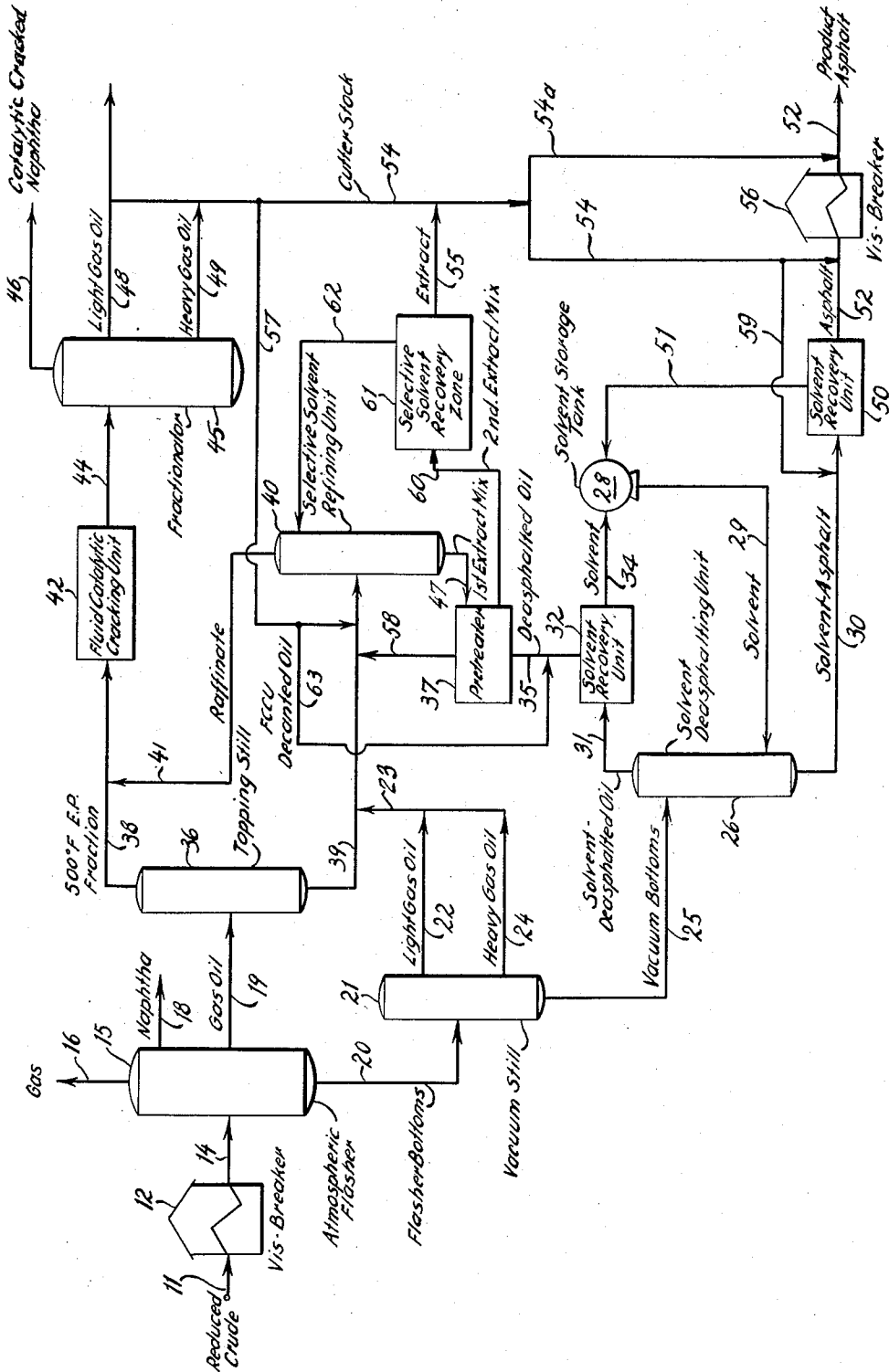


Aug. 12, 1958

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WITH LIGHT HYDROCARBONS
Filed Dec. 30, 1955

