

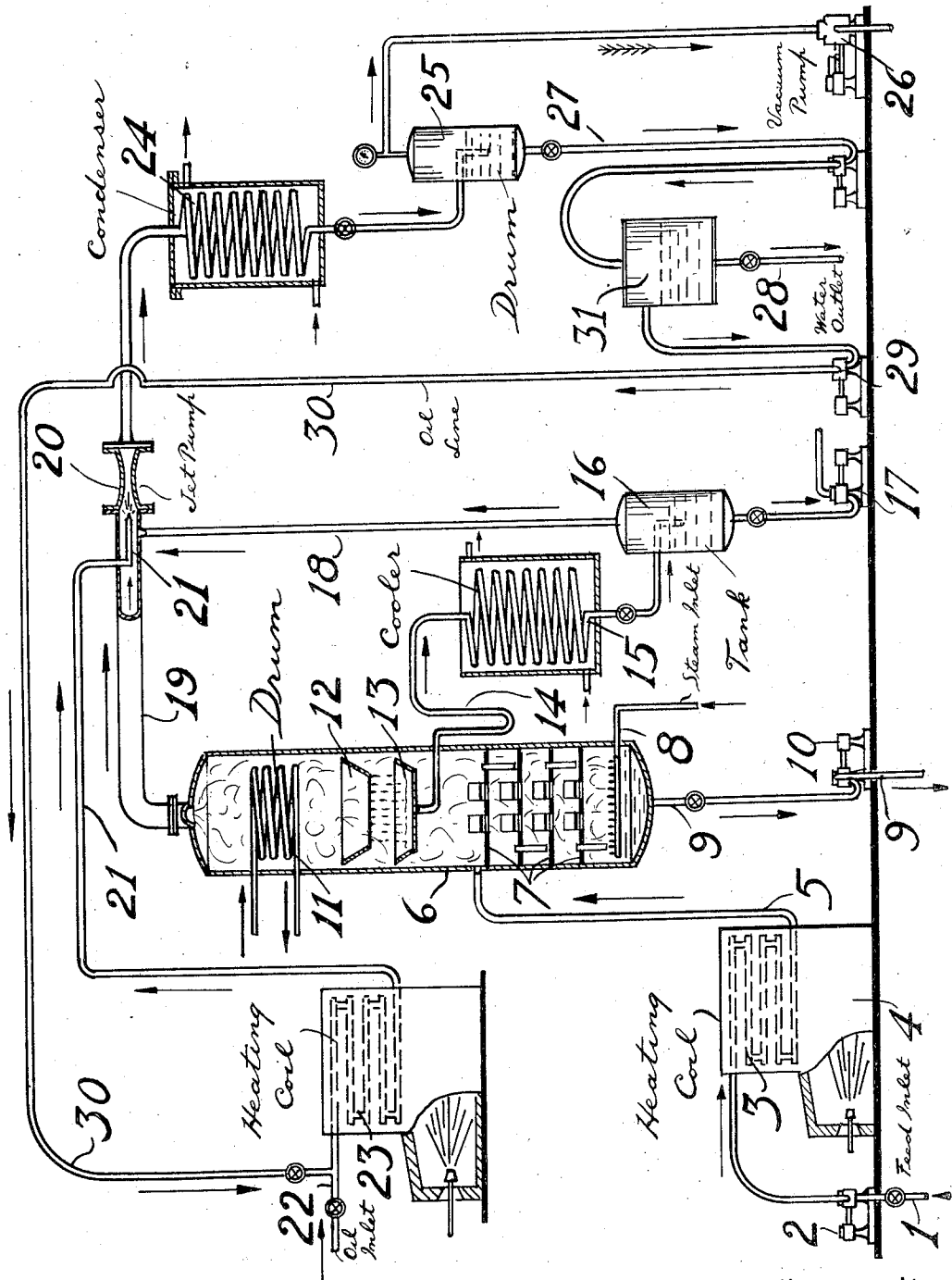
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METHOD FOR THE DISTILLATION OF EASILY DECOMPOSABLE MATERIALS

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METHOD FOR THE DISTILLATION OF
EASILY DECOMPOSABLE MATERIALSWarren K. Lewis, Newton, Mass., assignor to
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10 Claims. (Cl. 196—77)

The present invention relates to the art of distilling easily decomposable materials without substantial destruction and more specifically to a distillation method adapted to obtain efficient and economical distillation under sub-atmospheric pressure. The invention will be fully understood from the following description and the drawing.

