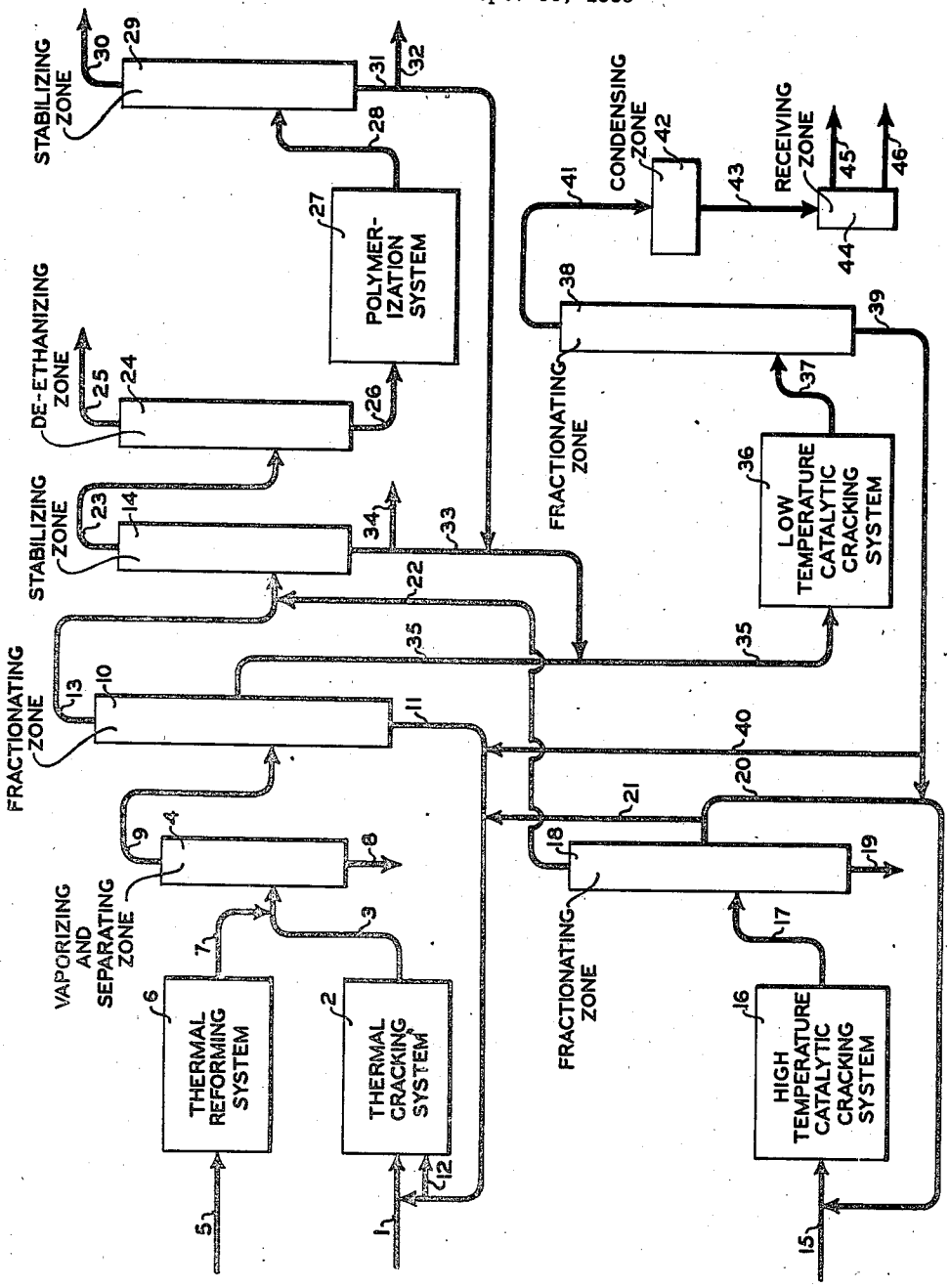
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HYDROCARBON CONVERSION

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HYDROCARBON CONVERSION

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This invention relates to a process for producing principally aviation gasoline but when desired both motor and aviation gasoline, and more specifically it is concerned with a novel combination of interdependent steps wherein hydrocarbon oils of different characteristics and selected intermediate conversion products are subjected to the optimum conditions for their conversion into gasoline.

