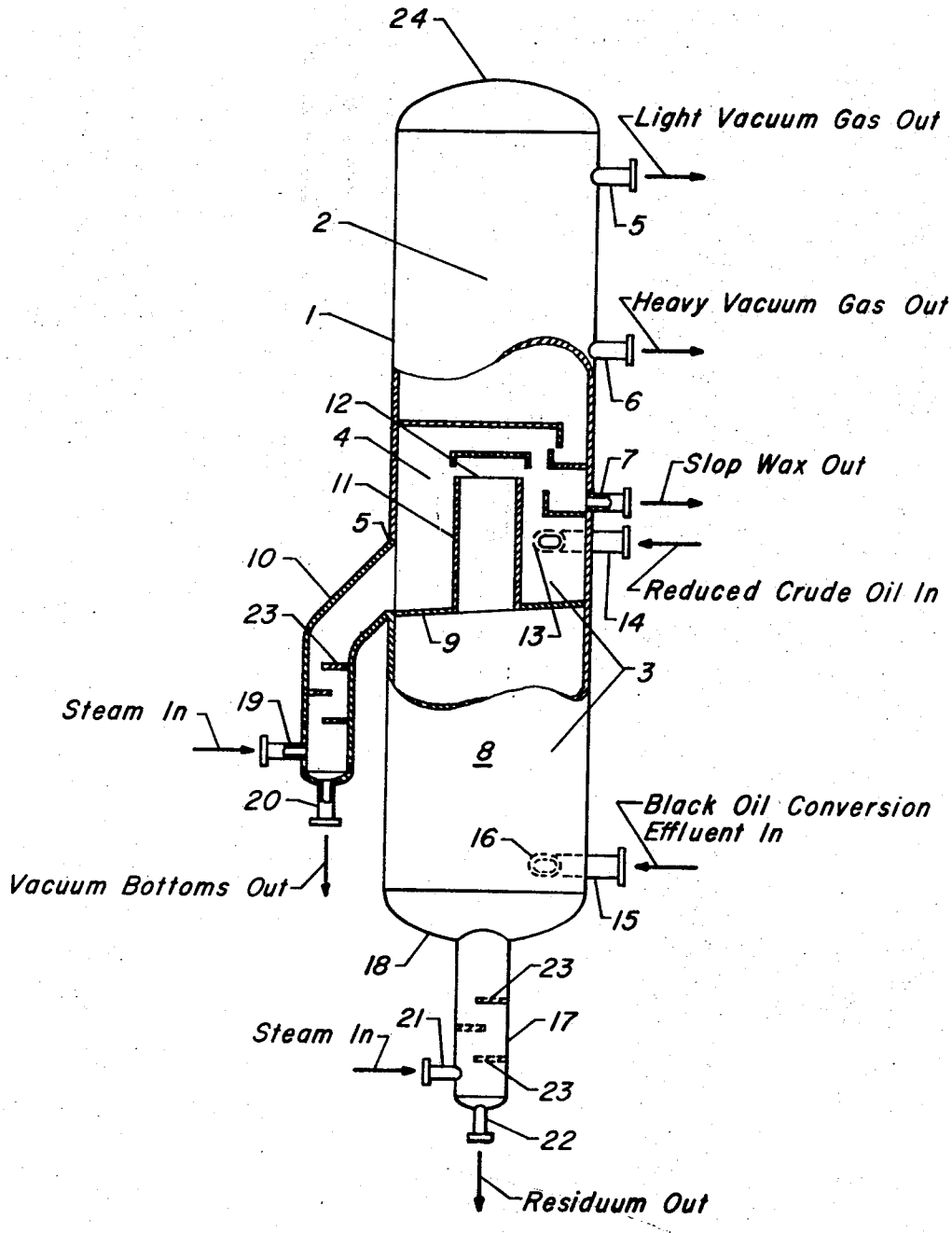
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HYDROCARBON FRACTIONATION COLUMN HAVING PLURAL FLASHING AND STRIPPING SECTIONS

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# HYDROCARBON FRACTIONATION COLUMN HAVING PLURAL FLASHING AND STRIPPING SECTIONS

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## ABSTRACT OF THE DISCLOSURE

Apparatus for distilling hydrocarbons designed in a stacked fashion so at least two different hydrocarbons, such as different crude oils, may be processed simultaneously, with the distillates being removed as combined products and at least two different bottoms product streams being recovered separately.