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2,847,353

TREATMENT OF RESIDUAL ASPHALTIC OILS WITH LIGHT HYDROCARBONS

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Application December 30, 1955, Serial No. 556,495

20 Claims. (Cl. 196—14.11)

This invention is related to the treatment of residual, asphaltic oils with light hydrocarbons for the separation of asphaltic constituents therefrom. More particularly, this invention is concerned with the treatment of asphaltic, residual hydrocarbon oils for the recovery of the asphaltic constituents therefrom and for the production of a deasphalted oil suitable for use as a catalytic cracking feed stock. In accordance with one embodiment, this invention relates to a process for deasphalting residual hydrocarbon oils for the production of an asphalt fraction and a deasphalted oil fraction which is subsequently treated in accordance with the practice of this invention for the production of a catalytic cracking feed stock characterized by a relatively low metals content.

It is an object of this invention to provide an improved process for the treatment of residual, asphaltic hydrocarbon oils.

It is another object of this invention to provide a process for the treatment of residual asphaltic hydrocarbon oils with liquid, low molecular weight hydrocarbons, such as liquefied normally gaseous hydrocarbons, for the production of an asphalt fraction and a deasphalted oil fraction particularly suitable as catalytic cracking feed stock.

It is still another object of this invention to provide a process for the treatment of residual asphaltic hydrocarbon oils wherein there is recovered a deasphalted oil fraction having a relatively reduced metals content and which is particularly suitable for use as a catalytic cracking charge stock.

How these and other objects of this invention are accomplished will become apparent with reference to the accompanying disclosure and drawing wherein there is schematically illustrated an embodiment of the practice of this invention.

Referring now in detail to the drawing a reduced crude, such as a mixture of reduced California crudes, having an initial boiling point greater than about 650° F., usually having a boiling point higher than about 800° F., amounting to about 35–75% by volume of the original crude, is supplied via line 11 to vis-breaking zone 12 where it is subjected to temperature, pressure and throughput conditions so as to mildly lower the viscosity of the reduced crude. A temperature in the range 800–1000° F., and a pressure in the range 50–800 p. s. i. g., are usually sufficient to effect mild vis-breaking of the reduced crude.

Vis-breaking of the reduced crude serves to reform or otherwise alter some of the high molecular weight or high boiling constituents of the reduced crude into relatively low molecular weight or low boiling constituents. The vis-breaking operation tends to produce lower boiling, more aromatic constituents which are generally more refractory in a catalytic cracking operation than lower boiling, more paraffinic hydrocarbons which are also produced. The vis-breaking operation complements and otherwise cooperates with a subsequent combination of deasphalting and solvent refining operations in accord-

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ance with this invention and described hereinafter. The vis-breaking operation increases the yield of naphtha recoverable from the reduced crude in that the relatively more aromatic hydrocarbons produced during the vis-breaking operations are separated in subsequent combination fractionation and deasphalting solvent-refining steps with the resulting production of a more paraffinic catalytic cracking charge stock suitable for the production of a catalytic cracked naphtha.

The mildly vis-broken reduced crude from vis-breaking zone 12 is introduced via line 14 into fractionator or atmospheric flasher 15 from which there is recovered overhead via line 16 a gas fraction comprising normally gaseous hydrocarbons, such as propane and the butanes, a naphtha fraction via line 18, such as a 430° F. end point naphtha, and a gas oil fraction via line 19. There is also recovered from flasher 15 a bottoms fraction via line 20. The flasher bottoms fraction is then introduced via line 20 into a vacuum still or distillation zone 21 where it undergoes further fractionation for the production of a light gas oil fraction recovered via line 22 and a heavy gas oil fraction recovered via line 24. A vacuum bottoms fraction is recovered from vacuum still 21 via line 25.

