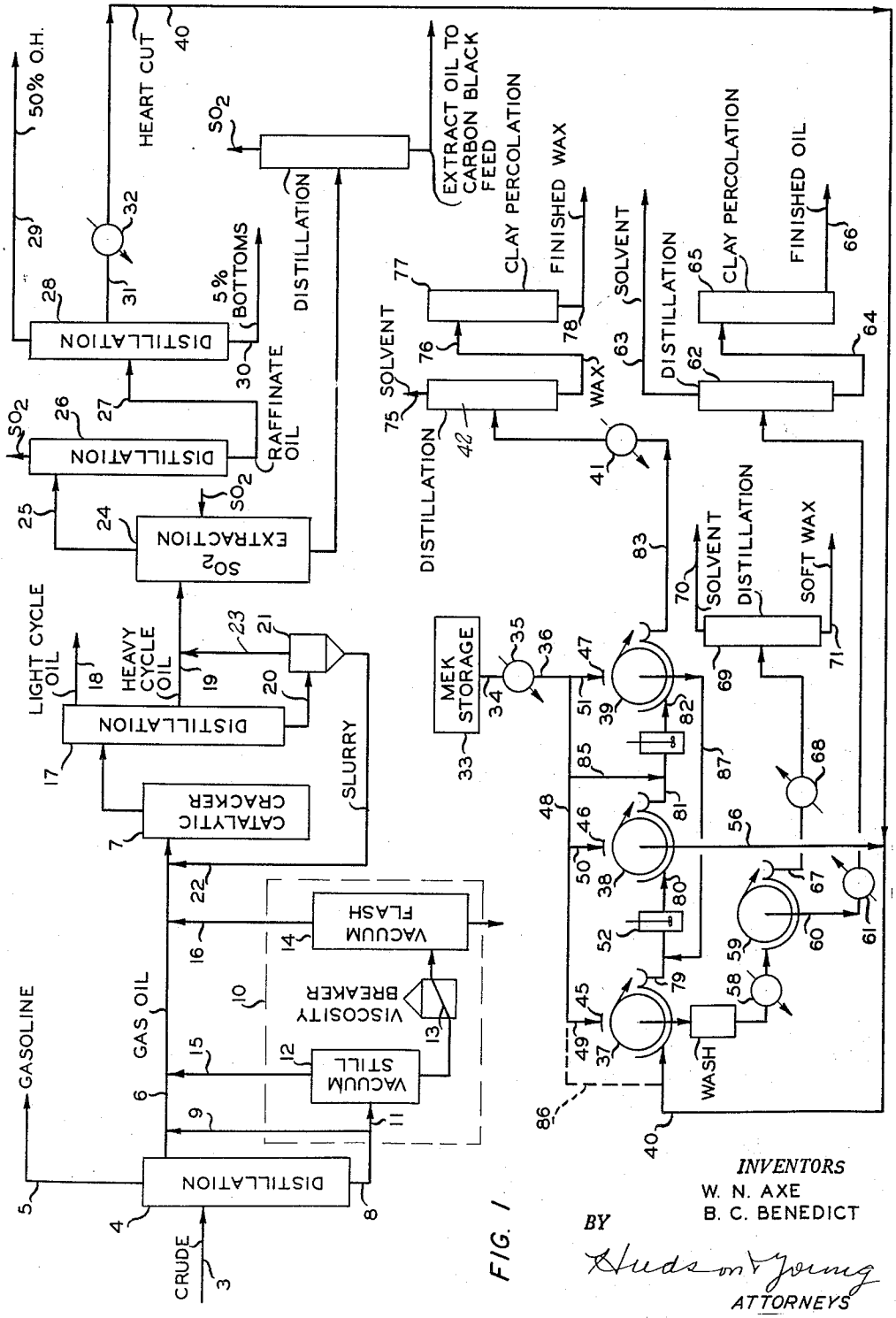


FIG. 1

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PRODUCTION OF DAIRY WAX AND LOW POUR POINT LUBRICATING OILS

Filed Aug. 6, 1959 2 Sheets-Sheet 2

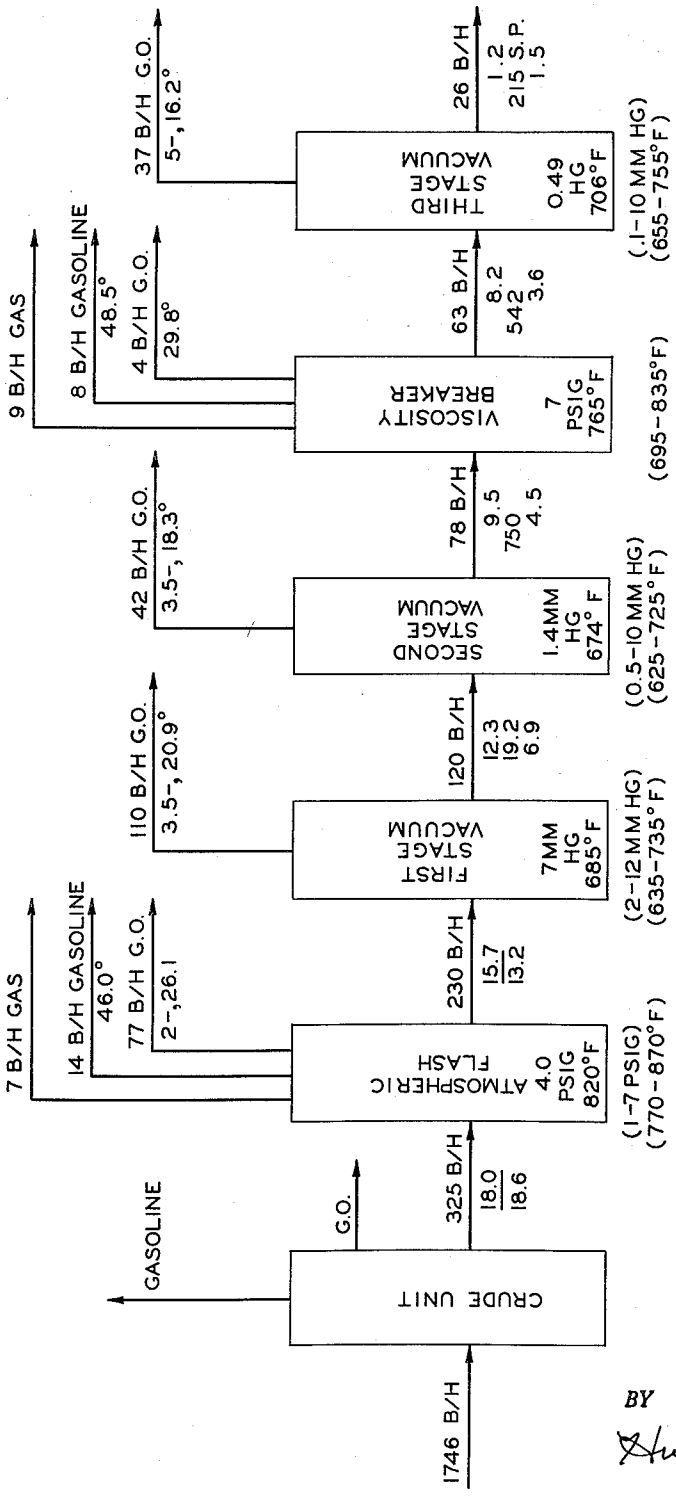


FIG. 2

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3,013,960

PRODUCTION OF DAIRY WAX AND LOW POUR POINT LUBRICATING OILS

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9 Claims. (Cl. 208—36)

This invention relates to a process for the production of a dairy wax. In another of its aspects, the invention relates to a process for the production of a low pour point lubricating oil. In a further aspect of the invention, it relates to the production of a dairy wax and/or a low pour point lubricating oil from a crude oil by topping the crude oil to remove gasoline and kerosene, a gas oil fraction, and an unvaporized distillation residue, flashing said residue at reduced pressure to recover additional gas oil, viscosity-breaking residue from the vacuum flashing, thus producing additional gas oil and deasphalting the residue, combining the gas oil and a portion of distillation residue, catalytically cracking said combined oil, obtaining a gas oil fraction, solvent-extracting said gas oil fraction obtaining a paraffinic extract, distilling said paraffinic extract to remove a heart cut therefrom, as later defined herein, dewaxing said heart cut to obtain said dairy wax and recovering a low pour point lubricating oil from the oil remaining after the dairy wax has been removed. In a specific embodiment of the invention, the effluent from the cracking step is distilled and a heavy cycle oil fraction is extracted with liquid sulfur dioxide and fractionated. The heart cut obtained according to the invention is cooled, a solvent added, and a wax product separated. After removal of wax and solvent constituents, the oil remaining is treated to recover the low pour point oil by further chilling and solvent and wax separation therefrom.

