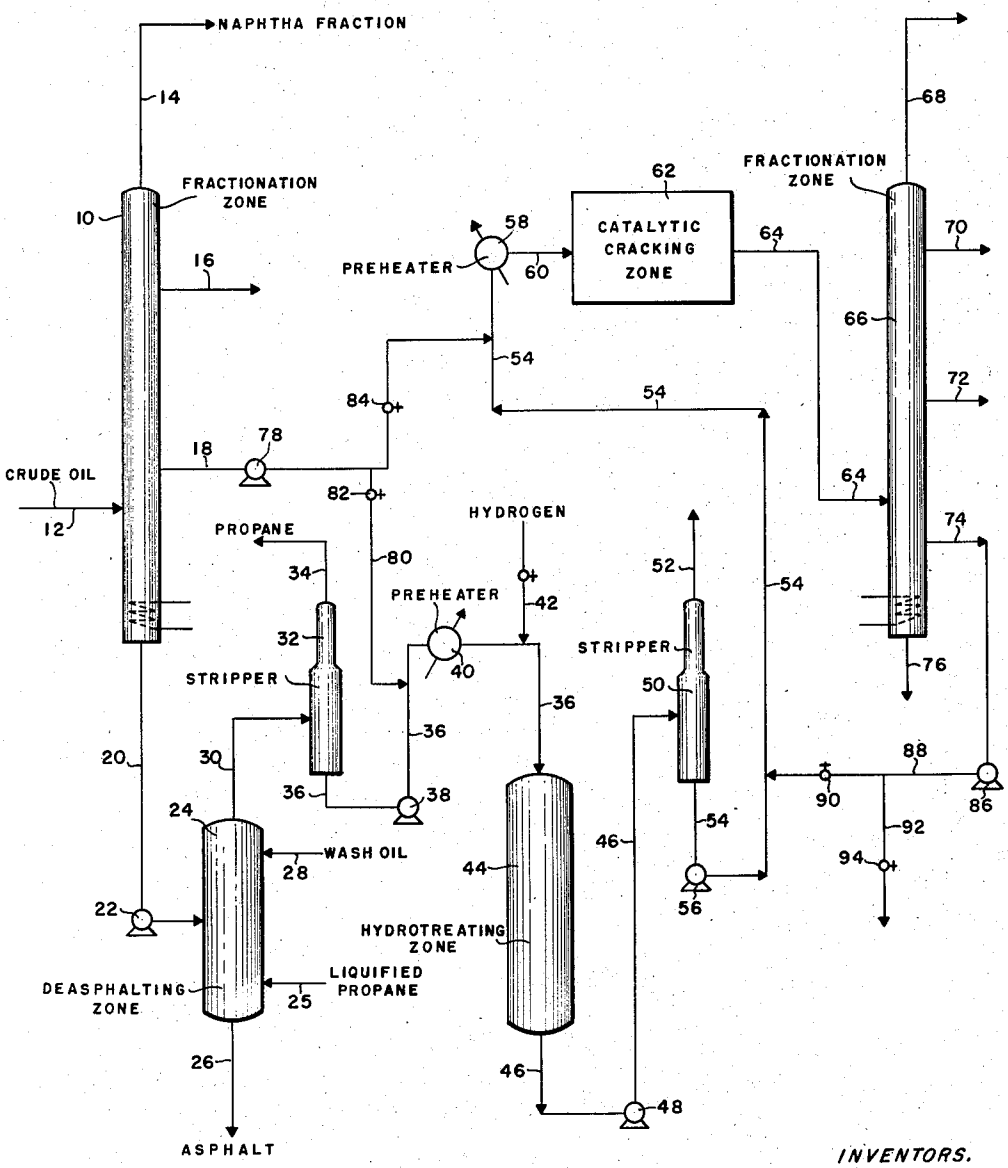
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HYDROCARBON TREATING PROCESS

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INVENTORS.

GILMORE T. GWIN,
BOYD N. HILL,
RICHARD S. MANNE,
NICK P. PEET,
GEORGE R. L. SHEPHERD,
ARMAND M. SOUBY,

BY Carl D. Ries
ATTORNEY.