The vacuum bottoms fraction recovered from vacuum still 21 via line 25, usually having a gravity °A. P. I. in the range 3–12 and a Conradson carbon residue in the range 15–40%, more or less, is introduced via line 25 into the upper part of solvent deasphalting tower or zone 26. The solvent deasphalting operation may be a batch operation, a multiple vessel operation or a substantially continuous liquid-liquid countercurrent treating operation, as indicated in the drawing, wherein the vacuum bottoms to be deasphalted is introduced via line 25 into the top of deasphalting tower 26 and flowed therein in countercurrent liquid-liquid contact with a suitable deasphalting solvent, such as a liquefied normally gaseous hydrocarbon, e. g., propane, n-butane, isobutane. The deasphalting solvent is introduced via line 29 into the bottom portion of deasphalting tower 26 from deasphalting solvent storage tank 23.

A suitable deasphalting solvent in accordance with the practice of this invention is a liquefied normally gaseous hydrocarbon such as ethane, ethylene, propane, propylene, normal butane, isobutane, n-butylene, isobutylene, pentane, isopentane and mixtures thereof, either alone or in the presence of a minor amount of additive materials to improve the deasphalting operation or otherwise increase the yield and quality of the deasphalted oil and/or the recovered asphalt. The deasphalting operation is carried out at any suitable deasphalting temperature and pressure, the temperature and pressure being adjusted so as to maintain the deasphalting solvent in the liquid phase during the deasphalting operation. A deasphalting temperature in the range 150–325° F., usually not more than 75 degrees Fahrenheit lower than the critical temperature of the deasphalting solvent, and a pressure in the range 200–800 p. s. i. g., are employed depending upon the composition of the deasphalting solvent and the composition of the vacuum bottoms undergoing deasphalting. Generally, a deasphalting solvent to vacuum bottoms volume charge ratio in the range 2–10 is employed within deasphalting tower 26. Deasphalting tower 26 may be operated isothermally or under a temperature gradient, top tower temperature greater than bottoms tower temperature by not more than about 40 degrees Fahrenheit. Also deasphalting tower 26 may be operated so that the vacuum bottoms is introduced therein at a number of points along the height of the tower and/or so that the deasphalting solvent is introduced therein at a number of points.

Following the deasphalting operation there is recovery

ered from deasphalting tower 26 a solvent deasphalted oil mix via line 31 and a solvent asphalt mix via line 30. The deasphalted oil in the mix in line 31 may have a gravity °A. P. I. in the range 10–25 and a Conradson carbon residue in the range 1–10% and a viscosity in the range 200–600 SUS @ 210° F., more or less. The solvent deasphalted oil mix is introduced via line 31 into solvent recovery unit 32 wherein at least a portion or substantially all of the deasphalting solvent is removed from the deasphalted oil and returned to deasphalting solvent storage tank 28 via line 34.

Referring now to the gas oil fraction recovered from atmospheric flasher 15 via line 19, this gas oil fraction is introduced into topping still 36 where there is produced overhead via line 38 a fraction having an end point of about 500° F., this overhead fraction being particularly suitable as a catalytic cracking charge stock. The bottoms fraction recovered from topping still 36 via line 39 is combined therein with the gas oil fractions recovered from vacuum fractionator 21 via lines 22 and 24.

The deasphalted oil recovered from solvent recovery unit 32 via line 35 is introduced into pretreater 37 wherein it is contacted with a liquid selective solvent for aromatic hydrocarbons, such as furfural. Pretreater 37 may be any suitable device for effecting liquid-liquid contact between the liquid selective solvent employed and the deasphalted oil being pretreated. Preferably pretreater 37 is an apparatus suitable for effecting continuous counter-current liquid-liquid contacting, such as a packed tower, a centrifugal contactor or a Rotating Disc Contactor. The deasphalted oil introduced into pretreater 37 is contacted with a solvent extract mix comprising selective solvent, such as furfural, together with dissolved hydrocarbons therein which is recovered from solvent refining unit 40, described hereinafter, and introduced into pretreater 37 via line 47. The resulting deasphalted oil raffinate from pretreater 37 is recovered therefrom via line 53 and introduced into line 39 for admixture with the bottoms fraction recovered from topping still 36 via line 39 and the gas oil fractions recovered from vacuum fractionator 21 via lines 22, 24 and 23. The resulting extract effluent from pretreater 37 is recovered via line 60 and introduced into selective solvent recovery zone 61 wherein the selective solvent, e. g., furfural, is recovered and recycled to solvent refining unit 40 via line 62. The resulting separated extract is recovered from selective solvent recovery zone 61 via line 55. Various selective solvents may be employed in solvent refining unit 40, these include furfural, phenols (Selecto), nitrobenzene, sulfur dioxide, β,β' -dichloroethyl ether (Chlorex), dimethyl formamide and other known selective solvents for aromatic hydrocarbons.