There are presently being used certain paraffin waxes in large amounts for paper and other containers for milk and other dairy products. These waxes are, therefore, known as dairy waxes. These waxes melt in the range of about 120 to about 135° F.

It is known that waxes which are contained in crude oils, possess a wide range of melting points. Thus, ordinary crude oils contain low and high melting point waxes and these include microcrystalline waxes. Thus, many crude oils contain paraffin fractions of high melting point and having a wax-like character. This waxy product is often associated with the lubricating oil fractions separated from these crudes, and is extremely detrimental therein because it adversely affects the low temperature properties of the lubricating oil, i.e., the lubricating oil has a high pour point. It has been the practice, therefore, to remove this wax from the lube oil fraction, and, of course, the wax so removed and collected has a certain commercial value.

In order to produce dairy waxes which are usually flexible coating waxes, in large quantities, economically and at a better price to the consumer, it is necessary to find a modus operandi which avoids the production of undesired amounts of waxes melting substantially above about 135° F. and microcrystalline waxes which are also high melting point waxes.

The production of low pour point lube oils, that is, lube oils which possess good lubricating and flow properties at low temperatures, can only be obtained with crude oil starting materials by treatment resulting in conditioning of the various segments or fractions of the oil and then dewaxing the same when such a fraction or fractions are so conditioned. Thus, it is important to produce a maximum quantity of low pour point oil with

a minimum of cost from an ordinary crude oil and this can be done only if a combination of steps can be devised in which each step in the combination, so to speak, preconditions the stock in said step for ensuing operations in such a manner that in said operations maximum beneficial results are more economically obtained.

This invention has as one of its principal and important objects the provision of a combination of interrelated steps, modified to yield improved quantities and quality of so-called dairy waxes and low pour point lubricating oils, in an art in which the vast knowledge available and the great many teachings make it extremely difficult for one skilled in the art, in a reasonable time, if at all, to develop by application of routine skill a reasonably acceptable combination of steps to yield improved amounts of dairy wax and/or a low pour point lubricating oil from a crude oil stock. Thus, a subordinate object of the invention is the provision of general indications to one skilled in the art of how to proceed to obtain maximum yields of a wax in the melting point range of, say, 120–135° F., at the same time obtaining maximum possible yields of valuable low pour point lubricating oils from the crude oil starting material, and this without producing undesirable quantities of high melting point waxes and microcrystalline waxes. As a further object of the invention, it provides a unitary combination of steps for obtaining dairy waxes and low pour point lubricating oils. Thus, it is a principal object of this invention not only to produce a lube oil which is free of detrimental waxy constituents, but to so alter the process technique that a wax is produced predominantly that has characteristics suitable for use in the dairy industry as an impregnant for paper containers.

Other aspects, objects and the several advantages of the invention are apparent from a study of this disclosure, the drawing and the appended claims.

According to the present invention, there is provided a process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of

(1) Distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(2) Subjecting a portion of the residual oil to vacuum distillation to recover a heavy gas oil therefrom;

(3) Subjecting the remainder of the residual oil, from which the heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(4) Recovering the thus-produced substantial quantities of gas oil by vacuum distillation;

(5) Charging said gas oils together with another portion of said residual oil to a catalytic cracking operation maintained under conditions to dehydrogenate naphthenes;

(6) Cracking said combination of oils in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics-containing gas oil containing the elements of said dairy wax and said low pour point oil;

(7) Solvent-extracting said last-mentioned gas oil obtaining a paraffine raffinate containing the elements of said dairy wax and the elements of said low pour point lubricating oil;

(8) Distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead had been removed therefrom;

(9) Dewaxing said heart cut fraction to remove therefrom a solvent phase of soft wax and oil;

(10) Separating the solvent, soft wax and oil-containing phase from a resulting dairy wax-containing phase;

(11) Removing solvent from said dairy wax-containing phase to recover said dairy wax;

(12) Further dewaxing said solvent, soft wax and oil-containing wax to recover a soft wax and solvent phase and an oil and solvent phase;

(13) Separating oil and solvent phase from said soft wax and solvent phase; and

(14) Removing solvent from said oil and solvent phase to recover said low pour point lubricating oil.

