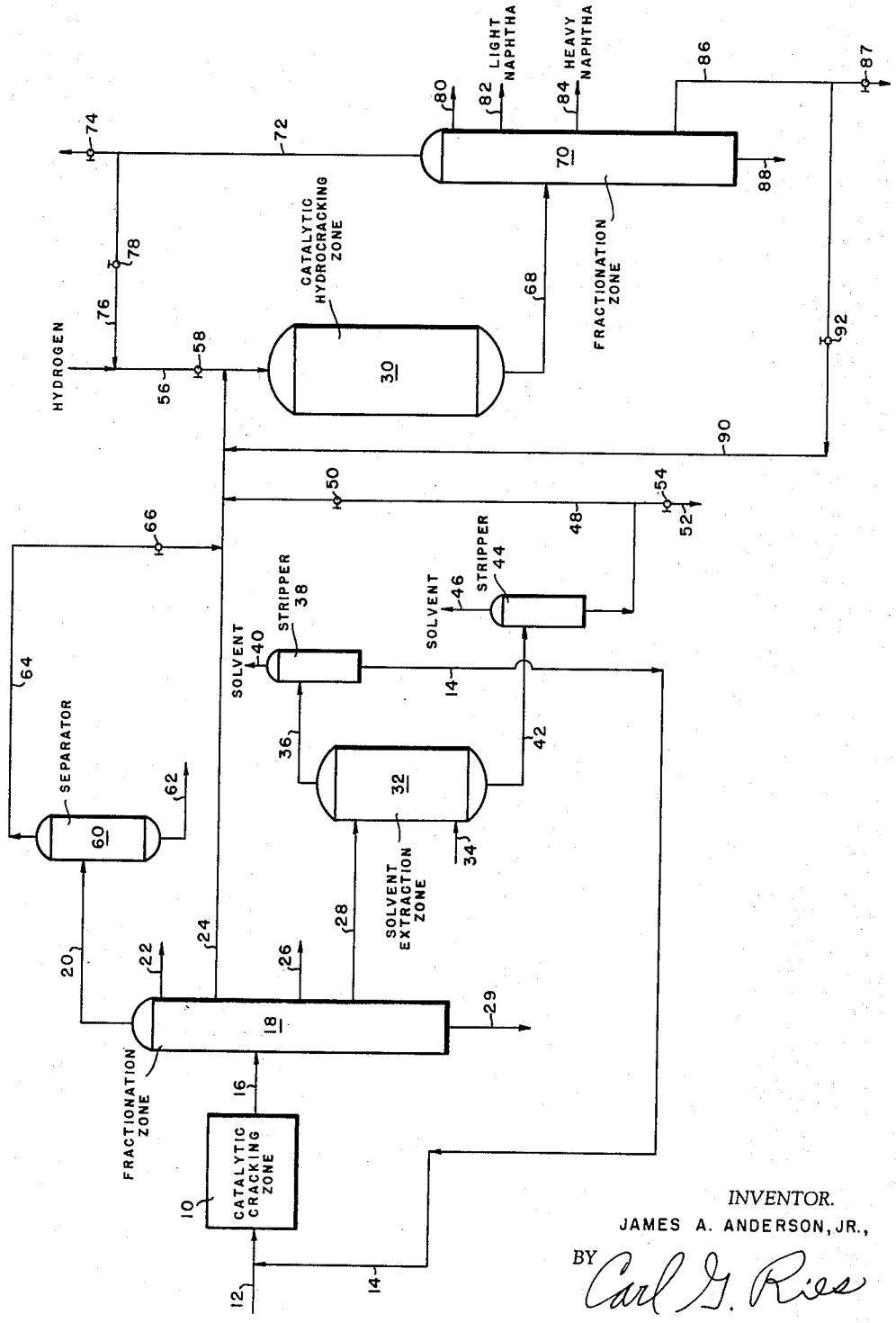
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CATALYTIC CONVERSION OF HEAVY NAPHTHA FRACTIONS

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CATALYTIC CONVERSION OF HEAVY NAPHTHA FRACTIONS

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This invention relates to a method for preparing high octane gasoline boiling range products. More particularly, this invention relates to a method for the catalytic conversion of low octane number heavy naphthas to high octane number light naphthas.