The resulting admixture in line 39 comprising the bottoms fraction from topping still 36, the gas oil fractions from vacuum still 21 and the selective solvent pretreated deasphalted oil from pretreater 37 is introduced into solvent refining unit 40 wherein it flows in liquid-liquid counter-current contact with a liquid selective solvent, such as furfural, which selectively dissolves the more aromatic hydrocarbons therefrom. As previously indicated, the resulting extract mix from solvent refining unit 40 comprising selective solvent and extracted hydrocarbons is recovered via line 47 and introduced into pretreater 37.

The aromatic type hydrocarbons contained in the extract mix introduced into pretreater 37 via line 47 and employed to contact or pretreat the deasphalted oil should increase the solvent power of the selective solvent for the metal-containing components in the deasphalted oil being thus pretreated and thus assist in their removal from the deasphalted oil. Furthermore, since the concentration of the metal-containing components would be greater in the deasphalted oil than in the admixture in line 39 introduced into the selective solvent refining unit a

greater overall degree of metals removal is achieved. Also, the selective solvent contained in the deasphalted oil raffinate recovered from the pretreater 37 via line 38 serves to predilute the deasphalted oil raffinate introduced in admixture with the gas oils and bottoms fraction via line 39 into selective solvent refining unit 40. This predilution of the feed to the selective solvent refining unit 40 increases the efficiency of the solvent refining operation therein. Still further, the deasphalted oil introduced into pretreater 37 via line 35 removes from the extract mix the lower molecular weight more paraffinic hydrocarbons therein which may have been taken into solution in the extract mix during the refining of the combined feed admixture supplied to the selective solvent refining unit 40 via line 39. These more paraffinic materials are returned continuously to the selective solvent refining unit 40 and thus the overall yield of the raffinate recovered from solvent refining unit 40 via line 41 is increased. The contacting or scrubbing of the extract mix within pretreater 37 should result in a reduction in the quantity of the more paraffinic materials withdrawn from pretreater 37 as solvent effluent via line 60 and eventually removed from the system as extract suitable as cutter stock via line 55.

The resulting raffinate from selective solvent refining unit 40 having a reduced metals content, e. g., vanadium, nickel, copper and iron, in the range 0.2–5 p. p. m., after having been freed of its selective solvent content, is combined via line 41 with the 500° F. end point overhead fraction recovered from topping still 36 via line 38 and introduced as feed stock to fluid catalytic cracking unit 42 where it is contacted with fluidized cracking catalyst. These cracking catalysts are usually oxides of metals of groups II, III, IV and V of the periodic table.

A suitable cracking catalyst comprises a silica-alumina catalyst containing about 5–30% by weight alumina. The average particle size of the cracking catalyst particles is usually below about 200 microns, a size sufficient to produce a dense fluidized bed of cracking catalyst. The resulting catalytic cracked effluent from fluid catalytic cracking unit 42 is introduced via line 44 into fractionator 45 wherein it is fractionated into a catalytic cracked naphtha recovered via line 46, a catalytic cracked light gas oil recovered via line 48 and a relatively heavy cycle gas oil recovered via line 49.

The solvent asphalt mix recovered from deasphalter 26 via line 30 is introduced into asphalt solvent recovery zone 50 wherein the deasphalting solvent is recovered via line 51 for return to deasphalting solvent storage tank 28. To the substantially solvent-free asphalt recovered from asphalt solvent recovery zone 50 via line 52, which asphalt may have a ring and ball softening point in the range 180–325° F., is added at least a portion of the gas oil fractions recovered from catalytic cracking fractionator 45 via lines 48, 49 and at least a portion of the selective solvent-free extract recovered from solvent recovery zone 61 via line 55, the resulting stream of combined catalytic cracked gas oils and selective solvent extract being added via line 54 as cutter stock to the substantially solvent-free asphalt.

