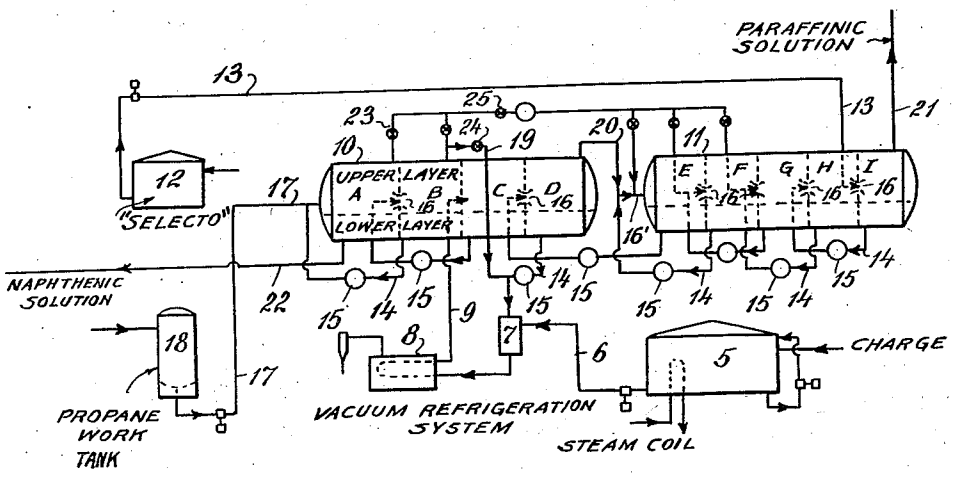
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METHOD OF TREATING OILS

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METHOD OF TREATING OILS

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4 Claims. (Cl. 196—13)

This invention is directed to methods of solvent refining mineral oils to produce therefrom lubricant oil fractions of high viscosity index and low viscosity gravity constant (v. g. c.). Solvent refining is a process wherein an oil is admixed with some liquid capable of exercising preferential solvent power for one of the groups of constituents in the oil, followed by phase separation, followed by removal of the solvent and the extracted constituent group admixed therewith. Double solvent refining is that variation of the above process wherein two solvents are employed, one exhibiting preferential solvent power for the paraffinic constituents of low v. g. c., and the other exhibiting preferential solvent power for the naphthenic or aromatic constituents of high v. g. c. These two solvents are usually allowed to flow countercurrently through a series of mixing and settling stages, the oil to be treated being introduced at some stage intermediate in the series. This invention is concerned with the operation of such a treating system.

A solvent reagent commonly used for naphthenic solvent is "tar acid", a mixture preponderating in cresylic acid, known commercially as "selecto." The paraffinic solvent commonly used is propane in liquid form or mixtures of similar light hydrocarbons, commercially termed "propane".

To properly understand not only the reasons giving rise to this invention, but the invention itself, reference is now made to the drawing attached to this specification, the single figure of which shows an extractive apparatus suitable for commercial practice of the double solvent refining process and of this invention as applied thereto.

Referring to the drawing, the method of operation is as follows: Raw oil to be treated, stored in tank 5, passed through pipe 6 to mixer 7, where it is mixed with materials later described, thence through cooler 8 and pipe 9 to enter chamber C of extractor 10. Extractors 10 and 11 are composed respectively of successive chambers A, B, C, D, and E, F, G, H, I, and may be separate as shown, or combined in one body. Each chamber is a settling space wherein phase separation may occur between the raffinate phase, composed of paraffinic oil plus paraffinic solvent, and the extract phase composed of naphthenic oil and naphthenic solvent. Naphthenic solvent, hereinafter spoken of as "selecto", usually a mixture of cresylic and similar tar acids, originates in tank 12, and passes through pipe 13 to enter chamber I, wherein, after contact with oil, it becomes extract. Thereafter, the extract moves through the settling chambers in reverse order, bing withdrawn from each chamber by a pipe 14, in which there is a pump 15, and introduced into the preceding chamber as the jetting medium in a jet mixing device 16 which is so mounted as to entrain raffinate layer from the preceding chamber. The only variants from this setup are in chamber I where the jet is fed by pipe 13, between chambers B and C where the jet mixer is replaced by an external mixer to permit of cooling after mixing, before chamber E, where the mixer is replaced by a pipe section 16' having the same function as 16, and before chamber A, where extract is pumped into pipe 17. The paraffinic solvent, usually liquid propane, and hereinafter referred to as propane, originates in tank 18, and passes through pipe 17 to enter chamber A, where, after contacting with and saparating from extract, it becomes known as raffiinate, which raffinate proceeds through chamber A to I in order by means of mixers 16 and pipes 19 and 20. In the operation thus described, the oil introduced at 6 is separated into a paraffinic raffinate phase containing propane and some "selector" which emerges from the extraction system by pipe 21, and a naphthenic extract phase containing "selector" and some propane which emerges by pipe 22.