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HYDROCARBON TREATING PROCESS

Gilmore T. Gwin, Boyd N. Hill, Richard S. Manne, Nick P. Peet, George R. L. Shepherd, and Armand M. Souby, all of Baytown, Tex., assignors, by mesne assignments, to Esso Research and Engineering Company, Elizabeth, N.J., a corporation of Delaware

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This invention relates to a method for the treatment of heavy petroleum crude oil fractions. More particularly, this invention is directed to a method for treating heavy petroleum crude oil fractions in order to obtain an enhanced yield of high quality catalytic cracking feed stock.

In the refining of crude petroleum, it is generally desirable to minimize the yield of residual oils in favor of lighter gasoline and distillate heating oil fractions. Thus, it is common practice to catalytically crack virgin gas oil distillate fractions in the presence of a suitable cracking catalyst such as a silica-alumina catalyst in order to provide high octane gasoline boiling range products and good quality fuel oils. In general, the virgin gas oil hydrocarbon fractions which are best suited for use as catalytic cracking feed stocks are gas oil fractions boiling within the range of about 600° to about 950° F. Virgin gas oil fractions within this boiling range are generally characterized by a relatively high naphthenes content, a relatively low aromatics content, a relatively low Conradson carbon content, and a relatively low metals content (i.e., organometallic compounds of nickel, iron, and vanadium).

It has heretofore been proposed to enhance the amount of catalytic cracking feed stock obtainable from the crude petroleum by treating a virgin residuum fraction with a liquefied normally gaseous hydrocarbon in the presence of a wash oil in order to obtain a high boiling deasphalted oil. Such a process is disclosed, for example, in copending Peet application Ser. No. 493,371, filed March 10, 1955 and entitled "Solvent Deasphalting of Residual Oils with Wash Oil to Remove Metal Contaminants" (now U.S. Patent No. 2,853,426). While an improved recovery of catalytic cracking feed stock components is obtainable by a method of this nature, the results still leave much to be desired in that potential catalytic cracking feed stock components are still discarded. Heretofore, this has been the case in that a wash oil is effective for removing metal contaminants but comparatively ineffective with respect to Conradson carbon reduction.

Thus, it has been discovered in accordance with the present invention that a limitation on the deasphalting step is imposed by the Conradson carbon content, metals content, and aromatics content of the deasphalted oil in that unsatisfactory results are obtained in catalytically cracking deasphalted oils having a Conradson carbon content in excess of about 4 weight percent and a nickel content in excess of about 1 part per million (p.p.m.).

It has now been discovered that the above and similar problems may be overcome through the provision of a process wherein a petroleum hydrocarbon crude oil residuum fraction is:

(*a*) Deasphalted with a liquefied normally gaseous hydrocarbon under conditions to provide a deasphalted oil having a Conradson carbon content within the range of about 4.5 to 6.5 weight percent; and wherein

(*b*) The thus-prepared deasphalted oil is subjected to mild hydrogenation in the presence of a cobalt molybdate catalyst under conditions including a pressure within the

range of about 600 to 950 p.s.i.g., a temperature within the range of about 675° to 775° F., a space velocity within the range of about 1 to 3 v./v./hr., and a hydrogen charge rate of about 400 to 2000 cubic feet of hydrogen per barrel of feed. The conditions should be such that not more than about 5 percent of the feed stock is converted to lower boiling hydrocarbon products.

When this is done, numerous advantages are obtained. Thus, the Conradson carbon content of the deasphalted oil is lowered to a value of about 4 weight percent or less. It would not be expected that such a reduction would be obtainable under the mild hydrogenation conditions that are utilized in that the feed stock is a high boiling relatively refractory material.

In addition, there is obtained a surprisingly enhanced reduction in the amount of metal contamination. This is of particular importance in that metal contaminants such as nickel, iron, and vanadium adversely affect catalytic cracking reactions even when such contaminants are present in only trace amounts in the feed stock to a catalytic cracking unit.

Still further, there is a surprising increase in the yield of catalytic cracking feed stock that is obtainable from the petroleum crude oil. Still further, the aromatics content of the deasphalted oil is significantly reduced.

The invention will be further illustrated by the accompanying drawing which is a schematic flow sheet illustrating a preferred method for practicing the process of the present invention.