In accordance with one feature of this invention at least a portion of the light gas oil recovered via line 48 and/or the heavy gas oil or FCCU decanted oil recovered via line 49 are passed via lines 54 and 57 to solvent refining unit 40 for the recovery of the more paraffinic constituents therefrom as raffinate via line 41 to provide additional catalytic cracking charge stock and for the recovery of the more aromatic constituents therefrom as extract via line 55 as cutter stock. If desired, particularly when the gas oil recovered from fractionator 45, such as the FCCU decanted oil, possesses a relatively high metals content, e. g., more than about 30 p. p. m., heavy metals the gas oils are introduced via lines 57 and 63 together with the deasphalted oil as feed to pretreater 37 to reduce its metals content.

Pretreater 37 is operated at any suitable temperature and pressure for effecting liquid-liquid contacting for the removal of the more aromatic components contained in the feed thereto. The operating conditions and solvent dosages employed within pretreater 37 are influenced to some extent by the composition of the feed thereto and the type of selective solvent employed therein. In the

Portions of the above-identified vacuum still bottoms were solvent deasphalted, with liquid isobutane as the deasphalting solvent, employing a solvent:oil volume ratio of 5:1 at various temperatures in the range 200–275° F. and at a pressure in the range 230–335 p. s. i. g. The results of these operations are set forth in accompanying Table No. I.

Table No. I

Solvent	Temp., ° F.	Press., P. s. i. g.	Deasphalted Oil				
			Yield, Wt. Percent	Carbon Residue, Percent	p. p. m. Fe	p. p. m. Ni	p. p. m. V
Charge.....				26	80	150	350
Isobutane.....	200	230	46.0	5.9	6	11	9
Do.....	235	335	40.1	5.0	6	8	5
Do.....	270	475	35.6	3.0	8	3	3

instance where furfural is employed as the selective solvent pretreater 37 is operated at a solvent dosage in the range 75–250%, e. g., 125%, basis oil charge whereas selective solvent refining unit 40, employing the same solvent (furfural) might be operated at a relatively lower solvent dosage in the range 10–100%, e. g., about 25%, basis oil charge thereto. By operating in accordance with this feature of the invention the yield of recoverable catalytic cracked naphtha is further increased.

Desirably, especially when a particularly heavy crude, such as San Ardo California crude, is the source of the reduced crude introduced into the above-described operations via line 11, the asphalt in line 52, prior to the addition of cutter stock thereto via line 54, is subjected to vis-breaking, as indicated by vis-breaking zone 56 in the drawing, and the cutter stock added to the resulting vis-broken asphalt via line 54a. Desirably, also, a portion of the combined stream employed as cutter stock is admixed via line 59 with the solvent asphalt mix recovered from deasphalter 26 via line 30 prior to introducing the same into asphalt solvent recovery unit 50 for the recovery of the deasphalting solvent therefrom. This addition of cutter stock to the solvent asphalt mix prior to introduction into the asphalt solvent recovery unit is desirable in order to alleviate coke deposition and reduce cracking which might occur within the furnace heating tubes and upon the heated surfaces within the asphalt solvent recovery system.

The following is illustrative of the practice of this invention. A mixture comprising California crudes was atmospherically distilled to about 50–55% volume reduced crude based on the original crude mixture and charged through a heater operated under mild viscosity-breaking conditions at an outlet temperature of 850° F. The resulting mildly viscosity-broken reduced crude was introduced into an atmospheric flasher from which was recovered overhead approximately 46% total volume yield of gas, naphtha and atmospheric viscosity-broken gas oil, basis reduced crude, in the following amounts: gas 1% volume; 430° F. end point naphtha 3.5% volume; gas oil 41.5% volume, the atmospheric flasher being operated at a maximum temperature of about 790–800° F. The remaining atmospheric flasher bottoms having a gravity of about 12° A. P. I. and a Conradson carbon residue of about 15 was introduced into a vacuum still operated at about 25 mm. Hg and at a temperature of 665° F. There was recovered overhead from the vacuum still gas oil fractions amounting to about 42% by volume of the vacuum still charge and a heavy bottoms fraction amounting to about 16% by volume basis original crude mixture or about 33.8% by volume basis reduced crude. The vacuum still bottoms has a gravity of about 3.6° A. P. I., a penetration (100 gm./5 sec./77° F. cm. $\times 10^{-2}$) in the range 27–29 and a Conradson carbon residue in the range 26–33.

