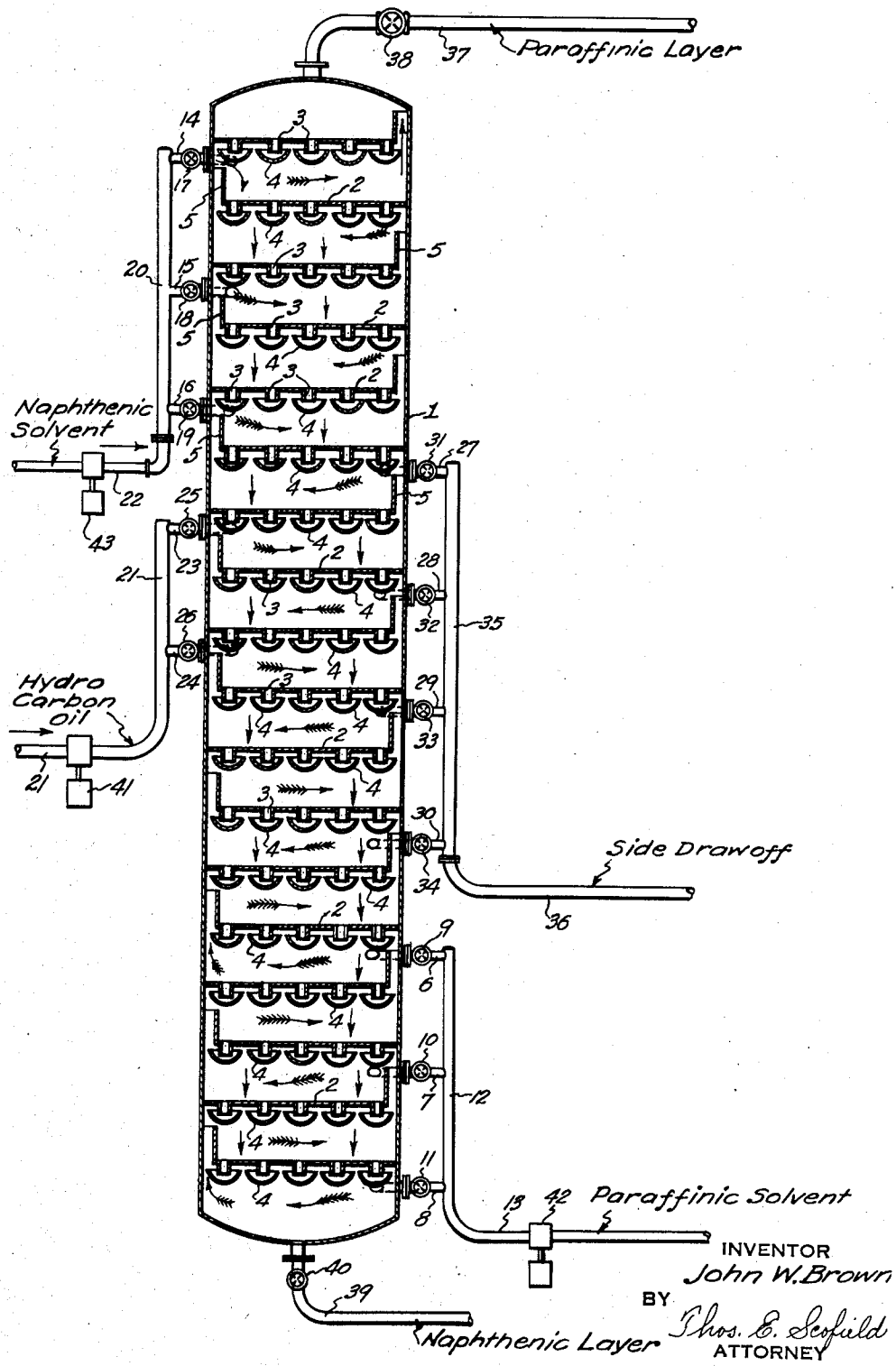
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CONTACTING APPARATUS

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CONTACTING APPARATUS

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My invention relates to a contacting apparatus and more particularly to an apparatus for contacting liquids of different specific gravities, as for example, contacting hydrocarbon oils for treatment with selective solvents.

Hydrocarbon oils must be refined before they can be successfully employed as lubricating oils. A crude lubricating distillate or residuum is made up of a mixture of hydrocarbons. Some of these compounds are highly paraffinic, some are of intermediate character, and some are highly naphthenic or asphaltic. Processes have been developed whereby the oils to be treated are passed into contact with respective selective solvents which are adapted to selectively dissolve the paraffinic and non-paraffinic components. These processes permit the refiner to completely wash the paraffinic oil of its naphthenic constituents and, at the same time, to completely recover the paraffinic oil from the naphthenic residue.

