

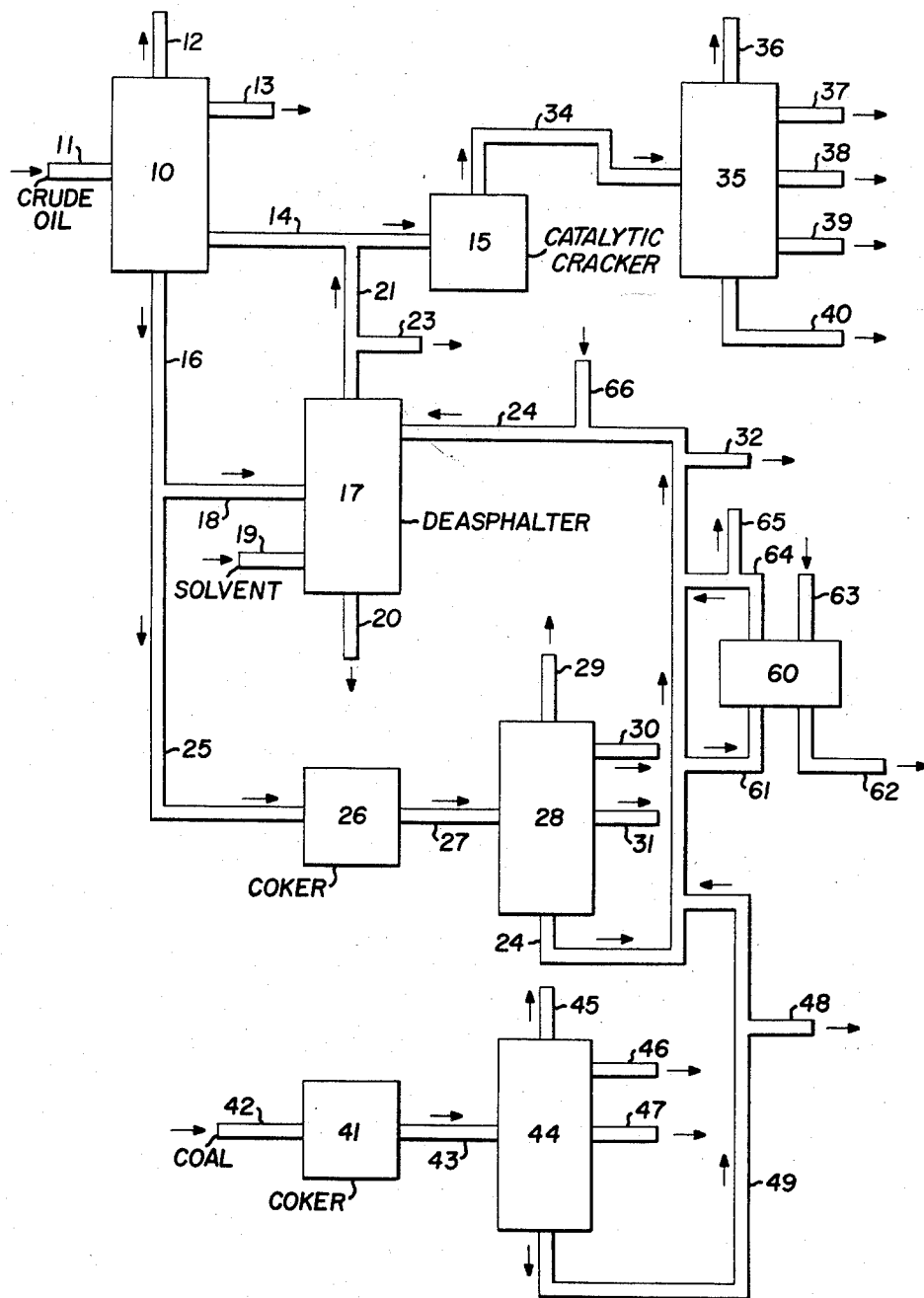
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PROCESS FOR PRODUCING HIGH QUALITY FUELS FROM CRUDE RESIDUA

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PROCESS FOR PRODUCING HIGH QUALITY FUELS FROM CRUDE RESIDUA

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The present invention is concerned with an improved method of processing crude oil, and more particularly, relates to a method of processing the higher boiling components of crude oil for the manufacture of high quality motor fuels, lubricating oils and the like. The invention is specifically concerned with an integrated operation for the removal of asphaltic constituents from the higher crude oil fractions in order to prepare better feed oils for subsequent cracking operations, particularly for a catalytic cracking operation.

