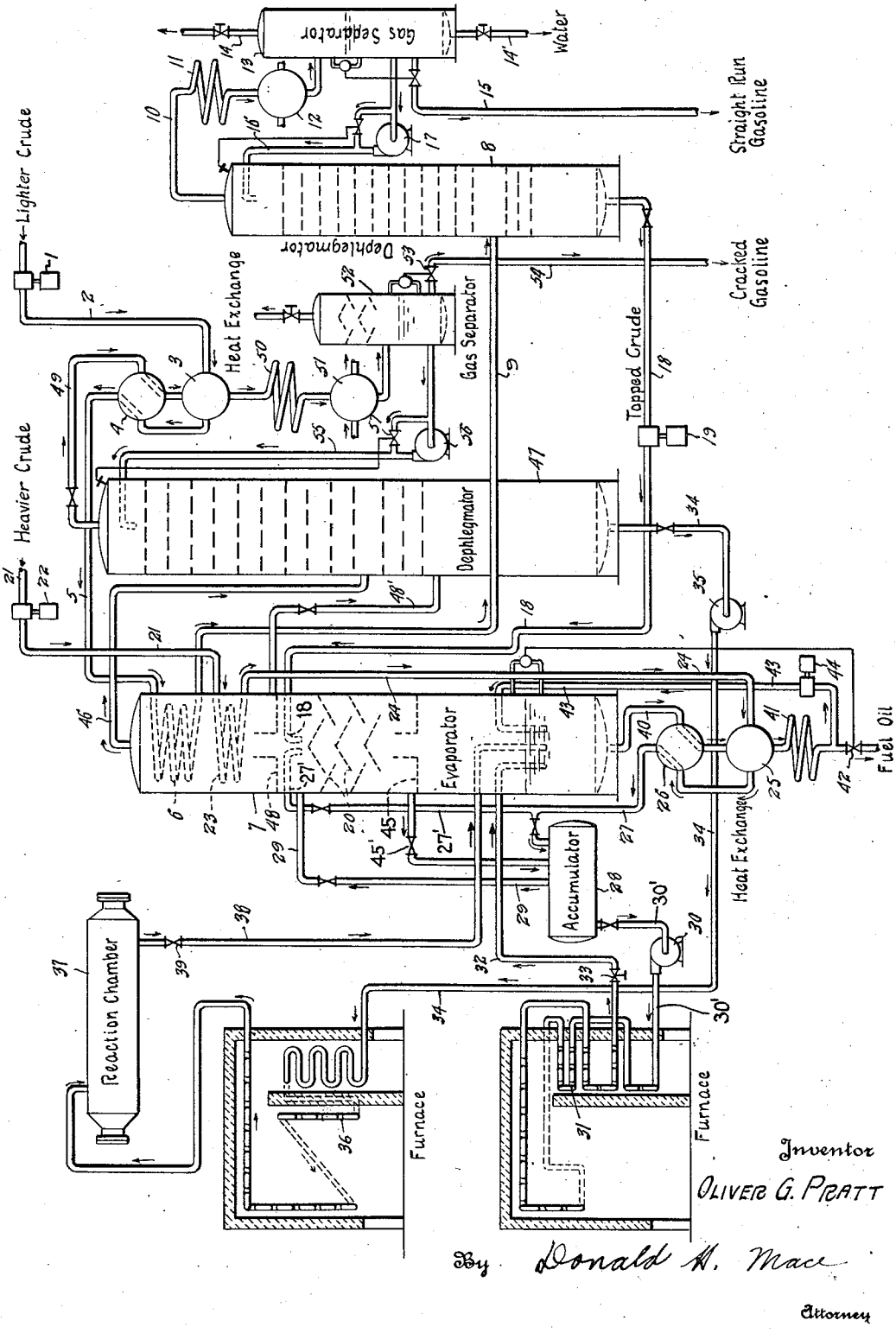
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TREATING HYDROCARBON OILS

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TREATING HYDROCARBON OILS

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This invention relates in general to the treatment of hydrocarbon oils and more particularly has reference to a process for converting high boiling point oils into hydrocarbons having low boiling points.

