

[54] **METHOD FOR INCREASING A REFINERY'S CAPACITY FOR PROCESSING METALS-CONTAINING RESIDUAL-TYPE HYDROCARBONS**

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Related U.S. Application Data

[63] Continuation of Ser. No. 694,248, Dec. 28, 1967, abandoned.

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[58] Field of Search.....**208/81, 82, 83, 92, 187**

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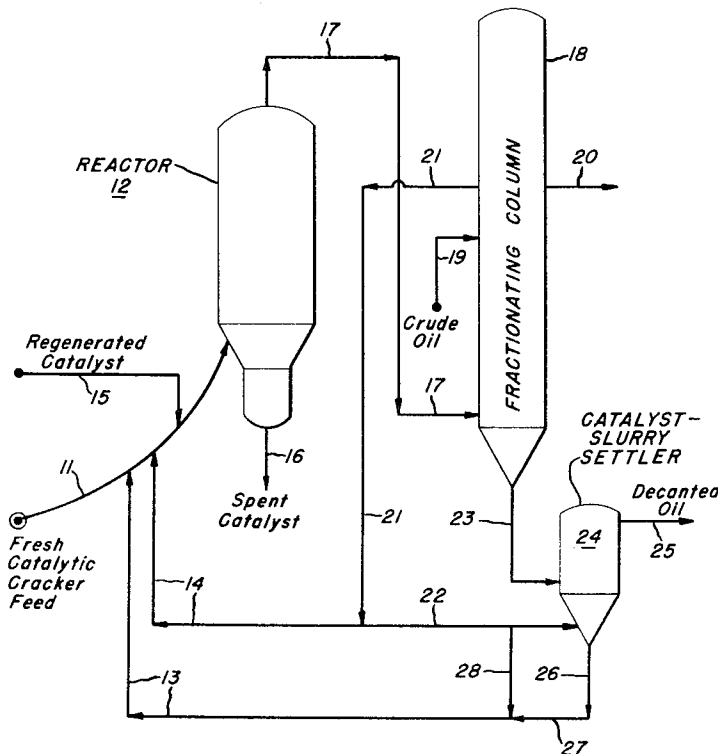
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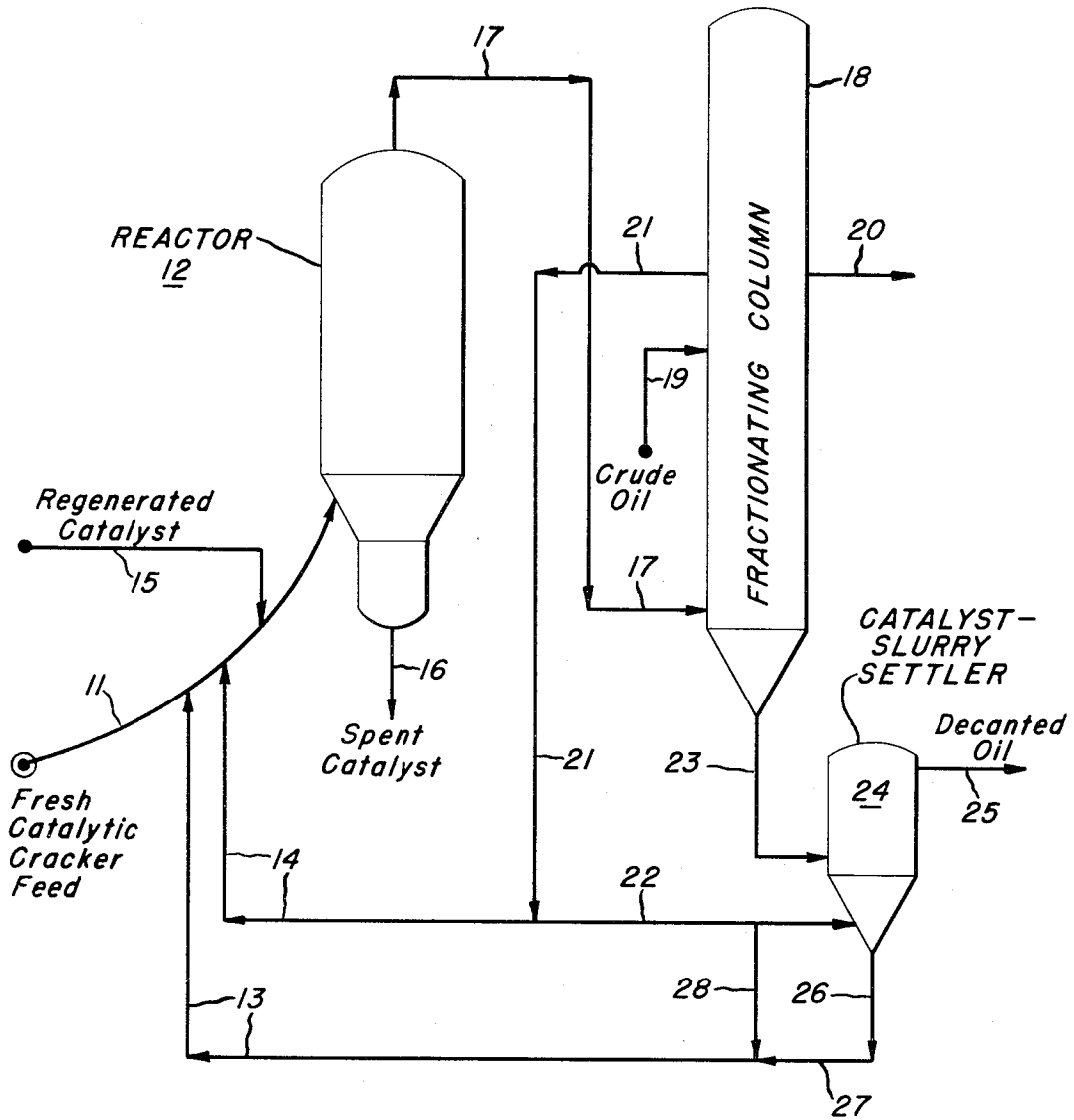
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[57] **ABSTRACT**