The invention involves principally thermal reforming treatment of a relatively light hydrocarbon oil, such as gasoline, naphtha, or kerosene, or any desired mixture thereof, thermal cracking treatment of a relatively heavy hydrocarbon oil, such as topped or reduced crude, high temperature catalytic cracking treatment of an oil intermediate to the two first mentioned oils, such as kerosene or gas-oil, polymerization treatment of the gases formed in the process, and low temperature catalytic cracking treatment of the gasolines formed in the process, including the polymer gasoline, in commingled state with light intermediate conversion products from the thermal cracking and reforming treatments.

The gasolines formed in the thermal cracking and reforming and high temperature catalytic cracking treatments generally contain high percentanges of olefinic hydrocarbons and, of course, the polymer gasoline formed by the polymerization of olefinic gases is predominantly olefinic. These gasolines, naturally, due to their high olefin content, have high octane ratings, but their susceptibility to anti-knocking agents is relatively poor. In addition, cracked gasolines containing a high percentage of olefins, after relatively short storage periods and frequently upon use, have been shown to contain undesirable gum compounds. The cracked gasolines employed as ordinary motor fuel, at the present time, are inhibited with suitable antioxidants to retard the formation of gums, and this method, in so far as gasoline for motor vehicles is concerned, has proven to be entirely satisfactory.

The standards adopted for aviation gasoline, on the other hand, require a gasoline containing a relatively small proportion of olefins in order to limit the possibilities of motor failure due to the presence or formation of gums in the gasoline. I have found that I can produce a gasoline of low potential gum content, which meets the acid heat requirements, and upon the addition of minor amounts of antiknocking agents the octane requirements of aviation gasoline by subjecting any one or all of gasolines formed in the thermal cracking and reforming treatments in the high temperature catalytic cracking treatment and the gas polymerization treatment to low temperature catalytic cracking treatment in the presence of intermediate conversion products formed in a thermal cracking treatment. The gasoline produced in this manner has a relatively low olefin content and a good susceptibility to antiknocking agents.

The term "thermal cracking treatment" as used throughout the specification and claims refers to the conversion of heavy hydrocarbons into lighter hydrocarbons by heat and pressure, and in all cases involves the scission of carbon to carbon bonds, although other reactions may also be involved. The term "thermal reforming treatment," on the other hand, refers to the treatment of relatively light hydrocarbons to improve their octane rating and may involve the scisson of carbon to carbon bonds, the scission of carbon to hydrogen bonds, cyclization, and many other reactions of lesser importance. The term "polymerization treatment" refers generally to the polymerization of olefinic gases into normally liquid polymers in the presence of suitable polymerizing catalysts, such as phosphoric or sulphuric acids. The term "high temperature catalytic cracking treatment" refers to the treatment of hydrocarbon oils in the presence of catalytically active masses at temperatures ranging, for example, from 800 to 1200° F., at pressures varying from substantially atmospheric to 200 pounds or more per square inch, and at a liquid hourly space velocity of from 2 to 10 volumes of hydrocarbon material per volume of catalyst to effect substantial conversion to gasoline boiling range hydrocarbons and ordinarily involves the scission of carbon to carbon bonds, although other reactions, such as cyclization, and the scission of carbon to hydrogen bonds may also take place. The term "low temperature catalytic cracking treatment" refers to the treatment of hydrocarbons at relatively low temperatures ranging, for example, from 500 to 900° F., at pressures ranging from substantially atmospheric to 200 pounds or more per square inch, and at liquid hourly space velocities of from .5 to 2 volumes of hydrocarbon material per volume of catalyst in the presence of a catalyst of essentially the same composition as that employed in the high temperature catalytic cracking treatment and the reaction is essentially that of hydrogen transfer.