Certain crude oils contain considerable amounts of natural gasoline. Gasoline may be obtained from crude oils of this type by heating the same to temperatures sufficiently high to drive off the lighter fractions. In addition to obtaining gasoline from crude oils by separating the natural gasoline therefrom, it is also possible to obtain gasoline from heavy hydrocarbon oils by subjecting the heavy hydrocarbon oils to conditions of temperature and pressure favorable to cracking or conversion. In this instance, the molecules of the heavy hydrocarbon are broken down into smaller molecules, which result in the production of the so called light hydrocarbons. The present process contemplates the combination of the two processes outlined above, whereby crude oil may be treated to remove the natural gasoline fractions therefrom and then the topped crude is further treated to obtain further lighter products.

The major object of this invention is to devise a process of producing gasoline-like hydrocarbons from crude oil.

Another object of this invention is to devise a method whereby crude oil is subjected to treatments to remove the natural gasoline therefrom, and then is further treated to obtain additional quantities of gasoline from the remaining heavy hydrocarbons.

Yet another object of this invention is to devise a method of producing gasoline-like hydrocarbons from crude oil wherein two streams of crude oil having different specific gravities are treated simultaneously to remove natural gasoline therefrom and to obtain additional quantities of gasoline-like hydrocarbons from the remaining residue.

Still another object of this invention is to devise a method wherein two streams of crude oil of different specific gravities are treated to remove light fractions therefrom, and are then introduced together with a synthetic crude resulting from a cracking operation into an evaporator wherein vaporizable materials, including relatively clean stock suitable for drastic cracking, are separated from unvaporizable residues.

A still further object of this invention is to provide a method wherein two streams of crude oil are treated in a manner to obtain the maximum yield of gasoline-like hydrocarbons therefrom.

With these and other objects in view, the present invention comprehends the treatment of two streams of crude oil of different specific gravities wherein the stream of crude having the lowest specific gravity and a substantial natural gasoline content is separately treated to remove its natural gasoline fraction therefrom and in which the resulting topped crude, together with the second stream of crude oil, containing substantially little, if any, natural gasoline, are both introduced into a zone of reduced pressure, together with a synthetic crude resulting from a cracking operation to obtain a mixture of vapors from which gasoline-like hydrocarbons and stock suitable for the cracking operation may be obtained.

In order to make my invention more clearly understood, I have shown, in the accompanying drawing, means for carrying the same into practical effect, without limiting the improvements in their useful applications, to the particular construction which, for the purpose of explanation, have been made the subject of illustration.

In the drawing, the single figure is a diagrammatic representation of a plant layout in which the present process may be carried into effect.

As hereinbefore intimated, the present invention consists in the combination of processes for obtaining gasoline wherein natural gasoline is separated from one crude oil which contains a substantial quantity of natural gasoline and then the resulting topped crude is further treated together with additional heavier crude oil containing substantially little, if any, natural gasoline to obtain additional gasoline-like fractions. In carrying out the invention, the two crude oils are treated simultaneously in the system. The stream of crude oil having the highest natural gasoline content, or lower gravity, is separately heated to sufficiently high temperatures to effect the topping of the oil to vaporize and thereby separate the natural gasoline therefrom. The other, or second, stream of crude oil, which is of a higher specific gravity, and contains less natural gasoline, is subjected to a partial topping or distillation and is then heated in admixture with the other reduced crude (the first) to temperatures sufficiently high to effect vaporization of at least the lighter fractions, and preferably sufficient to effect cracking of the reduced or topped crude mixture to effect a substantial reduction of the viscosity of the mixture and the production of relatively clean stock suitable to be cracked into gasoline. These two crudes are then introduced together with a synthetic crude oil, produced as

a result of the cracking of relatively clean condensate stocks separated from the treated reduced crude-mixture, into a low-pressure evaporating zone wherein the lighter fractions separate as vapors from the heavy and unvaporized fractions.