The method comprises introducing a petroleum hydrocarbon stream containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons into the fractionating column associated with a catalytic cracker unit of the refinery. The introduction of the petroleum hydrocarbon stream into the fractionating column is accomplished at a point in the fractionating column above which substantially all of the recycle material is withdrawn from the fractionating column; it may comprise the injection of the petroleum hydrocarbon stream into the baffle section of the fractionating column. The petroleum hydrocarbon stream may be a crude oil, may be desalted, and may have been treated for the removal of any amount of water which is contained therein and which would appreciably and suddenly increase the amount of liquid water being added to the fractionating column.

10 Claims, 1 Drawing Figure





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CONTAINING RESIDUAL-TYPE HYDROCARBONS**

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation application of co-pending application Ser. No. 694,248, which was filed on Dec. 28, 1967, and is now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to the processing of a petroleum hydrocarbon stream which contains metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons. More particularly, this invention relates to a method for increasing the capacity of a petroleum refinery to process such a petroleum hydrocarbon stream. Still more particularly, this invention relates to increasing the crude-running capacity of petroleum refinery.

In the modern petroleum refinery, a petroleum hydrocarbon stream that contains metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons is subjected initially to distillation at atmospheric pressure. A crude oil is a typical example of such a petroleum hydrocarbon stream. The stream is separated by the distillation into various fractions, such as a light-gasoline fraction, a heavy-gasoline fraction, a kerosene or heater-oil fraction, a gas-oil fraction, a paraffin-distillate fraction, a heavy-wax distillate fraction, and residue. In the older refinery systems, the distillation of such hydrocarbon streams is performed in a battery of shell stills; in the newer operations, the distillation is performed in pipe stills. Often the bottoms fraction from the atmospheric-pressure distillation, referred to as being "topped", is distilled subsequently under vacuum or is charged to coking units. The cuts taken in these operations may be used in the production of lubricating oil, asphalt, and charge material to cracking units. Of course, the optimum methods for cutting such a hydrocarbon stream will be dictated by the market, the properties of the stream, local economic considerations, and the type of associated refining equipment in that particular refinery.