Considerable attention has been given to the treatment of petroleum hydrocarbon crude oils in order to provide high octane gasoline boiling range products.

However, a serious problem is encountered with respect to the treatment of heavy naphtha conversion fractions boiling within the range of about 220° to 430° F. prepared by the catalytic cracking of suitable cracking feed stocks such as virgin gas oils or the reforming (e.g., over platinum catalyst) of virgin naphtha. Heavy naphtha conversion fractions of this nature have poor volatility characteristics whereby they find only limited utility as components of premium motor fuels.

Thus, for example, thermal cracking of feeds of this nature in the presence of hydrogen is not satisfactory because the non-selective nature of a thermal conversion process results in the formation of excessive quantities of dry gas and olefins and in the provision of a light gasoline boiling range product having only a marginally improved octane number rating. Catalytic reforming is likewise unsatisfactory in that low conversions are realized and in that there is an insufficient increase in octane number rating to make the process economically attractive.

Catalytic hydrocracking of heavy naphtha feed stocks of the above nature over catalysts such as supported cobalt molybdate is not satisfactory in that at reasonable operating pressures there is excessive and rapid deactivation of the catalyst whereby it is not possible to obtain a sufficient improvement in octane number rating over prolonged operating cycles.

It has now been discovered that feed stocks of this nature boiling within the range of about 220° to 430° F. may be converted with high yield and good selectivity to high volatility, high octane number light naphtha fractions boiling within the range of about 120° to about 350° F. by a catalytic hydrocracking process which is conducted under specially controlled conditions.

In accordance with the present invention, the catalytic hydrocracking reaction is conducted in the presence of

a hydrocracking catalyst such as cobalt molybdate supported on gamma alumina, silica alumina, etc. and in the further presence of an essentially aromatic diluent having an initial boiling point at least 50° higher than the final boiling point of the naphtha feed stock, from about 10 to 100 volume percent of diluent being utilized, based on the feed. More preferably, from about 50 to 80 volume percent of diluent is employed. The diluent should be substantially free from hydrogen acceptors.

The aromatic diluent may be obtained from a variety of sources. Thus, aromatic extracts derived from the solvent treatment of petroleum hydrocarbon fractions such as catalytic cracking cycle stock fractions, lubricating oil fractions, etc. which contain in excess of 50 volume percent and normally in excess of about 85 volume percent of aromatics may be employed.

The hydrocracking conditions to be employed should suitably include a temperature within the range of about 850° to 950° F., a liquid hourly space velocity (for the naptha feed stock) within the range of about 0.5 to about 1 v./v./hr., a pressure within the range of about 300 to about 950 p.s.i.g., and a hydrogen charge rate within the range of about 200 to about 6000 standard cubic feet of hydrogen per barrel of total naphtha and diluent feed stock. For best results it is preferable to utilize a temperature within the range of about 900° to about 950° F., a space velocity within the range of about 0.7 to about 1.0 v./v./hr., a pressure within the range of about 700 to about 950 p.s.i.g., and a hydrogen charge rate within the range of about 500 to 2000 cubic feet of hydrogen per barrel of total feed.

The naphtha hydrocarbon feed stock which is treated in accordance with the present invention is a converted naphtha fraction boiling within the range of about 220° to about 430° F. and, more preferably, within the range of about 350° to 430° F.

It is a feature of the present invention that the naphtha feed stock is substantially free from components boiling below about 220° F. in that such components have an adverse effect with respect to the production of maximized amounts of light high octane number naphthas.

The invention will be further illustrated with respect to the accompanying drawing wherein the single figure is a schematic flow sheet illustrating a preferred method of practicing the process of the present invention.

