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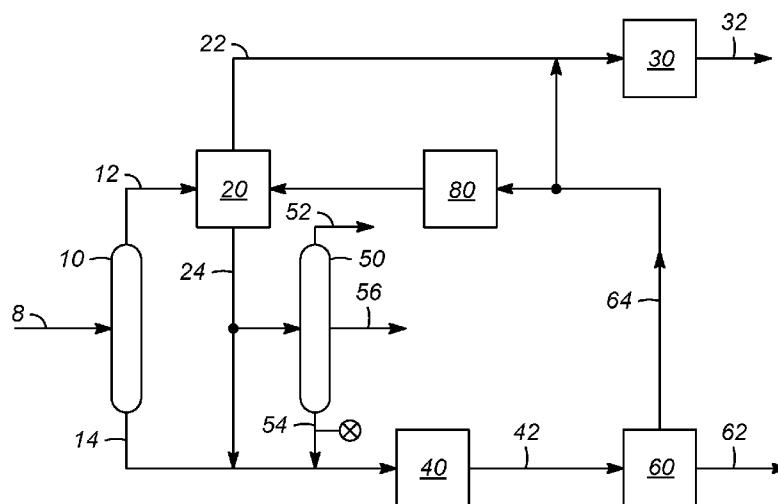


FIG. 1

(57) Abstract: A process is presented for recovering the components for a gasoline blending pool to meet the E70 specifications. The process includes the separation of the naphtha feedstock into a light naphtha stream and a heavy naphtha stream. The process further includes separating the light naphtha stream to recovery high quality non-normal hydrocarbons having normal boiling points above 70C, and to separate for adding to the feed to the reforming unit, hydrocarbons that have lower boiling points.



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FLOW CONTROL TO MEET E70 GASOLINE SPECIFICATIONS

STATEMENT OF PRIORITY

[0001] This application claims priority to U. S. Application No. 62/334,914 which
5 was filed May 11, 2016, the contents of which are hereby incorporated by reference in its
entirety.

FIELD OF THE INVENTION

[0002] This invention relates to an improved process combination for the conversion of
hydrocarbons, and more specifically for the selective production of high octane light naphtha
10 product as intermediates for production of gasoline.

BACKGROUND OF THE INVENTION

[0003] Fuel quality demands and environmental concerns have led to the widespread
removal of antiknock additives containing lead, and to the subsequent reformulation of
gasoline. Because of the demands of modern internal-combustion engines, refiners have had
15 to modify processes and install new processes to produce gasoline feedstocks that contribute
to increasing the “octane,” or autoignition resistance. Premature autoignition causes the
“knock” in internal combustion engines. Refiners have used a variety of processes to upgrade
the gasoline feedstocks, including higher fluid catalytic cracking (FCC), isomerization of
light naphtha, higher severity catalytic reforming, and the use of oxygenated compounds.
20 Some of these processes produce higher octane gasoline feedstocks by increasing the
aromatics content of the gasoline at the expense of reducing the content low-octane paraffins.
Gasolines generally have aromatics contents of 30% or more.

[0004] Faced with tightening automotive emission standards, refiners are having to
supply reformulated gasoline to meet the stricter standards. Requirements for the
25 reformulated gasoline include lower vapor pressure, lower final boiling point, increased
oxygenate content, and lower content of olefins and aromatics. Aromatics, in particular
benzene and toluene, have been the principal source of increasing the octane of gasoline with
the removal of lead compounds, but now the aromatics content may eventually be reduced to

less than 25% in major urban areas and to even lower ranges, such as less than 15%, in areas having severe pollution problems.

[0005] Alternate formulations for gasolines have been comprising aliphatic-rich compositions in order to maintain the octane ratings, as refiners have worked to reduce the aromatic and olefin content of gasolines. Currently, the processes for increasing the aliphatic content of gasolines include the isomerization of light naphtha, isomerization of paraffins, upgrading of cyclic naphthas, and increased blending of oxygenates. However, oxygenates are also becoming an issue as the use of methyl tertiary-butyl ether (MTBE) is being phased out, and ethanol has become the primary oxygenate for use with gasoline.

[0006] New technology, and processes can increase the production of alkylates for gasoline blending to reduce the aromatic content. Adding a complementary unit to process butenes to existing refinery process units provides a convenient upgrade, while improving the economic returns of a refinery with a minimal capital cost, and increases the flexibility of a refinery to shifting product demands.