Turning now to Fig. 1, there is shown a fractionation zone **10** of any suitable construction, such as an atmospheric distillation pipe still. Petroleum hydrocarbon crude oil is charged to the fractionation zone by way of a charge line **12** and fractionated in the zone **10** to provide a plurality of distillate fractions such as an overhead naphtha fraction **14**, a distillate fuel oil fraction **16**, and a virgin gas oil fraction **18** boiling within the range of about 650° to about 950° F. A residuum fraction **20** comprised principally of components boiling above about 950° F. is discharged from the zone **10** by way of a bottoms line **20** containing a pump **22**.

The thus-obtained bottoms fraction is charged to a deasphalting zone **24** which is of a construction such that the residuum fraction may be treated with a liquefied normally gaseous hydrocarbon such as liquefied propane, liquefied butane, or a mixture thereof.

Preferably, a deasphalting tower is employed as schematically shown in the drawing in order to provide countercurrent liquid-liquid contact of the residuum feed stock with the liquefied normally gaseous hydrocarbon. In this situation, the liquefied normally gaseous hydrocarbon is charged to the deasphalting zone **24** adjacent the bottom of the tower by way of a charge line **25** and the residuum fraction is charged to the tower adjacent the midportion thereof. As a consequence, there is provided an asphalt fraction which is discharged from the deasphalting zone by way of a bottoms line **26** and a solution of deasphalted oil in liquefied normally gaseous hydrocarbon.

Preferably, the solution of deasphalted oil is countercurrently contacted with a wash oil fraction separately introduced into the wash oil tower **24** adjacent the top thereof by way of a charge line **28**. As a specific example, the wash oil may comprise a heavy fraction of catalytic cracking cycle stock having a specific gravity within the range of about 1.02 to 1.2. The manner in which such a wash oil may be obtained and utilized is described in greater detail in said Peet Patent No. 2,853,426. The wash oil serves to materially reduce the metals content of the deasphalted oil. However, the wash oil has only a slight effect with respect to the Conradson carbon content of the deasphalted oil.

As has been indicated, the deasphalting step is conducted in accordance with the present invention in order to provide for a deasphalted oil having a Conradson carbon content within the range of about 4.5 to 6.5. This may be accomplished by utilizing a comparatively lower deasphalting temperature, a comparatively larger amount of liquefied normally gaseous hydrocarbon, or a liquefied normally gaseous hydrocarbon containing a comparatively large amount of butane.

By way of example, in deasphalting a West Texas crude residuum to obtain a deasphalted oil having a Conradson carbon content of about 3.5 weight percent, the solvent-to-oil ratio may be about 4:1, the solvent may consist of a mixture of about 70 volume percent of propane with 30 volume percent of butane and the deasphalting temperature may include a temperature of 180° F. at the top of the tower and a temperature of 160° F. at the bottom of the tower. In obtaining a deasphalted oil having a Conradson carbon content of about 5.5, there may be employed the same solvent-to-oil ratio but the solvent in this situation may consist of a mixture of about 62 volume percent of propane with about 38 volume percent of butane. The deasphalting temperature may include a temperature of 150° F. at the top of the tower and a temperature of 130° F. at the bottom of the tower.

The solution of deasphalted oil in liquefied normally gaseous hydrocarbon is withdrawn from the top of the deasphalting tower **24** by way of a discharge line **30** and passed to a suitable stripping zone **32** wherein the liquefied normally gaseous hydrocarbon is flashed from the deasphalted oil, the volatilized hydrocarbon being discharged from the stripping zone **32** by way of a line **34**.

The deasphalted oil is discharged from the stripping zone **32** by way of a bottoms line **36** containing a pump **38** leading to a preheater **40** wherein the deasphalted oil is preheated to a temperature within the range of about 625° to 725° F., resulting in an average reactor temperature of about 675° to about 775° F. The preheated feed stock has admixed therewith an amount of a hydrogen-containing gas sufficient to provide for about 400 to 2000 cubic feet of hydrogen per barrel of feed stock, the hydrogen being introduced by way of a hydrogen charge line **42**.

The resultant mixture is charged to a hydrotreating zone **44** containing a bed of cobalt molybdate catalyst, the catalyst preferably being utilized in pilled form. A suitable catalyst may comprise from about 10 to 20 weight percent of the oxides of cobalt and molybdenum supported on high surface area gamma alumina.