It is well known in the art to distill crude oil in order to segregate various boiling fractions such as motor fuels, gas oils, residual oils and the like. It is also known that due to an increasing demand for motor fuels, it is desirable to crack not only conventional gas oil fractions but also to crack the higher boiling constituents such as those constituents boiling up to about 1000°–1100° F. and higher. However, these fractions have been difficult to process efficiently due to the fact that these fractions contain metallic-organic contaminants and complex asphaltic hydrocarbon molecular constituents. In accordance with the present invention, these undesirable metal-containing and asphaltic constituents are removed in an integrated operation, resulting in the production of increased yields of high quality gasolines, lube oils and the like. In accordance with the present invention, the crude oil is distilled, a high boiling fraction segregated, and this fraction then treated with a product derived from a thermal coking operation of carbonaceous material such as coal or heavy petroleum residua.

The process of the present invention may be fully understood by reference to the drawing illustrating embodiments of the same. Referring specifically to the drawing, a crude oil is introduced into distillation zone 10 by means of feed line 11. The distillation zone is operated in a conventional manner in order to segregate various boiling hydrocarbon fractions. Gases are removed overhead by means of line 12, while motor fuel constituents are removed by means of line 13. A conventional gas oil fraction is segregated by means of line 14 and passed into a catalytic cracking zone 15. A heavy residual fraction comprising those constituents boiling above about 850°–950° F. is removed by means of line 16. It is to be understood that distillation zone 10 may comprise a plurality of zones and that other fractions or streams may be segregated.

Fluid catalytic cracking zone 15 is a conventional unit operated at a pressure in the range from about 2–100 pounds and at a temperature in the range from 900°–1050° F. Typical catalysts are used as, for example, silica-alumina and the like, which are maintained in a fluid state by means of upflowing gases.

In accordance with a specific adaptation of the present invention, the residual fraction removed by means of line 16, is segregated into two streams. One stream is introduced into a deasphalting zone 17 by means of line 18. In this zone the fraction is contacted with a de-

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asphalting solvent, such as a liquefied normally gaseous hydrocarbon, such as propane, butane and the like.

The deasphalting solvent is introduced into zone 17 by means of line 19. The asphalt is removed by means of line 20, while the deasphalted oil is removed by means of line 21. This stream after removal of the solvent is preferably passed to fluid catalytic cracking zone 15. A portion of the stream may be removed by means of line 23 and employed as a high quality lube oil.

In accordance with the present invention, a high boiling aromatic wash oil, secured as hereinafter described, is introduced into the top of zone 17 by means of line 24.

Deasphalting zone 17 may comprise any suitable number and arrangement of stages. The temperature employed may vary in the range from about 120°–220° F., preferably in the range from about 140°–200° F. The amount of solvent used per volume of oil is in the range from about 0.5–10, preferably about 2–6 volumes of solvent per volume of oil.

The amount of wash oil introduced by means of line 24 is preferably in the range from 5–40 volume percent based on the oil feed. The preferred quantity is from about 10–20% based on oil feed. The wash oil introduced by means of line 24 functions as a demetalizing and deasphalting aid. In general, this wash oil should contain at least 60% aromatics, and preferably contain from 80–90% aromatics. The wash oil should have a low metal content, preferably less than 5 parts per million of vanadium and nickel. The initial boiling point of the wash oil should be above about 850° F., preferably above 950° F.

In accordance with the specific concept of the present invention, the second portion of the crude residuum is introduced into coking zone 26 by means of line 25. In zone 26 the temperature is maintained in the range from about 900°–1050° F. and the pressure is in the range from about 2–100 p.s.i.g. It is preferred that the coking operation be a fluid coking operation. In this type of operation, the feed is sprayed into the unit and contacted with small particles of coke which are heated to the reaction temperature by partial combustion in a second vessel.

The coking products are withdrawn from coking zone 26 by means of line 27 and passed to a distillation zone 28. In this zone temperature and pressure conditions are adapted to segregate a gaseous fraction which is removed by means of line 29, a fraction boiling in the motor fuel boiling range which is removed by means of line 30, a heavier fraction which is removed by means of line 31 and a deasphalting aid fraction which is removed by means of line 24. At least a portion of this fraction, as described heretofore, is recycled or passed to deasphalting zone 17. A portion of the fraction may be removed from the system by means of line 32.