It will be seen from the above that under normal conditions of operating, a constant amount of oil is introduced at pipe 9, a constant amount of "selecto" at pipe 13, and a constant amount of propane at pipe 17. It will also be noted that the supply of reagent to any stage consisting of a mixer and settler is dependent upon the ability of the stage preceding in the use of that reagent to reject the reagent. Thus the supply of paraffinic solvent in stage D, for example, is dependent upon the amount of propane plus paraffinic oil— commonly referred to as "raffinate"— separated in C, while the supply of naphthenic solvent in D is dependent upon the amount of "selecto" plus naphthenic oil,—commonly referred to as "extract"—separated in E. In commercial operation of such a system, at high rates of separation it has developed that the solvent requirements at the various stages are not the same, more solvent being required in some stages than in others. This might be solved by the introduction of more fresh solvent to a particular stage except for the fact that stages of treatment requiring high ratios are adjacent stages requiring low ratios, and both are intermediate between stages requiring intermediate ratios.

The object of this invention is to provide a method of operating a double solvent refining system to provide control over the ratios of solvents present in intermediate stages of the system and to permit individual variation of such ratios while maintaining a constant overall throughput of solvent.

For an example of the method and its application, referring again to the drawing, the operation conducted in chambers A and B requires a relatively high ratio of paraffinic solvent. The operation in chambers C and D requires a lower ratio of solvent, and the operation in chambers E and F requires a higher proportion of solvent to paraffinic oil than would be the case if the raffinate introduced to these chambers were the raffinate produced by flowing the whole of the propane used in chambers A and B through chambers C and D and then into E and F. This demand may be met and the difficulty corrected by installing pipe 23, valve 26 in pipe 19 and valve 25 in pipe 23. Then the raffinate layer produced in chamber A, which is comparatively rich in paraffinic solvent and poor in paraffinic oil may be divided, less being introduced into chambers B, C, and D, and the remainder being introduced to chambers E, and F, or G. Thus the double advantage of treating in E and F with a solvent rich raffinate is obtained, while at the same time the requirements of C and D are properly served. At the same time, it permits the amount of quality of solvent employed in chambers A, B, H, I to be the same, in proper accordance with their usual requirements. In commercial operation, this change has been found not only to permit of better and more constant operation at the same rate of throughput, but to enable the operation at higher rates of throughput for equal yield without derangement of operation.

We claim:

1. A method for double solvent refining of petroleum lubricant fractions, comprising the following steps: Flowing a paraffinic solvent and a naphthenic solvent countercurrent through a series of stages each consisting of a mixing step and a settling step, introducing an oil to be treated to a stage intermediate the ends of the series, removing paraffinic solvent and a raffinate oil from one end of the series, removing naphthenic solvent and an extract oil from the other end of the series, and by-passing a portion of one solvent across at least one intermediate stage so that the throughput of solvent in that intermediate stage may be less than the total throughput, the throughput at the initial and end stages may be equal to the total throughput, and the relative concentration of solvent in the solvent-solute phase formed by the solvent at the point of reintroduction may be greater than in the absence of such by-passing.

2. A method for double solvent refining of petroleum lubricant fractions, comprising the following steps: Flowing a paraffinic solvent and a naphthenic solvent countercurrent through a series of stages each consisting of a mixing step and a settling step, introducing an oil to be treated to a stage intermediate the ends of the series, removing paraffinic solvent and a raffinate oil together from one end of the series, removing naphthenic solvent and an extract oil together from the other end of the series, and by-passing a portion of the paraffinic solvent from a stage prior in order of paraffinic solvent flow to the stage where oil is introduced to a stage subsequent to oil introduction, whereby the throughput of that solvent at the stage of oil introduction is decreased, and the relative concentration of that solvent in the solvent-raffinate phase at the stage of reintroduction is increased, while the total throughput of that solvent remains constant and substantially equal in the initial and final zones in the direction of its flow.

3. In a duosol extraction process for separating a hydrocarbon oil into portions of different properties which comprises introducing a selective solvent for non-paraffinic oil components into a multi-stage countercurrent extraction apparatus at a first point, introducing auxiliary solvent for paraffinic components at a second point spaced from the first, said auxiliary solvent and selective solvent being adapted to form two liquid phases when mixed with said oil under the conditions of the process, counterflowing said solvents in the apparatus, introducing said hydrocarbon oil into the counterflowing solvents at a third point intermediate said first and second points, and removing said counterflowing solvents containing dissolved oil components at spaced points on either side of said third point, the improvement which comprises increasing the capacity of said apparatus by withdrawing a portion of the auxiliary solvent phase from a stage near said second point and introducing it into a non-adjacent stage in the direction of flow of the auxiliary solvent phase.

4. A method for double solvent refining of petroleum lubricant fractions, comprising the following steps: Flowing a paraffinic solvent and a naphthenic solvent countercurrent through a series of stages each consisting of a mixing step and a settling step, introducing an oil to be treated to a stage intermediate the ends of the series, removing paraffinic solvent and a raffinate oil together from one end of the series, removing naphthenic solvent and an extract oil together from the other end of the series, and by-passing a portion of the paraffinic solvent from a stage prior in order of paraffinic solvent flow to the stage where oil is introduced to a stage subsequent to oil introduction.

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CERTIFICATE OF CORRECTION.

Patent No. 2,184,858. December 26, 1939.

DOUGLAS L. HOOKER, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 20, for "saparating" read separating; lines 26 and 28, for "selector" read "selecto"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of March, A. D. 1940.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)