The reaction involved in low temperature catalytic cracking is essentially one of transferring hydrogen from the heavier hydrocarbons to the

lighter olefinic hydrocarbons to convert the latter into paraffinic hydrocarbons, although cracking, cyclization, and isomerization may also be involved. It is believed that in the low temperature catalytic cracking treatment saturated hydrocarbons and particularly the naphthenic hydrocarbons of the intermediate conversion products act as hydrogen donors for the olefinic hydrocarbons of the gasoline, while the olefinic hydrocarbons become saturated to form paraffinic hydrocarbons and the naphthenic hydrocarbons are converted to aromatic hydrocarbons. Various other reactions, such as, for example, dehydrogenation and cyclization of an aliphatic hydrocarbon to form an aromatic hydrocarbon with the formation of two or three molecules of hydrogen which attach to the unsaturated olefinic hydrocarbons may also take place. However, since the invention is concerned primarily with a process and apparatus in which the various reactions may be conducted, further discussion with regard to the chemical reactions which may possibly be involved is unnecessary, for a full understanding of the invention which is to be described in more detail later.

In one specific embodiment the invention comprises subjecting a relatively heavy hydrocarbon oil and a heavy reflux condensate to pyrolytic conversion in a thermal cracking system, concurrently therewith subjecting a relatively light hydrocarbon oil to pyrolytic conversion in a thermal reforming system, commingling the conversion products from said thermal reforming system and said thermal cracking system, separating a non-vaporous liquid residue from the vaporous conversion products of the mixture and recovering the former, fractionating said vaporous conversion products to form light and heavy reflux condensates and to separate fractionated vapors in the gasoline boiling range, concurrently subjecting a hydrocarbon oil boiling intermediate to the two first mentioned oils, together with intermediate conversion products formed in this and a subsequent step to conversion in a high temperature catalytic cracking system, fractionating the conversion products from said high temperature catalytic cracking system to separate liquid residue, intermediate conversion products, and gasoline boiling range vapors, recovering said liquid residue, subjecting the intermediate conversion products to further conversion in the same system, commingling said gasoline boiling range vapors with said fractionated vapors from the first mentioned fractionation and stabilizing the mixture to remove substantially all of the normally gaseous hydrocarbons and hydrogen from the normally liquid hydrocarbons, fractionating said normally gaseous hydrocarbons and hydrogen to remove gases consisting essentially of hydrogen, methane, and C_2 hydrocarbons from the heavier normally gaseous hydrocarbons, recovering the former, subjecting said heavier normally gaseous hydrocarbons to polymerization treatment, stabilizing the products of the polymerization treatment to separate unreacted normally gaseous hydrocarbons from the normally liquid polymers, recovering the former, commingling said normally liquid polymers and said normally liquid hydrocarbons from the first mentioned stabilization with the light reflux condensate from the first mentioned fractionation and subjecting the mixture to conversion treatment in the low temperature catalytic cracking system, fractionating the conversion products from said low temperature catalytic cracking system to separate gasoline boiling range hydrocarbons from the higher boiling components, supplying said higher boiling components to the conversion treatment in said high temperature catalytic cracking system, cooling and condensing said gasoline boiling range hydrocarbons and recovering the resulting distillate and gas as products of the process.

The accompanying drawing illustrates diagrammatically the flow of the invention. Simplified means have been adapted in illustrating the various conversion systems for convenience and for ease in demonstrating the flexibility of the process.

Referring now to the drawing, a relatively heavy hydrocarbon oil, such as, for example, topped or reduced crude oil is introduced through line 1 to thermal cracking system 2. Concurrently therewith, heavy reflux condensate, formed as hereinafter described, is likewise introduced to thermal cracking system 2. The hydrocarbon oil and heavy reflux condensate introduced to thermal cracking system 2 are subjected to pyrolytic conversion therein in either the same or separate heating coils and the conversion products thereafter subjected to prolonged conversion, when desired, in a communicating reaction chamber. Conversion temperatures employed in system 2 may vary depending upon the type of charging stock treated and whether one or more heating coils are employed. However, in general, conversion temperatures will fall within the approximate range of 800 to 1000° F. while employing superatmospheric pressures of from 100 to 500 pounds or more per square inch.

The conversion products from cracking system 2 are directed through line 3 into vaporizing and separating zone 4, which is preferably maintained at a reduced pressure relative to that employed in system 2, in order to obtain a separation between the vaporous and liquid conversion products and to effect substantial further vaporization of said liquid conversion products to form a non-vaporous liquid residue. The pressure employed in zone 4, depending upon the conditions employed in system 2, may range, for example, from 25 to 200 pounds or more per square inch.