The lighter or vaporous fractions evolved in the low-pressure evaporating zone are dephlegmated to produce a reflux condensate and vaporous fraction consisting chiefly of gasoline-like hydrocarbons. The reflux condensate produced comprises the relatively clean charging stock for the cracking operation in which the synthetic crude introduced into the evaporator is produced.

Referring now to the drawing, there is shown a diagrammatic layout in which a low specific gravity crude oil having a substantial natural gasoline content, such as Pettus crude (47° A. P. I.) is forced by a pump 1 through a supply line 2. From the pump 1, the crude oil passes serially through heat exchangers 3 and 4, wherein the temperature of the crude is raised by the heat abstracted from vapors passing through the heat exchangers and being discharged into condensing means 50 and from the system. From the heat exchanger 4, the crude oil then passes through conduit 5 through a heat exchange element 6, which is positioned in the upper portion of an evaporator tower 7. In passing through the heat exchangers 3 and 4 and through the heat exchange element 6 in the evaporator 7, the crude oil gradually has its temperature raised until the oil is hot enough to cause the evolution of the lighter fractions, including the gasoline-like constituents thereof, upon a release of pressure thereon. It has been found that desirable results may be obtained by so proportioning the surfaces of the heat exchangers 3 and 4 so that a crude oil at a temperature of approximately 70° F. upon emerging from the heat exchanger 4 will be raised to a temperature of 358° F. The surface of the heat exchange element 6 and the conditions should be regulated so that upon being discharged from the heat exchange element 6, the temperature of the crude will be approximately 550° F.

If the crude is at a temperature of approximately 550° F. as it is discharged from the heat exchange element 6, the lighter, or volatile fractions, including gasoline, will be vaporized upon the introduction of the crude into the topping tower or dephlegmator 8. As the crude is introduced into the tower 8 by way of the conduit 9, the lighter fractions vaporize and pass upwardly through the trays positioned in the upper portion of the tower 8. The heavier material which does not vaporize, together with the condensed material which separates from the vapors in their passage up through the trays in the tower 8, collects in the lower portion of this tower. The lighter uncondensed fractions which consist essentially of gasoline and incondensible gases pass off from the tower 8 through the discharge conduit 10 into the condenser 11 in which the condensible gasoline fractions are converted into the liquid form. From the condenser 11, the condensed material passes through a cooler 12 and then the condensed material is passed into the gas separator 13 wherein the incondensible gases are separated from the liquid product.

Gas separator 13 is provided with the usual gas outlet 14 and with the water and sludge outlet 14. The outlet for the straight run gasoline is positioned above the bottom of the gas separator and the discharge of the gasoline through this conduit 15 is regulated by a float controlled valve clearly shown in the drawing. It has been found advantageous to recycle a definite quantity of the straight-run gasoline by introducing the same into the upper portion of the tower 8 to serve as a reflux cooling medium for the vapors passing upwardly through the trays in this tower and undergoing fractionation therein.

As clearly shown in the drawing, a conduit 16 extends from the separator 13 to the upper portion of the tower 8. This conduit 16 has a forcing pump 17 positioned therein for forcing the desired quantity of gasoline from the separator into the tower 8 as hereinbefore described. In order to control the rate of flow of the gasoline into the upper portion of the tower, a thermostat is located in the uppermost portion thereof adjacent the vapor discharge conduit for controlling a by-pass about the pump 17. With this arrangement, it will be appreciated that the temperature of the vapors being discharged from the tower 8 may be carefully regulated.

The topped crude which collects in the lower portion of the tower 8 is forced through conduit 18 by the pump 19 into the evaporating tower 7 adjacent the upper portion thereof. This topped crude is preferably sprayed into the evaporator 7 to insure intimate contact between the crude and the vapors passing upwardly through the evaporator. In the drawing, baffle plates 20 have been shown positioned just below the outlet of the conduit 18, which serve to more initimately contact the vapors with the crude introduced therein.