SUMMARY OF THE INVENTION

[0007] The present invention provides for a process to improve the yields of high octane components for gasoline.

[0008] A first embodiment of the invention is a process for improving stream cracker feed and processing gasoline blending components, comprising passing a naphtha feedstream to a fractionation column to generate an overhead stream comprising hydrocarbons with normal boiling points below 90°C, and a bottoms stream comprising heavies; passing the overhead stream to a separation unit to generate an extract stream comprising normal hydrocarbons and a raffinate stream comprising non-normal hydrocarbons; passing the extract stream to a cracking unit; and passing the bottoms stream to a reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 72°C. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 81°C. An embodiment of the invention is one, any or all of prior

embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 98°C. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph

5 wherein the separation unit is an adsorption separation unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the light desorbent is a normal paraffin with a boiling point lower than the lightest feed component, or higher than the boiling point of the heavies components. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up

10 through the first embodiment in this paragraph further comprising passing the raffinate stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing a portion or all of the raffinate stream to a second fractionation column to generate a second overhead stream and a second bottoms stream. An embodiment of the

15 invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the overhead stream comprises isobutane and isopentane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column has a side draw, and further comprising generating a side draw stream comprising

20 high octane light naphtha product, wherein the high octane light naphtha product comprises isopentane, cyclopentane, methylcyclopentane and isohexane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the high octane light naphtha product to a gasoline blending stock. An embodiment of the invention is one, any or all of

25 prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column has a side draw, and further comprising generating a side draw stream comprising high octane light naphtha product, wherein the high octane light naphtha product comprises isopentane, cyclopentane, methylcyclopentane, isohexanes, cyclohexane, benzene, and dimethylpentanes. An embodiment of the invention is one, any or

30 all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the high octane light naphtha product to a gasoline blending stock. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up

through the first embodiment in this paragraph further comprising passing the second bottoms stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the second overhead stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the reforming unit generates a reformat stream, and further comprising passing the reformat stream to an aromatics recovery unit to generate an aromatics stream and an aromatics raffinate stream comprising normal alkanes. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the aromatics raffinate stream to the cracking unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal hexane and rich in iso-hexane isomers such that the ratio of iso-hexanes to normal hexane is greater than 3. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal pentane and rich in iso-pentane such that the ratio of iso-pentane to normal pentane is greater than 3. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal butane and rich in iso-butane such that the ratio of iso-butane to normal butane is greater than 3.

[0009] A second embodiment of the invention is a process for improving naphtha stream cracker feedstock and processing gasoline blending components, comprising passing a naphtha feedstream to a fractionation column to generate an overhead stream comprising hydrocarbons with normal boiling points below 75°C, and a bottoms stream; passing the overhead stream to an adsorption separation unit to generate an extract stream comprising normal hydrocarbons and a raffinate stream comprising non-normal hydrocarbons; passing the raffinate stream to a second fractionation column to generate an overhead stream, a side stream and a second bottoms stream; passing the extract stream to a cracking unit; and passing the bottoms stream to a reforming unit to generate a reformat. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second

embodiment in this paragraph further comprising operating the second fractionation column with a second bottom product cut point of 70°C (at atmospheric pressure) and sending the second bottoms product to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising operating the second fractionation column with a second top product cut point of 30°C (at atmospheric pressure) and sending the second overhead product to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising using the side product from the second fractionation column for gasoline blending. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph wherein the adsorption separation column uses a light desorbent. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph wherein the light desorbent is n-butane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising passing the reformat to an aromatics recovery unit to generate an aromatics stream, and an aromatics raffinate stream comprising non-aromatic compounds. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising passing the aromatics raffinate stream to the adsorption separation unit.

[0010] Without further elaboration, it is believed that using the preceding description that one skilled in the art can utilize the present invention to its fullest extent and easily ascertain the essential characteristics of this invention, without departing from the spirit and scope thereof, to make various changes and modifications of the invention and to adapt it to various usages and conditions.

[0011] Other objects, advantages and applications of the present invention will become apparent to those skilled in the art from the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWING

[0012] Figure 1 is a diagram of the process for removing normal paraffins from a light naphtha stream and to generate a more desirable gasoline blending mixture.

