

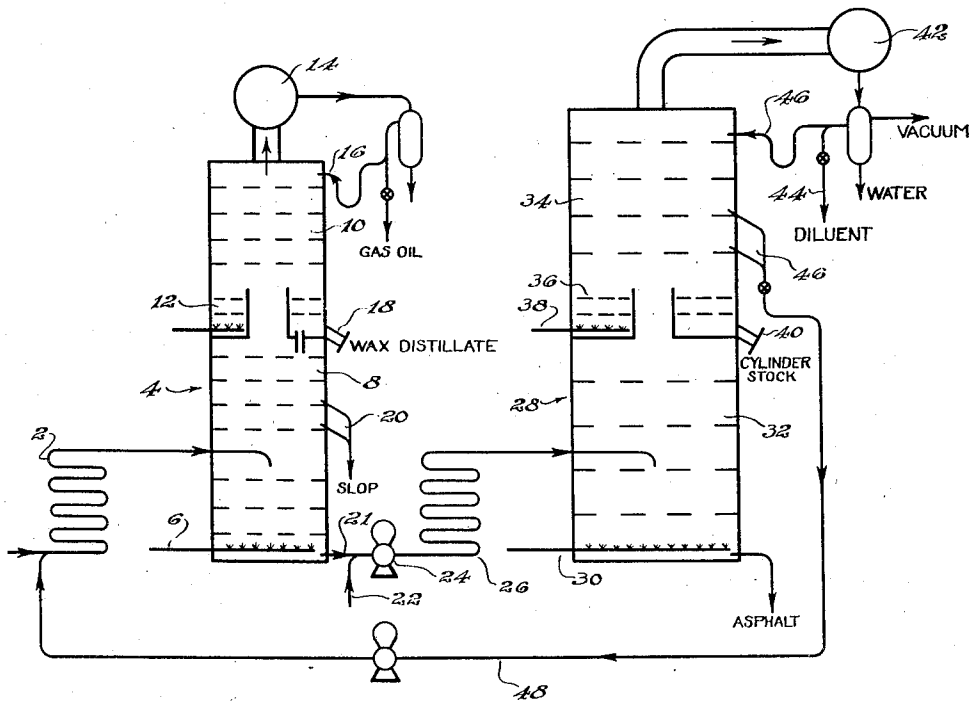
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METHOD OF DISTILLING HEAVY LUBRICATING OILS

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METHOD OF DISTILLING HEAVY
LUBRICATING OILS

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The present invention relates to methods of distilling heavy lubricating oils and more particularly to improvements in the method described in my Patent No. 1,905,156, dated April 25, 1933.

The method described in my patent consists in fractionating a reduced crude by a primary distillation to obtain a residue consisting of heavy lubricating oils and asphalt, mixing the residue with a light diluent such as kerosene or gas oil, and flash vaporizing the diluent and the lubricating oil together as a unit from the asphalt in a vacuum column. The flash vapors are then rectified or fractionally condensed to separate the diluent from the lubricating oils.

As explained in the patent, the final column is preferably not called upon to effect any rectification between adjacent fractions and accordingly, the heaviest lubricating fraction is determined in its characteristics by the cut in the primary column. That is to say, if cylinder stock containing only the heaviest lubricating oil components of the crude is desired, substantially all of the lighter constituents should be removed in the primary column.

However, in view of the overlapping characteristics of the components of the crude, a small quantity of undesirable oils may find their way into the final column. These undesirable oils which may be termed intermediates, may result from a failure to attain a perfect separation in the primary column or from a slight decomposition in the final heating stage. The intermediates, although small in quantity, would lower the flash point of the cylinder stock if permitted to collect therein. If not permitted to collect in the cylinder stock, they would pass overhead with the diluent and eventually would so build up in the diluent as to prevent further use thereof in the process.

According to the present invention, the diluent and cylinder stock are separated by rectification in the final column and the intermediates are caused to collect in a portion of the rectifying section from which they are continuously bled.

In the preferred form of the invention, the cylinder stock is subjected to a side stripping operation to remove any remnant of light and intermediate oils and the vapors thus evolved are contacted with the descending reflux. As a consequence, the undesired intermediates being subjected to vaporization from below and to condensation from above tend to concentrate in the lower decks of the rectifying section from which they are continuously withdrawn so that they have no opportunity to build up in the column.

The material bled off comprises only a small percentage of the total amount of liquid handled. As a further feature of the invention, this material may be returned to the primary column for segregation of any valuable constituents it may contain.

As stated in my patent, it is undesirable to attempt rectification over a large number of decks because of the back pressure in the vaporizing zone. According to the present invention, only a few decks are required, since any incompleteness of separation between the lubricating oil and the diluent is taken care of by the bleeding of a small quantity of liquid from the rectifying section. Consequently, the heavy lubricating stock may be manufactured to substantially any desired specifications of viscosity and flash point and the diluent may be recovered in substantially its original form suitable for re-use in the process or for any other purpose.

The accompanying drawing is a diagram of the preferred form of apparatus for practicing the present invention.

The reduced crude from which the lighter materials such as gasoline, kerosene, and part of the gas oil have been removed is continuously pumped through a pipe heater 2 into the vaporizing zone of a primary column 4. Steam is introduced at 6 below the point of feed. In this column, the oil is divided into three products, namely, a gas oil overhead, a wax distillate side product, and a residue containing the remainder of the lubricating oils (cylinder stock) and asphalt. Accordingly, the column is provided with a rectifying section 8 above the feed, an upper rectifying section 10, and a side stripping section 12, all of which are provided with contact decks of any suitable form. The gas oil is condensed in a condenser 14 and after it is decanted from the water, a part is returned through the pipe 16 as reflux, the remainder being withdrawn as a product. Stripped wax distillate is drawn off the stripping section at 18. A slop draw-off 20 is provided at one or more decks of the rectifying section 8 for a purpose later to be described.