In accordance with this invention, a second stream of crude oil is treated simultaneously with the first stream of crude oil. This oil may be of a higher specific gravity than the first stream of crude oil. Thus, for example, it has been found that an oil such as Refugio crude (23° A. P. I.) may be satisfactorily treated along with the Pettus crude hereinbefore mentioned. This stream of crude is forced through the conduit 21 by the pump 22 into a heat exchange element 23 located in the upper portion of the evaporating tower 7. The element 23 has been shown mounted below the element 6, but it is within the scope of this invention to vary the positioning of these elements.

The second stream of crude oil is heated in the element 23 by heat abstracted from the vapors passing upwardly through the evaporator and the oil then passes through conduit 24 to heat exchangers 25 and 26, wherein the crude is further heated by contact with the unvaporized material discharged from the lower portion of the evaporator 7. By way of example, it has been found that the process operates effectively if a crude of approximately 70° F. is heated to 306° F. upon passing from the heat exchange element 23, and has its temperature raised to approximately 625° F. after passing through the heat exchangers 25 and 26. This second stream of crude is then passed from the heat exchanger 26 through conduit 27 into an accumulator 28 in which some of the lighter fractions vaporize and thereby separate. Instead of introducing the preheated heavier crude directly into the accumulator tank 28 it may be introduced through the line 27' directly into the evaporator tower 7 at a point above the baffle plates 20 whereby it comes into intimate contact with the hot vapors ascending the tower 7 and the lighter constituents thereof, including fractions suitable as stock for

the cracking operation, are vaporized. The lighter fractions which are separated from the body of oil in the accumulator 28 pass from the accumulator through the conduit 29 into the evaporator 7 at a point above the baffle plates 20. The unvaporized or residual portions of the crude oil charged to the evaporator tower 7 are collected at an intermediate point of the tower by means of a trap-out plate 45 and are withdrawn from the tower 7 through a conduit 45' and passed to the accumulator tank 28. Under certain conditions of operation a certain portion of the vapors flowing through the tower 7 may be condensed in the space occupied by the baffles 20, and this condensate will, of course, be collected on the trap-out plate 45 together with the unvaporized or residual portions of the crude oil.

The unvaporized crude stock thus accumulated in tank 28 thus comprises the unvaporized portions of both the crude oils charged to the system through lines 2 and 21. This heavy crude may be withdrawn through line 30' and forced by pump 30 through a heating coil 31 mounted in a suitable furnace. The crude stock during its flow through the coil 31 is raised to a temperature sufficiently high to effect vaporization of any of its vaporizable constituents and is preferably heated to a suitable cracking temperature, say, for example, 800 to 900° F., more or less, whereby its viscosity is lowered and certain lower boiling products are formed which are suitable as clean stock for a more drastic cracking operation. The oil during its flow through the coil 31 may be maintained under a substantial superatmospheric pressure, for example, 100 to 600 lbs. more or less.

The highly heated products are discharged from the coil 31, after the desired treatment has been effected, through line 32, provided with a pressure reducing valve 33, into the lower portion of the low pressure evaporator tower 7 wherein the lighter vaporizable constituents thereof vaporize. These products are discharged into the tower 7 at a point below the trap-out plate 45 and are preferably discharged into a body of liquid oil maintained in the lower portion of the tower 7. The tower 7 may be maintained under a suitable reduced pressure, for example, pressures ranging from substantially atmospheric to 100 or 200 lbs. gauge may be maintained within the tower 7.

The evolved vapors pass upwardly through the tower 7 and assist the distillation of the crude oil stock charged thereto above the baffle plates 20. The vapors, including vapors derived from the crude oil charged to the tower 7 and/or the accumulator 28, continue their upward travel and flow past the heat exchange coils 23 and 6 whereby they give up a portion of their heat to the crude oil stocks flowing therethrough. Any condensed portions of the vapors are collected in the upper portion of the tower 7 on trap out plate 48 from which they may be withdrawn for a purpose hereinafter set forth.