DETAILED DESCRIPTION OF THE INVENTION

[0013] The present invention is a process that improves flexibility in the operation of a refinery, and enables the refiner to readily shift product with minimal additional equipment. The operation of the new and existing equipment allows for shifting of production to increase higher value products as the market shifts. Market shifts include the price of raw materials, or oil, and the demand for different products such as precursor materials to plastics, such as light olefins or aromatics, or increased production of gasoline blending streams. Traditional processing of a naphtha feedstream is to only use the naphtha splitter, which segregates according to boiling point ranges. However, there are significant overlaps of boiling points of different hydrocarbons, wherein the operation of a cracking unit works most efficiently with normal hydrocarbons, and the reforming unit performs more efficiently on heavier hydrocarbons and aromatic precursors such as methylcyclohexane and cyclohexane, and naphthenes. It is also advantageous to remove normal C5 and C6 hydrocarbons from the feed to the reforming unit.

[0014] The present invention allows for increasing the normal hydrocarbon content to be passed to a cracking unit, while separating desirable aromatic to be passed to a reforming unit, and separating out desirable components from a naphtha feedstream for the use in meeting gasoline blending conditions that satisfy E70 gasoline specifications.

[0015] By removing n-hexane, one increases the amount of components that have a higher boiling point and help customers meet the E70 specification. n-hexane has a low octane and is not desirable in gasoline. It also has a normal boiling point of 69°C which is close to other light naphtha components such as methylcyclopentane (72°C) that do have high octane and are desirable for gasoline blending. By separating the n-hexane using LD MaxEneTM or another separation technology, more methylcyclopentane can be blended into gasoline to help refiners meet the E70 specification.

[0016] The present invention includes the processing of a naphtha feedstream to improve the feed to a steam cracker, and to improve the composition of a gasoline blending stock. The present invention is presented in the form wherein the temperatures are temperatures for a fractionation process operated at, or near, atmospheric pressures, and boiling points are normal boiling points. The invention is intended to include appropriate shifts in temperatures for changes in operating pressures. One of ordinary skill in the art working with hydrocarbons would readily understand and know the temperature shifts for fractionation at

either higher or lower pressures, and can determine the temperature shift from the Clausius-Clapeyron equation. For example, the boiling points are expected to rise for operations with increased pressures, and to drop for operations with decreased pressures, relative to atmospheric pressure.

5 [0017] The process, as shown in Figure 1, includes passing a naphtha feedstream 8 to a first fractionation column 10, wherein the fractionation column 10 is operated to generate an overhead stream 12 comprising hydrocarbons with normal boiling points below 90°C, and a bottoms stream 14 comprising heavies. The overhead stream 12 is passed to a separation unit 20 to generate an extract stream 22 having normal hydrocarbons and a raffinate stream 24
10 having non-normal hydrocarbons. The extract stream 22 is passed to a cracking unit 30 and the bottoms stream 14 is passed to a reforming unit 40. By sending components with normal boiling points below 90C, such as dimethylpentanes, these components can be further separated from the normal paraffins in the overhead stream 12, and recovered in the raffinate stream 24 for collection into a gasoline blending pool. In a preferred embodiment, the
15 separation unit 20 is an adsorption separation unit, and is operated with a light desorbent. The light desorbent is a normal paraffin with a boiling point lower than the lightest feed component, or higher than the boiling point of the heavies components. The choice of desorbent can be determined for optimum separation and recovery of the desorbent. One such desorbent is n-butane.

20 [0018] An alternate process is to operate the fractionation column 10 to generate an overhead stream 12 comprising hydrocarbons with normal boiling points below 98°C. By operating at a higher temperature, the overhead stream 12 will include heavier paraffins, such as n-heptane. The overhead stream 12 is then separated to recover the n-heptane and other normal paraffins, and the normal paraffins are then passed to the cracking unit 30, to generate
25 a cracking process stream 32 comprising light olefins. The removal of n-heptane reduces the heat requirements and improves the efficiency of the reformer.

[0019] By operating the fractionation column 10 at higher temperatures, the feed 14 to a reforming unit 40 will have an improved quality, and reduce the energy load in converting the heavier hydrocarbons C8+ to aromatics. In addition, the overhead stream 12 after passing
30 through the separation unit 20 will have a raffinate 24 lower in normal hydrocarbons and higher in iso-paraffins and other non-normal compounds, such as cyclohexane. The compounds in the raffinate stream 24 will be of higher quality for passing to the reforming

unit 40 and operation of the reforming unit 40 can be at less severe conditions, or lower temperatures.