At one or more selected times during the year, certain hydrocarbon shortages may exist. For example, the unusually high demand for gasoline might result in depleted inventories. Moreover, the situation might be complicated by the fact that the refinery at that time might be operating at maximum capacity for treating hydrocarbon streams containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons. The ability of that particular refinery to process such hydrocarbon streams could be limited to a volume which is insufficient to meet product requirements. Additional capacity for processing such petroleum hydrocarbons streams would be required. Additional capacity might be attained by charging such petroleum hydrocarbon streams to the reactor of the catalytic cracking unit in the refinery. However, such operation would prove to be of limited value, since the metals that are found in the stream would quickly accumulate on the catalyst employed in the catalytic cracking unit and rapidly poison the catalyst. Metals which are found in petroleum hydrocarbons and which are deleterious to petroleum refining catalysts include nickel, vanadium, copper and iron.

Now it has been found that the introduction of a petroleum hydrocarbon stream into the fractionating column or tower associated with a catalytic cracking unit in the refinery will permit effective initial processing of the stream without appreciably affecting the catalyst in the catalytic cracking unit in a deleterious manner. If local economic considerations are favorable, the above operation can be performed to provide for the initial processing of petroleum hydrocarbon streams containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons, thus enabling the refiner to augment his depleted inventories of particular products.

Summary of the Invention

Briefly, in accordance with the present invention, there is provided a method for increasing the capacity of a petroleum hydrocarbon refinery for the processing of a petroleum hydrocarbon stream containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons, wherein the refinery includes as a processing unit a catalytic cracking unit and a fractionating column or tower associated therewith. This method comprises introducing the petroleum hydrocarbon stream into the fractionating column associated with the catalytic cracking unit. This petroleum hydrocarbon stream is to be introduced into the associated fractionating column at a point in the fractionating column above which substantially all of the recycle material is withdrawn from the fractionating column. A preferred embodiment of this method comprises injecting the petroleum hydrocarbon stream into the baffle section of the fractionation column associated with the catalytic cracking unit.

A typical example of a petroleum hydrocarbon stream containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons is a crude oil. If such petroleum hydrocarbon stream contains significant amount of salt, the stream generally should be desalted. However, if the salt content is very low, desalting may not be required. If the stream contains water in an amount which might result in a sudden and appreciable increase in vapor when it is introduced into the fractionating column, the water is to be removed prior to the charging of the stream to the fractionating column.

Accompany Drawing

One FIGURE accompanies this application. This FIGURE is a simplified flow diagram of that portion of a refinery wherein the present method is applied. It depicts a specific embodiment of the present invention, which embodiment is described fully herein in subsequent paragraphs. Only the main pieces of refinery equipment necessary to the present invention are shown. These include the reactor of a catalytic cracking unit, the fractionating column or tower associated with the catalytic cracking unit, and the catalyst-slurry settler. Auxiliary equipment, such as associated pumps, heat exchangers, and valves, are not shown. One having ordinary skill in the art would recognize where such auxiliary equipment would be required. This drawing is presented for the purpose of illustration only and is not intended to limit the scope of the present invention.

Discussion and Specific Embodiment

Typical petroleum hydrocarbon streams which contain metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons are crude oils and refinery "slop" streams. A refinery "slop" stream is a stream comprising odds and ends of oil produced at various places in the plant, which stream must be rerun or further processed to be made usable. Either of the above typical streams can be treated in the present invention to increase a refinery's capacity for processing such petroleum hydrocarbon streams.

Petroleum hydrocarbon crude oils that are refined in the typical petroleum hydrocarbon refinery are very complex mixtures. They contain many individual compounds, which range from methane to asphaltic materials. While the lighter crudes are fluid, certain of the heavier crudes are so viscous that they must be heated before they can be pumped. The principal hydrocarbon compounds found in a petroleum hydrocarbon crude oil are aromatics, paraffins, naphthenes, and asphaltic materials. The paraffins are generally concentrated in the higher-boiling fractions. The crude oil contains sulfur, nitrogen, carbon residue, and salt. The sulfur content of American crude oils may be less than 0.25 percent, or it may be greater than 2 percent. While the average nitrogen content for American crude oil is about 0.15 percent, the nitrogen content may exceed 0.25 percent. The carbon residue, as determined by distillation to coke residue in the absence of air, usually varies between about 0.1 percent and about 5 percent. On occasion, a carbon residue may approach 15 percent. The salt content of a crude oil could be as high as about 0.6 pound of salt per barrel of crude. Such salt would deposit in various pieces of refinery equipment and would eventually promote corrosion and plugging of such equipment. Moreover, the salt, in all probability, might poison many of the typical refining catalysts. In view of this, the crude oil, or other petroleum hydrocarbon stream which is being introduced into the fractionating column associated with the catalytic cracking unit, is preferably desalted previously.