Turning now to the drawing, there is schematically shown a catalytic cracking zone **10**, such as a fluidized catalytic cracking zone, to which a suitable feed stock such as a virgin gas oil feed stock is charged by way of a line **12**. A gas oil boiling range recycle fraction **14** obtainable in a manner to be described subsequently may be admixed with the virgin feed charged to the catalytic cracking zone **10** if desired.

Within the catalytic cracking zone **10** the gas oil feed stock is contacted with a suitable cracking catalyst such as a silica alumina cracking catalyst under catalytic cracking conditions whereby at least a portion of the feed stock is converted to lower boiling more valuable prod-

ucts. The hydrocarbon products from the catalytic cracking zone 10 are charged by way of a line 16 to a suitable fractionation zone 18. For purposes of conveniences, the fractionation zone 18 has been shown as a single distillation column. It will be understood, of course, that in actual practice the fractionation zone 18 may comprise a plurality of distillation towers, together with suitable auxiliary equipment in order to obtain satisfactory recovery and fractionation of the products of the catalytic cracking zone 10.

By way of example, within the fractionation zone 18 the products from the catalytic cracking zone may be fractionated to provide a gaseous overheads fraction 20 containing hydrogen and normally gaseous C_1 to C_4 hydrocarbons. There may also be provided a high octane number light naptha fraction 22 and a heavy naptha fraction 24 boiling within the range of about 220° to about 430° F. and, more preferably, within the range of about 350° to about 430° F. There may also be obtained heavier distillate fractions such as a heating oil fraction 26, a gas oil boiling range fraction 28 and a bottoms fraction 29.

The heavy naptha fraction 24 obtained from the catalytically cracked petroleum hydrocarbons will normally be characterized by comparatively low octane number and a comparatively low volatility whereby it is of only limited utility. However, in accordance with the present invention, the heavy naptha fraction 24 is further treated in order to improve the properties thereof in a catalytic hydrocracking zone 30 in the presence of a suitable hydrocracking catalyst such as gamma alumina supported cobalt molybdate in the presence of added hydrogen and aromatic diluent.

The aromatic diluent may be obtained, for example, by subjecting the gas oil boiling range recycle fraction 28 to solvent extraction in an extraction zone 32 in the presence of a solvent such as liquefied sulfur dioxide, liquefied normally gaseous hydrocarbons such as propane, butane, etc. which will selectively remove aromatics from the recycle fraction 28.

Thus, for example, the fraction 28 may be charged to a solvent extraction tower adjacent the top thereof for countercurrent contact with a suitable solvent such as liquefied sulfur dioxide introduced adjacent the bottom of the tower by way of a line 34. A raffinate fraction 36 comprising a solvent solution of extracted oil may be withdrawn from the top of the tower 32 and charged to a stripper 38 for the removal of solvent through an overheads line 40. The thus-treated oil may suitably be withdrawn from the stripper 38 by way of a recycle line 14 for further treatment in the catalytic cracking zone 10 in the above-described manner.

An extract fraction 42 which may contain residual amounts of solvent is withdrawn from the bottom of the extract tower 32 and charged to a stripper 44 wherein solvent is removed overhead by way of the line 46. The aromatics extract (which may contain from about 85 to 95 volume percent of aromatics and boil within the range of about 600° to about 900° F.) may be withdrawn from the bottom of the stripper 44 by way of a withdrawal line 48 controlled by a valve 50 leading to the charge line 24 for the catalytic hydrocracking reactor 30. In this fashion the aromatic diluent and the heavy naptha fraction required for successful operation of the catalytic hydrocracking zone 30 may be simultaneously prepared by the catalytic cracking of gas oil fractions.

As has been indicated above, from about 10 to 100 volume percent of the heavy aromatic diluent 48 is admixed with the heavy catalytic naptha 24 to be charged to the catalytic hydrocracking zone 30. Excess aromatic diluent may be discharged from the system by way of a discharge line 52 controlled by a valve 54.