[0020] A further alternate process is to operate the fractionation column 10 to generate an overhead stream 12 comprising hydrocarbons with normal boiling points below 81°C. By operating at a lower temperature, the overhead stream 12 will include hydrocarbon components such as benzene and cyclohexane. The overhead stream 12 is then separated to recover the benzene and cyclohexane components into the raffinate stream 24, and then to pass the raffinate stream 24 to the reformer 40, wherein the cyclohexane is converted to benzene. The benzene will pass through the reformer 40 without reacting.

[0021] A further alternate process is to operate the fractionation column 10 to generate an overhead stream 12 comprising hydrocarbons having normal boiling points below 72°C. By operating at a still lower temperature, the overhead stream 12 will include hydrocarbon components such as methylcyclopentane. The overhead stream 12 is then separated to recover methylcyclopentane into the raffinate stream 24, and then to pass the raffinate stream 24, or a portion thereof, to a gasoline blending pool.

[0022] In one embodiment, the process includes passing the raffinate stream 24 to the reforming unit 40 to generate a reformat stream 42 comprising aromatics. In an alternate embodiment, the raffinate stream 24 is passed to a second fractionation column 50. The second column 50 generates a second overhead stream 52 and a second bottoms stream 54. In one embodiment, the second fractionation column 50 is operated to generate the overhead stream 52 containing isobutane and isopentane that is sent to the reforming unit 40. The second bottoms stream 54 can be passed to the reforming unit 40.

[0023] In another embodiment, the second fractionation column 50 can include a side draw stream 56. The side draw stream 56 comprises high octane light naphtha product wherein the high octane light naphtha product includes isopentane, cyclopentane, methylcyclopentane and isohexane. This high octane light naphtha product can be passed to a gasoline blending stock, wherein the high octane light naphtha product provides a mixture of hydrocarbons that will help meet the E70 specifications for gasoline. The second fractionation column 50 can be a divided wall column, or other set up for providing separation of the raffinate stream 24 into three process streams. This is also intended to include the possibility of using two separate fractionation columns for the second fractionation column 50.

[0024] In one embodiment, the second overhead stream 52 is passed to the reforming unit 40. The second overhead stream 52 will generally isomerize to a mixture of normal and iso-C4 and C5 paraffins. The reforming catalyst will isomerize a portion of the lower molecular weight hydrocarbons as they will not aromatize. The reforming unit 40 generates a reformate stream 42, which is passed to an aromatics recovery unit 60. The aromatics recovery unit 60 will generate an aromatics stream 62 and an aromatics raffinate stream 64. The aromatics raffinate stream 64 comprises normal paraffins and some isoparaffins.

[0025] The aromatics raffinate stream 64 can be passed to the cracking unit 30, or can be passed to the adsorption separation unit 20. When the raffinate stream 64 is passed to the separation unit 20, it may be first hydrotreated, or passed to a hydrotreatment unit 80, before being passed to the separation unit 20. The hydrotreatment unit 80 can be used to hydrogenate olefins, or facilitate the removal of any sulfur that is obtained from the aromatics recovery unit 60.

[0026] In one embodiment, the feed to the catalytic reforming unit 40 includes the bottoms stream 14, and a portion of, or all of the raffinate stream 24. The feed to the catalytic reforming unit is depleted in normal paraffins in the C4 to C6 range. The feed is rich in iso-paraffins in the C4 to C6 range. In one embodiment, the ratio of iso-paraffins to normal paraffins for each of butanes, pentanes, or hexanes, will be greater than 3. The catalyst in the reforming unit 40 also will isomerize the iso-paraffins to normal paraffins in the C4 to C6 range. The normal paraffins will be passed out in the reformate stream 42, and will be separated in the aromatics recovery unit 60. The normal paraffins will be passed out in the aromatics raffinate stream 64. The aromatics raffinate stream 64 can be passed to the cracking unit 30. In an alternative, the aromatics raffinate stream 64 can be passed to the adsorption separation unit 30 to separate iso-paraffins in the C4 to C6 range and recycle them to the reforming unit 40 for further isomerization.