Still according to the present invention, the utilization of the viscosity-breaking step upon the vacuum reduced crude oil distillation residue not only increases the recoverable elements of dairy wax and/or low pour point lubricating oil which can be recovered elsewhere in the process, but it also enhances the yields and relative proportions of desirable fractions which are obtainable from the catalyst in the catalytic cracking operation, and, therefore, from the crude oil, which it is to be understood is not merely a simple chemical reaction of carbon to carbon scission but involves, in the presence of the catalyst, various other reactions such as hydrogen transfer, resulting in saturation, saturation by alkylation, some polymerization, isomerization, etc. Therefore, according to the invention, the specific sub-combination of distillation, viscosity-breaking and catalytically cracking, especially as further combined with the ensuing steps to obtain the heart cut of raffinate from which the dairy wax and low pour point lubricating oil are obtained, is, in the now preferred form of the invention, a most important one.

Further, according to the present invention, the removal of the heart cut fraction from a raffinate obtained, as here, from a solvent extraction of a cycle oil or gas oil from a catalytic cracking operation, is also an important feature since it permits the later recovery of a good yield of desirable dairy wax and the low pour point oil, as set forth and described

Referring now to the drawings, FIGURE I is a diagrammatic showing of the steps in an embodiment of the present invention. FIGURE II is an elaboration of steps concerned with the treatment of the distillation residue including the vis-breaking operation.

The feed stock employed in the operations described in the drawings is a low wax Mex-Tex crude oil. It will be noted, however, that crude oils such as waxy Texas Panhandle crude, asphaltic West Kansas crude, and Venezuelan crudes are included among the crude oils which can be utilized effectively in the operations of the invention. Blends of such crude oils can also be used. In some instances, the crude will already have been subjected to a topping operation. A method of characterizing feed stocks, as here described, by vacuum flashing, is given in Johnson and Mills, "Industrial and Engineering Chemistry," volume 44, page 1624 (July 1952).

Referring now to FIGURE I, crude feedstock fed by pipe **3** is distilled in column **4**. A light overhead comprising gasoline and/or kerosene is removed by pipe **5**. A gas oil fraction, removed by pipe **6**, is passed to catalytic cracking operation **7**. A bottoms fraction is withdrawn by pipe **8** and divided, part being charged to the catalytic cracker by pipe **9**, and part sent to a deasphalting operation **10**, through pipe **11**. In the now preferred operation, deasphalting is effected by first vacuum distilling in column **12** and then vis-breaking at a temperature of 750 to 800° F., in coil **13**, and finally vacuum flashing in tower **14**. The overheads from both vacuum still **12** and vacuum flash tower **14** are fed to the catalytic cracker by pipes **15** and **16**, respectively.

The cracked product is distilled in distillation tower **17** to obtain a light cycle oil taken off at **18**, a heavy cycle oil obtained at **19**, and a bottoms fraction **20** containing catalyst fines. This last fraction is decanted at **21** and the catalyst slurry returned to the cracking step by pipe **22**. The decant oil obtained at **23** is combined with the heavy cycle oil in **19** and extracted with liquid SO_2 at **24**. The light cycle oil is removed from the process, in accordance with the invention. Removal of SO_2 from the raffinate obtained at **25** is effected in distillation tower **26**, and the raffinate passed by pipe **27** into distillation tower **28** is distilled into an overhead fraction **29**, approximately 50 percent, a bottoms fraction **30** of approximately five percent, and a heart cut **31**. It is this heart cut which is further processed according to the invention. The extract oil from the SO_2 unit can be processed for feed-stock for carbon black production since it contains elements or fractions rendering it especially useful for this purpose.

Heart cut **31** is chilled in chiller **32** and conducted to rotary filters **37**, **38** and **39** where a multistage separation of the solid wax is made. The heart cut fraction containing the slurry of wax first enters filter **37**. Methyl-ethyl ketone, or other suitable solvent from storage tank **33** is conducted by pipe **34** to chiller **35**, then by pipes **36**, **43**, **49**, **50**, and **51** to wash sprays **45**, **46**, and **47**. As illustrated in FIGURE I, the wax is filtered in three stages with countercurrent flow of added solvent, conducted as follows: fresh solvent is added to each stage in the wash spray and to the slurry feed to the last filtration (by pipe **85**); the liquid phase separated from the last stage is used to slurry the feed to the second stage; the liquid phase separated from the second stage filtration is used to dilute the original heart cut feed stream to the first filter stage. If desired, additional solvent from storage can be added to feed stream **40**, as shown by dotted line **86**.