In addition to the thermal cracking treatment of a heavy hydrocarbon oil, the invention also proposes to thermally reform a relatively light hydrocarbon oil, such as gasoline, naphtha, or kerosene, or any mixture thereof, and to catalytically crack an intermediate oil, such as gas-oil, at relatively high temperatures to produce more valuable products than either of the two last mentioned charging stocks. The use of either of these operations is optional and may depend upon the amount of high octane substantially saturated motor fuel desired, which may vary for each specific case. In accordance with the objects of the invention, however, since both thermal reforming and high temperature catalytic cracking yield a gasoline product rich in olefinic hydrocarbons and since the objective in all cases is to treat each hydrocarbon oil under the optimum conditions for the production of motor fuel, such operations may be conveniently employed in combination with a thermal cracking treatment and the gasolines produced in all cases subjected to low temperature catalytic cracking treatment to produce a substantially saturated motor fuel.

Thermal reforming treatment, in the case here

illustrated, may be accomplished by directing a relatively light hydrocarbon oil, such as, for example, gasoline, naphtha, or kerosene, or any mixture thereof, through line 5 into thermal reforming system 6. Thermal reforming system 6, in most instances, will comprise a heating coil to which the hydrocarbons are charged and will employ conversion temperatures ranging, for example, from 900 to 1050° F. and superatmospheric pressures of the order of 500 to 1200 pounds or more per square inch. The conversion products from system 6, in the case here illustrated, are directed through line 7, commingling in line 3 with the conversion products from system 2 and the mixture thereafter introduced to zone 4 where the vaporous components are separated from the liquid components in the manner previously described.

Liquid residue separated in zone 4 is removed therefrom by way of line 8, cooled and recovered as a product of the process, or subjected to any desired further treatment, the latter comprising, for example, coking or solvent extraction. Vaporous conversion products, together with vapors evolved within zone 4, are removed therefrom by way of line 9 and introduced to fractionating zone 10, which is preferably maintained at a superatmospheric pressure substantially the same as that employed in zone 4.

The vapors introduced to fractionating zone 10 are subjected to fractionation therein to separate fractionated vapors boiling in the range of gasoline or, when desired, containing hydrocarbons boiling above the range of gasoline from the higher boiling components and the latter condensed in zone 10 as light and heavy reflux condensate. Heavy reflux condensate formed in zone 10 is removed therefrom by way of line 11 and introduced to thermal cracking system 2, either by commingling the same with the heavy hydrocarbon oil in line 1 when a single heating coil is employed, or by introducing the heavy reflux condensate to system 2 by way of line 12 when separate heating coils are employed. Fractionated vapors separated in zone 10 are removed therefrom by way of line 13, preferably cooled and introduced to stabilizing zone 14 for treatment as hereinafter described either alone or in commingled state with cooled vapors boiling substantially in the range of gasoline, formed as subsequently described, in a high temperature catalytic cracking system.

When the high temperature catalytic cracking system is employed, an oil boiling intermediate to the thermal cracking and thermal reforming stocks is introduced through line 15 to high temperature catalytic cracking system 16, either alone or in admixture with intermediate conversion products formed in the system, or in a subsequent low temperature catalytic cracking system. The high temperature catalytic cracking system 16 may comprise, for example, a heating coil wherein the intermediate hydrocarbon oil or the mixture is vaporized and raised to the desired conversion temperature, preferably in the absence of pyrolytic cracking. In addition, system 16 included a reactor zone, and preferably a plurality of reactor zones containing a suitable cracking catalyst with which the hydrocarbon vapors are contacted preferably while maintaining the temperature of the vapors substantially the same as that employed on the outlet of the heating coil. In addition, since relatively short periods of operation are employed in the catalytic cracking because of the rapid deposition of carbon upon the surface and within the pores of the catalyst particles, provisions are made for reactivating the catalyst and for segregating one or more of the reactors to accomplish reactivation while conversion of the hydrocarbon vapors is being accomplished in the other or others.