The mixture of heavy naptha and aromatic diluent is charged to the hydrocracking zone in the presence of added hydrogen. The hydrogen may be obtained, for example, from an extraneous source and may be charged by a line 56 controlled by a valve 58. Alternately, all or a portion of the hydrogen required for the catalytic hydrocracking process may be obtained by charging the gaseous overheads fraction 20 from the fractionation zone 18 to a separator 60 wherein the fraction is separated into a normally gaseous fraction discharged by way of a line 62 and a hydrogen rich fraction discharged by way of a line 64 controlled by a valve 66 leading to the charge line 24 for the catalytic hydrocracking zone 30.

The hydrocracking conditions to be employed within the hydrocracking zone 30 have been set forth above and include a temperature within the range of 850° to 950° F., a liquid hourly space velocity for the catalytic naphtha within the range of about 0.5 to about 1.0 v./v./hr., a pressure within the range of about 300 to about 950 p.s.i.g., and a hydrogen charge rate within the range of about 200 to about 6000 cubic feet of hydrogen per barrel of total feed (catalytic naphtha and diluent).

Within the catalytic cracking zone 30, the naphtha feed stock is at least partially converted to a high octane number high volatility light naphtha fraction.

The products from the catalytic hydrocracking zone 30 are discharged by way of a line 68 leading to a fractionation zone 70 of any suitable construction and comprising one fractionation tower (as shown) or a plurality of fractionation towers, together with auxiliary equipment. Within the fractionation zone 70, the products may be fractionated to provide a normally gaseous overheads fraction discharged by line 72 controlled by a valve 74, such fraction containing hydrogen and minor amounts of dry gas, such as methane, formed during the hydrocracking reaction. If desired, all or a portion of the normally gaseous fraction 72 may be recycled to the hydrogen charge line 56 by way of a recycle line 76 controlled by a valve 78.

There is also recovered a first distillate fraction 80 comprised essentially of butanes and pentanes and a substantial yield of a light naphtha fraction 82 boiling within the range of about 125° to about 350° F. or, if desired, within the range of about 125° to about 220° F.

There is also obtained from the fractionation zone 70 a heavy naphtha fraction 84 boiling within the range of about 220° to about 430° F. and, more preferably, within the range of about 350° to about 430° F. A heavy fraction 86 boiling within the boiling range of the diluent is recovered by way of a discharge line 86 controlled by a valve 87. There is also obtained a bottoms fraction 88.

The diluent boiling range fraction 86 may be discharged from the system or, if desired, may be recycled by way of a recycle line 90 controlled by a valve 92.

In accordance with one form of the present invention, the catalytic hydrocracking zone, after being initially placed onstream, is supplied substantially exclusively with recycle diluent, the valve 50 in the line 48 being closed after start-up operations are complete. A comparatively small amount (about 5 to 10 volume percent) of the heavy naphtha charge stock to the catalytic cracking zone 30 is converted into a highly aromatic material boiling within the diluent boiling range. Thus, in continuous operations, a minor amount of diluent boiling range material will be continuously discharged from the system by opening the valve 87 as required. Thus, the aromatic diluent initially supplied to the hydrocracking zone 30 by way of the line 48 will gradually and progressively be replaced by a diluent formed in situ by the catalytic hydrocracking of the heavy naphtha feed stock.

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

In conducting the following-described experiments, the catalyst employed consisted essentially of 15 weight percent of oxides of cobalt and molybdenum supported on

gamma alumina, the catalyst being employed in the form of a fixed bed of catalyst in a reactor provided with suitable means for the preheating of naphtha feed stock, aromatic diluent, and hydrogen to the desired reaction temperature. In addition, a premixer was provided for intimately admixing the naphtha feed, the aromatic diluent, and hydrogen prior to their introduction into the reactor. Freshly sampled natural gas blanketed feeds were utilized in all experiments. The spent catalyst from each experiment was washed with benzene and benzene was thereafter evaporated therefrom prior to testing of the catalyst samples for surface area and combustible carbon. The feed stock for the experiment and the diluent had the properties set forth in the following table.

