Dec. 10, 1929. E. R. COX ET AL 1,738,870

APPARATUS FOR THE SEPARATION OF HYDROCARBONS

Filed Dec. 1, 1927

Fig. 3.

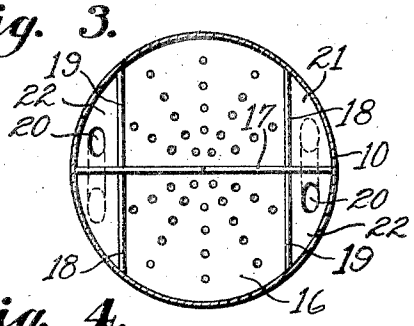


Fig. 2.

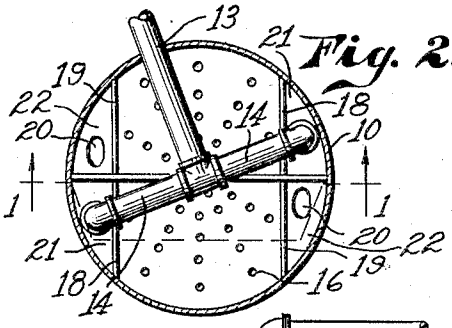


Fig. 4.

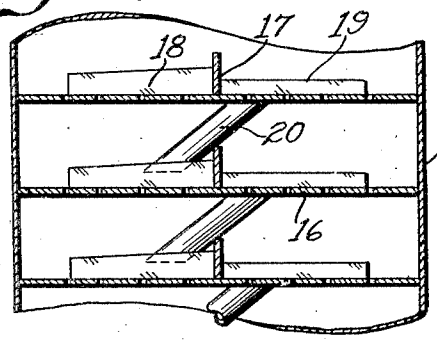


Fig. 1.

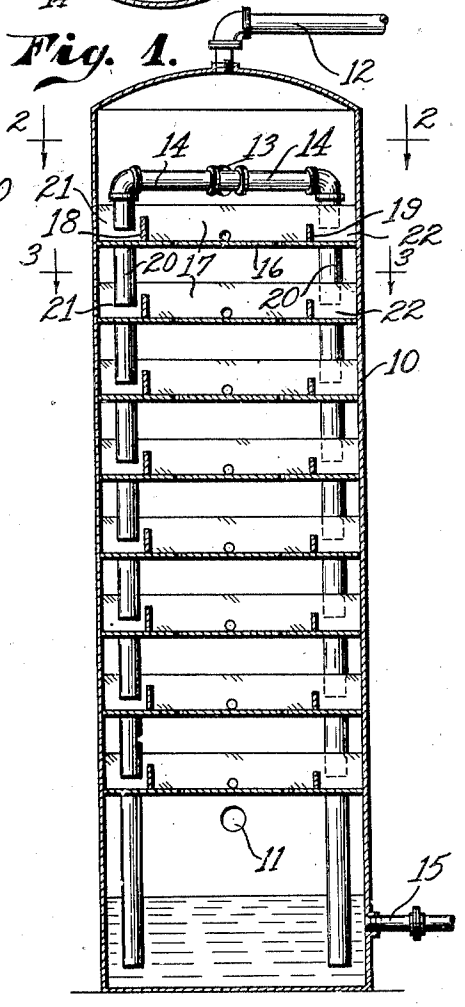
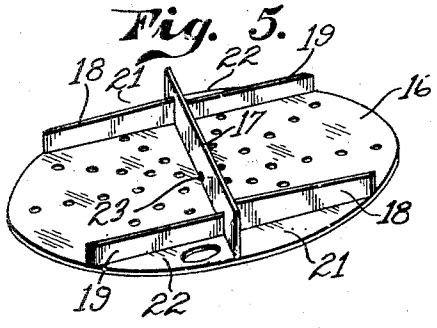


Fig. 5.



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UNITED STATES PATENT OFFICE

EDWIN R. COX, OF VENICE, AND HOWARD S. COLE, JR., OF LOS ANGELES, CALIFORNIA, ASSIGNORS TO CALIFORNIA PETROLEUM CORPORATION, OF LOS ANGELES, CALIFORNIA, A CORPORATION OF CALIFORNIA

APPARATUS FOR THE SEPARATION OF HYDROCARBONS

Application filed December 1, 1927. Serial No. 236,997.

Our invention relates to a tray or series of trays suitable for an absorber, evaporator, or fractionating column for the separation of hydrocarbons or other liquids having fractions of different volatility. The object of this invention is to so distribute the liquid hydrocarbons upon the tray or trays, that, considering the concentration of any component of the liquid, the difference in concentration between the liquid upon any portion of one tray, and that upon the corresponding portion of the tray immediately above or below, shall be substantially equal throughout the tray.

The following example is for the purpose of illustrating the type of progressive concentrations to be obtained in our invention, and is solely intended for clarification. Assuming that a series of trays are used and numbered from the top downward, that the liquid travels downward, and that the enrichment is one percent per tray; if the concentration at any point on tray number four is five and one half per cent, the concentration at a point immediately above this on tray number three would be four and one-half per cent, and at the corresponding point on tray number five would be six and one-half per cent. We accomplish this by causing the liquid to travel in the same direction and upon parallel lines at all corresponding points in vertical alignment.