This invention relates to an improved apparatus for refining hydrocarbons. More particularly, this invention relates to an improved apparatus for fractionating two hydrocarbons of different chemical compositions in a single fractionation tower, wherein it is desirable for the bottom products to be maintained separately.

It is recognized that various means of simultaneously fractionating hydrocarbons of different types are known by those skilled in the art. In the past distillation of different types of hydrocarbons have been processed in separate facilities or at different times to maintain segregated bottom products. Lately, however, in order to save the expense of duplicate facilities and/or costly shutdowns, attempts have been made to provide methods and apparatus that would in effect minimize the duplicity of equipment and processing necessary for handling various types of hydrocarbons.

One such scheme uses separate vessels to segregate the bottom fractions. One vessel contains a flashing-stripping section and a fractionation tower, and the other, only a flashing-stripping section. A conduit connects the vessels at the flashing sections so that vapors from the two vessels are in communication with each other. Thus, the overhead stream of the two vessels are fractionated in a single tower, whereas the heavy boiling bottoms remain in the separate vessel to be transported to separate operations. Disadvantages are inherent in this scheme, for, although, such a scheme does save some duplication of equipment, additional foundations and support members are required for a second vessel. In addition, the connecting piping must be large so as to minimize pressure drops between the vessels, and when the flashing zones are operated at different temperatures, differential expansion problems are likely to arise.

Another scheme uses a single vessel but establishes two distinct and separate flashing-stripping areas by vertically partitioning the lower end of the vessel. This scheme eliminates costly duplication of equipment, supports, and the inherent problems of differential expansion between the separate vessels but prevents efficient utilization of tangential nozzle systems. Additionally, it introduces possibilities of structural weakness into the vessel since the vertical partition will most likely be subjected to different temperatures under normal operating conditions.

A third scheme utilizes a single vessel again, but partitions the two flashing-stripping sections horizontally. In this way, different flashing zone temperatures will not be as critical to the strength of the partition, for stresses are distributed more evenly. In addition advantages of tangential nozzle systems are fully realized. A basic disadvantage of this scheme lies in the construction of the



composite tower itself. To be efficient, stripping must occur in a relatively narrow cross-sectional zone. If, on one hand, the whole width of the external shell is used for the stripping areas, inefficiencies would occur because of the large area. On the other hand, if the stripping area is made narrower, the structure becomes difficult to design and construct. Additionally, even if the stripping area is narrower than the external cross-section of the tower, its volume will necessarily add to the overall length of the relatively wide cross-sectional tower, thereby increasing the tower cost.

Therefore, it is an object of this invention to provide an improved apparatus to be used for distilling hydrocarbons.

It is still another object of this invention to provide an improved apparatus to be used for distilling simultaneously at least two different hydrocarbons, such as different crude oils, in such a manner that the bottoms products from the distillation column are maintained separately.

It is a specific object of this invention to provide an improved apparatus to be used for distilling in a single column a heated reduced crude oil and a heated black oil conversion effluent in such a way that their bottoms products are maintained separately, and the overhead distillate products are recovered as combined products resulting from both oils.

Accordingly, the present invention provides for an improved fractionation apparatus comprising a vertically elongated chamber having an upper flashing section, an upper external stripping section attached to said upper flashing section and having fluid communication therewith, a lower flashing section in said chamber below said upper flashing section, a lower stripping section connected to the lower portion of said lower flashing section and having fluid communication therewith, said lower and upper flashing sections in said chamber being separated by a partition adapted to pass vapors from the lower section and to prevent liquid flow therebetween, a common fractionating section above said upper flashing section, a conduit means extending above said partition from said lower flashing section to said upper flashing section, said conduit providing vapor communication between said flashing sections, a feed inlet for introducing a heated hydrocarbon into said upper flashing section, a feed inlet for introducing a heated hydrocarbon into said lower flashing section, a stripping inlet means for introducing stripping material into each of said stripping sections, at least one outlet in the fractionating section of said chamber, a bottom fraction outlet in said lower stripping section, and bottom fraction outlet in said upper stripping section.