Table I

FEED STOCK INSPECTIONS

Description	350°–430° F. Fraction of Heavy Catalytic Naphtha	Light Catalytic Naphtha	450° F.+ SO_2 Kerosene Extract
Distillate Inspections:			
Boiling Range, ° F.	Total	Total	450° F.+
Vol. Percent of Feed	100.0	100.0	100.0
° API	35.3	57.5	16.1
IBP, ° F.	350	144	460
° F. at—			
5%	355	167	464
10%	356	173	466
20%	358	181	470
30%	360	190	473
40%	361	200	475
50%	363	212	479
60%	365	227	483
70%	367	246	487
80%	370	269	494
90%	374	295	505
95%	380	310	517
FBP, ° F.	396	349	530
Percent Recovery		98.0	
Percent Loss		1.0	
FIA Analysis—			
Aromatics, Vol. Percent	6.9	17.0	84.8
Olefins, Vol. Percent	18.3	60.4	7.0
Saturates, Vol. Percent	20.8	22.6	8.2
Sulfur, Wt. Percent	0.16	0.10	0.09
Bromine No., eg./gm.	20.4	104.0	1.5
MSA Optical Density			

EXAMPLE I

In the first of a series of runs, the aromatic kerosene extract and heavy naphtha feed stock of Table I were admixed in the ratio of 2 parts by volume of diluent with 3 parts by volume of heavy catalytic naphtha. The mixture was charged to the reactor at a temperature of about 925° F., a pressure of about 750 p.s.i.g., together with 1000 cubic feet of hydrogen per barrel of total liquid feed material (diluent plus naptha). The charge rate was about 1.5 v./hr./v. (0.6 v./hr./v. diluent plus 0.9 v./hr./v. naphtha). For comparative purposes, runs were made under the above-described reaction conditions with a charge material consisting of the heavy naphtha, the heavy naptha again being charged at the rate of 0.9 v./hr./v. to provide a direct comparison. The results that were obtained are set forth in the following table.

Table II

Type of Operation	Feed	Diluent		Non-Diluent	
Run number		T-210-1	T-210-2	T-212	T-212A
Hours on Catalyst		0–32	33–57	0–18	19–62
Yields, Vol. Percent of Feed:		(1)	(1)		
Dry Gas (Wt. Percent of Feed)		15.2	12.8	8.1	7.6
C_4+C_5		10.0	11.0	7.5	6.3
125°–350° F.	8.0	46.7	44.3	33.0	19.8
350°–430° F.	92.0	62.2	63.7	46.2	62.0
430° F.+		(30.7)	(28.0)	6.1	3.4
Total C_4+	100.0	88.2	91.0	92.8	92.5
Octane Numbers:					
Effective RON [2]—					
125°–350° F.		98.4	97.2	99.1	99.8
350°–430° F.	95.0	99.8	98.4	103.4	101.5
Effective MON [2]—					
125°–350° F.		92.5	95.5	87.6	86.1
350°–430° F.	83.6		93.0	90.2	94.1
Bromine Number:					
125°–350° F.		1.7	2.0	9.1	51.0
350°–430° F.	18.2	1.1	2.0	4.8	11.2
	Fresh		Used		Used
Catalyst Inspections:					
Surface Area, M.²/Gm.	173.0		100.2		0.4
Carbon, Wt. Percent			13.8		23.8

[1] Dilute-free basis (negative 430° F.+yield indicates diluent contribution to gasoline and dry gas yields).
[2] +3 Vol. percent tetraethyl lead.

