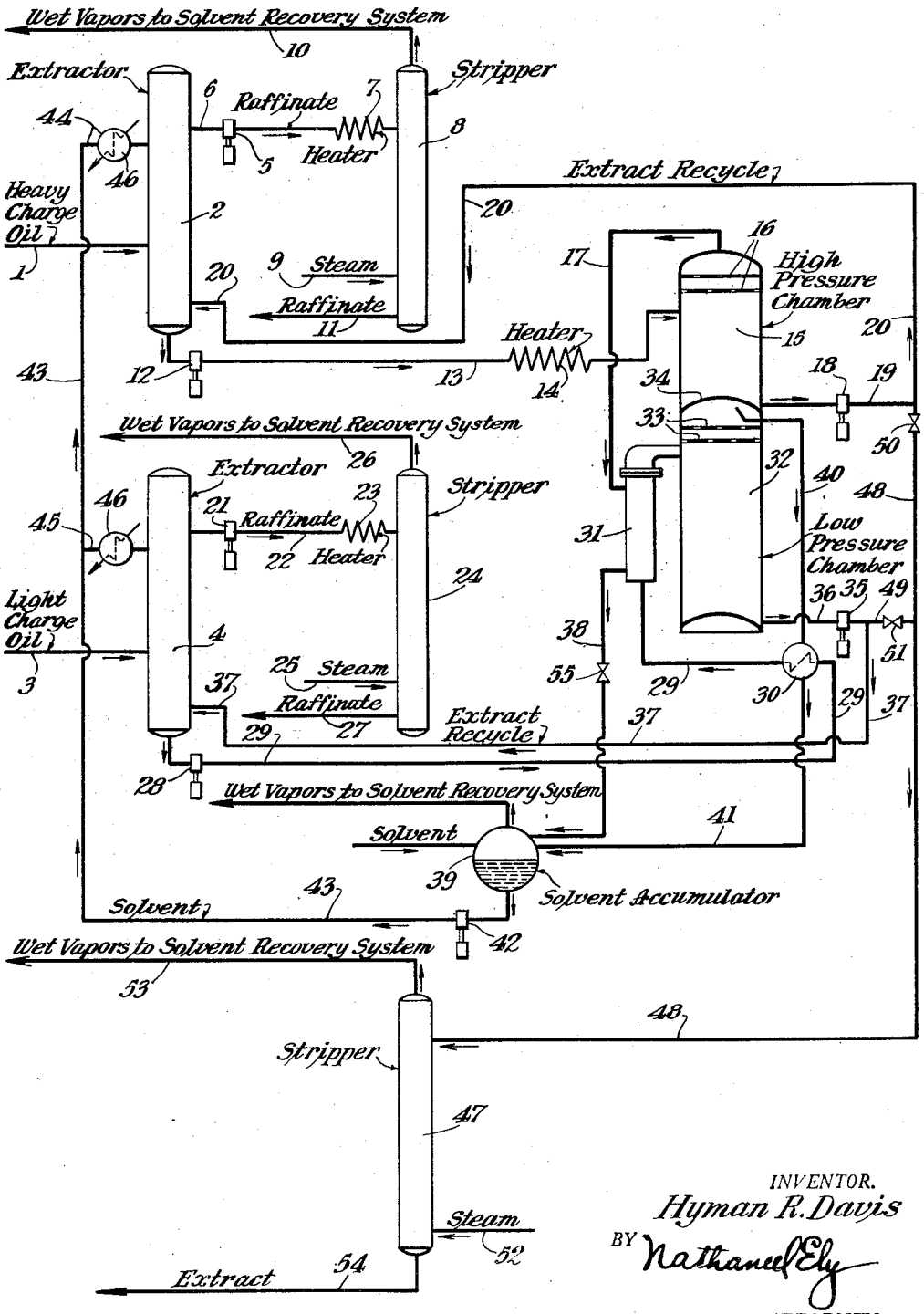
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SOLVENT EXTRACTION

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SOLVENT EXTRACTION

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This invention relates to solvent extraction of hydrocarbon oils and more particularly to the extraction of lubricating oils.

In the production of lubricating oils by customary solvent extraction processes, varying demands for oils of different character require frequent reconditioning of the extraction system to obtain a required end product. A system which has been conditioned to handle one charge oil for the production of a lubricating oil of given viscosity index must be reconditioned in order to handle another charge oil and produce a lubricating oil of different viscosity index. In addition to that disadvantage, expensive tankage is required to retain one charge oil in reserve while another is being processed.