Wax from the filters, after heating in heater **41**, stripping of solvent in distillation tower **42** and clay percolation treatment in tower **77**, was found to have a melting point in the range 120–135° F., was colorless and odorless, and well suited for coating paper milk containers.

Oil and solvent phase obtained from the first filter **37** is passed through cooler **58** into filter **59**. Oil and solvent from filter **59** passes by pipe **60** and heater **61**, in which it is heated to about 450° F., to distillation tower **62** where solvent is removed from this phase at **63**. Oil recovered at **64** is clay-treated at **65**, at a temperature of 120–180° F., the finished product being recovered at **66**. A yield of about 65 percent based on the heart cut size is obtained at **66**.

The oil and solvent effluent from the wax filters is further adjusted for viscosity by addition of methyl ethyl ketone, as described, and then chilled in **58** to a temperature of about −10° F. This precipitates a residue of soft wax, which, when heated to 420° F. and distilled is stripped of solvent in **69**, as noted. A yield of 11 percent, based upon the heart cut size, is obtained at **71**.

The wax-containing phase from filter **59** is passed via pipe **67** and heater **68** to distillation **69**. After removal of solvent at **70**, the wax product obtained at **71** is found to be relatively soft with a melting point of approximately 55° F., and is suitable for use in polish formulations, etc.

The oil produced at **66** was found to be very satisfactory as a lubricant, having a viscosity of about 39 SUS at 210° F., API of 33.5 ± 1.

The method of removing the wax from the heart cut oil fraction is conventional. The oil is cooled to a temperature in the range of 25 to 35° F., a supply of methyl ethyl ketone is cooled to this same temperature and used to dilute the oil phase to a viscosity suitable for handling on the filters. Solvent can also be added to successive stages of filtration, as described, and be used to wash the solid wax on the filters. In general, an amount of solvent about 4.4 times the weight of oil is added prior to entering the filters, and another portion is used for washing the filter cake and further dilution. This solvent is recovered in succeeding operations and only a small amount need be added as make-up. We prefer to use methyl ethyl ketone as the solvent, although other solvents such as diethyl ketone, methyl n-butyl ketone, methyl isobutyl ketone, methyl n-propyl ketone, acetone-ben-

zol mixture, propane, petroleum naphthas, ethylene dichloride, etc., may be used.

The wax collected in the filtration step, which is shown here as filters **37**, **38** and **39**, is melted in heater **41** and the solvent removed by distillation at **42**, as noted, and removed by pipe **75**. The stripped, molten wax is then passed by pipe **76** over a bed of bauxite or fuller's earth in tower **77** at a temperature in the range 120 to 200° F., and preferably 180° F. A yield, based upon the heart cut size, of about 24 percent is obtained at **78**.

Referring now to FIGURE II, there is shown in diagrammatic form with suitable legend and operational data, the processing of a Mex-Tex crude oil according to the invention, including, with amplification, the distillation of the crude oil, the vacuum distillation or flashing of the crude oil distillation residue, the vis-breaking operation and the vacuum flashing which are, respectively, **4**, **12**, **13** and **14** of FIGURE I. Also, on FIGURE II, there are given, on the respective portions of this figure, conditions which are employed in an elaboration of that portion of FIGURE I which is identified in the box defined by the dashed lines **10**. The parentheses in FIGURE II include ranges of pressures and temperatures which are within the scope of the invention.

The additional operational details involved in the invention and in its several steps can be routinely supplied by one skilled in the art in possession of this disclosure and will to an extent, as he will understand, depend upon the crude oil and ultimate product characteristics selected.

The properties of the flexible coating wax, the lubricating oil and the soft wax are given in the following table.