As indicated, the hydrotreating conditions employed within the zone **44** include a pressure within the range of about 650 to 950 p.s.i.g., an average reactor temperature within the range of 675° to 775° F., and a space velocity within the range of about 1 to 3 v./v./hr.

The product from the hydrotreating zone is discharged therefrom by way of a line **46** containing a pump **48** leading to a stripping zone **50** wherein gaseous components of the hydrotreating zone effluent are removed by way of a line **52** to provide a liquid product discharged from the stripping zone **50** by way of a line **54** containing a pump **56**.

The liquid hydrotreated product prepared in this fashion is characterized by a Conradson carbon content of about 4 weight percent or less, a substantially reduced nickel content, and an aromatics content of about 15 percent, such product constituting a good quality feed stock for catalytic cracking.

Thus, the hydrotreated product may be charged by way of the line **54** to a preheater **58** and from thence by way of a line **60** to a catalytic cracking zone **62** of any suitable construction. Thus, for example, the cracking zone may comprise a fluidized catalytic cracking unit wherein at least a portion of the feed stock is catalytically cracked in vapor phase in the presence of finely divided silica-alumina cracking catalyst.

The effluent from the catalytic cracking zone **62** may be charged by way of a line **64** to a fractionation zone **66** wherein the catalytic cracking product may be separated into a plurality of fractions including a gaseous hydrocarbon overhead fraction **68**, a high octane naphtha fraction **70**, a heating oil distillate fraction **72**, a gas oil boiling range distillate fraction **74**, and a bottoms residuum fraction **76**.

It is a feature of the present invention that the yield of high octane boiling range naphtha is enhanced by the feed pretreating process of the present invention and that, moreover, the octane number of the thus-obtained naphtha fraction is increased, as compared with the octane number otherwise obtained.

It will be understood that the deasphalted oil obtained from the stripping zone **32** may be admixed with a virgin gas oil boiling range hydrocarbon fraction, such as the fraction **18**. In this situation, the virgin gas oil fraction is pumped by means of a pump **78** to a branch line **80** controlled by a valve **82** leading to the charge line **36** for the preheater **40**. When this is done, the quality of the virgin gas oil is materially enhanced through the substantial removal of sulfur therefrom. Alternately, of course, the valve **82** may be closed and a valve **84** in the line **18** may be opened whereby the virgin gas oil will be directly charged to the preheater **58** for the cracking zone **62**.

It will be further understood that, if desired, the gas oil distillate fraction **74** obtained by fractionation of the products from catalytic cracking may be pumped by a pump **86** to a recycle line **88** controlled by a valve **90** leading to the charge line **54** for the preheater **58** of the catalytic cracking unit **62**. Alternately, all or a portion of the recycle gas oil fraction may be discharged from the system by way of a branch line **92** controlled by a valve **94** leading from the recycle line **88**.

As a specific example of the present invention, a West Texas petroleum hydrocarbon crude oil may be charged to the fractionation zone **10** by way of the charge line **12** and there fractionated to provide a gas oil fraction **18** boiling within the range of 650° to 950° F. and constituting about 33 volume percent of the crude oil. A residuum fraction constituting about 12 volume percent of the crude oil may be discharged from the zone **10** by way of the line **20** and thereafter deasphalted in the zone **24** to provide a deasphalted oil having a Conradson carbon content of about 5.2 weight percent. In this situation, about 60 percent of the residuum fraction **20** is recovered as deasphalted oil, as contrasted with about a 45 percent recovery when deasphalted so as to obtain a deasphalted oil having a Conradson carbon content of about 3.5 weight percent.

The high Conradson carbon content deasphalted oil may thereafter be separated from the liquefied normally gaseous hydrocarbon solvent in the stripper **32** and passed to the hydrotreating zone **44** wherein the deasphalted oil may be subjected to hydrotreating conditions as set forth above. As a consequence, the Conradson carbon content of the deasphalted oil is reduced by about 30 to 50 percent to provide for a hydrotreated product having a Conradson carbon content of about 3 to 4 weight percent. Thus, an additional 15 volume percent of the residuum fraction may be utilized as catalytic feed stock through the provision of the process of the present invention due to the satisfactory reduction of Conradson carbon that is obtained.