As an alternative to this system, a method may be used whereby two or more extraction stages are treated as one system. The extract solution from each stage is immediately combined and passed to a single-, or double-effect recovery system. This method has the disadvantage of recycling to each extraction stage an extract that is not of a proper composition for each stage alone since it is a blend of the original extracts from each of the aforesaid extract stages.

An important object of my invention is to provide in a simple, satisfactory and economical manner for the solvent extraction of different lubricating oils simultaneously from different charge oils within a single system.

A further object of my invention is to provide, in such simultaneous processing of different charge oils, for recycle of the extracts of the different charge oils to the appropriate extraction zones.

A still further object of my invention is to provide for such simultaneous processing of different charge oils while, at the same time, maintaining all the benefits of a multiple effect evaporator recovery system and in a manner to require a minimum of equipment.

Other objects and advantages of my invention will appear from the following description taken with the accompanying drawing showing a flow sheet of a suitable system for carrying out my invention.

According to the invention, a heavy charge oil and a light charge oil are introduced simultaneously into separate extraction zones and, within each zone, contact of the charge with the solvent is effected under thermal conditions suited to the particular charge. The raffinate phase is passed from each zone, heated and introduced to a steam stripping zone individual to the

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extraction zone, for separation of solvent from the raffinate or desired end product. The extract phase is withdrawn from the heavy oil extraction zone, heated and introduced to a high pressure vaporization zone, wherein the solvent is vaporized from the extract, the latter being recycled to said extraction zone in which it originated. At the same time, the extract phase is withdrawn from the light oil extraction zone, passed in indirect heat exchange relation to the vapor from the said high-pressure vaporization zone and then introduced to a low pressure vaporization zone wherein the solvent is vaporized from the extract. From the low pressure vaporization zone the extract is recycled to the light oil extraction zone where it originated. The solvent recovered from the extract within both the high pressure vaporization zone and the low pressure vaporization zone is recycled to the extraction zones and heat-conditioned in the course of its recycle to regulate the temperatures within the extraction zones.

In the operation of the system shown in the drawing the charge of heavy oil is continuously introduced through line 1 to an extraction column 2. Simultaneously, the light oil charge is introduced through line 3 to an extraction column 4. Within each column counter-current contact is effected between the respective charge and the solvent. From the upper portion of column 2 the raffinate phase, comprising the lubricating oil component of the charge and some solvent, is forced by the pump 5 through line 6 and a heater 7 to a stripping column 8. Steam is introduced to the lower portion of this stripping column through the line 9, and the steam and recovered solvent are passed off from the top of the column through the line 10 to a solvent recovery system, not shown. From the bottom of the stripping column the recovered raffinate is withdrawn through the line 11.

The extract phase or solution within the column 2 is withdrawn from the bottom of the column and passed by the pump 12 through line 13 and a heater 14 to a high pressure chamber 15 having rectifying plates 16 within the upper portion thereof. Solvent vaporized by the heat supplied by the heater is passed off from the space above the rectifying plates through the overhead line 17. Recovered extract is recycled by the pump 18 through lines 19 and 20 to the lower portion of extraction column 2 for further recovery of raffinate.

From the upper portion of extraction column 4 the raffinate phase, comprising the lubricating

oil component of the charge, together with some solvent, is passed by the pump 21 through line 22 and heater 23 to the upper portion of a stripping column 24. Steam is supplied to the lower portion of the column through line 25, and the steam and recovered solvent are passed off from the top of the column through line 26 to the solvent recovery system. From the bottom of the stripping column the recovered raffinate is withdrawn through line 27.

The extract phase within the column 4 is withdrawn from the bottom of the column and passed by the pump 28 through line 29, a condenser 30 and an evaporator 31 to a low pressure chamber 32 having rectifying plates 33 within the upper portion thereof. As shown, this chamber, together with the high pressure chamber 15, may be defined by a single column, partitioned as at 34. The evaporator 31 is of a shell-and-tube type and the line 29 delivers to the tube side while the line 17 which conducts the hot solvent vapors from the high pressure chamber 15 delivers to the shell side of the evaporator. Thereby, the extract phase delivered by the line 29 is heated to vaporize the solvent component thereof by passing it in indirect heat exchange relation with the hot vapor from chamber 15. Thus, the heat input obtained from the single heater 14 is utilized to vaporize the solvent component from the extract phase delivered from both of the extraction columns.

Within the low pressure chamber 32 the extract is recovered from the solvent and settles within the lower portion of the chamber. A pump 35 recycles the recovered extract through lines 36 and 37 to the lower portion of the extraction column 4, where it originated, for increasing the yield of raffinate.