Table I

SO_2 RAFFINATE WAX

I. Wax properties:	
Melting point, ASTM, F	126
Tensile strength, p.s.i	200
Oxidation stability, minutes	120
II. Oil properties:	
Vis at 210 F., SUS	39.5
Vis at 100 F., SUS	97.3
Viscosity index	110
Gravity, API	33.9
Pour point, F	0
Color, ASTM	2
Flash, F	395
III. Soft wax properties:	
Vis at 210 F., SUS	39
Vis at 100 F., SUS	87.7
Viscosity index	130
Gravity, API	36.5
Cloud point, F	66
Pour point, F	55

The following are physical properties of a low pour point oil prepared according to the invention.

Table II

Physical Property	After End Point Cutting (4.3% Removed)
Viscosity @ 100, SSU	99.3.
Viscosity @ 210, SSU	39.51.
Viscosity Index	108.
Neut. No	Less than 0.01.
Carbon Residue (RAMBS)	.08.
Color	3½.
API Gravity @ 60° F	33.4.
Pour Point, F	+10.
Flash Point, F	390.

EXAMPLE

There is charged 2020 b./h. of Mex-Tex crude through pipe **3** into crude distillation unit **4**. A topped crude is removed at 8 and 81 b./h. charged through **9** and **6** into catalytic cracker **7**. In addition, 442 b./h. of topped crude is charged into the vacuum train (see FIGURE II), and 268 b./h. of vacuum gas oil is charged into the catalytic cracker through **15** and **6**. 174 b./h. is charged through vis breaker furnace **13** and into vacuum flasher **14** from which 149 b./h. is charged through **16** and **6** into catalytic cracker **7**. The catalytic cracker is operated to produce from its effluent by distillation at **17**, 76 b./h. light cycle oil **18**, 152 b./h. heavy cycle oil **19** and 66 b./h. of heavy bottoms **20**. The bottoms are charged into a settler **21** yielding 30 b./h. of slurry oil which recycled into the catalytic cracker through pipe **22**. 46 b./h. of decant oil from **21** and 152 b./h. of heavy cycle oil are charged into the SO_2 extraction unit **24**. SO_2 is charged to extractor **24** at a rate of 0.756 barrel SO_2 per barrel of charge oil. Temperatures in tower **24** are 98° F. and 95° F. at top and bottom respectively. About 75 percent raffinate and 25 percent extract are obtained. Raffinate is charged to distillation column **26** through **25**. After SO_2 removal, 149 barrels per hour raffinate oil is passed by pipe **27** to distillation **28**. (Equivalent to 3,588 barrels per stream day or 44,000 pounds per hour.) Distillation **28** yields 2,300 pounds per hour bottoms at **30**, 19,620 pounds overhead at **29**, and 22,080 pounds per hour wax distillate at **31**. This distillate is passed by way of chiller **32**, mixed with 112,351 pounds per hour of second stage filtrate from filter **38** obtained by way of pipe **56** and, after cooling to 25° F., a total of 132,213 pounds per hour is charged into filter **37**. 119,961 pounds per hour filtrate from **37** is dewaxed in filter **59**. Wax cake from filter **37** is passed by **79** to tank **52** and repulped with filtrate from filter **39**, passed to tank **52** by way of pipe **87**. 121,464 pounds per hour charge is fed through **80** into filter **38** from which filtrate passes to pipe **56** for use as described. Wax from **38**, mixed with 106,095 pounds per hour of methyl ethyl ketone totaling 116,007 pounds per hour, is charged through **82** to filter **39**. Filtrate from charge at a rate of 108,022 pounds per hour is mixed with wax from filter **38**, as described. Wax from filter **39** at a rate of 9242 pounds per hour is passed to heater **41** and then distilled in column **42**, yielding 3,986 pounds per hour methyl ethyl ketone through pipe **75** and 6,006 pounds per hour stripped wax through pipe **76**. This wax is percolated through bauxite or an equivalent material at 180° F., yielding 5,708 pounds per hour of fully refined wax at pipe **78**. This wax has a very low oil content (usually less than 0.5 percent) of good color (about 25 Saybolt), good odor and good taste.

Filtrate from filter **37** is chilled to −10° F. in cooler **58** before it is dewaxed in filter **59**, filtrate from which passes at 116,939 pounds per hour through heater **61** to distillation **62**, overhead from which is 102,156 pounds per hour of methyl ethyl ketone. SAE 10 oil passes by pipe **64** to clay percolation **65** producing finished lubricating oil at **66**.