The preferred cracking catalysts for use in the present process consist in general of a precipitated alumina hydrogel and/or zirconia hydrogel composited with silica hydrogel, the gel composite being washed, dried, formed into particles, and calcined to produce a catalytic mass. It is not intended, however, that the process should be limited to these particular catalysts, for other catalysts, such as, for example, the hydrosilicates of alumina, acid treated clays, and the like, may be used within the broad scope of the invention.

In the following specification and claims the terms silica, alumina, silica-zirconia, and silica-alumina-zirconia masses are used in the broad sense to designate the synthetic composites referred to above. The preferred catalysts may be prepared by precipitating silica from a solution as a hydrogel within or upon which the alumina and/or zirconia are deposited also by precipitation as hydrogels. The silica hydrogel may conveniently be prepared by acidifying an aqueous solution of sodium silicate by the addition of a required amount of hydrochloric acid. After precipitating, the silica gel is preferably washed until substantially free from alkali metal salts. The washed silica hydrogel is then suspended in a solution of alumina and/or zirconia salts and an alkaline precipitant, such as ammonium hydroxide, ammonium carbonate or ammonium sulfide added to the solution to precipitate aluminum and/or zirconium hydrogels. The final precipitate, comprising essentially hydrated silica and hydrated alumina and/or zirconia, is washed to substantially completely remove water soluble materials and dried at about 300° F. and pelleted or sized to produce particles of catalyst after which the catalyst particles are calcined at a temperature in the approximate range of 1000 to 1500° F. Various other procedures, such as, for example, coprecipitation of the hydrated gels may be employed, when desired, to produce the preferred catalyst.

When using the preferred catalysts temperatures of the order of 800 to 1200° F. may be employed with a pressure ranging, for example, from substantially atmospheric to 200 pounds or more per square inch and with liquid hourly space velocities of from 2 to 10 volumes of hydrocarbon material per volume of catalyst.

The conversion products from system 16 are removed therefrom by way of line 17 and introduced to fractionating zone 18, which is maintained at substantially the same or at a reduced pressure relative to that employed in system 16. When heavy hydrocarbons, unsuitable for further conversion either in system 2 or system 16, are present in the conversion products from system 16, provisions may be made in zone 18 for separating the same from the lighter hydrocarbons. This may be accomplished by separating the non-vaporous liquid hydrocarbons from the vaporous hydrocarbons in the lower portion of zone 18 and recovering the former by way of line 19. The lighter vaporous hydrocarbons are fractionated in zone 18 to separate vapors boiling substantially in the range of gasoline or, when desired, vapors, including hydrocarbons, boiling above the range of gasoline from the higher boiling hydrocarbons, the latter being

condensed in the fractionating zone. Reflux condensate formed in zone 18 is removed therefrom by way of line 20 and subjected to further conversion in system 16, as previously described, or supplied in part or all to thermal cracking system 2 by directing the same through line 21 into line 11 and commingling it therein with reflux condensate from zone 10. Vapors separated in zone 18 are removed therefrom by way of line 22 and commingled in line 13 with fractionated vapors from zone 10, as previously described.

Vapors from zones 18 and 10, preferably after cooling and condensation thereof, are subjected to stabilization in zone 14 by fractionation to remove substantially all of the normally gaseous hydrocarbons. To accomplish this, zone 14 is preferably maintained under a superatmospheric pressure of from 50 to 200 pounds per square inch with a top temperature of from 100 to 200° F. The normally gaseous hydrocarbons and hydrogen separated in zone 14 are removed therefrom by way of line 23 and introduced to deethanizing zone 24 which is operated under a superatmospheric pressure ranging, for example, from 400 to 800 pounds or more per square inch, wherein the C_2 normally gaseous hydrocarbons, methane, and hydrogen are separated by fractionation from the heavier normally gaseous hydrocarbons. The light gas fraction, including the C_2 hydrocarbons separated in zone 24, is removed therefrom by way of line 25 and recovered as a product of the process or subjected to any desired further treatment.