The resulting deasphalted oils had a gravity in the range 15.3–16.8° A. P. I., a viscosity SUS 210° F. in the range 238–281 and a K factor about 11.7. There was recovered from the aforesaid deasphalting operations an asphalt having a ring and ball softening point in the range 200–300° F.

A high boiling petroleum fraction comparable to the deasphalted oil recovered from the aforesaid deasphalting operation is subjected to liquid-liquid contact with furfural solvent extract mix at a solvent dosage in the range 100–200%, e. g., 125%, basis oil charge, the furfural solvent extract mix having been derived from the furfural solvent refining of the resulting deasphalted oil raffinate in admixture with VPS gas oil, said subsequent furfural refining being carried out at a solvent dosage in the range 15–75%, basis oil charge. The raffinate resulting from the subsequent furfural refining operation possesses a significantly lower metals content, substantially below 30 p. p. m., in range 20–5 p. p. m. and lower.

In accordance with another feature of this invention the subsequent solvent refining operation and/or the solvent pretreatment is carried out in the presence of a substantial amount of a light liquid hydrocarbon, such as the deasphalting solvent in an amount in the range 10–200 vol. percent, more or less, based on the deasphalted oil undergoing treatment either in pretreater 37 or in solvent refining unit 40. By so operating the metals content of the resulting refined deasphalted oil is further reduced, e. g., below about 5 p. p. m. The advantages of carrying out a solvent refining operation in the presence of liquid low molecular weight hydrocarbons, e. g., deasphalting solvent present due to the incomplete removal of deasphalting solvent from the deasphalted oil issuing from deasphalting unit 26 via line 31, is more completely set forth in my copending patent application Serial No. 547,638, filed November 18, 1955, the disclosures of which are herein incorporated and made a part of this disclosure.

As will be apparent to those skilled in the art in the light of the foregoing, many substitutions, changes and alterations are possible in the practice of this invention without departing from the spirit or scope thereof.

I claim:

1. A process for treating a residual oil containing asphaltic constituents which comprises heating said oil to an elevated temperature under vis-breaking conditions, fractionating the resulting vis-broken oil to yield a first gas oil fraction and a first bottoms fraction, fractionating said first bottoms fraction to produce a second gas oil fraction and a second bottoms fraction, fractionating said first gas oil fraction to separate therefrom constituents having a boiling point not greater than about 500° F. and to yield a third bottoms fraction, subjecting said second bottoms fraction to contact with a liquid deasphalting solvent under deasphalting conditions to separate said asphaltic constituents from said second bot-

toms fraction and to yield a deasphalted oil fraction, contacting said deasphalted oil fraction with a first solvent extract mix to yield a deasphalted oil raffinate and a second solvent extract mix, combining said third bottoms fraction, said second gas oil fraction and said deasphalted oil raffinate, subjecting the resulting combined stream to solvent refining in contact with a liquid solvent at least partially immiscible therewith under the conditions of contacting and which is a selective solvent for relatively more aromatic hydrocarbons, recovering from the aforesaid solvent refining operation said first extract mix and a finished raffinate having a reduced amount of relatively more aromatic hydrocarbons relative to said combined stream, recovering from said second extract mix an extract having an increased amount of relatively more aromatic hydrocarbons relative to said combined stream, combining said finished raffinate with said constituents having a boiling point not greater than about 500° F., and subjecting the resulting combined stream to catalytic cracking.

2. A process in accordance with claim 1 wherein said elevated temperature is in the range 750–1000° F. and wherein said deasphalting solvent comprises a hydrocarbon selected from the group consisting of ethane, propane, normal butane, isobutane, normal pentane, isopentane and mixtures thereof.

