

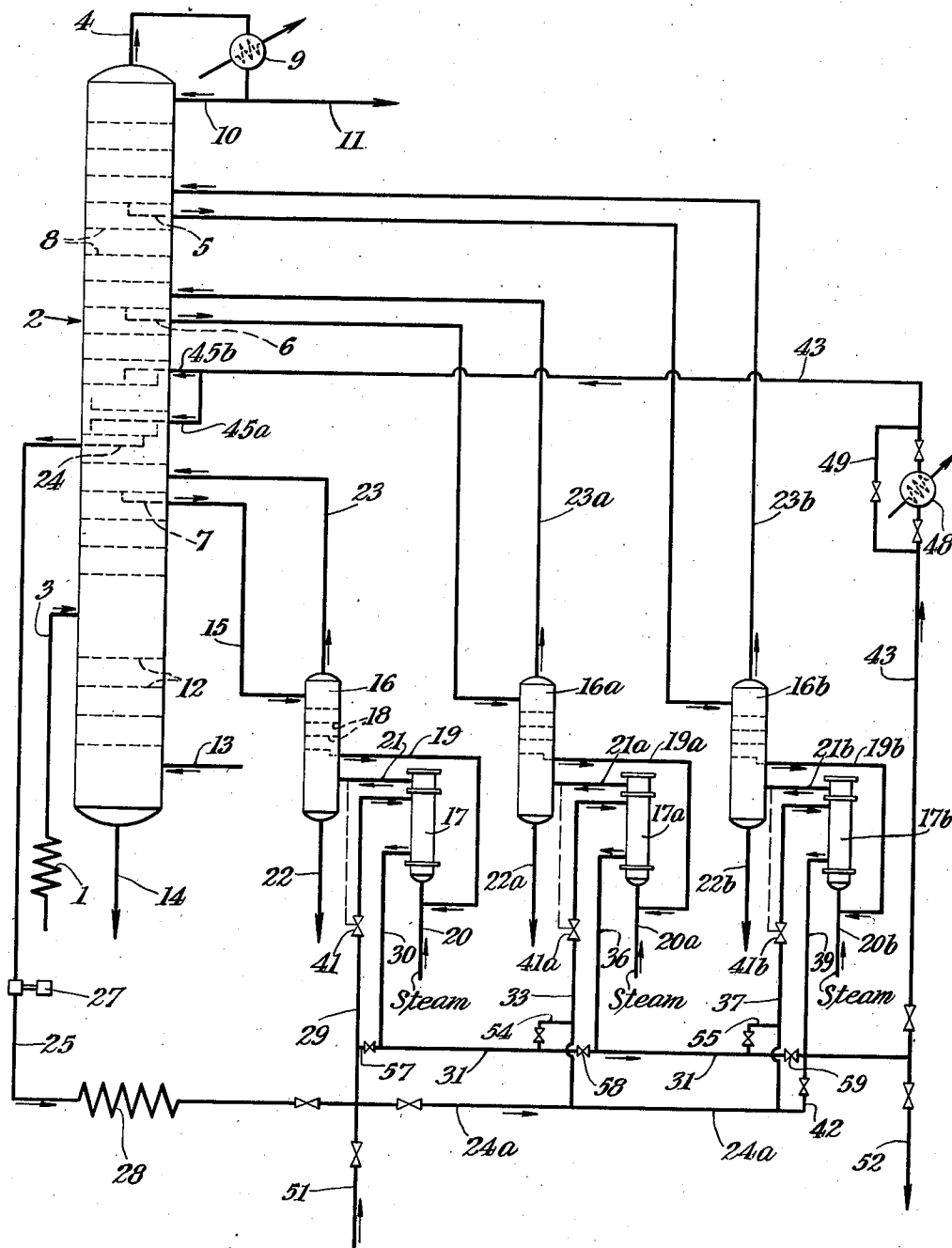
June 15, 1943.