The heavy normally gaseous hydrocarbons separated in zone 24, which include the C_3 and C_4 hydrocarbons, are removed therefrom by way of line 26 and introduced to polymerization system 27. Polymerization system 27 may comprise, for example, a heating coil or heat exchanger used for heating the normally gaseous hydrocarbons to the desired polymerizing temperature. In addition, it may include a reactor, and preferably a plurality of reactors containing polymerizing catalysts with which the normally gaseous hydrocarbons are contacted. Furthermore, reactors employed in system 27 are preferably provided with a means for withdrawing heat during the polymerization reaction.

Catalysts which may be employed for effecting polymerization in system 27 may comprise, for example, a phosphoric acid-containing catalyst or a sulfuric acid catalyst. However, sulfuric acid is more selective to the polymerization of the C_4 hydrocarbons, and particularly isobutene, and therefore the phosphoric acid-containing catalyst is the preferred catalyst. The phosphoric acid-containing catalyst consists in general of a mixture of a relatively inert carrier, such as kieselguhr impregnated with the ortho or pyrophosphoric acid and is preferably precalcined before using. When using the preferred catalyst, polymerizing temperatures in the approximate range of 250 to 450° F. may be employed with a superatmospheric pressure ranging, for example, from 500 to 1200 pounds or more per square inch.

The products from the polymerization treatment in zone 27 are removed therefrom by way of line 28 and introduced to stabilizing zone 29 wherein the residual normally gaseous hydrocarbons are separated by fractionation from the normally liquid polymers. Stabilizing zone 29, in the case here illustrated, may be operated under a superatmospheric pressure of from 40 to 150 pounds or more per square inch. Normally gaseous hydrocarbons separated in zone 29 are removed therefrom by way of line 30 and recovered as a product of the process, and preferably the butane hydrocarbons contained therein are separated therefrom for blending to increase the vapor pressure of the distillate recovered from the process.

Normally liquid polymers separated in zone 29 are removed therefrom by way of line 31 and a portion or all may be recovered as a product of the process by way of line 32. Preferably, however, and in accordance with the object of this invention, at least a portion of said normally liquid polymers are commingled with the normally liquid hydrocarbons removed from zone 14 by way of line 33. The normally liquid hydrocarbons removed from zone 14 by way of line 33 may also be recovered in part or all as a product of the process by way of line 34. However, they are preferably commingled with the normally liquid polymers, as previously described, and the mixture introduced to line 35. In line 35 the normally liquid polymers and hydrocarbons are commingled with light reflux condensate removed from zone 10 and the mixture introduced to low temperature catalytic cracking system 36.

Low temperature catalytic cracking system 36 may comprise, for example, a heating coil to which the mixture is supplied for heating to the desired conversion temperature. In addition, it may comprise a plurality of reactor zones containing a cracking catalyst of essentially the same composition as that described in connection with the high temperature catalytic cracking treatment in system 16 to which the heated mixture is supplied. The low temperature catalytic cracking treatment in system 36 may employ conversion temperatures ranging, for example, from 500 to 900° F., pressures ranging, for example, from substantially atmospheric to 200 pounds or more per square inch, and liquid hourly space velocities of from .5 to 2 volumes of hydrocarbon material per volume of catalyst.

The conversion products from system 36 are removed therefrom by way of line 37 and introduced to fractionating zone 38, which is preferably maintained at substantially the same or at a reduced pressure relative to that employed in system 36. The conversion products introduced to zone 38 are subjected to fractionation therein to separate fractionated vapors boiling in the range of gasoline from the higher boiling hydrocarbons and the latter condensed as reflux condensate in the fractionating zone. Reflux condensate formed in zone 38 is removed therefrom by way of line 39 and commingled in part or all with the reflux condensate from zone 18 in line 20 for conversion in system 16, or a portion or all may be directed through line 40 and commingled with the heavy reflux condensate from zone 10 in line 11 for conversion in system 2.

Fractionated vapors separated in zone 38 are removed therefrom by way of line 41 and subjected to cooling and condensation in condensing zone 42. Distillate, together with undissolved and uncondensed gases, are directed from zone 42 through line 43 into receiving zone 44 where the distillate and gases are collected and separated. Undissolved and uncondensed gases separated in zone 44 are removed therefrom by way of line 45 and recovered as a product of the process. Distillate collected and separated in zone 44 is removed therefrom by way of line 46 and recovered as a product of the process.