The solvent recovered from the extract solution within the high pressure chamber 15, after passing through the evaporator 31, is conducted through line 38, provided with a valve, to a solvent accumulator 39. The solvent vapor recovered within the low pressure chamber 32 is passed from the space above the rectifying plates 33 through the line 40 to the condenser 30. There it imparts heat to the extract delivered through the line 29 and is liquefied and then passed through the line 41 to the accumulator 39. A pump 42 passes the solvent from the accumulator through a line 43 which is connected by branch lines 44 and 45 to the extraction columns 2 and 4 respectively. Thereby, the recovered solvent is recycled to said columns. Within each of said branch lines there is a heat exchanger 46 through which either heating or cooling fluid may be passed in indirect heat exchange relation to the solvent. By control of the temperature of the delivered solvent, proper thermal conditioning of the extraction columns is obtained.

Elimination of the extract from the system is effected through a stripping column 47. A line 48 is connected to the extract recycle line 19 and leads to the upper portion of said stripping column. A line 49 also connects the extract recycle line 36 with said line 48. By means of a valve 50 in the line 48 and located adjacent the point of connection of said line with the line 19, and by means of a valve 51 in the line 49, the delivery of the extract from the system to the stripper 47 may be controlled. Steam is introduced to the lower portion of the stripping column through the line 52 and steam and recovered solvent are passed from the top of the column through the line 53 and delivered to the aforesaid solvent recovery system. Through line 54 the extract is withdrawn from the column 47 and from the extraction system.

It is thus apparent from the foregoing disclosure of my invention that I have discovered a new method providing for the solvent extraction of two different oil stock charges in one system while separately treating the extract solutions from each stage and, at the same time, maintaining all the advantages of a double effect recovery system for the extract solutions.

As an example of the employment of the system for the processing of two particular charge oils, it will be assumed that the heavy charge oil is a deasphalted petroleum residuum, that the light charge oil is an S. A. E. 10 petroleum distillate and that furfural is employed as the solvent. Then, assuming that the heavy oil is charged to the extraction column 2 at the rate of 1,000 bbls. per day, that the light oil is charged to the extraction column 4 at the rate of 2,000 bbls. per day, and that the solvent is charged to each of said extraction columns at the rate of 4,000 bbls. per day, the following approximate thermal and pressure conditions are maintained for optimum performance of the system. A temperature of 180° F. is maintained within the lower portion of the extraction column 2 and a temperature of 285° F. is maintained within the upper portion of said column. The heat input of the heater 7 should be such that the raffinate solution is introduced into the stripper 8 at 430° F., and the heat input of the heater 14 should be such that the extract solution is introduced into the high pressure chamber 15 at 450° F. A pressure ranging from 30 to 50 lbs. gage, is preferably maintained within this chamber. For the light oil extraction column 4 suitable temperatures are 150° F. for the lower portion of the column and 220° F. for the upper portion of the column. The heat input of the heater 23 is also preferably such that the raffinate solution is introduced into the stripper 24 at 430° F., while the heat input by the heat exchanger 31 is preferably such that the extract solution is introduced into the low pressure flash chamber 32 at 340° F. Preferably this chamber is maintained at atmospheric pressure, or only a few pounds above atmospheric.

While furfural is mentioned as a satisfactory solvent for employment in the process, other well-known solvents such as nitrobenzene, phenol, crotonaldehyde, chlorex, cresylic acid, liquid sulfur dioxide and benzene, for examples, as well as numerous other solvents, may be employed satisfactorily. It will also be understood that the employment of the process is not limited to the extraction of lubricating oils. The process may be employed to advantage in processing a variety of different charges to obtain end products other than lubricating oils.

It is, of course, to be understood that the present disclosure of my invention is merely illustrative and in no wise limiting and that the invention comprehends such modifications as will come within the scope of the following claim:

I claim:

In the recovery of solvent and products from the solvent extraction of two independent hydrocarbon oils, in which a relatively heavy charge oil is contacted with a solvent within a first extraction zone at relatively high temperature and simultaneously a lighter charge oil is contacted with solvent within a second extraction zone at lower temperature thereby forming an extract solution and a raffinate solution in each zone, the

process which comprises passing the extract solution from the first-mentioned extraction zone through a heating zone and thence to a vaporization zone and there vaporizing the solvent from the extract under relatively high pressure, simultaneously passing the extract solution from the second-mentioned extraction zone through a plurality of heating zones and thence to another vaporization zone, maintaining the second-mentioned vaporization zone under lower pressure than the first-mentioned vaporization zone, and supplying the heat for the extract solution for vaporization of the solvent therefrom within said lower pressure zone by passing the extract solution in indirect heat exchange relation with the vaporized solvent from the first and second vaporization zones, and recycling a portion of the

extracts from said vaporization zones to the respective extraction zones.

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