The drawing is a semi-diagrammatic representation, in side elevation, of an apparatus particularly adapted to the distillation of petroleum lubricating oils.

In the distillation of lubricating oils and other easily decomposable materials of high boiling point, it is desirable to conduct the distillation with the least possible decomposition and to this end the distillation is ordinarily conducted at reduced pressure or, in other words, under vacuum. The introduction of jet pumps greatly increased the commercially practical degree of pressure reduction so that distillations at 50 or 25 or even 10 m. m. of mercury, absolute pressure, have become common. The efficiency of the venturi or jet pump is, however, extremely low, being of the order of 1 to 2% as ordinarily conducted. The present invention relates to the art of distilling lubricating oils under vacuum which can be efficiently and economically produced.

Referring to the drawing reference character 1 denotes a feed line which conducts the oil to be distilled from storage, not shown. Pump 2 forces the oil rapidly through a heating coil 3 arranged in a furnace setting 4. The heated oil discharges through pipe 5 into a distillation drum 6 which is maintained under high vacuum.

Drum 6 is substantially constructed and braced in a known manner to withstand the external pressure. The oil preferably discharges above a series of liquid-vapor contact zones which may be in the form of plates 7 fitted with bell caps and over-flow pipes which are well known in the art. Steam may be introduced at the lower end of chamber 6 below the series of plates 7, by means of a pipe 8, in order to strip the residue as is frequently used in oil distillation but it is preferable to omit the steam, which reduces the obtainable vacuum. The residue is withdrawn by a pump 10 through a pipe 9 to storage or to a similar unit for further distillation.

A cooling coil 11 is arranged in the upper end of chamber 6 to condense the heavy vapors and a deflecting shield 12 may be placed around the inner wall of the drum to conduct the condensate into a pan 13, from which it may be

withdrawn by a pipe 14. The oil stream is cooled in a cooler 15 and collected in a run-down tank 16. Pump 17 removes the oil from the run-down tank which is balanced by a line 18 connecting the upper end thereof to the vapor pipe to be referred to immediately below.

Gas, steam and very light oil constituents are drawn from drum 6 through a vapor pipe 19 which contains a constricted portion 20 in the form of a Venturi nozzle referred to hereinafter as the jet pump. The motive power for the jet is a stream of vaporized oil injected through a pipe 21. The oil is supplied by line 22 and is vaporized in the heating coil 23. The particular nature of the oil will be made clear below.

From the jet the mixed vapors flow to a condenser 24 which is adapted to condense the oil injected by means of line 21 and the products therefrom are discharged into a drum 25. Gases are removed from this drum by a vacuum pump 26, which may be of the displacement type, and the oil is removed separately by means of a pipe 27. The drum 31 may be used to effect a separation between the oil and condensed steam, if the latter has been used during distillation, and water may be removed by pipe 28 to the sewer. The oil is preferably forced by a pump 29 through a pipe 30 and back to the inlet of the heating coil 23 for re-use as a motive power for the jet pump.

The driving fluid which is used for the jet pump is a high boiling, easily vaporizable hydrocarbon material. Heavy naphtha, kerosene and similar cuts may be used, but it is preferable to use the highest molecular weight material available, such as gas oil. By properly choosing the particular cut it is possible to obtain oil mixtures of molecular weight above 120, say up to 200 or higher which have vapor pressure of 5 to 10 mm. of mercury absolute pressure at condenser temperatures. Such cuts are admissible for the present purposes. The fraction utilized is adapted to evaporate freely without any substantial decomposition at the relatively high pressure existing in pipe coil 23 so as to supply a substantially vaporized, undecomposed oil at the nozzle inlet. Coal tar fractions may be used but ordinarily petroleum fractions are more readily available, cheaper and more satisfactory in that they are liquid at low temperatures at which coal tar fractions ordinarily solidify and what is more important they have higher vapor densities for a given boiling point. Heavily cracked gas oils which are highly refractory and of high specific gravity are admirably adapted to the present purpose. Furthermore they are of little value as gas

carburants and Diesel fuels, so that they may be obtained for the present purpose at low cost. Although it is not necessary to closely fractionate the oil used for the jet pump, it preferably boils
5 between about 400 and 650° F. or from 500 to 600° F. and should be free, on the one hand, from low boiling ends which would give high vapor pressure and on the other from very high boiling fractions which are not readily vaporized. It
10 is, in fact, desirable to steam the oil before returning to coil 23 for re-use in order to remove traces of low boiling fractions dissolved from the distillation gases.