Two important properties of a petroleum hydrocarbon crude oil are gravity and viscosity. The gravity of most crude oils is found to fall within the range between about 10°API and about 45°API. The viscosity of the typical crude oil may range between about 40 SSU and about 60 SSU at 100°F. Occasionally, the viscosity of a crude oil may approach 6,000 SSU at 100°F.

Typical crude oils contain various metals, such as nickel, vanadium, iron and copper. These metals will poison various catalysts that are employed in the refining of petroleum hydrocarbons. They will poison any catalytic cracking catalyst. Such metals are deposited on the catalyst and deleteriously affect its activity and selectivity.

Petroleum hydrocarbon streams, such as crude oil, and in particular those streams containing high-boiling hydrocarbon fractions, contain various amounts of hydrocarbons that have coke-forming tendencies. Such hydrocarbons easily deposit coke on the walls of refining equipment and preferentially deposit coke on any catalyst which is contacted with the hydrocarbons. Such coke deposition on the catalyst deleteriously affects the performance of the catalyst.

Petroleum hydrocarbon streams also may contain various amounts of water.

The present invention is adaptable to a refinery which has as a processing unit a catalytic cracking unit and an associated fractionating column or tower. The invention is a method for increasing the capacity of the refinery for processing petroleum hydrocarbon streams which contain metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons. In accordance with the present invention, the selected petroleum hydrocarbon stream is introduced into the fractionating column associated with a catalytic cracking unit in the refinery.

Catalytic cracking is one of the most commercially used catalytic refining operations for petroleum hydrocarbon streams. This refining operation is usually performed in a unit employing a moving catalyst bed (moving-bed unit) or a fluid-type catalyst (fluid-bed unit). The fluid-bed unit is typical. The fluid-type catalyst, which must resist temperature changes and abrasion, may be either natural catalyst or a synthetic catalyst. Generally, the natural catalysts are composed of silica and alumina as principal components. The synthetic cracking catalysts are made generally from high-purity silica and alumina or silica and magnesia. More recently, synthetic catalysts have been prepared wherein zeolitic crystalline aluminosilicate molecular sieves are suspended in a matrix of an amorphous material, such as silica-alumina or alumina.

Typical reactor operating conditions in a catalytic cracking unit include a temperature within the range between about 850°F. and about 1,000°F.; a pressure within the range between about 10 psig and about 30 psig; a weight hourly space velocity within the range between about 0.5 and about 100 pounds of hydrocarbon per hour per pound of catalyst or more; and a catalyst-to-oil ratio (weight) within the range between about 1.5 and about 20.

The typical fractionating column or tower that is operated in conjunction with a catalytic cracking unit is operated under the following conditions. Ordinarily, the pressure is maintained within a range between about 5 psig and about 25 psig. Generally, the temperature at the bottom of the column is maintained within the range between about 650°F. and about 750°F. The effluent from the reactor of the catalytic cracking unit is introduced into the fractionating column at a point near its bottom. This effluent may be at a temperature as high as 1,000°F. However, it is immediately quenched when it enters the fractionating column and attains a temperature similar to that found at the bottom of the column. Ordinarily, the temperature at the top of the fractionating column is maintained within the range between about 200°F. and about 300°F. Fractions separated from the effluent from the reactor of the catalytic cracking unit, such as a heavy-cycle-gas-oil fraction, may be recycled to the reactor. Lighter fractions are withdrawn from the fractionating column as usable petroleum products. Typically, the highest-boiling fractions are removed from the bottom of the fractionating column and are passed to a catalyst-slurry settler. These highest-boiling fractions contain any catalyst fines that are carried over from the reactor to the fractionating column. Since such catalyst particles cannot be vaporized, they remain entrained in the highest-boiling material as the latter is withdrawn from

the fractionating unit at its bottom and passed to a catalyst-slurry settler. In the catalyst-slurry settler, the heavy liquid hydrocarbons are withdrawn as decanted oil while the catalyst particles are withdrawn as a slurry from the bottom of the settler and recycled to the hydrocarbon feedstream that is being charged to the reactor of the catalytic cracking unit. In this way, the catalyst particles entrained in the reactor effluent are returned to the reactor.