Thus, it is seen that this invention provides for an improved and unique apparatus to be used for distilling hydrocarbons of two different chemical compositions in a single fractionating tower, wherein the bottom fractions are maintained separately. Typically the tower will be in the form of a cylindrical chamber although various shapes are contemplated within the scope of this improvement. Being of single vessel construction, duplication of foundation and support members is avoided. The horizontal partition minimizes structural weaknesses that are apt to occur when operating the two flashing sections at different temperatures. Also, when a tangential nozzle or inlet system is used as an inlet means into the flashing sections, such system's potential will be fully realized, since no break along the circumference exists to hamper centrifugal flow. In addition, the novel feature of placing the upper stripping section externally to the main chamber will aid in efficient design, construction, and operation of the tower. Designing the sizes of the flashing sections will be independent of designing the stripping sections, since they are separated from each other and one is not contained within the other. Construction will be less

costly since less total vessel height is required than if the strippers were internal. Operation efficiency will be fully realized for the stripping section can be designed and made as narrow as desired, without affecting the size of the flashing section.

Reference to the accompanying drawing and the following description will serve to more fully illustrate the design and construction of the present invention as well as to assist in further pointing out the advantageous features in connection therewith.

## DESCRIPTION OF DRAWING

Referring to the drawing, reference number **1**, designates the shell of an upright elongated chamber. As mentioned heretofore, the shell will normally be cylindrically shaped, but other shapes are contemplated within the scope of this improvement. This chamber is composed of two distinct internal sections, i.e. a fractionation section **2** and a flashing section **3**. The fractionating section **2** extends above the upper flashing section **4** and consists of a plurality of trays, baffles, bubble caps, downcomers, and wiers arranged in a conventional manner. Fractionation products are taken off as side streams or overheads via outlets **5**, **6**, and **7**. Some of these products are cooled and recycled back into the fractionating section **2** as reflux through reflux inlets not shown, as per usual fractionation practices.

The flashing section **3**, is divided into two separate and distinct sections **4** and **8** by a partition **9**, this partition being adapted to pass vapors from the lower section and to prevent liquid flow between the two flashing sections. In a preferred form, the partition **9** is slightly sloped to enhance fluid flow toward the upper external stripping section **10**. A conduit means **11** is provided to establish communication between the flashing sections **4** and **8**. It is to be noted that the upper outlet **12** of the conduit **11** is located above the inlet port **13** in order to prevent splashing of upper inlet hydrocarbons into the lower flashing section **8**. Inlet **14** supplies heated hydrocarbons through port **13** to upper flashing section **4**. Similarly, inlet **15** supplies heated hydrocarbons of a different chemical composition through port **16** into the lower flashing section **8**. In their preferred form, inlets **14** and **15** intersect the flashing section chambers in a tangent manner, thereby establishing centrifugal flow for incoming hydrocarbons. In this way any foaming of the incoming hydrocarbons is minimized. Attached to the lowest part of the upper flashing section **4**, at **5**, is an external stripping section **10**. The lower stripping section **17** may be similarly attached to the botttom **18** of the vertical column as shown in the drawing or, alternatively, be a mere extension of the lower flashing section **8**. Steam or other stripping material enters stripping section **10** through steam inlet means **19** and passes up through the section driving off the lower boiling fractions. The remaining bottom fractions are carried off via outlet **20** to storage or further processing. In a like manner steam enters stripping section **17** through steam inlet means **21** to strip and drive off the lighter fractions, while the unvaporized heavier bottom fractions are carried to storage or other processing by way of outlet **22**. The stripping sections **10** and **17** may be of conventional design and utilize a plurality of vertically spaced stripping trays **23**. The trays **23** are indicated as side-to-side pans; however, preforated plates or other conventional contact trays may well be used.