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2,321,826

METHOD OF FRACTIONATING HYDROCARBON OILS

Filed May 13, 1941



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UNITED STATES PATENT OFFICE

2,321,826

METHOD OF FRACTIONATING HYDRO-CARBON OILS

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Application May 13, 1941, Serial No. 393,186

9 Claims. (Cl. 196—85)

The present invention relates to the fractional distillation of hydrocarbon oils such as petroleum and the like and more particularly to a method of improving the quality of the several fractions obtained therefrom.

In the operation of a fractionating column for hydrocarbons, it is common practice to withdraw one or more side streams from the column at different levels and to introduce such side streams into stripping units individual to each stream. As is well known, such side streams represent particular fractions of the hydrocarbon mixture being distilled. The operation of the stripping units is in the nature of a further distillation of the side streams. The purpose of such supplemental distillation is to free the respective side streams of retained low boiling constituents commonly called "light ends."

These light ends deleteriously affect the distillation characteristics and more especially the flash point of the oil withdrawn as a finished product. Consequently, the further the stripping operation is carried out on a given fraction comprising one of the side streams, the greater will be the improvement in the distillation specifications of the resulting product. Naturally, there are practical limitations beyond which it becomes uneconomical to extend the stripping operation.

The operation of these stripping units is effected by vaporization of the undesirable light ends from the side stream, which vaporization may be produced according to various methods commonly employed in the art. One such method includes the introduction of low-boiling vapors from the main fractionating column into the stripping column countercurrently to the withdrawn side stream with or without the supply of heat at the base of the stripping column. This method has the objection that the composition of the recycled vapors is too close to that of the material which it is desired to strip out in order to permit effective stripping.

Another method has been the production of a partial pressure effect by the introduction of steam into the stripping column. According to this method, it is necessary to maintain a rather close relation between the cooling effect resulting from the vaporization of the low boiling components and the partial pressure effect of the steam in order to secure efficient operation in the stripping column. That is to say, where steam stripping is used, vaporization of the light ends presupposes cooling; and, if the cooling effect is permitted to overbalance the partial pressure effect of the steam, an effective stripping atmos-

phere no longer prevails in the column. This condition tends to become aggravated so that it is necessary to use a relatively larger quantity of steam in order to effect vaporization; and eventually a maximum point of stripping effect is reached beyond which further elimination of the light materials is not effected regardless of the amount of stripping steam used.

We have discovered that, in side stream steam stripping, a more effective stripping operation can be accomplished if a more intimate mixture of the steam with the side stream is formed and if, at the time the mixture of steam and oil is effected, sufficient heat is supplied to the mixture to prevent a temperature drop therein because of the vaporization induced by the steam. The method and apparatus for utilizing this discovery will be described hereinafter.

It is an object of our invention to provide an improved method of side stream steam stripping characterized by simplicity, efficiency, and economy of operation.

An important object of the invention is to provide a method of side stream stripping which contemplates intimately mixing steam with the partially stripped side stream obtained from the lowest contacting element of a stripping column, passing the resulting mixture in a comparatively restricted stream through a heating zone in which sufficient heat is supplied to the mixture to prevent a drop in the temperature thereof because of vaporization of the lighter components thereof, then separating the steam and the remaining low boiling components from the partially stripped side stream by releasing the mixture from the restricted heating zone, and countercurrently contacting the steam so released with the incoming side stream in its passage through the stripping column.

Another object of the invention is to provide an improved method of supplying heat to a side stream undergoing stripping from a hot circulating stream, preferably taken from the main fractionating column, which circulating stream may be additionally heated prior to its use in the stripping unit to a sufficiently high temperature level to provide a suitable temperature difference for a flow of heat to the side stream undergoing stripping. Since the circulating stream may be taken in any desired quantity, it offers a convenient and flexible heat source.

A further object of the invention is the provision of a method which contemplates successively correcting the boiling range of a plurality of sidestream fractions by the application of in-

direct heat to a plurality of stripping units arranged in parallel, series, or series-parallel relation with respect to the application of the heat source.