An example of one specific operation of the process as above described is approximately as follows:

A 25° A. P. I. gravity Mid-Continent reduced crude oil was subjected to conversion in a heating coil at an outlet conversion temperature on the heating coil of 930° F. and an outlet pressure of 250 pounds per square inch, and the conversion products from the heating coil introduced to a reaction chamber maintained at substantially the same pressure as that employed on the outlet of the heating coil.

In another step of the process, a 54° A. P. I. gravity straight run gasoline from a Mid-Continent crude oil was subjected to pyrolytic reforming treatment in a heating coil employing an outlet temperature of 1000° F. and an outlet pressure of approximately 750 pounds per square inch.

The conversion products from the reaction chamber were commingled with the conversion products from the reforming treatment and the mixture introduced to a vaporizing and separating chamber maintained at a superatmospheric pressure of approximately 75 pounds per square inch. In the vaporizing and separating chamber non-vaporous liquid residue of 10° A. P. I. gravity was separated from the vaporous conversion products and the former recovered as a product of the process. The vaporous conversion products were introduced to a fractionator maintained at substantially the same pressure as that maintained in the vaporizing and separating chamber and subjected to fractionation therein to separate fractionated vapors boiling substantially in the range of gasoline from the higher boiling components and the latter condensed as light and heavy reflux condensate. The heavy reflux condensate was subjected to pyrolytic conversion in a third heating coil employing an outlet conversion temperature of 945° F. and an outlet pressure of approximately 250 pounds per square inch and the conversion products therefrom commingled with the conversion products from the first mentioned heating coil prior to their introduction to the reaction chamber.

In another step of the process a 36° A. P. I. gravity gas-oil from a Mid-Continent crude oil was vaporized and heated to a temperature of 950° F. and the vapors subjected to contact with a silica-alumina-zirconia catalyst at a pressure of approximately 60 pounds per square inch and a liquid hourly space velocity of 4. The conversion products from this treatment were subjected to fractionation at a superatmospheric pressure substantially the same as that employed in the catalytic conversion reaction to separate vapors boiling in the range of gasoline from the higher boiling components and the latter condensed as reflux condensate and supplied to the thermal cracking treatment in commingled state with the heavy reflux condensate formed as previously described.

The gasoline boiling range hydrocarbons, together with the gaseous hydrocarbons formed in the process after cooling and condensation, were commingled and the mixture introduced to a stabilizing zone maintained at a superatmospheric pressure of approximately 60 pounds per square inch whereby to separate substantially all of the normally gaseous hydrocarbons and hydrogen from the gasoline distillate. The normally gaseous hydrocarbons and hydrogen were introduced to a de-ethanizing zone maintained at a superatmospheric pressure of approximately 600 pounds per square inch to separate the lighter gases, including those having two carbon atoms to the molecule, from the heavier normally gaseous hydrocarbons and the former recovered as a product of the process.

The heavier normally gaseous hydrocarbons, comprising C_3 and C_4 hydrocarbons, were subjected to polymerization in the presence of a phosphoric acid-containing catalyst at a temperature of 400° F. and a superatmospheric pressure of 1000 pounds per square inch. The products of the polymerization reaction were fractioned at a pressure of 60 pounds per square inch to separate residual normally gaseous hydrocarbons from the normally liquid polymers and the former recovered as a product of the process.

The normally liquid polymers and the distillate were commingled with light reflux condensate, formed as previously described, and the mixture heated to a temperature of 750° F. and subjected to contact with a silica-alumina-zirconia catalyst at a pressure of approximately 100 pounds per square inch and a liquid hourly space velocity of 1. The conversion products from this treatment were subjected to fractionation at a superatmospheric pressure substantially the same as that maintained in the catalytic treatment to separate gasoline boiling range hydrocarbons from the heavier hydrocarbons and the latter condensed as reflux condensate and supplied to the thermal cracking treatment in commingled state with the heavy reflux condensate. Fractionated vapors were subjected to cooling and condensation and the resulting distillate and gas collected and separated.

The yields from this operation, based on the total charge to the process comprising approximately 40% reduced crude oil, 25% straight-run gasoline, 35% gas-oil, were approximately as follows:

60% 300 end point gasoline having an octane rating of 71, a bromine number of 9, and 27% of 10° A. P. I. gravity residue, the balance being attributed principally to gas and loss.