We attain this by means of the apparatus illustrated in the accompanying drawing, in which:

Fig. 1 is an elevational view of a typical absorber with eight trays as seen on the broken section line 1—1 of Fig. 2; Fig. 2 is a section as seen on the line 2—2 of Fig. 1 showing a tray in plan view; Fig. 3 is a section as seen on the line 3—3 of Fig. 1, the down spouts from the adjacent upper tray not being shown; Fig. 4 is a section of a fragment of the absorber as seen at right angles to the section of Fig. 1 and on an enlarged scale; and Fig. 5 is a perspective view of a tray removed from the shell.

The absorber comprises a closed shell 10 having an inlet 11 for gas at the bottom and an outlet pipe 12 at the top. An inlet pipe 13 for the absorbent liquid has two branches 14. The outlet for the absorbent liquid is by pipe 15. Absorbent liquid passes into the top and is spread flowing downwardly over trays arranged intermediate the top and bottom of the shell absorbing gas in its travel and being progressively enriched until it reaches the bottom of the shell passing outwardly through pipe 15. The gas which is the solute enters at 11, passes upwardly, the undissolved gas passing out through pipe 12. The invention resides particularly in the trays which will now be described.

As the trays are alike in structure, it is sufficient to describe the details of one and its functional relation to the others. In the following description, dimensions are given merely to illustrate. These admit of wide variation. Each tray consists of a flat bottom plate 16, a division wall 17, six inches high, extending through the center, two high or distributing dam plates 18, four inches high, two low or liquid level maintaining dams 19 two inches high, and two down spouts 20, six inches in diameter and extending to within one and one-half inch of the next tray below. The portion of the tray between the dam plates is perforated throughout with one-eighth inch holes, spaced one-half inch centers.

The operation is as follows: The absorbent oil entering at 13, divides into two streams in branches 14, which deliver the oil into the intake reservoirs 21 formed by division wall 17 and high dams 18. Here it overflows over dams 18, flows across the tray and overflows over low dams 19 into discharge reservoirs 22 from which it is conducted by downspout 20 into intake reservoir 21 on the tray below, this being on the opposite side of the division wall 17. This path is secured by inclining the downspouts as shown in Fig. 4 or any other suitable conducts. Thus, the oil flows downward through the absorber in two roughly helical paths which are substantially independent, and unite at the bottom, where it is conducted away through outlet pipe 15. They would be entirely independent except that a small hole 23 is provided at the center of each division plate 17 to equalize the streams.

The gas, entering at 11, passes upwardly through the perforations in each plate and bubbling through the head of oil maintained there by the dams passes out at 12. It is this bubbling action which secures the intimate contact which is necessary for efficient absorption.

The progressive enrichment of the oil may be followed from tray to tray. Assuming for convenience an enrichment of one per cent for each pass across a tray it is apparent that the difference in concentration between corresponding points on successive trays is always one per cent. It will be noted that the path of travel across a tray is slightly shorter near the division wall 17 than that next to the outer shell. To compensate for this, particularly in trays of large diameter, we prefer to make the height of distributing dam 18 slightly less at the outer end than that at the inner end, thus giving the crest a slight slope outward. This feature, however, we do not consider to be entirely essential to satisfactory operation and the slope is slight.

In general, what we regard as novel and valuable in our invention is the combined attainment of two results, viz (1), a uniform difference in concentration of corresponding parts of successive trays, and (2), a uniform rate of enrichment in different parts of each tray.

What we claim is:

1. A tray of the character described comprising a bottom, a central division wall; two distributing dams, one each on opposite sides of said wall and spaced along the length thereof to form diagonally disposed intake reservoirs, two liquid level maintaining dams, one each on opposite sides of said wall forming diagonally disposed discharge reservoirs, there being absorption reservoirs formed intermediate said distributing and liquid level maintaining dams one on each side of said wall with perforate bottom sections.

2. A tray of the character described comprising a bottom, a central division wall with an equalizing passage therethrough; two distributing dams one each on opposite sides of said wall and spaced along the length thereof to form diagonally disposed intake reservoirs; two liquid level maintaining dams, one each on opposite sides of said wall forming diagonally disposed discharge reservoirs, there being absorption reservoirs intermediate said distributing and liquid maintaining dams with perforate bottom sections.

3. A circular tray of the character described comprising a bottom, a division wall, high dams on opposite sides of and forming with said wall intake reservoirs located at opposite ends, low dams on opposite sides of and forming with said wall discharge reservoirs located at opposite ends, there being intermediate absorption reservoirs between said high and low dams with their bottoms perforate, said high dams having outwardly and downwardly sloping crests so as to uniformly distribute the liquid over the tray.

4. A tray of the character described comprising a central division wall; two distributing dams, one on each side of and at opposite ends of said wall forming diagonally disposed discharge reservoirs, there being absorption reservoirs intermediate said distributing and liquid level maintaining dams with perforate bottom sections, the crests of said distributing dams sloping outwardly and downwardly so as to uniformly distribute the liquid over the tray.

5. A tray of the character described comprising a central division wall with an equalizing passage therethrough; two distributing dams with outwardly and downwardly sloping crests, one each on opposite sides of and at opposite ends of said wall forming diagonally disposed intake reservoirs; two liquid level maintaining dams, one each on opposite sides of and at opposite ends of said wall forming diagonally disposed discharge reservoirs, there being absorption reservoirs intermediate said distributing and liquid level maintaining dams with perforate bottom sections.

In witness that we claim the foregoing we have hereunto subscribed our names this 29th day of September, 1927.

HOWARD S. COLE, JR.
EDWIN R. COX.