A special object is the provision of a method for side stream steam stripping whereby considerable flexibility in the application of an indirect heat source to the side stream during stripping is permitted.

Further objects and advantages of our invention will be apparent from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing, which is a diagrammatic flow sheet of a process in which the invention may be carried out.

The principal feature of our invention relates to what may be roughly regarded as two phases of side stream stripping. The first phase may be said to consist of contacting countercurrently a side stream with steam in a stripping unit provided with a heating zone of restricted area. The second phase may be said to consist of intimately mixing steam with the partially stripped side stream after removal thereof from the countercurrent contacting zone, maintaining the resulting mixture during passage thereof through the heating zone at a sufficiently high temperature level to avoid a drop in temperature thereof caused by the vaporization effect produced by the mixing of the steam with the oil, and then utilizing such steam in countercurrently contacting the side stream as contemplated by the first phase.

The apparatus for carrying out this feature of the invention may comprise a stripping column and a reboiler, which may be located either internally or externally of said column and is interconnected to the lower portion thereof. As the process is carried out, a side stream is withdrawn from the main fractionating column and is introduced into the top of the stripping column, the upper portion of which is provided with bubble plates or similar contact devices. The partially stripped side stream is removed from the lower-most bubble plate and is mixed with steam; the resulting mixture is passed through the reboiler, from which it is then released, and the steam then passes upwardly in countercurrent relation to the descending side stream. Because of the restricted area in which the mixture of steam and oil is effected, a more intimate mixture of these substances is obtained whereby more effective vaporization of the light ends is promoted. By supplying heat to the mixture as it passes through the reboiler, the temperature thereof is prevented from dropping with the result that greatly improved stripping is obtained.

The source for supplying heat to the reboiler may consist of a circulating stream taken from the main fractionating column. If this stream does not have a high enough temperature, it may be additionally heated before being introduced into the reboiler so that it has a sufficiently high temperature level to allow the transfer of heat to the side stream to compensate for the cooling resulting from the vaporization produced by the partial pressure effect of the steam.

A plurality of side stream fractions may be withdrawn from the main fractionating column; in such case, the respective stripping units may be arranged so that the circulating stream supplies heat to all of them. As already stated, the circulating stream may be passed in parallel, series, or series-parallel relation to the stripping units. In this way it is possible to use the same

circulating stream for operating the several stripping units.

The fact that the circulating stream may be taken from the main fractionating column in sufficient quantity as the necessary heating medium for the reboilers greatly simplifies our process. Furthermore, by effecting a further cooling of the circulating stream to a temperature lower than that at which it was removed from the main fractionating column, we obtain a convenient and expeditious method for providing an intermediate refluxing of the main fractionating column. As is well known in the art, this is a desirable expedient in order to reduce the size of the fractionating column.

Referring to the accompanying drawing we have illustrated our invention as applied to the fractional distillation of a hydrocarbon oil or a mixture of hydrocarbons although it is equally applicable to the fractional distillation of mixtures of other types of liquids. As is the customary practice, the hydrocarbon oil, suitably heated in a heater 1, is charged to fractionating column 2 through line 3. The oil is preferably heated to such a temperature that it may be flashed to the desired extent in the lower portion of the column. The flashed vapors are then separated into fractions, which are removed as an overhead stream as at 4 and as side streams as at 5, 6, and 7. To accomplish this fractionation, the tower 2 may be equipped with suitable bubble decks 8 or the like. Reflux, comprising a portion of the overhead condensate from condenser 9, is introduced into the tower 2 at 10. The remainder of the overhead condensate is removed at 11 as the overhead product. The liquid portion of the heated oil flows downwardly over bubble decks 12, by means of which any remaining low boiling constituents are separated. To aid in this separating action, steam may be introduced at 13. The stripped residual oil is removed as a bottoms stream at 14.