[0027] In one embodiment, the process is for generating gasoline blending components. The process includes passing a naphtha feedstream 8 to a first fractionation column 10 to generate an overhead stream 12 comprising hydrocarbons with normal boiling points below 75°C, and a bottoms stream 14. The overhead stream 12 is passed to an adsorption separation unit 20 to generate an extract stream 22 comprising normal hydrocarbons and a raffinate stream 24 comprising non-normal hydrocarbons. The raffinate stream 24 is passed to a second fractionation column 50 to generate an overhead stream 52, a side stream 56 and a

second bottoms stream 54. The bottoms stream 14 is passed to the reforming unit 40 to generate a reformat 42.

[0028] The raffinate stream 24 comprises hydrocarbons that are useful for a gasoline blending pool. The second fractionation column 50 is operated to generate the second
5 bottoms product with a cut point of 70°C (at atmospheric pressure), and sending the second bottoms stream 54 to the reforming unit 40. The second fractionation column 50 is operated to generate the second top product cut point of 30°C (at atmospheric pressure), and sending the second overhead stream 52 to the reforming unit 40 to isomerize the isoparaffins. The side stream 56 from the second fractionation column 50 is passed to a gasoline blending pool.

10 [0029] While to present invention is aimed at optimizing the yields of the two process units, a cracking unit and a catalytic reforming unit, the process can also be used to improve the yields of each individual unit. Hydrocarbon streams comprise a complex mixture. The first separation process is typically around boiling points, where cuts are made on boiling point ranges. Other means of separation are also employed downstream to pull out specific
15 classes of hydrocarbons.

[0030] It has been found that more intricate separations of the hydrocarbon streams can increase yields for downstream process units, while maintaining substantially constant flow rates to the downstream processing units. A typical feedstream to a cracking unit, and a reforming unit is a straight run naphtha feedstream. But it is intended that other feedstreams
20 can be used for this process, and as used hereinafter, the term naphtha feedstream is meant to encompass other potential hydrocarbon feedstreams that can be used in cracking and reforming.

[0031] The second separation unit 20 is preferably an adsorption-separation unit, and the separation is controlled by the choice of adsorbent and desorbent. For the present process, the
25 separation unit 20 is designed for separating normal hydrocarbons in the light naphtha stream 12. The normal hydrocarbons are separated and sent out in the extract stream 22, with a raffinate stream 24 comprising non-normal hydrocarbons.

[0032] The raffinate stream 24 can be passed to a reforming unit 40 to generate a process stream 42 comprising aromatics. The process stream 42 can be passed to an aromatics
30 complex for conversion to higher value products.

[0033] While the invention has been described with what are presently considered the preferred embodiments, it is to be understood that the invention is not limited to the disclosed

embodiments, but it is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

SPECIFIC EMBODIMENTS

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[0034] While the following is described in conjunction with specific embodiments, it will be understood that this description is intended to illustrate and not limit the scope of the preceding description and the appended claims.

[0035] A first embodiment of the invention is a process for improving stream cracker
10 feed and processing gasoline blending components, comprising passing a naphtha feedstream to a fractionation column to generate an overhead stream comprising hydrocarbons with normal boiling points below 90°C, and a bottoms stream comprising heavies; passing the overhead stream to a separation unit to generate an extract stream comprising normal hydrocarbons and a raffinate stream comprising non-normal hydrocarbons; passing the
15 extract stream to a cracking unit; and passing the bottoms stream to a reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 72°C. An embodiment of the invention is one, any or all of prior embodiments in this
20 paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 81°C. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons
25 having normal boiling points below 98°C. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the separation unit is an adsorption separation unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the light desorbent is a normal paraffin with a boiling point lower than
30 the lightest feed component, or higher than the boiling point of the heavies components. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the raffinate

stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the raffinate stream to a second fractionation column to generate a second overhead stream and a second bottoms stream. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the overhead stream comprises isobutane and isopentane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column has a side draw, and further comprising generating a side draw stream comprising high octane light naphtha product, wherein the high octane light naphtha product comprises isopentane, cyclopentane, methylcyclopentane and isohexane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the high octane light naphtha product to a gasoline blending stock. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the fractionation column has a side draw, and further comprising generating a side draw stream comprising high octane light naphtha product, wherein the high octane light naphtha product comprises isopentane, cyclopentane, methylcyclopentane, isohexanes, cyclohexane, benzene, and dimethylpentanes. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the high octane light naphtha product to a gasoline blending stock. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the second bottoms stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the second overhead stream to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the reforming unit generates a reformate stream, and further comprising passing the reformate stream to an aromatics recovery unit to generate an aromatics stream and an aromatics raffinate stream comprising normal alkanes. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph further comprising passing the aromatics raffinate stream to the cracking unit. An

embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal hexane and rich in iso-hexane isomers such that the ratio of iso-hexanes to normal hexane is greater than 3. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal pentane and rich in iso-pentane such that the ratio of iso-pentane to normal pentane is greater than 3. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the first embodiment in this paragraph wherein the feed to the catalytic reforming unit has a feed that is depleted in normal butane and rich in iso-butane such that the ratio of iso-butane to normal butane is greater than 3.