In addition to the streams of crude oil introduced into the evaporator 7, there is also a stream of highly heated synthetic crude introduced therein. To produce this synthetic crude, a suitable cracking stock is forced through conduit 34 by a force pump 35, into the cracking coils 36 of a suitable cracking furnace, wherein it is heated to a relatively high cracking temperature, say 850 to 975° F., more or less, under a relatively high pressure, say 500 to 1000 lbs., more or less. As shown in the drawing, the cracking unit is of the so called tube and tank type, in which the oil is heated to a cracking temperature in the coil 36 and is then introduced before consummation of the cracking into an enlarged reaction chamber 37. The reaction chamber 37 is maintained under substantially the same pressure as the cracking coil 36 and the large body of oil collected therein undergoes a reaction wherein the heavier fractions are converted into a mixture of low boiling point hydrocarbons. The product resulting from the reaction in the chamber 37 is what is known as a synthetic crude. This material is discharged by way of the line 38 provided with a pressure reduction valve 39 into the low pressure evaporator tower 7, preferably into the body of liquid maintained in the lower portion thereof.

Upon the release of pressure and the introduction of the highly heated synthetic crude into the lower portion of the evaporator 7, there is an instantaneous vaporization of certain of the fractions, due to the release of pressure and the contained heat therein. These vapors admix with the vapors evolved from the other products discharged into the tower 7 and pass upwardly through the tower 7 and are contacted with the down-flowing body of the first stream of topped crude and with the reflux condensate produced by contact of the vapors with the heat exchange elements 6 and 23. Thus, it will be appreciated that the vapors passing from the tower will be subjected to a reflux action, and at the same time will serve to preheat the two streams of crude oil passed through the elements 6 and 23, respectively, the reflux condensates produced being collected on the trap out plates 45 and 48.

The body of liquid which collects in the lower portion of the evaporator 7 will consist of the heavier fractions which are not vaporized upon a release of pressure on the products from the coil 31 and the products from the cracking coil 36 and drum 37 (synthetic crude) introduced thereinto. The lower portion of the evaporator 7 is provided with a discharge conduit 40 through which the residue may be released. It will be noted that in passing through the conduit 40, the residual material passes through the heat exchangers 26 and 25 and thereby serves to preheat the second stream of crude introduced into the system by way of the conduit 24. After passing from the heat exchanger 25, the residual material may then pass through a cooling coil 41 wherein its temperature is materially lowered. From the coil 41, the residue may be either discharged from the valve 42 or recycled into the body of oil maintained in the lower portion of the tower 7 by way of the line 43 and the forcing pump 44. By recycling a portion of the cooled residual material, the temperature of the body of liquid maintained in the lower portion of the evaporator 7 may be reduced to such an extent as to prevent excessive vaporization of the material introduced therein. It will be noted that the valve 42 is controlled by a float arrangement clearly illustrated in the drawing, which serves to maintain the level of the liquid in the lower portion of the evaporator at a predetermined height.

Vaporous material is discharged from the upper portion of the tower 7 through the line 46 into the dephlegmator or fractionating tower 47. The dephlegmator may be of the usual construction and contain suitable fractionating elements, for example, bubble-cap trays, screen plates, disc

and doughnut plates, etc., for effecting the refluxing of the vapors passing upwardly through the same. The reflux condensate separated from the vapors as it flows upwardly through this tower constitutes a relatively clean stock and thus serves very satisfactorily as a cracking stock for the cracking unit, i. e., coil 36 and drum 37. Connections have been shown whereby the liquid collected in the lower portion of the dephlegmator 47 may be forced by pump 35 into the cracking coil 36. In addition to the vaporous material introduced into the dephlegmator 47, it has been found advantageous to conduct a portion of the fractions condensed in the evaporator 7 into the dephlegmator. As clearly shown in the drawing, a conduit extends from the trap-out tray 48 in the upper portion of the evaporator whereby the condensed fraction collected on this tray is conducted through the conduit 48' into the dephlegmator 47 below the point at which vapors from the tower 7 enter the dephlegmator 47. A portion of this material will be vaporized when introduced into the dephlegmator, but the largest portion will be recycled with the reflux condensate to the cracking coil 36.