The side streams removed at 5, 6, and 7 represent certain fractions of the hydrocarbon oil which are desired as end products. Even though a fairly close fractionation may be accomplished in the tower 2, these side streams invariably contain an appreciable amount of low boiling material which must be removed before the fractions can meet product specifications and market requirements.

In accordance with our invention, a side stream withdrawn as at 7 is passed through line 15 to a stripping apparatus which may comprise a stripping column 16 having connected to the lower portion thereof a reboiler 17. As is characteristic of a conventional stripping column, bubble plates 18 are located in the upper portion of the stripping column 16. The side stream removed at 7 flows downwardly over the plates 18 whereby it is subjected to the stripping effect of steam introduced as will hereinafter be described for the removal of light ends. The partially stripped side stream is removed from the lowest plate through line 19 and is then introduced into the base of the reboiler 17. The reboiler 17 may be of a conventional type provided with a bundle of tubes forming a heating zone enclosed within an outer shell, through which a heating medium circulates. The heating medium circulated through the shell side of reboiler 17 may be supplied from any suitable source which has a sufficiently high temperature so that a suitable temperature difference can be obtained and the quantity of which is sufficiently great so that an

adequate amount of heat is provided. As already pointed out, under proper conditions a stream of oil may be continuously circulated from column 2 through the reboiler.

Stripping steam from line 20 is mixed with the partially stripped side stream in line 19 before it enters reboiler 17. The introduction of the steam into the side stream in this manner provides for the formation of a more intimate mixture. By passing this mixture through a confined or restricted zone such as afforded by the tube side of the reboiler, we can obtain the more intimate mixture and can simultaneously provide sufficient heat to maintain the cooling effect resulting from vaporization of the remaining light ends in balanced relation with the partial pressure effect produced by the steam. In this way a substantial improvement is obtained in the stripping operation.

The mixture of the steam and the side stream is returned by line 21 to the stripper 16 at a point in the lower portion thereof. The release of the mixture from the restricted zone effects a separation of the steam and the remaining light ends from the side stream. The steam and vapors pass upwardly through stripper 16 wherein the steam countercurrently contacts the side stream introduced through line 15 for the removal of a portion of the light ends therefrom. The finished side stream is withdrawn from the base of the stripper 16 through line 22, and the stripped vapors and steam are returned to tower 2 by means of line 23.

It is frequently the practice to withdraw a plurality of side streams from a fractionating column for boiling range correction treatment. In such case, as indicated in the drawing, stripping units identical with that already described may be used. Where a plurality of side streams is thus treated, however, it is convenient to provide a single heating source for all the stripping units.

In many instances a stream of oil at a sufficiently high temperature and in sufficient quantity is not available at a particular plant for this heat exchange duty. If such is the case, a stream may be withdrawn as at 24 for fractionating column 2 for circulation in a predetermined manner through the reboilers of the several stripping units. It is preferable to withdraw such stream at a point above the point of withdrawal of the lowest side stream as indicated. The use of such a stream provides a flexible heat source since the quantity of the stream can be readily varied. Inasmuch as the stream withdrawn at 24 is lower in temperature than the lowest withdrawn side stream, it is passed through line 25 by means of pump 27 to heater 28 wherein its temperature is sufficiently raised so as to provide a suitable temperature difference for the transfer of heat to the side stream in reboiler 17. It will be appreciated that heater 28 and heater 1 may be positioned in the same furnace setting. It will also be appreciated that the quantity, if not the temperature, of other streams such as the bottoms stream 14 will not ordinarily be sufficient to provide an adequate source of heat for this purpose.

The reboilers for the several stripping columns 16, 16a, and 16b are preferably connected in parallel with respect to the circulating stream or heating medium in line 24 because of the greater degree of control and flexibility afforded by this system. In such case, a portion of the circulating stream is passed through line 29 from manifold 24a into the shell side of reboiler 17

wherein a transfer of heat to the mixture of steam and oil passing through the tubes thereof is effected. The circulating heating medium is discharged from reboiler 17 through line 30 into the return manifold 31.