In the following Table III are given processing data which are applicable to catalytic cracker **7** of FIGURE I.

Table III

PROCESSING DATA—CATALYTIC CRACKER

	Reactor	Ranges
Bed Temperature, ° F	908	875–925
Top Pressure, p.s.i.g	14.1	5–20
Oil Charge Temperature, ° F.:		
Fresh Feed Thru Coil	730	500–775
Topped Crude	224	200–400
Reslurry	576	200–600
Space Velocity	1.8	1–10
Cat/Oil Ratio (wt.)	3.47	2–10
Catalyst Circulation, Tons/min	16.7	10–40
Catalyst Residence Time, min	9.6	16–4
Injection Steam to T.C., #/Hr	2,656	1,000–5,000
Stripping Steam, #/Hour	18,001	9,000–30,000
Injection Steam, #/Hour	17,229	8,000–30,000

Reasonable variation and modification are possible within the scope of the foregoing disclosure, drawings and the appended claims to the invention, the essence of

which is that there have been provided steps in combination permitting the efficient economical processing of a crude oil to obtain high yields of improved dairy waxes and low pour point oils, the combination including the steps as discussed, and particularly depending upon the treatment of the residual oil from the distillation of the crude oil to remove gasoline and kerosene therefrom, the treatment in the viscosity-breaking operation, as described, the combination of the gas oils and a portion of the residual oil also as described, and the cracking of these oils under conditions to dehydrogenate naphthenes, and the selection of the so-called heart cut fraction followed by the dewaxing and wax and oil recovery operations, also as described.

We claim:

1. A process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of:

(*a*) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(*b*) subjecting a first portion of the residual oil to vacuum distillation to recover a heavy gas oil therefrom;

(*c*) subjecting the said first portion of the residual oil, from which the heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(*d*) recovering the said substantial quantities of gas oil by vacuum distillation;

(*e*) charging said gas oils together with another portion of said residual oil to a catalytic cracking operation maintained under conditions to dehydrogenate naphthenes;

(*f*) cracking the combination of said gas oils and said another portion of said residual oil in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax and said low pour point oil;

(*g*) solvent-extracting said last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax and the elements of said low pour point oil;

(*h*) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(*i*) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(*j*) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase;

(*k*) removing solvent from said dairy wax-containing phase to recover said dairy wax;

(*l*) further dewaxing said solvent soft wax and oil-containing phase to recover a soft wax and solvent phase and an oil in solvent phase;

(*m*) separating oil in solvent phase from said soft wax in solvent phase; and

(*n*) removing solvent from said oil in solvent phase to recover said low pour point lubricating oil.

2. A process for the production of dairy wax which comprises the steps of:

(*a*) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(*b*) subjecting a first portion of the residual oil to vacuum distillation to recover a heavy gas oil therefrom;

(*c*) subjecting the said first portion of the residual oil, from which the heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(*d*) recovering the said substantial quantities of gas oil by distillation;

(*e*) charging said gas oils together with another portion of said residual oil to a catalytic cracking operation maintained under conditions to dehydrogenate naphthenes;

(*f*) cracking the combination of said gas oils and said another portion of said residual oil in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax;

(*g*) solvent-extracting said last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax;

(*h*) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(*i*) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(*j*) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase; and

(*k*) removing solvent from said dairy wax-containing phase to recover said dairy wax.

3. A process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of:

(*a*) cracking a gas oil containing elements of a hard coating dairy wax in a catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax and said low pour point oil;

(*b*) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax and the elements of said low pour point oil;

(*c*) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(*d*) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(*e*) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase;

(*f*) removing solvent from said dairy wax-containing phase to recover said dairy wax;

(*g*) further dewaxing said solvent soft wax and oil-containing phase to recover a soft wax and solvent phase and an oil in solvent phase;

(*h*) separating oil in solvent phase from said soft wax in solvent phase; and

(*i*) removing solvent from said oil in solvent phase to recover said low pour point lubricating oil.

4. A process for the production of dairy wax which comprises the steps of:

(*a*) cracking a gas oil containing elements of a hard coating dairy wax in a catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax;

(*b*) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax;

(*c*) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(*d*) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(e) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase; and

(f) removing solvent from said dairy wax-containing phase to recover said dairy wax.