Vaporous material discharged from the upper portion of the dephlegmator is caused to pass serially through heat exchangers 4 and 3, respectively, to cool down the vapors and to preheat the first stream of crude introduced into the system. From the heat exchanger 3, the vapors pass to the condenser 50, and thence to a cooler 51 from which they are introduced into a gas separator 52. Separator 52 may be constructed similarly to the gas separator 13 and may be provided with a suitable float control mechanism for operating the valve 53 in the discharge conduit 54. As in the treatment of the first stream of crude oil, a portion of the gasoline separated in the separator 52 is recycled through conduit 55 by the pump 56 and is introduced into the upper portion of the dephlegmator 47 to serve as a reflux cooling medium for the fractionating operation. The flow of this liquid into the upper portion of the dephlegmator is thermostatically controlled by the by-pass valve 57.

When treating crude oil in accordance with the present invention, it will be appreciated that the cracking stock undergoing drastic cracking in the system for the production of low boiling gasoline-like products will always be clean and free from residual material which tends to clog up the cracking unit. In carrying out the present invention, it is possible to treat two streams of crude oil simultaneously obtaining a straight run natural gasoline and a cracked gasoline. By subjecting the crude oil to the several stages of treatments as herein described, a maximum yield of desired low boiling products can be obtained from the crude oil.

In operating the process the following conditions of operation may be employed:

The stock charged to the system through line 2 may comprise Peltus crude having a gravity of 47° A. P. I. and the stock charged through line 21 may comprise Refugio crude having a gravity of 23° A. P. I. Both of these stocks may be charged at substantially equal rates. With these stocks the following conditions of temperature and pressure may be employed. The Peltus crude may be preheated prior to its discharge into tower 8 to about 550° F. The temperature at the top of tower 8 may be maintained at about 280° F. and the temperature at the bottom of the tower 8 may be maintained at about 500° F. The Refugio crude may be preheated in the coil 23 and exchangers 25 and 26 to about 625° F. The following temperatures may be employed in the evaporator tower 7; about 600° F. at the top, about 650° F. immediate the coil 6, about 700° F. at the trap-out plate 48, and about 735° F. at the bottom. A pressure of about 60 lbs. may be maintained within the tower 7. The fractionator tower 47 may be maintained under a similar pressure and a temperature of about 375° F. may be maintained at its top and a temperature of about 575° F. maintained at its bottom. A pressure of about 400 lbs. may be maintained on the oil in the coil 31 and it may be heated to about 870° F. during its flow therethrough, while a pressure of about 750 lbs. may be maintained at the outlet of coil 36 and within the chamber 37, the oil being heated to about 925° F. during its passage through the coil 36.

With a charge of 2000 bbls. per day of Pettus crude and a like charge of Refugio crude, under the above conditions of operation, 880 bbls. per day of natural gasoline may be recovered and withdrawn through line 15 and about 1350 bbls. per day of gasoline may be withdrawn through the line 54. About 1080 bbls. per day of crude may be withdrawn from the bottom of the tower 8 and charged to the evaporator through line 18. About 3000 bbls. per day of reduced crude stock may be supplied to the coil 31 from the tank 28 and about 5830 bbls. per day of clean condensate stock may be charged through the cracking coil 36 and drum 37. About 1465 bbls. per day of heavy fuel oil may be withdrawn from the evaporator tower 7 through the line 42.

While in the foregoing description reference has been made to specific temperatures and pressures when treating certain definite types of crude oil, it should be clearly understood that these temperatures and pressures may vary within reasonable limitations, depending upon the particular type of crude oils subjected to treating.