Another portion of the circulating stream is passed through line 33 from manifold 24a into reboiler 17a. In this case heat is transferred to the mixture of the partially stripped side stream withdrawn through line 19a and the steam introduced through line 20a while the mixture is passing through the restricted tube-side heating zone of reboiler 17a. The mixture, properly heated, is then discharged into column 16a by means of line 21a. The finished side stream is removed at 22a, and the steam and stripped vapors are returned to column 2 through line 23a. The heating medium is returned through line 36 to the return manifold 31.

The remainder of the circulating stream is passed through line 37 from manifold 24a into reboiler 17b, in which heat is transferred to the mixture of the partially stripped side stream passed through line 19b and the steam introduced through line 20b. The heated mixture is then passed through line 21b into column 16b, from which the stripped side stream is removed at 22b. The steam and stripped vapors are returned to column 2 through line 23b. Line 39 is provided for the discharge of the heating medium from the shell side of reboiler 17b into the return manifold 31.

For efficient stripping operation, control valves 41, 41a, and 41b may be provided for the regulation of the amount of heating medium passed through each reboiler. In this way the heat transfer from the circulating stream to each side stream may be nicely controlled, and the proper balance between the cooling effect due to the vaporization and the partial pressure effect produced by the steam may be maintained. A valved by-pass 42 may be provided so that any excess heating medium need not be circulated through any of the reboilers.

The circulating heating medium is returned to column 2 through line 43. In the usual case the temperature of this heating stream after passage through all the reboilers will be about the same or somewhat lower than the temperature at which it was withdrawn from column 2. Accordingly, the circulating stream may then be returned to column 2 as at 45a. In this manner a stream of oil may be continuously circulated as the heating medium for the several stripping units.

This method of providing a heat source for the stripping operations also has the advantage that an intermediate refluxing or cooling of the main fractionating column may be simultaneously provided. When intermediate refluxing is to be used, the circulating heating medium, after passage through the several reboilers, is passed through exchanger or cooler 48 in line 43. In such case the circulating stream is cooled to a temperature considerably below that at which it is removed from column 2. The additionally cooled circulating stream is then returned to column 2 preferably at a point as at 45b above the point of withdrawal. The effect of this intermediate refluxing or cooling is to reduce the condensing load at the top of column 2 and to reduce the size of column 2 as is well known in the art. It will be noted that line 49 is provided to by-pass the circulating stream around cooler

48 when it is not desired to operate column 2 with the intermediate reflux.

A stream of oil or other fluid, external to the distillation system, may also be used as the circulating heating medium provided such stream is available not only in sufficient quantity but also at a temperature sufficiently high to provide an adequate temperature difference to effect a heat transfer in the several reboilers. In such case, this stream is introduced into the heat exchange system through line 51 and will be circulated through the several reboilers for heat exchange purposes in accordance with the predetermined arrangement. After passage through the several reboilers, the stream may be conveniently withdrawn from the system as at 52. As already pointed out, however, such a stream will not usually be available in the ordinary plant.

Although the heating medium is preferably circulated through the several reboilers in parallel as described because of the greater flexibility provided, it may also be circulated through the reboilers in series relation if such operation is found desirable. In such case, lines 54 and 55 are provided so that a series flow can be accomplished. The circulating stream then flows from line 25 through line 29 to reboiler 17, through line 30 to return manifold 31 and through lines 54 and 33 to reboiler 17a, through line 36 to return manifold 31 and through lines 55 and 37 to reboiler 17b, and through line 39 and return manifold 31 to return line 43. Preferably valved line 57 and valves 58 and 59 are provided so that the amount of heating medium passed through each reboiler may be controlled and so that flexibility of operation may be obtained.