From Table II it will be noted that unsatisfactory results were obtained in the absence of a diluent. Thus, with respect to bromine number, it will be noted that substantially constant values were obtained over the total 57 hour reaction period whereas there was an excessive increase in bromine number during the latter portion of the non-diluent experiment. In addition, with respect to volatility improvement, the run conducted in the presence of a diluent provided for an almost constant rate of volatility improvement (measured as the total volume of C_4–350° F. product) whereas there was a material decline in volatility improvement with respect to the non-diluent run. Still further, with respect to the catalyst inspections, it will be noticed that the unregenerated catalyst at the end of the 57-hour diluent run still had a surface area of about 100 meters per gram and contained 13.8 weight percent of carbon whereas with the non-diluent run the catalyst was substantially completely deactivated, having a surface area of 0.4 m.²/gm.

With respect to motor octane number improvement, it will be noted that the diluent operation provided for a much more effective product than the non-diluent separation, the research octane numbers of the diluent and non-diluent products being substantially equivalent.

EXAMPLE II

An additional series of runs were conducted with the feed stocks of Example I. The reaction conditions were the same with but one exception. Thus, a substantially higher temperature of about 975° F. was employed. The results that were obtained are set forth in Table III.

Table III

Type of Operation	Feed	Diluent	Non-Diluent
Run Number		T-218	T-216
Hours on Catalyst		0-48	0-30
Yields, Vol. Percent of Feed:			
Dry Gas (Wt. Percent)		10.8	9.5
C_4+C_3		11.2	9.5
125°-350° F.	8.0	36.5	30.6
350°-430° F.	92.0	51.7	47.2
430° F.+		(8.5)	2.8
Total C_4+	100.0	90.9	90.1
Octane Numbers:			
Effective RON [2]—			
125°-350° F.		99.6	101.8
350°-430° F.	95.0	100.9	103.0
Effective MON [2]—			
125°-350° F.		88.0	92.6
350°-430° F.	83.6	91.6	91.0
Bromine Number:			
125°-350° F.		24.2	19.6
350°-430° F.	18.2	9.2	7.8
	Fresh	Used	Used
Catalyst Inspections:			
Surface Area, M.²/Gm.	173.0	1.2	1.1
Carbon, Wt. Percent		23.7	23.3

[1] Diluent-free basis (negative 430° F.+yield indicates diluent contributions to gasoline and dry gas yields).
[2] +3 Vol. Percent tetraethyl lead.

From Table III it will be observed that unsatisfactory results were obtained with both the diluent and non-diluent type operation in that in each instance the catalyst was substantially completely deactivated.

EXAMPLE III

In another series of runs, employing the naphtha and diluent of Example I, the operating conditions included a temperature of 925° F., a hydrogen charge rate of about 1000 cubic feet of hydrogen per barrel of total feed, a charge rate of about 1.5 v./hr./v. (1.0 v./hr./v. naphtha feed rate and 0.5 v./hr./v. diluent feed rate). However, in this situation, the pressure that was utilized was about 220 p.s.i.g. The results that were obtained are set forth in Table IV.

Table IV

Type of Operation	Feed	Diluent T-246		Non-Diluent T-242	
Run Number					
Hours on Catalyst		5-20	21-32	5-20	21-32
Yields, Vol. Percent of Feed:		(1)	(1)		
Dry Gas (Wt. Percent of Feed)		3.8	2.7	8.1	6.9
C_4+C_3		4.7	2.7	7.3	6.1
125°-350° F.	57.0	58.3	57.	52.7	54.5
350°-430° F.	43.0	35.7	37.5	29.1	29.2
430° F.+		(4.2)	(1.0)	3.8	3.0
Total C_4+	100.0	94.5	96.2	92.9	92.8
Octane Numbers:					
Effective RON [2]—					
125°-350° F.	98.0	97.2	96.7	97.1	97.5
350°-430° F.	92.7	97.8	93.9	98.4	95.9
Effective MON [2]—					
125°-350° F.	85.4	86.0	83.8	92.0	87.4
350°-430° F.	82.0	86.5	84.3	92.3	84.9
Bromine Number:					
125°-350° F.	53.3	25.4	48.9	8.9	22.4
350°-430° F.	26.4	9.5	13.0	4.9	7.5
	Fresh		Used		Used
Catalyst Inspections:					
Surface Area, M.²/Gm.	173.0		5.2		24.7
Carbon, Wt. Percent			20.8		18.5

[1] Diluent-free basis (negative 430° F.+yield indicates diluent contribution to gasoline and dry gas yields).
[2] +3 Vol. percent tetraethyl lead.