Although the jet pump has been shown in connection with a pipe still, it will be understood that it can be adapted for use with shell stills for either continuous or batch operation. It is also generally the case that sufficient low temperature heat is available about a refinery
15 to evaporate the oil or, at least, to furnish a substantial portion of the heat necessary for this purpose. For this reason the heat efficiency of the method is ordinarily very satisfactory. The pumping efficiency is also several fold greater
20 than can ordinarily be obtained by the use of high pressure or low pressure steam as ordinarily employed in connection with jet pumps. For example, by substituting a gas oil for steam, the pumping efficiency may be easily raised from say
25 1 or 2 to 8 or 10%. The amount of oil required for pumping, as may be appreciated, varies considerably with the particular installation, the particular type or design of pumps, the relative freedom from leakage, the vacuum maintained and other factors, but it has been found that ordinarily the amount required is from about 5 to
30 30 gallons of gas oil per 100 cu. ft. of incompressible gas to be handled.

In the following claims the words "constricted outlet" are to be interpreted to mean constricted in the form of a Venturi jet with the usual gradual decrease of cross section to the neck and gradual re-expansion of cross section, the driving fluid being introduced at the neck.

15 The present invention is not to be limited to any theory of the operation of the jet pump nor to any particular hydrocarbon fraction as the pumping medium, but only to the claims in which it is desired to claim all novelty in the invention.
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I claim:

1. An improved process for non-destructive distillation of easily decomposable materials which comprises evaporating such material in a
55 distillation zone, withdrawing gases from said zone through a constricted outlet, discharging a stream of vaporized high boiling hydrocarbon

material substantially free from constituents having a high vapor pressure through the constricted outlet whereby the distillation zone is maintained at a sub-atmospheric pressure and condensing the vaporized hydrocarbon.

2. Process according to claim 1 in which the vaporized high boiling hydrocarbon is a distillate free from fractions boiling below 400° F.

3. Process according to claim 1 in which the vaporized high boiling fraction is a petroleum fraction.

4. Process according to claim 1 in which the high boiling hydrocarbon is petroleum fraction selected from the class of heavy naphthas, kerosene and gas oil.

5. An improved process for non-destructive distillation of heavy petroleum fractions which comprises evaporating such fractions in a distillation zone, condensing the high boiling vapors and separately removing said condensate, withdrawing gases and light vapors from the evaporation zone through a constricted outlet, discharging a stream of a separately vaporized high boiling petroleum fraction substantially free from constituents having a high vapor pressure through
25 said constricted outlet whereby the evaporation zone is maintained at a sub-atmospheric pressure and condensing the vaporized high boiling fraction.

6. Process according to claim 5 in which the stream of the vaporized petroleum fraction and gas is cooled so as to condense the former and discharged into a space held under vacuum from which liquid and gas are separately withdrawn.

7. Process according to claim 5 in which the stream of the vaporized petroleum fraction and gas is cooled so as to condense the former and discharged into a space held under vacuum from which liquid and gas are separately withdrawn and said liquid is re-vaporized and returned to the constricted outlet of the evaporation zone.

8. Process according to claim 5 in which the petroleum fraction is a gas oil.

9. Process according to claim 5 in which the oil to be distilled and the separate petroleum fraction are heated separately by a passage through elongated heating zones and the oil to be distilled is discharged into the evaporation zone, and the heated separate petroleum fraction is discharged through the constricted outlet.
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10. Process according to claim 5 in which the high boiling petroleum fraction is characterized by a vapor pressure less than 10 mm. of mercury at condenser temperature and a molecular weight in excess of 120.

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