Circulation of the heating medium through the several reboilers in series-parallel relation may also be practiced if desired. Appropriately positioned valves as indicated in the drawing are provided so that any particular flow of the circulating stream may be accomplished.

As previously indicated, reboiler 17 for stripping column 16 may be positioned either externally or internally thereof. The ordinary arrangement of the apparatus is as shown in the drawing. Our invention, however, may also be carried out in a stripping column provided with an internal reboiler adapted to heat the partially stripped side stream in a zone of restricted area.

Our invention is particularly adaptable to the fractional distillation of hydrocarbon oils and the like. It may be employed in conjunction with pressure, atmospheric, or vacuum distillation. It may be used in the distillation of crude oils, reduced crudes, and other mixtures of hydrocarbon oils. In all these cases our invention provides an improved method of obtaining a superior side stream product.

Our invention finds particular application in the vacuum distillation of a reduced or topped crude such as a Mid-Continent reduced crude for the production of lubricating oil fractions and asphalt. In this case it is customary to withdraw several side streams from the vacuum distillation column, each of which streams contains a small percentage of undesirable low boiling constituents. Frequently these low boiling components comprise from 3 to 5% of the side stream. Such small percentages are sufficient, however, to lower the flash point of the lubricating oil fractions materially below product specifications. By means of our invention, these low boiling constituents may be effectively removed, and lubricating oil fractions having a quality

superior to that of fractions obtained by customary side stream stripping can be produced.

The following operating data on such a vacuum distillation of a typical Mid-Continent reduced crude are given by way of example. The quantities are based on a charge of 100 bbls. of reduced crude, which is introduced into column 2 at a temperature of 760° F. The stream removed at 14 comprises 15 bbls. of asphalt at 700° F. As in the process described, three finished lubricating oil side streams are produced. The lowermost side stream comprises 31 bbls. of a cylinder stock having a viscosity of 150 Saybolt Universal seconds at 210° F.; it is removed at a temperature of 625° F. from stripper 16. The intermediate side stream comprises 12 bbls. of a viscous neutral oil whose viscosity is 55 S. U. seconds at 210° F.; it is removed at a temperature of 550° F. from stripper 16a. The uppermost side stream comprises 15 bbls. of a non-viscous neutral oil having a viscosity of 140 S. U. seconds at 100° F.; it is removed from stripper 16b at a temperature of 440° F. The overhead comprises 27 bbls. of a heavy gas oil. The circulating stream removed at 24 has a temperature of 600° F. and is heated to 740° F. before being passed through the several reboilers; it is returned to column 2 at 45a at a temperature of 600° F. On the same basis, this circulating stream consists of approximately 35 bbls.

Furthermore, in such vacuum distillation there are no available external fluid streams which could be used as the circulating heating medium. Accordingly, in such a situation the proposed method of continuously circulating a stream of oil not only provides a convenient, readily available heating medium but also permits advantage to be taken of a circulating intermediate reflux stream. In addition, the bottoms asphalt stream is not sufficient either in quantity or in temperature to be used as the heat source; it is also undesirable for such purpose because of its poor characteristics for efficient heat transfer.

It will be seen that our improved process combines the advantages of side stream steam stripping and side stream reboiling and at the same time eliminates the disadvantages of each. The temperature of the side stream is not lowered as in ordinary steam stripping since the heat input from the reboiler supplies the heat of vaporization of the undesired constituents and prevents a drop in temperature from occurring. In like manner, since the partial pressure effect of the steam permits the low boiling constituents to vaporize at a lower temperature, only enough heat must be supplied to take care of the heat of vaporization of the undesired constituents at the lower effective pressure; it is not necessary as in customary reboiling practice to raise the temperature of the side stream in order to effect flashing and vaporization of the undesirable low boiling constituents.

Results similar to those obtained by the improved process described above may also be produced in a stripping column provided with an internal reboiling coil if the steam is introduced into the oil well below the reboiling coil so that the steam and vapors, in rising through the oil in a plurality of column-like relatively restricted paths, form an intimate mixture with the oil that is maintained at a relatively constant temperature by the heat supplied from the reboiling coil.