One object of my invention is to provide an apparatus for contacting hydrocarbon oils with selective solvents by counter current contacting.

Another object of my invention is to provide a counter current treating tower for the treatment of hydrocarbon oils.

Other and further objects of my invention will appear from the following description.

The accompanying drawing is a diagrammatic sectional elevation of a contactor containing one embodiment of my invention.

In general, my invention contemplates the provision of apparatus in which naphthenic and paraffinic solvents are passed into contact with the oil to be treated in counter current flow, that is, the fresh paraffinic solvent is brought into contact with oil previously treated by paraffinic solvent which is being progressively used. Similarly, the naphthenic solvent is brought into contact with oil which has been previously treated by partially used naphthenic solvent.

More particularly referring now to the drawing, a tower 1, which may be made of sheet steel or any other suitable material, is provided with a number of decks 2. Each deck is provided with a plurality of downwardly extending tubes 3. The tubes 3 communicate with the decks 2 and have their lower ends covered with cap members 4, of any suitable design. The cap members are such that their upper lips project beyond the lower ends of tubes 3. The small pools of liquid which gather in respective caps 4 are adapted to seal the lower open ends of tubes 3. Each deck is provided with at least one opening having a riser 5 providing communication between respective spaces formed by the decks 2 and the walls of the tower 1. Communicating with a number of lower decks are pipes 6, 7, and 8, controlled by valves 9, 10, and 11, respectively. Pipes 6, 7, and 8 enter a manifold 12 communicating with a line 13. Communicating with a plurality of upper decks are pipes 14, 15, and 16, controlled by valves 17, 18, and 19 respectively. The pipes 14, 15, and 16 communicate with a manifold 20, which communicates with pipe 22. A number of pipes 23 and 24 provide communication with a plurality of intermediate decks of the contactor and the pipe 21. Pipe 23 is controlled by a valve 25, and pipe 24 is controlled by a valve 26. Also communicating with a plurality of intermediate decks of the contactor are pipes 27, 28, 29, and 30, controlled by valves 31, 32, 33, and 34, respectively. The pipes 27, 28, 29, and 30 communicate with a manifold 35 which communicates with a pipe 36. The top of the tower 1 is provided with a pipe 37 controlled by a valve 38. The bottom of the tower is provided with a pipe 39 controlled by a valve 40.

In operation I may employ as a naphthenic solvent any one of a number of solvents known to the art, such as a cresol base, furfural, phenol, B—B' dichlor ethyl ether, crotonaldehyde, nitrobenzene, sulphur dioxide, and the like. For the paraffinic solvents, I may employ propane, ethane, butane or the like. The paraffinic solvent is always very much lighter than the naphthenic solvent and the solution of propane and the hydrocarbon oil is always lighter than the naphthenic solvent, the use of the apparatus being so controlled as to make a solution through which the naphthenic solvent will flow. The naphthenic solvent is not miscible with the paraffinic solvents.

In operation, the hydrocarbon oil to be treated is introduced through line 21 by pump 41 and is pumped through either lines 23 or 24 or both, depending upon the position of valves 25 and 26, and is discharged through the line 23 or 24 or both, into the tower at an intermediate deck or decks thereof. The paraffinic solvent is pumped by pump 42 through line 13 and is introduced to one or a number of lower decks of the tower, depending upon the position of valves 9, 10, and 11. The naphthenic solvent is introduced through line 22 and is pumped by pump 43 through line 20 and is introduced to one or a number of upper decks of the tower, depending upon the position of valves 17, 18, and 19. In the drawing, the feathered arrows indicate the path of flow of the paraffinic solvent and the plain arrows indicate the path of flow of the naphthenic solvent.

It will be observed that, in each succeeding deck of the tower going toward the top thereof, the liquid will have increasingly stronger concentrations of paraffinic substances. In one of the lower decks of the tower, the oil has already been contacted with paraffinic solvent so that a smaller percentage of paraffinic substances will be present in the oil moving toward the bottom of the tower. In order to dissolve these smaller

percentages of paraffinic substances from the oil, fresher paraffinic solvent must be employed. This is automatically taken care of by introducing the paraffinic solvent at the lower decks of the tower. Similarly, the liquid in the tower will have increasingly smaller concentrations of naphthenic substances toward the top of the tower. In one of the upper decks of the tower, the concentration of naphthenic substances will be small and, in order to remove them, fresher naphthenic solvent must be employed. This is accomplished by introducing the naphthenic solvent at the top of the tower. It will be observed that, in my construction, the freshest naphthenic solvent contacts the oil having the least naphthenic substances present and the freshest paraffinic solvent contacts the oil having the least paraffinic substances present. The naphthenic solvent flowing down the tower will dissolve naphthenic substances so that the lower decks of the tower will have solutions of naphthenic substances in the naphthenic solvent and will form a naphthenic layer or layers in the lower deck or decks of the tower. Similarly, the solution in the upper decks of the tower will be paraffinic substances, in solution in the paraffinic solvent.