[0036] A second embodiment of the invention is a process for improving naphtha stream cracker feedstock and processing gasoline blending components, comprising passing a naphtha feedstream to a fractionation column to generate an overhead stream comprising hydrocarbons with normal boiling points below 75°C, and a bottoms stream; passing the overhead stream to an adsorption separation unit to generate an extract stream comprising normal hydrocarbons and a raffinate stream comprising non-normal hydrocarbons; passing the raffinate stream to a second fractionation column to generate an overhead stream, a side stream and a second bottoms stream; passing the extract stream to a cracking unit; and passing the bottoms stream to a reforming unit to generate a reformate. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising operating the second fractionation column with a second bottom product cut point of 70°C (at atmospheric pressure) and sending the second bottoms product to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising operating the second fractionation column with a second top product cut point of 30°C (at atmospheric pressure) and sending the second overhead product to the reforming unit. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising using the side product from the second fractionation column for gasoline blending. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph wherein the adsorption

separation column uses a light desorbent. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph wherein the light desorbent is n-butane. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph
5 further comprising passing the reformat to an aromatics recovery unit to generate an aromatics stream, and an aromatics raffinate stream comprising non-aromatic compounds. An embodiment of the invention is one, any or all of prior embodiments in this paragraph up through the second embodiment in this paragraph further comprising passing the aromatics raffinate stream to the adsorption separation unit.

10 [0037] Without further elaboration, it is believed that using the preceding description that one skilled in the art can utilize the present invention to its fullest extent and easily ascertain the essential characteristics of this invention, without departing from the spirit and scope thereof, to make various changes and modifications of the invention and to adapt it to various usages and conditions. The preceding preferred specific embodiments are, therefore,
15 to be construed as merely illustrative, and not limiting the remainder of the disclosure in any way whatsoever, and that it is intended to cover various modifications and equivalent arrangements included within the scope of the appended claims.

[0038] In the foregoing, all temperatures are set forth in degrees Celsius and, all parts and percentages are by weight, unless otherwise indicated.

CLAIMS

1. A process for improving stream cracker feed and processing gasoline blending components, comprising:

5 passing a naphtha feedstream to a fractionation column to generate an overhead stream comprising hydrocarbons with normal boiling points below 90°C, and a bottoms stream comprising heavies;

 passing the overhead stream to a separation unit to generate an extract stream comprising normal hydrocarbons and a raffinate stream comprising non-normal hydrocarbons;

10 passing the extract stream to a cracking unit; and

 passing the bottoms stream to a reforming unit.

2. The process of claim 1 wherein the fractionation column is operated to generate an overhead stream comprising hydrocarbons having normal boiling points below 72°C or 81°C or 98°C.

15 3. The process of claim 1 wherein the separation unit is an adsorption separation unit.

4. The process of claim 1 wherein the light desorbent is a normal paraffin with a boiling point lower than the lightest feed component, or higher than the boiling point of the heavies components.

20 5. The process of claim 1 further comprising passing the raffinate stream to the reforming unit.

6. The process of claim 1 further comprising passing the raffinate stream to a second fractionation column to generate a second overhead stream and a second bottoms stream.

25 7. The process of claim 6 wherein the overhead stream comprises isobutane and isopentane.

8. The process of claim 6 wherein the fractionation column has a side draw, and further comprising generating a side draw stream comprising high octane light naphtha product, wherein the high octane light naphtha product comprises isopentane, cyclopentane, methylcyclopentane, isohexanes, cyclohexane, benzene, and dimethylpentanes.

30 9. The process of claim 6 further comprising passing the second bottoms stream to the reforming unit and passing the second overhead stream to the reforming unit.

10. The process of claim 1 wherein the reforming unit generates a reformat stream, and further comprising passing the reformat stream to an aromatics recovery unit to generate an aromatics stream and an aromatics raffinate stream comprising normal alkanes, and further comprising passing the aromatics raffinate stream to the cracking unit.