From Table IV it will be observed that unsatisfactory results were again obtained in that there was a rapid deactivation of the catalyst, in this situation the catalyst being deactivated most rapidly in the presence of the diluent.

EXAMPLE IV

As has been indicated, the naphtha feed stock for the present invention should preferably be free from naphtha components boiling below about 220° F. This is illustrated by the results that were obtained when charging a light catalytic naphtha boiling primarily within the range of about 125° to about 300° F. to the reactor in the absence of diluent and in the presence of about 1000 cubic feet of hydrogen per barrel of feed stock at a temperature of about 975° F. and a pressure of about 750 p.s.i.g. at a charge rate of about 3 v./hr./v. The results that were obtained are set forth in the following table.

From Table V it will be observed that the selectivity of the feed stock to motor fuel products was poorer in this situation than in the preceding examples, there being a considerable loss of material boiling within the range of about 125° to 220° F. and no substantial improvement in the overall quality of the product material boiling within this range. Still further, there was a decrease in research octane number with respect to products boiling below about 250° F. It will be observed that, while not reported in the table, at the end of the run, the catalyst had a surface area of about 13.0 meters per gram (173 meters per gram fresh) and contained about 23 percent of carbon.

These results demonstrate that it is undesirable to include substantial quantities of naphtha boiling below about 220° F. in the feed stock to the catalytic hydrocracking step.

Having described my invention, what is claimed is:

1. A method which comprises subjecting a non-virgin hydrocarbon feed stock boiling within the range of about 220° to about 430° F. to catalytic hydrocracking conditions in the presence of a fixed bed of hydrocracking catalyst in a catalytic hydrocracking zone under conversion conditions including a temperature within the range of about 850° to about 950° F. and a pressure within the range of about 300 to 950 p.s.i.g. in the presence of about 10 to 100 volume percent of an essentially aromatic hydrocarbon diluent boiling within the range of about 450° to about 900° F. and about 200 to 6000 cubic feet of hydrogen at a naphtha feed stock charge rate of about 0.5 to about 1 v./hr./v. and recovering from the products of said hydrocracking step a high octane low volatility

Table V

CATALYTIC HYDROCRACKING OF LIGHT CATALYTIC NAPHTHA

Run Number	Feed		T-244			
Hours on Catalyst			3-14		15-32	
Yields, Vol. Percent of Feed:						
Dry Gas (Wt. Percent)			16.1		11.1	
C_4+C_5	5.4		18.6		13.6	
125°-200° F.	39.4		25.7		30.6	
200°-250° F.	25.0		16.0		18.8	
250°-300° F.	19.2		12.9		14.3	
300°-350° F.	9.6		7.1		7.0	
350° F.+	1.4		2.6		3.1	
Total C_4+	100.0		82.9		87.4	
	RON	MON	RON	MON	RON	MON
Effective Octane Numbers [1]:						
125°-200° F.	101.5	85.2	97.2	90.4	98.4	85.5
with f=		4.05		1.65		2.85
200°-250° F.	99.8	83.3	98.4	88.2	99.1	85.1
with f=		3.35		1.65		2.25
250°-300° F.	97.2	86.3	101.5	90.6	98.4	85.8
with f=		2.40		1.30		1.65
300°-350° F.	95.1	83.7	102.4	91.9	97.6	84.6
with f=		1.80		1.25		1.30
Bromine Number:						
125°-200° F.	128		47.8		97.3	
200°-250° F.	104		35.8		63.3	
250°-300° F.	72		17.4		47.2	
300°-350° F.	44		10.8		33.2	
FIA Aromatics, Vol. Percent:						
125°-200° F.	4.2		7.6		5.3	
200°-250° F.	17.5		46.2		23.6	
250°-300° F.	35.2		70.2		49.2	
300°-350° F.	51.1		79.9		68.2	

[1] +3 Vol. percent tetraethyl lead.

naphtha fraction boiling within the range of about 120° to about 330° F.