As has been noted above, the petroleum hydrocarbon streams that may be employed in the present invention may contain both salts and appreciable quantities of water. In view of the statements made in prior paragraphs, the petroleum hydrocarbon stream that is being processed according to the present invention is preferably desalted prior to its introduction into the fractionating column, if it contains significant amounts of salts. Since these salts might coagulate into relatively large particles when the hydrocarbon stream is flashed in the fractionating column and then settle with the catalyst in the catalyst-slurry settler associated with the fractionating column, they would be subsequently sent to the reactor of the catalytic cracking unit via the catalyst-slurry recycle stream to poison the catalyst. In addition, equipment corrosion and plugging would, in all probability, result subsequently. Therefore, these salts are preferably removed prior to the introduction of the hydrocarbon stream into the fractionating column. Moreover, if the liquid water content of the hydrocarbons being charged to the fractionating unit is not uniform and would increase suddenly, a hazardous condition could be set up by the appreciable pressure increase resulting from the sudden vaporization of the water. Therefore, any amount of water contained in the petroleum hydrocarbon stream that would appreciably increase the amount of liquid water being charged to the fractionating column is to be removed from the hydrocarbon stream prior to its introduction into the fractionating column. The desalting and water removal will promote more safe and efficient operation of the catalytic cracking unit and its associated fractionating column.

The petroleum hydrocarbon stream containing metals, hydrocarbons having a coke-forming tendency, and residual-type hydrocarbons is to be introduced into the fractionating column at a point in the fractionating column above which substantially all of the recycle material is withdrawn. In this way, the metals content of the recycle streams will be minimized, since they will not be contaminated significantly by the metals-containing stream that is introduced into the fractionating column at a lower level. Advantageously, the petroleum hydrocarbon stream may be injected into the baffle section of the fractionating column. A major portion of the metals that are contained in the petroleum hydrocarbon stream that is being introduced into the fractionating column during the practice of the present invention remains in the highest-boiling fraction of the stream. Therefore, this major portion of the metals is removed from the fractionating column as bottoms or residual streams. In view of this, sufficient amounts of the metals found in the original hydrocarbon stream are removed therefrom so that those streams that are withdrawn from the fractionating column to be recycled to the reactor of the associated catalytic cracking

unit or are withdrawn to be used as petroleum products are relatively free of metals. Furthermore, those hydrocarbons having coke-forming tendencies and residual-type hydrocarbons will remain in the bottoms and will be removed from the system when the bottoms fraction is withdrawn.

In accordance with the present invention, salts and water are removed from the petroleum hydrocarbon stream prior to its introduction into the fractionating column. Metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons are eliminated during the fractionation. As a result thereof, the catalyst in the catalytic cracking unit will not be contaminated and poisoned. Corrosion and plugging of equipment and the risk of hazards will be minimized.

The present invention may be more easily understood through the use of the following example and accompanying FIGURE. The following example, which is a specific embodiment of the present invention, is presented for the purpose of illustration only and is not intended to limit the scope of the present invention.

EXAMPLE

In this specific embodiment, a 42° API light B crude was treated according to the present invention. Initially, it was passed through a desalter and a knock-out drum for removal of salt and water, respectively, prior to its introduction into the fractionating column associated with a catalytic cracking unit. The results of a typical analysis of this crude is presented in Table I.

TABLE I

Analytical Results Obtained With Light B Crude		
Sulfur, wt. %		0.29
Distillation, ° F.		
IBP		112
10%		217
20%		271
30%		330
40%		397
50%		485
60%		573
70%		660
80%		-
90%		-
Max.		700
Rec.		77.5
Gravity, °API		42.1
Conradson Carbon, wt. %		1.33
Nitrogen, wt. %		0.057
Metals, ppm		
Fe		3.6
V		3.6
Ni		2.7
Cu		0.7
Pb		0.8
True Color		1400+
Viscosity, SSU at 100° F.		36.32
Salt, PTB		31