The apparatus typically operates in the following manner: A reduced crude oil having a gravity of 20.3° API and a viscosity of 100 centistokes at 150° F. is fed through inlet **14** and port **13** at a temperature of about 750° F. into flashing section **4**. Both flashing sections **4** and **8** are held at an absolute pressure of 1.6 inches Hg through a conventional means not shown. A black oil conversion effluent having a gravity 15° API and a viscosity of 0.6 centistoke at 735° F. is fed through inlet **15** and port **16** at a temperature of approximately 770° F.



into flashing section **8**. Immediately, some of the lower boiling fractions are flashed upward from both flashing sections **4** and **8** into the fractionating section **2** of the column. Those from the lower flashing section **8** must first pass through conduit **11** into flashing section **4**. The higher boiling materials pass down through their respective stripping sections **10** and **17** where the remainder of the lower boiling fractions are stripped from them by the steam entering steam inlet means **19** and **21**. Typically, the remaining higher boiling fractions in both stripping sections are quench through quenching lines not shown to 600° F. before being removed. It is to be emphasized that the apparatus is designed so that there is no liquid contact between the two hydrocarbons introduced into the system. Only the lower boiling fractions communicate with each other through conduit **11**. The higher boiling fractions are completely separate so one will not contaminate the other. From external stripping section **10**, vacuum bottoms are removed through outlet **20** to a heat exchanger and then to further processing. The residuum of stripping section **17** is removed through outlet **22** to a heat exchanger and to storage. The lower boiling fractions enter the fractionating section which, as heretofore mentioned, is of conventional design for the products desired to be separate. Typically, the first collecting trays collect slop wax which has a boiling range 675° F. to 770° F. It is removed via outlet **7** at a temperature of approximately 675° F. and recycled at a higher level of the fractionation section so as to enhance the further condensing of slop wax. At outlet **6** a heavy vacuum gas oil which has a boiling range between 550° F. and 675° F. is removed to heat exchanger at 550° F. From the heat exchanger most of the heavy vacuum gas oil is further processed, but a portion is recycled as reflux at a higher elevation of the chamber at approximately 150° F. Similarly, at outlet **5**, a light vacuum gas oil which has a boiling range between 225° F. and 550° F. is removed to a heat exchanger at 225° F. where some is sent to processing, the remainder being recycled as reflux at 100° F. All remaining vapors including steam are passed overhead from the top of the column **24**, as waste material.

It is seen that by utilizing the apparatus as described heretofore, hydrocarbons of different chemical compositions can be fractionated simultaneously more efficiently than any previous scheme and apparatus has permitted. The complete single fractionation tower is essentially of a unit construction. No costly connection piping and pumping equipment is required to establish a flow pattern between various zones as would be the case in a multivessel apparatus. Differential expansion problems are minimized, and structural weakness due to temperature differences in the various zones are virtually eliminated because of the particular component placement.

It is also seen that design and construction of the apparatus itself is made relatively uncomplicated; for example, since the flashing sections are outlined by the outer shell of the chamber, their size can be determined by changing the depth alone or by reducing the chamber's diameter without affecting the stripping section size. Likewise the stripping sections may be designed independently of the flashing sections. Since the flashing sections are basically cylindrical, their configuration is also adaptable for efficient use of tangential inlets.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim as my invention:

**1.** Fractionation apparatus comprising a vertically elongated chamber having an upper flashing section, and upper stripping section disposed externally of said elongated chamber and connecting with said upper flashing

section and having direct liquid communication with said upper flashing section, a lower flashing section in said chamber below said upper flashing section, a lower stripping section connected to the lower portion of said lower flashing section and having fluid communication therewith, said lower and upper flashing sections in said chamber being separated by a transverse partition adapted to pass vapors from the lower section into said upper section and to prevent liquid flow therebetween, a common fractionating section above said upper flashing section, a conduit means extending upwardly from said partition to said upper flashing section, the upper end of said conduit means being spaced above the elevation of the hereinbelow specified first feed inlet, said conduit means providing vapor communication between said flashing sections, a first feed inlet for introducing a first heated hydrocarbon feed into said upper flashing section, a second feed inlet for introducing a second heated hydrocarbon feed into said lower flashing section, said first feed being independent of and having a different composition than both said second feed and the hereinbelow specified second bottoms fraction, stripping inlet means for introducing stripping material into each of said stripping sections, at least one product outlet in the fractionating section of said chamber, a bottoms fraction outlet in said upper stripping section for withdrawing a first bottoms



fraction therefrom, and a bottoms fraction outlet in said lower stripping section for withdrawing a second bottoms fraction therefrom.

2. The fractionation apparatus of claim 1 further characterized in that said feed inlet for introducing hydrocarbons into said flashing sections are tangent to the chamber, thereby establishing centrifugal flow for the incoming hydrocarbons.


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