Further advantages are obtained. For example, the nickel content of the high Conradson carbon content deasphalted oil is reduced by about 60 to 70 percent during the hydrotreating step whereby there is provided a hydrotreated product having a nickel content substantially less than the nickel content of the deasphalted oil. Thus, a deasphalted oil having about a 3.5 weight per-

cent Conradson carbon content will contain about 10 to 40 percent more nickel than the product obtained by hydrotreating a deasphalted oil having a Conradson carbon content of about 5 to 6.5.

In addition, there is about a 10 to 20 percent reduction in aromatics ring content for the hydrotreated product as compared with the high Conradson carbon content deasphalted oil and a sulfur reduction within the range of about 40 to 60 percent.

Improvements of this nature are not obtainable with other residuum treating processes. For example, hydrotreating of the entire residuum fraction without an intermediate deasphalting step will provide a catalytic cracking feed stock having a higher metals content and a higher aromatics ring content. Still further, about 40 percent less catalytic cracking feed stock is obtained by direct hydrotreating of the entire residuum fraction as contrasted with the deasphalting-hydrotreating process of the present invention. In similar fashion, a reduced yield and inferior quality of catalytic cracking feed stock, as compared with the process of the present invention, is experienced when the entire residuum is subjected to specifically different conversion operations such as hydrocracking, coking, severe thermal cracking, etc.

The present invention will be further illustrated by the following specific examples which are given by way of illustration and not as limitations on the scope of this invention.

EXAMPLE I

A West Texas petroleum hydrocarbon crude oil was fractionated to obtain a residuum fraction boiling above about 950° F. and constituting about 12.7 volume percent of the crude oil.

A first portion of the residuum fraction was deasphalted in a deasphalting tower with a liquefied mixture of propane with butane under conditions to provide a deasphalted oil having a Conradson carbon content of about 5.05 (hereafter referred to as DC feed). A second portion of the residuum fraction was deasphalted with a liquefied mixture of propane and butane to provide a deasphalted oil having a Conradson carbon content of about 6.5 weight percent (hereafter referred to as DD feed stock).

Each of the thus-prepared feed stocks was thereafter subjected to a hydrotreating operation in the presence of a commercially available catalyst consisting of about 15 weight percent of the oxides of cobalt and molybdenum supported on high surface area gamma alumina.

The inspections of the two feed stocks, the hydrotreating conditions employed and the results obtained are set forth in Table I.

Table I

Run No		DC-1	DC-2		DD-1
Process Conditions:					
Feed Rate, v./v./hr.		2.0	1.0		1.0
Hydrogen Rate, s.c.f./b.		494	485		499
Pressure, p.s.i.g.		800	800		800
Temperature, ° F.		750	700		700
Liquid Yield, Vol. Percent		98.8	97.1		97.3
Product Gas, s.c.f./b.		412	474		496
Desulfurization, Wt. Percent		57	52		41
	Feed			Feed	
Inspections on Total Product:					
Gravity, ° API	17.4	20.1	19.2	16.6	18.5
Sulfur, Wt. Percent	1.00	0.43	0.48	1.04	0.61
Conradson Carbon, Wt. Percent	5.05	3.8	4.1	6.5	4.1
Molecular Weight					
Ni, p.p.m.	1.88	0.92	0.82	3.58	1.66
V, p.p.m.	1.10	0.64	0.42	2.85	1.40
Fe, p.p.m.	1.85	0.35	0.25	0.90	0.55
Aromatic Rings, Wt. Percent	15.8	13.4	13.3	16.3	13.9

From Table I it will be observed that with the first (DC) feed stock a product was obtained having a Conradson carbon content of about 4 weight percent. Still further, the yield of liquid products was in excess of 97 percent. It was noteworthy that the nickel content of the product was less than about 1 p.p.m. whereas the nickel content of the feed stock was about 1.88 p.p.m. A similar result was obtained with the second (DD) feed stock.

EXAMPLE II

As a further example of the process of the present invention, the residuum fraction of Example I, supra, was deasphalted in a mixture of liquefied propane and butane to provide a deasphalted oil having a Conradson carbon content of about 5.2 weight percent (hereafter referred to as the DB feed stock). The qualities of this feed stock, the conversion conditions employed in the hydrotreating operation, and the results obtained are set forth in Table II. The catalyst for Example II was the same as the catalyst for Example I.