With reference to the accompanying FIGURE, fresh hydrocarbon feed, obtained from a conventional pipe still and other processing units (not shown), was passed through line 11 into the reactor 12 of a catalytic cracking unit. The flow rate of fresh feed to reactor 12 was 30,200 barrels per day (B/D). Prior to its introduction into reactor 12, the fresh feed was mixed with recycled catalyst slurry, heavy cycle gas oil, and regenerated catalyst. The recycled catalyst slurry was introduced into line 11 by way of line 13. The heavy cycle gas oil was introduced into line 11 by way of line 14. The regenerated catalyst was introduced into line

11 by way of line 15. These catalyst and hydrocarbon streams were thoroughly mixed with the fresh feed stream in line 11 as they flowed through line 11 into reactor 12. Spent catalyst was withdrawn from reactor 12 by way of line 16, while the hydrocarbon effluent from reactor 12 was withdrawn through line 17.

The reactor effluent was passed through line 17 into the bottom of fractionating column 18. Crude oil was introduced into the baffle section of fractionating column 18 by way of line 19. This crude oil, having properties listed in Table I, was the same type of crude oil that was treated in the pipe still mentioned above to provide the fresh feed to reactor 12. The charge rate of the crude oil was 6,450 B/D. About 1,500 B/D of heavy cycle gas oil product was withdrawn from fractionating column 18 through line 20, while 3,560 B/D of heavy cycle gas oil was withdrawn from fractionating column 18 by way of line 21. This latter heavy-cycle-gas-oil stream passing through line 21 was split into two streams. One stream, flowing at the rate of 3,100 B/D, was passed through the line 14 to be used as recycle hydrocarbons to be sent to reactor 12. The other stream, flowing at the rate of 460 B/D, was passed through the line 22 to be used as dilution oil as described below. Bottoms were withdrawn from the fractionating column 18 by way of line 23. This bottoms material contained the heavy hydrocarbons and catalyst fines which were entrained in the hydrocarbon effluent obtained from reactor 12. Other product fractions of usable petroleum hydrocarbons were withdrawn from fractionating column 18, but are not shown here.

The bottoms material was passed through line 23 into catalyst-slurry settler 24 where liquid hydrocarbons were separated and removed therefrom through line 25 as decanted oil. The flow rate of decanted oil was 4,200 B/D. The catalyst slurry that was separated from the liquid hydrocarbons in the catalyst-slurry settler 24 was withdrawn from catalyst-slurry settler 24 by way of line 26 to be passed through lines 26, 27, and 13 for introduction into the fresh feed stream in line 11. The flow rate of this catalyst-slurry recycle stream, including the dilution oil, was 590 B/D. The heavy cycle gas oil which was passed through line 22 was used as dilution oil for this catalyst slurry. Some of this dilution oil was introduced into the bottom of catalyst-slurry settler 24 by way of line 22, while a second portion was withdrawn from line 22 through line 28 to be added as additional dilution oil to the catalyst-slurry recycle stream passing through line 27.

The metals that were contained in the crude oil that was charged into fractionating column 18 by way of line 19 passed into the various products that were obtained from the fractionating column and catalyst-slurry settler 24. Of the metals that were introduced into fractionating column 18 with the crude oil, 3 percent appeared in the heavy cycle gas oil product that was

withdrawn in line 20 and 5 percent appeared in the heavy cycle gas oil that was recycled to the reactor 12. The decanted oil was found to contain about 91 percent of the metals introduced into the system by means of the crude oil, while the catalyst slurry that was recycled to reactor 12 contained only 1 percent of the metals. Therefore, over 90 percent of the metals that were introduced into fractionating column 18 by way of the crude oil were removed from the system by way of the decanted oil and discarded. Furthermore, the hydrocarbons that would contribute heavily to coke production and residual-type hydrocarbons were removed also by means of the decanted oil. Since the crude oil had been desalted and treated for water removal previously, salt and water problems were not present. Only about 6 percent of the metals that were charged to fractionating column 18 ever reached reactor 12. This amount was not sufficiently large to adversely affect the cracking catalyst in reactor 12. This conclusion is supported by the data in Table II.