A preferred mode of operation is to pass the stream, removed by means of line 24, to a solvent extraction zone 60 by means of line 61. In this zone the oil is contacted with a solvent, such as phenol, furfural and the like, which solvents are characterized by having a preferential selectivity for the aromatic type constituents as compared to the more paraffinic type of constituents. Conditions are adjusted to secure the formation of a solvent extract phase and a raffinate phase. The solvent, such as phenol, is introduced into solvent treating zone 60 by means of line 63. The amount of solvent employed may vary in the range from 0.5 volume of solvent to 10 volumes of solvent per volume of oil. A preferred amount of solvent is about 1–2 volumes of solvent per volume of oil. The raffinate phase, relatively low in aromatics, is removed from treating zone 60 by means of line 62. The solvent extract phase, relatively rich in aromatics, is removed from treating zone 60 by means

of line 64 and handled in a manner to remove the phenol by means of line 65. However, under certain conditions, it is desirable to recycle the entire solvent extract phase removed by means of line 64 to zone 17. Under certain conditions, it is also desirable to add additional phenol to the system by means of line 66. The phenol in zone 17 is removed by suitable means from the stream removed by means of line 21 and by means of line 20.

The product from the catalytic cracking zone 15 is passed by means of line 34 into a distillation zone 35. Temperature and pressure conditions in zone 35 are adapted to remove overhead by means of line 36 a gaseous fraction. Constituents boiling in the motor fuel boiling range are removed by means of line 37, while heavier fractions, such as heating oils, cycle stocks, fuel oil and the like are removed from zone 35 by means of lines 38, 39 and 40.

While the operation has been described specifically with respect to a petroleum coke, an equally desirable source of the deasphalting wash oil is from a coal coking operation. In this type of thermal coking operation, a coal is introduced into a coker 41 by means of line 42. Temperature conditions in the coker are maintained in the range from about 1300°-2200° F. The coking products are withdrawn from zone 41 by means of line 43 and passed to a separation or distillation zone 44. Temperature and pressure conditions are adapted to remove lighter fractions by means of lines 45, 46 and 47. A heavy residual product is removed by means of line 49, and at least a portion of this product is passed to the deasphalting zone 17 by means of line 24. The remaining portion is removed as product by means of line 48. Here again, it may be desirable under certain conditions to solvent-treat in zone 60 to concentrate the aromatic constituents.

The present invention contemplates the employment as a deasphalting aid, a high boiling, highly aromatic fraction which is low in metallic content. In general, the fraction should boil in the range above about 850° F., preferably in the range above about 900° F. A typical satisfactory wash oil fraction is as follows:

Initial boiling point	° F.	850
50% dist. point	° F.	930
80% dist. point	° F.	989
95% dist. point	° F.	1020
Aromatic rings, wt. percent		60.7
Naphthenic rings, wt. percent		31.4

A typical satisfactory oil from a coal tar is as follows:

Initial boiling point	° F.	900
50% point	° F.	1050
Conradson carbon		42.2
Insoluble 86° naphtha		50
Specific gravity		1.268

While it is preferred that the coker gas oil be secured as described, it is to be understood that the coker gas oil may be derived from a different crude residuum rather than from the same crude residuum.

What is claimed is:

1. An improved process for the production of a petroleum fuel which comprises distilling a crude oil under conditions yielding a relatively high boiling residual fraction, separating said residual fraction into a first portion and a second portion, subjecting said first portion to a coking operation at pressures of from 2 to 100 p.s.i.g. and at temperatures of from about 900 to 1050° F. to form coking products, including a heavy aromatic fraction, segregating said heavy aromatic fraction from the coking products, introducing said heavy aromatic fraction as a wash oil into the top of a deasphalting zone, introducing said second portion into an intermediate point of said deasphalting zone, introducing a deasphalting solvent into the lower area of said deasphalting zone, segregating a deasphalted oil and subjecting said deasphalted oil to a catalytic cracking operation and thereafter recovering a high quality fuel from the cracked products.

2. Process as defined by claim 1 wherein said wash oil contains less than 5 parts per million of vanadium and nickel.

3. Process as defined by claim 1 wherein said deasphalting solvent comprises a liquefied normally gaseous hydrocarbon.

4. Process as defined by claim 1 wherein said wash oil contains at least 80 percent aromatics.

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