Table II

Run No		DB-1	DB-2	DB-3	DB-4	DB-5
Process Conditions:						
Feed Rate, v./v./Hr.		1.9	3.4	4.0	1.7	1.05
Hydrogen Rate, s.c.f./b.		514	594	509	574	486
Pressure, p.s.i.g.		800	800	800	800	800
Temperature, ° F.		750	750	700	700	700
Liquid Yield, Vol. Percent		105.9	103.3	101.8	104.6	101.6
Product Gas, s.c.f./b.		399	435	410	474	413
Desulfurization, Wt. Percent		62	47	31	46	53
	Feed					
Inspections on Total Product:						
Gravity, °API	16.0	18.7	18.0	17.1	17.8	18.1
Sulfur, Wt. Percent	1.37	0.52	0.72	0.95	0.74	0.64
Conradson Carbon, Wt. Percent	5.2	3.2	3.2	4.2	3.5	2.5
Molecular Weight						
Ni, p.p.m.	0.82	0.32	0.48	0.52	0.44	0.44
V, p.p.m.	0.34	0.04	0.12	<0.30	<0.30	<0.30
Fe, p.p.m.	2.10	0.40	0.45	0.40	0.55	2.70
Aromatic Rings, Wt. Percent	18.5	16.0	17.6	16.6	15.9	15.1

From Table II it is seen that in each instance products having a reduced metals content and a reduced Conradson carbon content were obtained. Note, however, from run DB-3 wherein the treating conditions included a space velocity of about 4 v./v./hr. that an undesirably low removal of sulfur was obtained.

EXAMPLE III

As has been indicated, in accordance with one embodiment of the present invention, the deasphalted oil is subjected to hydrogen treatment in admixture with a virgin gas oil fraction.

By way of example, a mixture of the deasphalted oil feed stock of Example II, supra, with a virgin gas oil was subjected to hydrogen treatment under the conditions set forth in Table III with the results that are likewise there reported.

Table III

HYDROTREATMENT OF BLEND OF HEAVY GAS OIL AND VIRGIN GAS OIL

Blend Composition, Vol. percent:		
Deasphalted Oil (16° API) (Table II)		35
Virgin Gas Oil (24° API)		65
Conditions:		
Pressure, p.s.i.g.		800
Temperature, ° F.		750
Feed Rate, v./v./hour		2.0
Hydrogen Rate, s.c.f./b.		500
Hydrogen Consumption, s.c.f./b.		180
Liquid Yield, Vol. percent of Feed		100
	Feed	
Inspections on Total Product:		
Gravity, ° API	21	24
Sulfur, Wt. Percent	1.78	0.35
Conradson Carbon, Wt. Percent	1.90	1.15
Nickel, p.p.m.	0.39	0.10
Vanadium, p.p.m.	0.44	0.05
Aromatic Rings, Wt. Percent	13.8	12.4
Desulfurization, Wt. Percent		80

As will be noted from Table III, the hydrogen treatment resulted in a substantial reduction of the nickel and vanadium content, together with a substantial removal of sulfur. In addition, the Conradson carbon content of the product was materially less than that of the feed stock. This demonstrates that the improved results of the present invention are obtainable even though the high Conradson carbon content deasphalted oil of the present invention is subjected to hydrogen treatment in the presence of a gas oil.

EXAMPLE IV

The catalytic cracking of feed stocks prepared in accordance with the present invention provides for an enhanced yield of high quality products. This is shown by the results that were obtained by the catalytic cracking of the hydrotreated product of Example III as compared with the catalytic cracking of the feed stock for the hydrotreating step of Table III. The composition of the catalytic cracking feed stock and the results obtained are set forth in the following table.