I claim:

1. The method of distilling crude oil for the production of gasoline-like products which comprises heating a flowing stream of condensate stock formed in the system to a cracking temperature under a superatmospheric pressure, maintaining the said stream at a cracking temperature until the desired conversion thereof is effected, thereafter discharging the heated products of conversion directly into an enlarged vaporizing zone wherein separation of vapors from liquids takes place, separately withdrawing evolved vapors from said vaporizing zone and passing them to a fractionating operation wherein said vapors are partially cooled and higher boiling constituents thereof undesired in the final distillate product are separated in the form of reflux condensate, passing a stream of crude oil charging stock, containing a substantial quantity of gasoline-like constituents, in indirect heat exchange with products of said conversion to effect heating of said crude to a distillation temperature, thereafter discharging the heated crude oil into a separate vaporizing zone wherein gasoline-like constituents thereof are separated as vapors leaving liquid topped crude, separately withdrawing said topped crude from said separate zone and discharging it into said first-named vaporizing zone and contacting it therein with evolved cracked vapors from the said conversion products, whereby said topped crude is subjected to further distillation and the resulting vapors are admixed with the vaporous products

from the cracking stage, collecting distilled liquids, and unvaporized portions of said topped crude, in said first-named vaporizing zone independently of the said residual products of said cracking operation, withdrawing said distilled liquids and unvaporized portions of said topped crude from said first named vaporizing zone and independently heating them to conversion temperature to reduce their viscosity, thereafter discharging the heated products directly into said first-named vaporizing zone wherein lighter constituents thereof separate as vapors and admix with the vaporous products from the cracking stage, and passing reflux condensate from said fractionating operation to said first-named high pressure cracking operation as charging stock therefor.

2. A method in accordance with claim 1 wherein the unvaporized residue from said converted residual products is collected separately from said distilled liquids and withdrawn from the system.

3. A method in accordance with claim 1 wherein an independent stream of crude oil containing substantially less gasoline than said crude oil first mentioned, is passed in heat exchange relation with products of said cracking operation and thereby heated to a distilling temperature, and the resulting distilled vapors and liquids are mixed with the distilled vapors and liquids of the first mentioned crude oil for treatment therewith.

4. A method in accordance with claim 1 wherein an independent stream of crude oil containing substantially less gasoline than said crude oil first mentioned, is passed in heat exchange relation with products of said cracking operation and thereby heated to a distilling temperature, the resulting distilled vapors and liquids are mixed with the distilled vapors and liquids of the first mentioned crude oil for treatment therewith, and unvaporized residue from the converted products is collected separately from said distilled liquids and withdrawn from the process.

5. A method in accordance with claim 1 wherein an independent stream of crude containing substantially less gasoline than said crude oil first mentioned, is passed in heat exchange relation with products of said cracking operation and thereby heated to a distilling temperature, and the resulting hot products are introduced into said vaporizing zone first mentioned, and contacted therein with products of conversion from the first mentioned cracking operation.

6. A method in accordance with claim 1 wherein an independent stream of crude, containing substantially less gasoline than said crude oil first mentioned, is passed in heat exchange relation with products of said cracking operation and thereby heated to a distilling temperature, the resulting hot products are introduced into said vaporizing zone first mentioned, and contacted therein with products of conversion from the first mentioned cracking operation, and wherein unvaporized residue from the converted products is collected separately from said distilled liquids, and withdrawn from the process.

7. A method in accordance with claim 1 wherein the heating and conversion of said condensate stock is carried out under relatively high superatmospheric pressure and wherein the said vaporizing zone, first mentioned, is maintained under a lower pressure.

8. Apparatus for treating hydrocarbon oil for the production of gasoline, which comprises in combination, a first cracking heater, a second cracking heater, an evaporator, a dephlegmator and a stripper, means for passing fresh charging stock first in indirect heat exchange relation with vapors formed in said dephlegmator, then in indirect heat exchange relation with vapors formed in said evaporator, means for passing the heated fresh stock into said stripper, to remove light fractions therefrom as vapors, means for passing liquid oil from said stripper into an intermediate point in said evaporator, means for removing liquid oil from a lower intermediate point in said evaporator, means for passing the removed liquid oil through said first cracking heater and back into said evaporator at a still lower point, means for transferring vapors from an upper point in said evaporator into said dephlegmator, means for passing reflux condensate from the bottom of said dephlegmator through said second cracking heater and into said evaporator at a point below said lower intermediate point, and means for removing vaporous products from said dephlegmator and from said stripper.