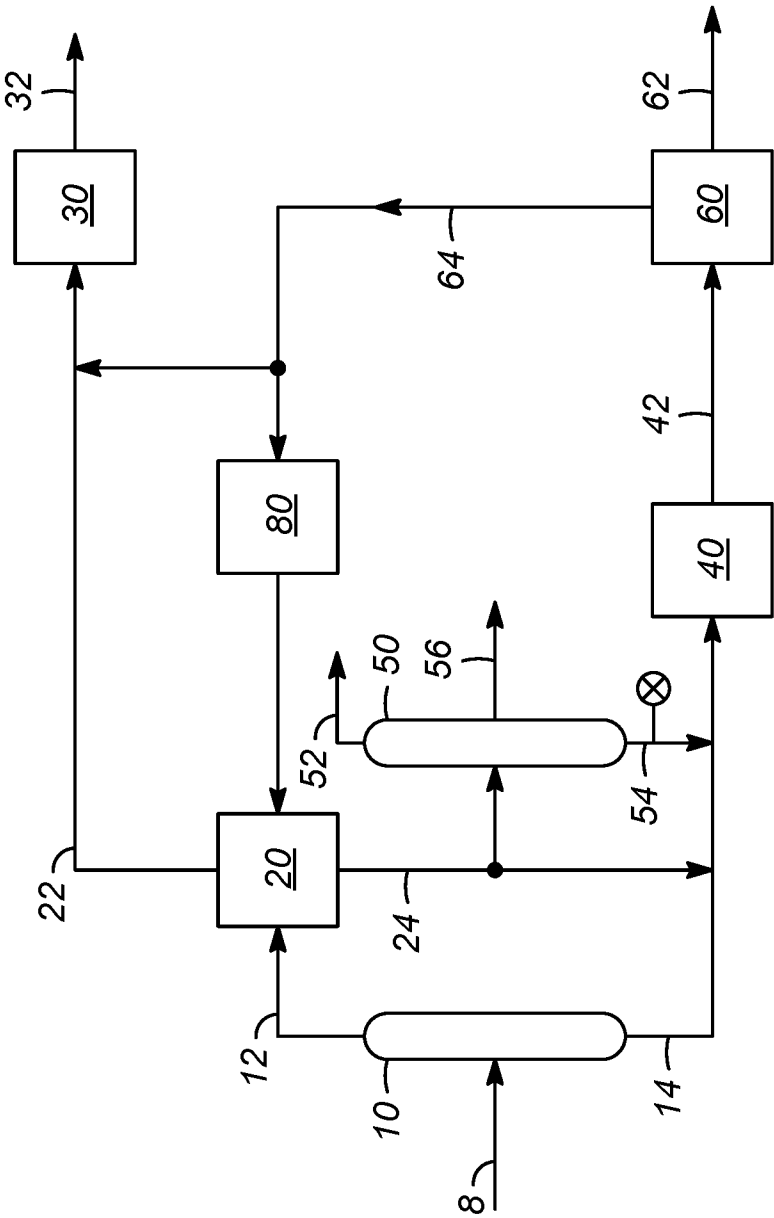


FIG. 1

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 2017/030016

A. CLASSIFICATION OF SUBJECT MATTER				
C10G 61/04 (2006.01)				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols)				
C10G 61/04				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)				
PatSearch, esp@cenet, USPTO, Google				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Y	US 2014/0357914 A1 (UOP LLC) 04.12.2014, paragraphs [0017]-[0020], claims	1-10		
Y	US 4181599 A (CHEVRON RESEARCH COMPANY) 01.01.1980, col. 3-4, fig. 1	1-10		
Y	EP 1930307 A1 (HALDOR TOPSOE A/S) 11.06.2008, claims	4		
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.				
* Special categories of cited documents: <table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 50%;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="vertical-align: top; width: 50%;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search		Date of mailing of the international search report		
19 June 2017 (19.06.2017)		20 July 2017 (20.07.2017)		
Name and mailing address of the ISA/RU: Federal Institute of Industrial Property, Berezhkovskaya nab., 30-1, Moscow, G-59, GSP-3, Russia, 125993 Facsimile No: (8-495) 531-63-18, (8-499) 243-33-37		Authorized officer A. Sedov Telephone No. 8 (495)-531-64-81		