The naphthenic solvent which is of high specific gravity will flow downwardly from compartment to compartment, through the tubes 3 and flow over the lips of the caps 4. Each compartment of the tower formed by adjacent decks 2 and the side walls of the tower acts as a contacting and settling unit in a multistage system. In each deck space, the two layers are brought into intimate contact and the layers are then allowed to separate before passing onward to the next contacting step. It will be observed that, as the paraffinic and naphthenic layers approach the opposite ends of the tower, they come into contact with more and more concentrated solutions of the opposite selective solvent. Hence, the paraffinic layer is stripped of its naphthenic content and the naphthenic layer of its paraffinic content, and the apparatus is such that the contact is more complete.

In adjusting the tower during commencement of operations, depending upon the specific gravity of the hydrocarbon oil charge, it may be desirable to vary the concentration of the paraffinic solvent such as propane. This can readily be accomplished by opening one of the valves 31, 32, 33, or 34 and withdrawing liquid from one of the decks with which the lines controlled by the valves communicate.

The tower may be used for contact with a single selective solvent; for example, if it is desired to treat with propane, only propane would be introduced at the bottom and the hydrocarbon oil to be treated through the manifold 20. Similarly, if it is desired to treat only with a naphthenic solvent, the hydrocarbon oil to be treated will be introduced through manifold 12 and the naphthenic solvent will be introduced through manifold 20. Since all hydrocarbon oil consists of naphthenic and paraffinic substances, the hydrocarbon oil will be thus separated into two layers which are withdrawn through respective drawoffs 37 and 39. The naphthenic and paraffinic solvents are then recovered by appropriate treatment. The paraffinic layer, for example, may be treated for dewaxing by any one of a number of suitable processes. The naphthenic layer may be deasphaltized. It will be observed that the wax is concentrated in the paraffinic layer and the asphalt compounds are concentrated in the naphthenic layer. By use of my apparatus, only the paraffinic layer need be subjected to dewaxing and only the naphthenic layer need be subjected to deasphaltizing.

It will be observed that I have accomplished the objects of my invention. I have provided a counter current contacting unit for the treatment of hydrocarbon oils, which may be advantageously employed for solvent treating processes.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of my claims. It is further obvious that various changes may be made in details within the scope of my claims without departing from the spirit of my invention. It is, therefore, to be understood that my invention is not to be limited to the specific details shown and described.

Having thus described my invention, what I claim is:

1. In a contacting apparatus, a shell, a plurality of decks extending across said shell at vertically spaced positions, said decks forming a plurality of vertically spaced compartments, each deck provided with a plurality of downwardly extending tubes, the upper ends of said tubes being substantially flush with the respective decks from which the tubes depend, cap members spacedly positioned over the lower ends of said tubes, adapted to form receptacles in which liquid may collect to form liquid seals for said tubes, and conduits extending upwardly from each deck alternately adjacent opposite walls providing additional communication between adjacent compartments for directing the flow of lighter fluid across the compartment space.

2. A contacting apparatus as in claim 1 provided with means for introducing liquid to a deck at the lower portion of said shell.

3. A contacting apparatus as in claim 1, provided with means for introducing liquid to a deck near the upper portion of said shell.

4. A contacting apparatus as in claim 1 in which said shell is provided with means for introducing liquid near the bottom thereof, means for introducing liquid near the top thereof, means for introducing liquid near the center thereof, and drawoffs at the top and bottom of said shell.

5. In a contacting apparatus, a shell, a plurality of decks extending across said shell at vertically spaced positions, said decks forming a plurality of vertically spaced compartments, each deck provided with a plurality of downwardly extending tubes, the upper ends of said tubes being substantially flush with the respective decks from which the tubes depend, cap members spacedly positioned over the lower ends of said tubes, said cap members forming receptacles in which liquid may collect to form liquid seals for said tubes, conduits extending upwardly from each deck alternately staggered, providing additional communication between adjacent compartments for directing the flow of lighter fluid transversely of the compartment spaces, said conduits terminating short of the plane of the ends of said downwardly extending tubes.

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