5. A process for the production of dairy wax which comprises the steps of:

(a) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(b) subjecting at least a portion of the residual oil, from which a heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(c) recovering the said substantial quantities of gas oil;

(d) cracking the combination of said gas oils in a catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax;

(e) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax;

(f) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(g) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(h) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase; and

(i) removing solvent from said dairy wax-containing phase to recover said dairy wax.

6. A process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of:

(a) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(b) subjecting at least a portion of the residual oil, from which a heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(c) recovering the said substantial quantities of gas oil;

(d) cracking the combination of said gas oils in a catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax and said low pour point oil;

(e) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax and the elements of said low pour point oil;

(f) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(g) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(h) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase;

(i) removing solvent from said dairy wax-containing phase to recover said dairy wax;

(j) further dewaxing said solvent soft wax and oil-containing phase to recover a soft wax and solvent phase and an oil in solvent phase;

(k) separating oil in solvent phase from said soft wax in solvent phase; and

(l) removing solvent from said oil in solvent phase to recover said low pour point lubricating oil.

7. A process for the production of dairy wax which comprises the steps of:

(a) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(b) subjecting at least a portion of the residual oil, from which a heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(c) recovering the said substantial quantities of gas oil;

(d) charging said gas oils together with another portion of said residual oil to a catalytic cracking operation;

(e) cracking the combination of said gas oils and said another portion of said residual oil in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax;

(f) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax;

(g) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40–60 percent overhead have been removed therefrom;

(h) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(i) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase; and

(j) removing solvent from said dairy wax-containing phase to recover said dairy wax.

8. A process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of:

(a) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(b) subjecting at least a portion of the residual oil, from which a heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(c) recovering the said substantial quantities of gas oil;

(d) charging said gas oils together with another portion of said residual oil to a catalytic cracking operation;

(e) cracking the combination of said gas oils and said another portion of said residual oil in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax and said low pour point oil;

(f) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax and the elements of said low pour point lubricating oil;

(g) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 2 to 10 percent bottoms and 40-60 percent overhead have been removed therefrom;

(h) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(i) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase;

(j) removing solvent from said dairy wax-containing phase to recover said dairy wax;

(k) further dewaxing said solvent soft wax and oil-containing phase to recover a soft wax and solvent phase and an oil in solvent phase;

(l) separating oil in solvent phase from said soft wax in solvent phase; and

(m) removing solvent from said oil in solvent phase to recove rsaid low pour point lubricating oil.

9. A process for the production of dairy wax and a low pour point lubricating oil which comprises the steps of:

(*a*) distilling a wax-bearing crude oil to obtain a gas oil and a non-vaporized residual oil therefrom;

(*b*) subjecting a first portion of the residual oil to vacuum distillation to recover a heavy gas oil therefrom;

(*c*) subjecting the said first portion of the residual oil, from which the heavy gas oil has been separated, to a viscosity-breaking operation under conditions to produce substantial quantities of gas oil therefrom and to deasphalt the same;

(*d*) recovering the said substantial quantities of gas oil by vacuum distillation;

(*e*) charging said gas oils together with another portion of said residual oil to a catalytic cracking operation;

(*f*) cracking the combination of said gas oils and said another portion of said residual oil in said catalytic cracking operation to produce essentially substantial quantities of heavy aromatics containing gas oil containing the elements of said dairy wax and said low pour point oil;

(*g*) solvent-extracting said low last-mentioned gas oil obtaining a paraffinic raffinate containing elements of said dairy wax and the elements of said low pour point oil;

(*h*) distilling said raffinate oil to remove approximately a heart cut fraction therefrom consisting of fractions remaining when about 5 percent bottoms and 50 percent overhead have been removed therefrom;

(*i*) dewaxing said heart cut fraction forming therefrom a solvent phase containing soft wax and oil and a dairy wax-containing phase;

(*j*) separating the solvent, soft wax and oil containing phase from the said dairy wax-containing phase;

(*k*) removing solvent from said dairy wax-containing phase to recover said dairy wax;

(*l*) further dewaxing said solvent soft wax and oil-containing phase to recover a soft wax and solvent phase and an oil in solvent phase;

(*m*) separating oil in solvent phase from said soft wax in solvent phase; and

(*n*) removing solvent from said oil in solvent phase to recover said low pour point lubricating oil.

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