I claim as my invention:

1. A conversion process which comprises subjecting hydrocarbon oil to thermal cracking, separating from the resultant products reflux condensate heavier than gasoline, a gasoline distillate and a normally gaseous fraction containing polymerizable olefins, subjecting said fraction to polymerization, separating a polymer fraction boiling substantially within the range of gasoline from resultant olefin polymers, and subjecting said polymer fraction to the action of a cracking catalyst at a temperature in the approximate range of 500 to 900° F. for a sufficient time and in admixture with a sufficient quantity of said reflux condensate to substantially saturate the polymers by the transfer of hydrogen thereto from the reflux condensate.

2. A conversion process which comprises subjecting hydrocarbon oil to thermal cracking, separating from the resultant products reflux condensate heavier than gasoline, a gasoline distillate and a normally gaseous fraction containing polymerizable olefins, subjecting said fraction to polymerization, separating a polymer fraction boiling substantially within the range of gasoline from resultant olefin polymers, and subjecting said polymer fraction and at least a portion of said gasoline distillate to the action of a cracking catalyst at a temperature in the approximate range of 500 to 900° F. for a sufficient time and in admixture with a sufficient

quantity of said reflux condensate to substantially saturate the polymers by the transfer of hydrogen thereto from the reflux condensate.

3. The process as defined in claim 1 further characterized in that said reflux condensate is separated into relatively light and heavy fractions, the heavier fraction thereof returned to the thermal cracking and the lighter fraction thereof combined with the olefin polymers as the hydrogen donor in the catalytic conversion step.

4. A conversion process which comprises thermally cracking hydrocarbon oil heavier than gasoline, thermally reforming a lighter oil containing gasoline fractions of low anti-knock value, fractionating the products of the cracking and reforming steps in admixture to separate therefrom reflux condensate heavier than gasoline, a gasoline distillate and a normally gaseous fraction containing polymerizable olefins, subjecting said fraction to polymerization, combining resultant olefin polymers with at least a portion of said gasoline distillate, and subjecting the resultant mixture to the action of a cracking catalyst at a temperature in the approximate range of 500 to 900° F. for a sufficient time and in admixture with a sufficient quantity of said reflux condensate to substantially saturate said mixture by the transfer of hydrogen thereto from the reflux condensate.

5. The process as defined in claim 4 further characterized in that said reflux condensate is separated into relatively light and heavy fractions, the heavier fraction thereof returned to the thermal cracking and the lighter fraction thereof combined with the olefin polymers as the hydrogen donor in the catalytic conversion step.

6. A process as defined in claim 4 which further includes catalytic cracking of a second oil heavier than gasoline and the combining of resultant olefinic gasoline with the materials subjected to the action of said cracking catalyst.

7. A conversion process which comprises subjecting hydrocarbon oil to thermal cracking, separating from the resultant products reflux condensate heavier than gasoline, a gasoline distillate and a normally gaseous fraction containing polymerizable olefins, subjecting said fraction to polymerization, separating a polymer fraction boiling substantially within the range of gasoline from resultant olefin polymers, and subjecting at least a portion of said polymer fraction to the action of a cracking catalyst at a temperature in the approximate range of 500 to 900° F. for a sufficient time and in admixture with a sufficient quantity of said reflux condensate to substantially saturate the polymers by the transfer of hydrogen thereto from the reflux condensate.

8. A conversion process which comprises subjecting hydrocarbon oil to thermal cracking, separating from the resultant products reflux condensate heavier than gasoline, a gasoline distillate and a normally gaseous fraction containing polymerizable olefins, subjecting said fraction to polymerization, simultaneously subjecting another hydrocarbon oil, heavier than gasoline, to catalytic cracking, combining resultant olefin polymers with resultant olefinic gasoline formed in the catalytic cracking step, and subjecting the mixture to the action of a cracking catalyst at a temperature in the approximate range of 500 to 900° F. for a sufficient time and in admixture with a sufficient quantity of said reflux condensate to substantially saturate the gasoline and polymers by the transfer of hydrogen thereto from the reflux condensate.

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