3. A process in accordance with claim 1 wherein said solvent refining operation is carried out in the presence of said deasphalting solvent.

4. A process in accordance with claim 1 wherein said deasphalted oil fraction is contacted with said first solvent extract mix in the presence of a light liquid hydrocarbon.

5. A process in accordance with claim 1 wherein said deasphalting solvent comprises isobutane.

6. A process in accordance with claim 1 wherein said deasphalting solvent comprises isobutane and wherein said selective solvent is furfural.

7. A process in accordance with claim 1 wherein said deasphalting solvent comprises isobutane, and wherein said selective solvent is furfural and wherein said deasphalting is carried out at a temperature not more than 75° F. below the critical temperature of the deasphalting solvent.

8. A process for treating an asphaltic residual oil which comprises heating said oil to an elevated temperature under vis-breaking conditions, fractionating the resulting vis-broken oil to yield a first gas oil fraction and a first bottoms fraction, fractionating said first bottoms fraction to produce a second gas oil fraction and a second bottoms fraction, fractionating said first gas oil fraction to separate therefrom hydrocarbons having a boiling point not greater than about 500° F. and to yield a third bottoms fraction, subjecting said second bottoms fraction to contact with a liquefied normally gaseous hydrocarbon under deasphalting conditions to separate asphaltic constituents from said second bottoms fraction and to yield a deasphalted oil fraction, contacting said deasphalted oil fraction with a first solvent extract mix to yield a deasphalted oil raffinate and a second solvent extract mix, combining said third bottoms fraction, said second gas oil fraction and said deasphalted oil raffinate, subjecting the resulting combined stream to liquid-liquid solvent refining in contact with a liquid selective solvent immiscible with said resulting combined fractions and which is a selective solvent for relatively more aromatic hydrocarbons, recovering from the aforesaid solvent refining operation said first extract mix and a finished raffinate having a reduced amount of more aromatic hydrocarbons and a lowered metals content relative to said combined stream, recovering from said second extract mix an extract having an increased amount of more aromatic hydrocarbons relative to said resulting combined stream, combining said finished raffinate with said hydrocarbons having a boiling point not greater than about 500° F., subjecting the resulting combined stream to catalytic cracking, separating from the resulting catalytic

cracked effluent a cracked gas oil fraction and admixing said extract and said cracked gas oil fraction with the asphaltic constituents separated from the aforesaid deasphalting operation.

9. A process in accordance with claim 8 wherein said elevated temperature is in the range 750–1000° F., wherein said liquefied normally gaseous hydrocarbon is a C₄ hydrocarbon, wherein said selective solvent is furfural and wherein the deasphalting conditions are such that the volume ratio of said liquefied normally gaseous hydrocarbon to said second bottoms fraction is about 5:1.

10. A process in accordance with claim 8 wherein said asphaltic constituents separated from said deasphalting operation are subjected to an elevated temperature under vis-breaking conditions prior to being admixed with said extract and said cracked gas oil fraction.

11. A process for treating a residual oil containing asphaltic constituents which comprises heating said oil to an elevated temperature in the range 750–1000° F. under mild vis-breaking conditions, fractionating the resulting vis-broken oil to yield a first gas oil fraction and a first bottoms fraction, fractionating said first bottoms fraction to produce a second gas oil fraction and a second bottoms fraction, fractionating said first gas oil fraction to separate therefrom hydrocarbons having a boiling point not greater than 500° F. and to yield a third bottoms fraction, subjecting said second bottoms fraction to liquid-liquid contact with a liquid deasphalting solvent comprised of a major amount of a C₄ paraffinic hydrocarbon under deasphalting conditions to separate asphaltic constituents from said second bottoms fraction and to yield a deasphalted oil fraction, contacting said deasphalted oil fraction with a first solvent extract mix to yield a deasphalted oil raffinate and a second solvent extract mix, combining said third bottoms fraction, said second gas oil fraction and said deasphalted oil raffinate, subjecting the resulting combined stream to liquid-liquid solvent refining in contact with furfural in the presence of a light paraffinic hydrocarbon suitable for use as a deasphalting solvent, recovering from the aforesaid furfural solvent refining operation said first extract mix and a finished raffinate substantially free of furfural and having a reduced amount of more aromatic hydrocarbons and a lowered metals content relative to said combined stream, recovering from said second extract mix an extract having an increased amount of relatively more aromatic hydrocarbons relative to said resulting combined fractions and said raffinate, combining said finished raffinate and said hydrocarbons having a boiling point not greater than about 500° F., subjecting the resulting combined stream to catalytic cracking, separating from the resulting catalytic cracked effluent a cracked gas oil fraction, recovering said asphaltic constituents separated during said deasphalting operation, adding a portion of said extract and said cracked gas oil fraction to said recovered asphaltic constituents, fractionating the resulting admixture containing said asphaltic constituents to separate therefrom said C₄ paraffinic hydrocarbons deasphalting solvent and admixing additional said extract and said cracked gas oil fraction with the resulting asphaltic constituents now substantially free of deasphalting solvent.