9. Apparatus according to claim 8 wherein a reaction chamber is interconnected between said second heater and said evaporator.

10. Apparatus according to claim 8 wherein means are provided for passing a second stream of charging stock in indirect heat exchange relation with vapors in said evaporator, then in indirect heat exchange with liquid residue collected in the bottom of said evaporator and finally passing the heated stock into said evaporator at a point adjacent to said intermediate point first mentioned.

11. Apparatus according to claim 8 wherein a trap-out tray is arranged in said evaporator above said intermediate point first mentioned and a connection is furnished for conducting liquid from said trap-out tray into a low point in said dephlegmator.

12. Apparatus for treating hydrocarbon oil for the production of gasoline, which comprises in combination, a first cracking heater, an evaporator, a dephlegmator, and a stripper, means for passing fresh charging stock in indirect heat exchange relation with hot products separated in said evaporator, means for passing the heated fresh stock into said stripper, to remove light fractions therefrom as vapors, means for combining liquid oil from said stripper with condensate collected at an intermediate point in said evaporator, means for passing the resulting liquid oil mixture through said first cracking heater and back into said evaporator at a point lower than said intermediate point, means for transferring vapors from an upper point in said evaporator into said dephlegmator, means for passing reflux condensate from the bottom of said dephlegmator through said second cracking heater and into said evaporator at a point below said point lower than said intermediate point, and means for removing vaporous products from said dephlegmator and from said stripper.

13. The method of treating hydrocarbon oil for the production of gasoline which comprises stripping relatively heavy hydrocarbon oil containing lighter constituents, in a stripping zone after indirect heat exchange with hot products of a cracking operation, passing resulting stripped residual products into direct heat exchange relation with hot overhead fractions derived from said cracking operation, to cause further stripping of said stripped residual products, removing vapors derived from said further stripping, passing resulting doubly-stripped res-

idue through a cracking zone wherein it is raised to a cracking temperature and subjected to conversion, introducing cracked products so formed into a separating zone wherein vapors separate from cracked residue, fractionating vapors so obtained to form a final desired light distillate and a reflux condensate, passing said reflux condensate through a separate cracking zone wherein it is raised to cracking temperature and subjected to conversion, introducing resulting cracked products into said separating zone in mixture with the cracked products from said cracking zone first-mentioned, and preventing cracked residue separated in said separating zone from passing to either of said cracking zones.

14. The method of treating hydrocarbon oil for the production of gasoline which comprises preheating crude hydrocarbon oil by indirect heat exchange with hot products of a cracking operation, introducing resulting preheated crude oil into a stripping zone wherein the lighter fractions thereof including any gasoline constituents vaporize, leaving liquid residue, separating a desired gasoline distillate from said vapors, passing said reduced crude through a second zone in countercurrent contact with hot cracked vapors derived from said cracking operation to aid in dephlegmating said vapors and cause further stripping of the reduced crude, removing the doubly stripped crude from said second zone, preventing mixture therewith of the residual products of said cracking operation, heating the doubly stripped crude so removed to a cracking temperature to cause conversion thereof under superatmospheric pressure, introducing the resulting hot cracked products with an accompanying reduction on the pressure thereon, into a third zone wherein vapors separate from liquid residue, utilizing said vapors as said hot cracked vapors first-mentioned, positively cooling the cracked products in said third zone to reduce sharply the temperature thereof and prevent excessive vaporization, fractionating vapors from said second zone separately from the vapors liberated in the stripping zone to form a final desired distillate and a clean reflux condensate, separately heating said reflux condensate to a cracking temperature to cause conversion thereof and combining the resulting products of conversion with the hot cracked products resulting from the heating to a cracking temperature of said doubly-stripped crude.

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