It will be apparent that modifications such as the substitution of an inert gas as the stripping medium in place of steam may be made. It is desired, therefore, to cover all such modifications

as come within the scope of the appended claims.

What is claimed is:

1. In the distillation of a hydrocarbon oil in a distillation zone from which a fraction of the oil is withdrawn as a side stream and is subjected to an independent boiling range correction treatment for the removal of retained undesirable low boiling components, which are partially removed by countercurrent contact of the side stream with steam in a stripping unit provided with a heating zone, the improvement which comprises withdrawing the side stream, partially stripped, from the lower portion of the stripping unit, mixing steam with said partially stripped side stream to effect vaporization of the remaining low boiling components therefrom, passing the resulting mixture in a comparatively restricted stream through said heating zone, simultaneously supplying heat to the mixture in an amount sufficient to prevent a drop in the temperature thereof because of the vaporization of the low boiling components, which temperature drop would deleteriously affect the stripping operation, and returning said mixture to the stripping unit at a point below the point of withdrawal of the partially stripped side stream.

2. In the distillation of a hydrocarbon oil in a distillation zone from which a fraction of the oil is withdrawn as a side stream and is subjected to an independent boiling range correction treatment for the removal of retained undesirable low boiling components, which are partially removed by countercurrent contact of the side stream with steam in a stripping unit provided with a reboiler, the improvement which comprises withdrawing the side stream, partially stripped, from the lower portion of the stripping unit, forming an intimate mixture of said partially stripped side stream with steam, said steam serving to effect vaporization of the remaining low boiling components therefrom, passing the intimate mixture in a comparatively restricted stream through said reboiler and simultaneously supplying heat to the mixture in an amount sufficient to prevent a drop in the temperature thereof because of the vaporization of the low boiling components, which temperature drop would deleteriously affect the stripping operation, and returning said mixture to the stripping unit at a point below the point of withdrawal of the partially stripped side stream.

3. In the distillation of a hydrocarbon oil in a distillation zone from which a fraction of the oil is continuously withdrawn as a side stream and is subjected to an independent boiling range correction treatment for the removal of retained undesirable low boiling components, the improvement which comprises continuously countercurrently contacting the withdrawn side stream with steam in a stripping unit in order to vaporize a portion of said low boiling components therefrom, said stripping unit being provided with a heating zone, withdrawing the partially stripped side stream from the lower portion of the stripping unit, mixing steam with said partially stripped side stream to effect vaporization of the remaining low boiling components therefrom, passing the resulting mixture in a comparatively restricted stream through said heating zone, simultaneously supplying heat to the mixture to maintain the temperature thereof sufficient for the desired stripping, returning said mixture to the stripping unit at a point below the point of withdrawal of the partially stripped side stream, thereby releasing the steam and the low boiling component vapors from said mixture, permitting

said steam to pass upwardly through the stripping unit for continuous countercurrent contact with the withdrawn side stream, removing the steam and the low boiling component vapors from the top of the stripping unit, and removing the stripped side stream from the bottom of the stripping unit.

4. In the distillation of a hydrocarbon oil which includes the steps of fractionating the oil in a fractionating zone, withdrawing a fraction of the oil as a side stream from the fractionating zone, and subjecting the withdrawn side stream to an independent boiling range correction treatment for the removal of retained undesirable low boiling components in a stripping unit provided with a reboiler, the improvement which comprises withdrawing the side stream, partially stripped, from the lower portion of the stripping unit, forming an intimate mixture of said partially stripped side stream with steam, said steam serving to effect vaporization of the remaining low boiling components therefrom, passing the intimate mixture in a comparatively restricted stream through said reboiler, separately withdrawing from the distillation zone a second stream for use as a heating medium, passing said second stream in indirect heat exchange relation in said reboiler with said side stream-steam mixture to supply heat thereto in order to prevent a drop in the temperature thereof because of vaporization of the low boiling components, returning said second stream to the distillation zone at a point above its point of withdrawal, and returning said side stream-steam mixture to the stripping unit at a point below the point of withdrawal of the partially stripped side stream.