Table IV

CATALYTIC CRACKING OF BLEND OF HEAVY GAS OIL AND VIRGIN GAS OIL

Blend Composition, Vol. Percent:		
Deasphalted Oil (16° API) (Table II)	35	
Virgin Gas Oil (24° API)	65	
	Not Hydrotreated	Hydrotreated (Table III)
Catalytic Cracking Yields:		
Cor. 430 Conversion, Vol. Percent	50	50
C_3 and Lighter, Wt. Percent	6.0	5.5
Butanes, Vol. Percent	3.4	3.3
Butylenes, Vol. Percent	6.4	6.8
C_5-430° F. Naphtha, Vol. Percent	39.4	40.5
430° F.+, Vol. Percent	50.0	50.0
Carbon, Wt. Percent	3.7	2.9
Octane Numbers of C_5-430° F. Naphtha:		
ASTM Method (3 cc. TEL/Gal.)	82.3	85.0
Research Method (3 cc. TEL/Gal.)	96.3	97.8

NOTE.—The lower carbon yield will permit going to higher conversion, which increases further the gains in naphtha yield and octane number.

From Table IV it will be observed that for the same degree of conversion there was obtained an increased yield of a naphtha fraction having an enhanced octane rating. As is set forth in the note at the bottom of the table, the low carbon yield that is obtained with the feed stock of the present invention permits a greater degree of conversion of the feed stock which, in turn, provides for a further yield of the high octane naphtha products from catalytic cracking.

EXAMPLE V

The improved results of the present invention are not obtainable with deasphalated oils having a Conradson carbon content in excess of about 6.5 weight percent.

By way of example, a West Texas residuum fraction was deasphalted with a liquefied mixture of propane and butane under conditions to provide a deasphalted oil having a Conradson carbon content of about 10.8 weight percent (hereafter referred to as feed stock D).

This highly refractory feed stock was thereafter subjected to a hydrotreating operation in the presence of a cobalt molybdate catalyst especially prepared to obtain the highest degree of catalyst activity obtainable with gamma alumina-supported cobalt molybdate catalysts. The catalyst consisted of about 15 weight percent of oxides of cobalt and molybdenum supported on gamma alumina, the catalyst having been activated by heat treatment for 24 hours at 1500° F. in dry air to provide a catalyst having a most frequent pore diameter of about 100 angstroms, a pore volume of about 1.085 cubic centimeters per gram, and a surface area of about 70 square meters per gram.

The characteristics of the feed stock, the hydrotreating conditions employed and the results obtained are set forth in Table V.

Table V

Run No.		D-1-1	D-1-2	D-2-2	D-3-1	D-3-2
Process Conditions:						
Feed Rate, v./v./Hr.		0.99	0.95	0.83	0.89	1.11
Hydrogen Rate, s.c.f./b.		2,285	2,487	2,439	1,872	1,288
Pressure, p.s.i.g.		800	800	800	800	800
Temperature, ° F.		755	753	783	822	821
Liquid Yield, Vol. Percent		97.6	97.7	95.7	94.3	95.6
Product Gas, s.c.f./b.						
Desulfurization, Wt. Percent		60.8	58.4	60.2	59.3	49.1
	Feed					
Inspections on Total Product:						
Gravity, °API	11.7	17.1	16.7	18.3	20.7	19.0
Sulfur, Wt. Percent	3.34	1.31	1.39	1.33	1.36	1.70
Conradson Carbon, Wt. Percent	10.8	7.87	7.61	8.34	8.24	9.6
Ni, p.p.m.	12.3	6 40	6.40	7.60	7.68	10.52
V, p.p.m.	22.7	8.40	9.68	5.60	12.24	15.96
Fe, p.p.m.	12.0	23.6	5.10	3.20	1.0	2.70

From Table V it will be observed that under the hydrotreating conditions of the present invention the products that were obtained had an excessively high Conradson carbon content and an excessively high metals content.

This particular set of experiments is of interest in that it is demonstrated that the use of temperatures of more than about 775° F. does not provide for a satisfactory maximized reduction of Conradson carbon content. Note that runs D–2–2, D–3–1, and D–3–2 which were conducted at temperatures of about 780° and 820° F. provided for products having the highest Conradson carbon content.

The improved results of the present invention are not obtainable when the entire residuum fraction is subjected to hydrogen treatment.

By way of specific example, a West Texas crude oil residuum fraction was subjected to hydrogen treatment with the results that are noted in Table VI.

Table VI

HYDROTREATING OF WEST TEXAS CRUDE RESIDUUM

Feed stock: 13.9% West Texas residuum.
Catalyst: Cobalt molybdate on alumina.