In the column 4, a close separation is made between the wax distillate and the cylinder stock so that the residue contains substantially only asphalt and cylinder stock of specified initial boiling point. As explained in my patent above referred to, the division between the lubricating oils is made in the primary distillation in order that the final vaporizing column may not be required to perform the duty of rectifying between the cylinder stock and any substantial amount

of adjacent lighter components. The residue is withdrawn from the column 4 by a pipe 21 and is mixed with diluent introduced by the pipe 22, this diluent being preferably a kerosene of narrow boiling range. The entire mixture is forced by a pump 24 through a pipe heater 26 into a final column 28, preferably at a temperature of about 700° F. In the column 28, all of the oils including the lubricating stock and diluent are flashed as a unit under the contained heat of the mixture, the vaporization being enhanced by maintenance of a vacuum and also by the use of steam introduced at 30. Above the point of feed, the column is provided with entrainment catching decks 32, and a rectifying section 34 wherein the separation of the cylinder stock from the diluent takes place. At the bottom of the rectifying section 34 is a steam stripping section 36 into which steam is introduced at 38 for the purpose of removing any remnant of diluent from the cylinder stock. The cylinder stock is drawn off the stripping section at 40. The diluent is condensed overhead in a condenser 42 to which any suitable vacuum pump or jet is connected. The condensed diluent is separated from the water, a part being withdrawn at 44, and the remainder being returned to the column as reflux through a pipe 46. The diluent withdrawn at 44 may be returned directly to the pipe 22, and thereby continuously recirculated in the system, but due to unavoidable loss, a small make-up is necessary and accordingly, it is preferred to run the pipe 44 to a storage tank from which it may be withdrawn as needed.

The mixture introduced into the column 28 may contain some intermediate components which are not desired in the lubricating stock. These undesirable materials may consist of a small amount of wax distillate which has not been completely removed in the primary column 4, or possibly of a small amount of material decomposed in the heater 26. In any event, they are components which would lower the viscosity of the cylinder stock. Furthermore, since they are being continuously introduced into the final column 28, they are equally undesirable in the diluent. If removed from the cylinder stock, they tend to concentrate in the diluent and if the diluent is continuously recycled, it eventually would become so contaminated as to be useless. It will be appreciated further that even if the diluent obtained at 44 is not continuously recycled, the presence of these intermediates would materially reduce the commercial value of the diluent.

Inasmuch as the undesired intermediates are being continuously removed from the cylinder stock in the stripping section 36, they tend to rise through the rectifying zone 34. At the same time, the descending reflux of diluent tends to force the intermediates down through the rectifying zone. As a consequence, they are found in greatest concentration on the lower decks of the rectifying zone.

According to the present invention, a small quantity of liquid on the lower decks of the rectifying zone is continuously bled off by bleed pipes illustrated at 46. The quantity of material thus bled off is preferably about 5 to 10% of the total quantity of diluent. This material comprises largely diluent with possibly a small amount of cylinder stock, contaminated with the undesired intermediate products, which have concentrated on the lower decks. As a result of the continuous

bleeding of the rectifying zone, the intermediates are not permitted to build up in the column and are therefore removed from the zone of reaction before they have an opportunity either to pass upwardly into the diluent or downwardly into the stripping section.

The material bled at 46 may be thrown away without great loss, since it is small in quantity as compared to the total volume of diluent. However, since it contains values in the form of diluent as well as cylinder stock, it is preferably returned through a pipe 48 into the feed line which runs to the primary column 4. By mixing with the original feed, the components associate themselves with corresponding components of the feed and ultimately find their proper places either in the overhead, the side product, or the residue. Any intermediate materials which are undesirable either in the cylinder stock or the wax distillate may be suppressed into the rectifying section 8 and ultimately find their way to the slop draw-off 20.

According to the present process, the cylinder stock can be manufactured to any desired specifications of gravity and viscosity, and the diluent may be recovered in form suitable for continuous recirculation in the process. Although it has been stated in my prior patent that a close separation between the cylinder stock and the diluent may be difficult to attain by ordinary methods, it will be understood that the bleeding of intermediates at 46 materially improves this separation and insures against the presence of any diluent in the cylinder stock or of any cylinder stock in the overhead diluent.

Having thus described the invention, what is claimed is:

1. The method of dividing a reduced crude which consists in subjecting the reduced crude to a primary distilling operation to leave a residue consisting of lubricating oils of a substantially predetermined initial boiling point in mixture with asphalt, mixing said residue with a diluent of materially lower boiling point, heating the entire mixture and introducing it into a vaporizing zone to vaporize the lubricating oils and the diluent as a unit, passing the vapors into a rectifying zone to contact with a descending reflux of diluent whereby lubricating stock is condensed, continuously bleeding from the rectifying zone a small quantity of reflux containing imperfectly separated lubricating oil and diluent components, and returning said bled material to the primary distilling operation.

2. The method of dividing a reduced crude which consists in subjecting the reduced crude to a primary distilling operation to leave a residue consisting of lubricating oils of a substantially predetermined initial boiling point in mixture with asphalt, mixing said residue with a diluent of materially lower boiling point, heating the entire mixture and introducing it into a vaporizing zone to vaporize the lubricating oils and the diluent as a unit, passing the vapors into a rectifying zone to contact with a descending reflux of diluent whereby lubricating stock is condensed, stripping the lubricating stock with steam to vaporize any light and intermediate components therefrom, bleeding from the rectifying zone a small quantity of material, and returning said bled material to the primary distilling operation.

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