5. In the distillation of a hydrocarbon oil in a distillation zone from which a plurality of separate fractions of the oil is removed as side streams and subjected to independent boiling range correction treatment for the removal of retained undesirable low boiling components in individual stripping units provided with heating zones, the improvement which comprises withdrawing each side stream, partially stripped, from the lower portion of its respective stripping unit, mixing steam with each partially stripped side stream to effect the vaporization of the remaining low boiling components therefrom, passing each resulting mixture in a comparatively restricted stream through its respective heating zone, separately withdrawing from the distillation zone another stream for use as a heating medium, additionally heating said other stream to a temperature higher than that of the lowest withdrawn side stream, passing said additionally heated stream in indirect heat exchange relation through said heating zones with said side stream-steam mixtures to supply heat thereto in order to prevent a drop in the temperature thereof because of vaporization of the low boiling components, returning said other stream to the distillation zone at a point above its point of withdrawal, and returning each side stream-steam mixture to its respective stripping unit at a point below the point of withdrawal of the respective partially stripped side stream.

6. In the distillation of a hydrocarbon oil in a distillation zone from which a plurality of separate fractions of the oil is removed as side streams and subjected to independent boiling range correction treatment for the removal of retained undesirable low boiling components in individual stripping units provided with reboilers, the improvement which comprises withdrawing

each side stream, partially stripped, from the lower portion of its respective stripping unit, forming an intimate mixture of each side stream with steam, said steam serving to effect vaporization of the remaining low boiling components therefrom, passing each resulting mixture in a comparatively restricted stream through its respective reboiler, separately withdrawing from the distillation zone another stream for use as a heating medium, additionally heating said other stream to a temperature higher than that of the lowest withdrawn side stream, passing said additionally heated stream in indirect heat exchange relation through said reboilers with said side stream-steam mixtures to supply heat thereto in order to prevent a drop in the temperature thereof because of vaporization of the low boiling components, cooling said other stream to a temperature below that at which it was withdrawn from the distillation zone, returning said cooled other stream to the distillation zone at a point somewhat above its point of withdrawal, thereby providing an intermediate reflux for said distillation zone, and returning each side stream-steam mixture to its respective stripping unit at a point below the point of withdrawal of the respective partially stripped side stream.

7. In the vacuum distillation of a reduced crude in a distillation zone for the production of a plurality of lubricating oil fractions, which are removed from the distillation zone as side streams and subjected to independent boiling range correction treatment for the removal of retained undesirable low boiling components in individual stripping units provided with reboilers, the im-

provement which comprises withdrawing each lubricating oil fraction, partially stripped, from the lower portion of its respective stripping unit, mixing steam with each partially stripped lubricating oil fraction to effect the vaporization of the remaining low boiling components therefrom, passing each resulting mixture in a comparatively restricted stream through its respective reboiler, separately withdrawing from the distillation zone another stream for use as a heating medium, additionally heating said other stream to a temperature higher than that of the lowest withdrawn lubricating oil fraction, passing said additionally heated stream through said reboilers in indirect heat exchange relation with said lubricating oil fraction-steam mixtures to supply heat thereto in order to prevent a drop in the temperature thereof because of vaporization of the low boiling components, returning said other stream to the distillation zone at a point above its point of withdrawal, and returning each lubricating oil fraction-steam mixture to its respective stripping unit at a point below the point of withdrawal of the respective lubricating oil fraction.

8. The improved distillation method as claimed in claim 5, which includes passing the heating medium stream through the several heating zones in parallel relation thereto.

9. The improved distillation method as claimed in claim 5, which includes passing the heating medium stream through the several heating zones in series relation thereto.

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