12. A process in accordance with claim 11 wherein said deasphalted oil raffinate in said combined stream subjected to furfural solvent refining contains admixed therewith C₄ paraffinic hydrocarbon deasphalting solvent.

13. A process in accordance with claim 11 wherein said deasphalting operation is carried out at a deasphalting solvent to second bottoms volume ratio of about 5:1 at a temperature in the range 200–300° F. and under sufficient pressure to maintain the deasphalting solvent in the liquid phase.

14. A process for treating an oil containing asphaltic constituents which comprises fractionating said oil to yield a gas oil fraction and a bottoms fraction containing

said asphaltic constituents, subjecting said bottoms fraction to contact with a liquid deasphalting solvent under deasphalting conditions to separate said asphaltic constituents from said bottoms fraction and to yield a deasphalted oil, recovering said deasphalted oil, contacting said deasphalted oil with a first solvent extract mix to yield a deasphalted oil raffinate and a second solvent extract mix, combining said gas oil fraction and said deasphalted oil raffinate, subjecting the resulting combined stream to solvent refining in contact with a liquid selective solvent which is at least partially immiscible therewith under the conditions of contacting and which is a selective solvent for relatively more aromatic hydrocarbons, and recovering from the aforesaid solvent refining operation said first extract mix and a finished raffinate having a reduced amount of relatively more aromatic hydrocarbons relative to said combined stream.

15. A process in accordance with claim 14 wherein said selective solvent is furfural.

16. A process in accordance with claim 14 wherein said deasphalting solvent is isobutane.

17. A process in accordance with claim 14 wherein said deasphalted oil subjected to contact with said first solvent extract mix and said deasphalted oil raffinate subjected to contact with said selective solvent contain deasphalting solvent admixed therewith.

18. A process for treating a residual oil containing asphaltic constituents which comprises heating said oil to an elevated temperature under vis-breaking conditions, fractionating the resulting vis-broken oil to yield a gas oil fraction and a bottoms fraction containing said asphaltic constituents, deasphalting said bottoms fraction by contact with a liquid deasphalting solvent to precipitate

said asphaltic constituents and to yield a deasphalted oil fraction, separating said deasphalted oil fraction, contacting said deasphalted oil fraction with a first solvent extract mix to yield a deasphalted oil raffinate, combining said deasphalted oil raffinate and said gas oil fraction, subjecting the resulting combined stream to solvent refining in contact with a liquid selective solvent, and recovering from the aforesaid solvent refining operation said first extract mix and a finished raffinate having a reduced amount of aromatic hydrocarbons relative to said combined stream.

19. A process in accordance with claim 18 wherein said deasphalting solvent is isobutane, wherein said selective solvent is furfural and wherein said deasphalted oil fraction contains a substantial amount of deasphalting solvent admixed therewith.

20. A process in accordance with claim 18 wherein said finished raffinate is subjected to catalytic cracking to produce a catalytic cracked effluent, separating from said catalytic cracked effluent a cracked gas oil fraction, recovering the aforesaid precipitated asphaltic constituents, combining said cracked gas oil fraction and said recovered asphaltic constituents and subjecting the resulting admixture to an elevated temperature under vis-breaking conditions.

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