TABLE II
CATALYST DATA

Days Before Starting crude addition	2									
Days After Starting crude addition	1 9		19 23							
Days After Stopping crude addition						1 5		8		
Catalyst activity	41.5	38.5	40.9	39.9	43.3	43.3	40.5	44.5	41.1	
Carbon	0.70	0.87	0.86	0.88	0.87	0.97	0.89	0.77	0.87	

In Table II are presented activity and carbon-factor data for the equilibrium catalyst that was in the catalytic cracking unit during this test. These data were obtained from small-scale testing runs made according to the method described in the paper entitled "Determination of Activity and Selectivity of Cracking Catalyst," which was authored by R. V. Shankland and G. E. Schmitkons and was presented at the Twenty-Seventh Annual Meeting of the American Petroleum Institute in Chicago, Illinois in November, 1947. This paper was published in the AMERICAN PETROLEUM INSTITUTE PROCEEDINGS, Vol. 27 (III), pp. 57-77 (1947). The activity is expressed as a relative activity. Both the activity and carbon factor are discussed in the above-cited paper. Data are presented for catalyst samples obtained 6 days and 2 days before crude oil was added to fractionating column 18; 1 day, 9 days, 19 days, and 23 days after the addition of crude oil was started; and 1 day, 5 days, and 8 days after the addition of crude oil was stopped.

Good performance of the catalytic cracking unit was obtained during this run. Product data are presented in Table III. Data are shown for products obtained 5 days, 3 days, and 1 day before crude oil was added to fractionating column 18; 1 day, 5 days, 10 days, 16 days, and 24 days after the addition of crude oil was started; and 3 days after the addition of crude oil was stopped.

TABLE III.—PRODUCT DATA

	Days before starting crude oil			Days after starting crude oil					Days after stopping crude oil
	5	3	1	1	5	10	16	24	
Feed:									
Gravity, ° API.....	26.8	26.8	26.2	26.3	26.0	26.5	26.3	25.6	26.0
ASTM Dist., ° F.:									
IBP.....	378	398	384	400	344	446	441	400	424

TABLE III.—PRODUCT DATA—Continued

	Days before starting crude oil			Days after starting crude oil					Days after stop-plug crude oil
	5	3	1	1					
					5	10	16	24	
10%.....	450	546	552	548	564	569	567	566	552
30%.....	637	622	642	642	652	658	655	659	644
50%.....	700	680	700	700	694	700	700	700	696
Naphtha, vol. percent.....	3.8	3.4	3.7	3.2	4.6	1.4	1.7	3.3	2.3
Sulfur, wt. percent.....		1.70	1.70				1.81		1.86
Yields, vol. percent:									
Net gasoline C ₅ -430.....	4.39	46.3	38.9	40.6	49.4	49.7	52.3	51.6	45.5
LCCO(as produced).....	40.4	35.8	32.4	33.2	24.9	30.3	34.8	39.1	31.9
HCCO.....	4.2	6.2	9.5	9.1	17.7	9.6	6.8	3.4	6.1
Decanted oil.....	7.2	10.7	11.9	11.9	13.3	13.2	14.8	15.6	6.9
Coke, wt. percent.....	5.8	5.6	4.5	4.7	5.8	5.7	6.0	6.0	6.3
Conversion.....	54.4	54.9	52.8	52.9	51.5	54.4	51.7	49.1	61.2
LCCO:									
Gravity, ° API.....	28.3	28.8	20.0	28.6	30.5	28.7	28.3	27.5	25.0
ASTM Dist., ° F.:									
IBP.....	357	348	351	356	350	366	360	364	370
10%.....	414	400	402	405	390	411	406	409	409
30%.....	467	448	448	447	419	442	446	456	460
50%.....	514	492	488	495	444	478	484	501	500
90%.....	608	580	571	577	515	560	578	603	597
EP.....	650	630	620	625	566	612	634	653	640
Naphtha, vol. percent.....	19.7	25.2	25.0	25.2	36.3	26.0	25.2	22.4	21.6
Sulfur, wt. percent.....			1.42				1.41		1.75
HCCO:									
Gravity, ° API.....	20.1	21.1	22.1	22.1	23.5	22.3	23.0	21.5	17.0
ASTM Dist., ° F.:									
IBP.....	422	390	422	422	400	368	380	340	376
50%.....	676	665	652	676	620	614	661	668	678
Naphtha, vol. percent.....	3.1	3.9	3.0	3.1	3.5	4.3	4.0	4.7	4.2
Sulfur, wt. percent.....		1.98	1.98				1.77		2.50
SHN:									
Gravity, ° API.....	54.0	53.8	53.5	53.0	54.2	52.1	54.0	53.0	52.7
ASTN Dist., ° F.:									
50%.....	244	244	250	248	243	250	250	253	253
90%.....	294	300	311	303	302	310	310	310	311
EP.....	342	340	343	344	341	361	346	349	357
RVP.....	3.6	3.5	3.5	2.3	3.5	3.8	3.6	3.6	3.5
Sulfur, wt. percent.....							0.14		
Unleaded octane No., research.....		91.0			89.7		87.7	87.5	87.7