2. A method as in claim 1 wherein the hydrocracking conditions include a temperature within the range of about 900° to about 950° F., a space velocity within the range of about 0.7 to about 1.0 v./hr./v., a pressure within the range of about 700 to 950 p.s.i.g., and a hydrogen charge rate within the range of about 500 to 2000 cubic feet of hydrogen per barrel of total feed.

3. A method as in claim 1 wherein the feed stock is a naphtha fraction obtained by the catalytic cracking of a gas oil boiling range hydrocargon and wherein the diluent is an aromatics extract obtained by the selective extraction of aromatics from a gas oil boiling range hydrocarbon produced by the catalytic cracking of a petroleum hydrocarbon gas oil fraction.

4. A method for treating the products obtained from the catalytic cracking of a hydrocarbon gas oil fraction which comprises the steps of recovering from the products of catalytic cracking a heavy naphtha fraction boiling within the range of about 220° to 430° F. and a heavier fraction boiling within the range of about 450° to 900° F., subjecting said heavier product fraction to solvent extraction in the presence of a solvent for the selective removal of aromatics to thereby provide an aromatics extract fraction boiling within the range of about 450° to 900° F., admixing from about 10 to 100 volume percent of said aromatic extract fraction with said heavy naphtha fraction and charging the resultant mixture to a catalytic hydrocracking zone containing a bed of a supported cobalt molybdate catalyst in the presence of about 200 to 6000 cubic feet of hydrogen per barrel of mixture under hydrocracking conditions including a temperature within the range of about 850° to 950° F. and a pressure within the range of about 300 to about 950 p.s.i.g. at a naphtha feed stock charge rate within the range of about 0.5 to 1 v./hr./v., and recovering from the products of said catalytic hydrocracking step a naphtha fraction boiling within the range of about 120° to about 350° F.

5. A method as in claim 4 wherein the hydrogen for the catalytic hydrocracking step is recovered from the products of catalytic cracking.

6. A method as in claim 5 wherein there is additionally recovered from the catalytic hydrocracking step an aromatics fraction boiling within the range of about 450° to about 900° F. and wherein said aromatic extract fraction initially derived from said products of catalytic cracking is replaced by said heavy aromatic fraction recovered from said catalytic hydrocracking step.

7. A method for treating the products obtained from the catalytic cracking of a hydrocarbon gas oil fraction which comprises the steps of recovering from the products of catalytic cracking a heavy naphtha fraction boiling within the range of about 350° to 430° F. and a heavier fraction boiling within the range of about 450° to 900° F., subjecting said heavier product fraction to solvent extraction in the presence of a solvent for the selective removal of aromatics to thereby provide an aromatics extract fraction boiling within the range of about 450° to 900° F., admixing from about 50 to 80 volume percent of said aromatic extract fraction with said heavy naphtha fraction and charging the resultant mixture to a catalytic hydrocracking zone containing a bed of a supported cobalt molybdate catalyst in the presence of about 500 to 2000 cubic feet of hydrogen per barrel of mixture under hydrocracking conditions including a temperature within the range of about 900° to 950° F. and a pressure within the range of about 700 to about 950 p.s.i.g. at a naphtha feed stock charge rate within the range of about 0.7 to 1 v./v./hr., and recovering from the products of said catalytic hydrocracking step a naphtha fraction boiling within the range of about 120° to about 350° F.

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