Conditions:		
Pressure, p.s.i.g.		800
Temperature, ° F.		786
Feed Rate, v./v./Hour		1.0
Hydrogen Rate, s.c.f./b.		3,000
Hydrogen Consumption, s.c.f./b.		380
	Feed	
Product Yields on Feed:		
C_3 and Lighter, Wt. Percent	----	1.1
C_4, Vol. Percent	----	0.7
C_5–430° F. Naphtha, Vol. Percent	----	6.3
430°–650° F. Heating Oil, Vol. Percent	----	7.1
650°–1,000° F. Gas Oil, Vol. Percent	14.0	32.9
1,000° F.+, Vol. Percent	86.0	53.9
Desulfurization, Wt. Percent	----	50
Inspections on Total Liquid Product:		
Gravity, ° API	8.8	14.9
Sulfur, Wt. Percent	3.90	1.95
Conradson Carbon, Wt. Percent	18.3	14.0
Naphtha Insolubles, Wt. Percent	6.5	5.7
Ni, p.p.m.	26.6	23.6
V, p.p.m.	40.1	36.4

From Table VI it will be observed that the product from the hydrotreating step contained excessively large amounts of Conradson carbon, nickel, and vanadium and that there was no material reduction of these components as compared with the feed stock.

Having described our invention, what is claimed is:

1. A method which comprises the steps of deasphalting a petroleum hydrocarbon residuum feed stock composed principally of components boiling above about 950° F. with a liquefied normally gaseous hydrocarbon under conditions to provide a deasphalted oil having a Conradson carbon content of about 4.5 to 6.5, recovering the deasphalted oil, subjecting the recovered deasphalted oil to hydrogen treatment in the presence of a cobalt molybdate catalyst under conversion conditions including a pressure within the range of about 700 to 950 p.s.i.g., a temperature within the range of about 675° to 775° F., a space velocity within the range of about 1 to 3 v./v./hr., and a hydrogen charge rate of about 400 to 2000 cubic feet of hydrogen per barrel of deasphalted oil and recovering as the liquid product from the hydrotreating step a catalytic cracking feed stock having a Conradson carbon content of not more than about 4 weight percent.

2. A method as in claim 1 wherein the hydrotreating conditions include a pressure of about 750 to 850 p.s.i.g., a temperature of about 700° to 750° F., a space velocity of about 1 to 2 v./v./hr., and a hydrogen charge rate of about 500 cubic feet of hydrogen per barrel of deasphalted oil.

3. A method as in claim 1 wherein the deasphalted oil is subjected to said hydrotreating operation in admixture with a petroleum hydrocarbon virgin gas oil fraction boiling within the range of about 650° to 950° F.

4. A method as in claim 1 wherein the solution of deasphalted oil and liquefied normally gaseous hydrocarbon obtained in the deasphalting step is countercurrently contacted with a wash oil prior to removal of the liquefied normally gaseous hydrocarbon from the deasphalted oil.

5. A method as in claim 4 wherein the liquefied normally gaseous hydrocarbon is a mixture of propane with butane and wherein the wash oil is a fraction of catalytic cracking cycle stock having a specific gravity within the range of about 1.02 to 1.2.

6. A method which comprises the steps of distilling a petroleum hydrocarbon crude oil under conditions to provide a petroleum hydrocarbon residuum fraction boiling above about 950° F. and a gas oil fraction containing components boiling below 950° F., deasphalting said residuum fraction with a liquefied normally gaseous hydrocarbon under conditions to provide a deasphalted oil fraction having a Conradson carbon content within the range of about 4.5 to 6.5, recovering said deasphalted oil, subjecting the recovered deasphalted oil to hydrogen treatment in admixture with at least a portion of said gas oil fraction in the presence of a supported cobalt molybdate catalyst under conversion conditions including a pressure within the range of about 700 to 950 p.s.i.g., a temperature within the range of about 675° to 775° F., a space velocity within the range of about 1 to 3 v./v./hr., and a hydrogen charge rate of about 400 to 2000 cubic feet of hydrogen per barrel of deasphalted oil, recovering as the liquid product from said hydrotreating step a catalytic cracking feed stock having a Conradson carbon content of not more than about 4 weight percent, said catalytic cracking feed stock being further characterized by a reduced metals content and a reduced aromatics content, and catalytically cracking said thus-prepared feed stock.

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