LCCO represents light catalytic cycle oil; HCCO, heavy catalytic cycle oil; and SHN, heavy stabilized naphtha.

The above example shows that petroleum hydrocarbon streams that contain metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons can be processed initially in a satisfactory manner in the fractionating column operated in conjunction with a catalytic cracking unit.

What is claimed is:

1. A method for increasing the capacity of a petroleum hydrocarbon refinery for the processing of a petroleum hydrocarbon stream containing metals, hydrocarbons having coke-forming tendencies, and residual-type hydrocarbons and being selected from the group consisting of a crude oil and a refinery slop stream, wherein the refinery includes as a processing unit a catalytic cracking unit and wherein a fractionating column is associated with said catalytic cracking unit and connected thereto to receive solely products from said catalytic cracking unit and to enable hydrocarbons to be recycled from said fractionating column to said catalytic cracking unit, which method consists of introducing said petroleum hydrocarbon stream into said fractionating column at a point in said fractionating column above which substantially all of the recycled hydrocarbons are withdrawn from said fractionating column.

2. The method of claim 1 wherein said petroleum hydrocarbon stream is a crude oil which has a gravity within the range between about 10° API and about 45° API and a viscosity within the range between about 40 SSU at 100°F. and about 6,000 SSU at 100°F.

3. The method of claim 1 wherein said fractionating column contains a baffle section and wherein said introducing said petroleum hydrocarbon stream into said fractionating column comprises injecting said petroleum hydrocarbon stream into the baffle section of said fractionating column.

4. The method of claim 2 wherein said crude oil has been desalted.

5. The method of claim 2 wherein said crude oil has been treated for removal of any amount of water contained therein that would appreciably increase the amount of liquid water being charged to said fractionating column so as to produce a hazardous condition in said fractionating column when said crude oil is introduced into said fractionating column.

6. The method of claim 3 wherein said petroleum hydrocarbon stream is a crude oil which has a gravity within the range between about 10° API and 45° API and a viscosity within the range between about 40 SSU at 100°F. and about 6,000 SSU at 100°F.

7. The method of claim 4 wherein said crude oil has been treated for removal of any amount of water contained therein that would appreciably increase the amount of liquid water being charged to said fractionating column so as to produce a hazardous condition in said fractionating column when said crude oil is introduced into said fractionating column.

8. The method of claim 6 wherein said crude oil has been desalted.

9. The method of claim 6 wherein said crude oil has been treated for removal of any amount of water contained therein that would appreciably increase the amount of liquid water being charged to said fractionating column so as to produce a hazardous condition in said fractionating column when said crude oil is introduced into said fractionating column.

10. The method of claim 8 wherein said crude oil has been treated for removal of any amount of water contained therein that would appreciably increase the amount of liquid water being charged to said fractionating column so as to produce a hazardous condition in said fractionating column when said crude oil is introduced into said fractionating column.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,717,569 Dated February 20, 1973

Inventor(s) Le Roy McAllister, Jr., et al.

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Title page, Inventor "Le Roy McAllister" should read -- Le Roy McAllister, Jr. --. Column 8, Table II, "6" should be in first column of table opposite "Days Before Starting Crude Addition"; "1", "9", "19", are not properly located in line headed "Days After Starting Crude Addition"; "1", "5", and "8" are not properly located in line headed "Days After Stopping Crude Addition"; Columns 9-10, Table III, Opposite heading "RVP" fourth column of numbers, "2.3" should be -- 3.3 --.

Signed and sealed this 26th day of February 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents