

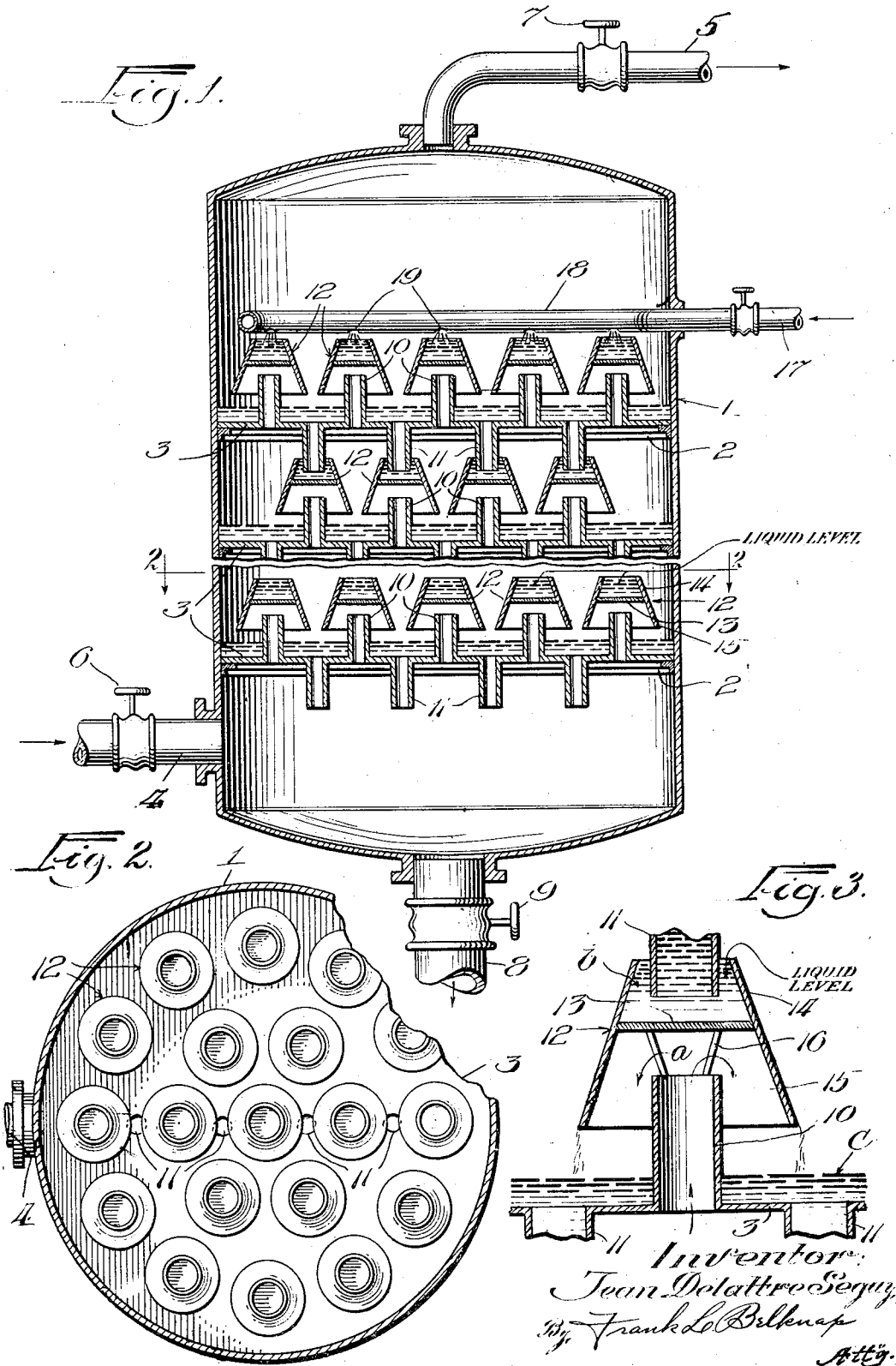
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DEPHLEGMATOR

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DEPHLEGMATOR

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The present improvements relate to dephlegmators and more particularly to dephlegmators for use in the fractionation of vapors produced in the cracking of hydrocarbon oil although the dephlegmator is for use for other purposes than this.

It is an object of the present invention to provide a dephlegmator in which efficient intimate contact is effected between the vapors and liquid.

The dephlegmator of this invention comprises briefly a shell in which superposed spaced plates are mounted having upwardly projecting open ended vapor pipes and downwardly projecting open ended overflow pipes. A cap is supported in spaced relation above each vapor pipe, each cap comprising an imperforate plate having an upwardly and downwardly extending flange therefrom, the arrangement being such to permit a pool of liquid to collect above the imperforate plate and overflow the top edge of the flange, while the vapors passing through the open ended vapor pipes are caused to have a downward travel.

Among the advantages of my dephlegmator may be cited the reboiling of the liquid pools formed above the imperforate plates by the heat of the vapors issuing from the open ended pipes immediately below said imperforate plate, and also the reboiling of the film overflowing down the sides of the caps in addition to the efficient and intimate contact between the vapors and this film.

Many other objects and advantages will be hereinafter more particularly brought out.

In the drawings, Fig. 1 is a diagrammatic vertical sectional view of the dephlegmator of this invention.

Fig. 2 is a cross sectional view taken on line 2-2 of Fig. 1.

Fig. 3 is an enlarged fragmentary vertical sectional view illustrating the arrangement of the vapor and liquid pipes and the spaced caps.

Referring more in detail to the drawings, 1 designates a shell in which are supported at spaced intervals throughout the height by means such as illustrated diagrammatically at 2, the plates or decks 3. This shell which

is preferably of metal may be of any size, i. e. between 2 and 5 feet in diameter and 20 to 30 feet high, more or less, depending upon the size of the plant in which it is used. The shell is provided with vapor inlet and outlet pipes 4 and 5, respectively, in which may be interposed control valves 6 and 7, respectively, a liquid drawoff pipe 8 in which may be interposed a control valve 9 may be provided.

The plates or decks 3 may be spaced say from 10 to 14 inches apart, more or less, as is obvious. Each of these plates extend preferably across the interior diameter of the shell 1 and are provided with a plurality of upwardly extending open ended relatively short pipes 10 and with downwardly extending open ended short pipes 11. The pipes 10 function as vapor pipes, and pipes 11 as liquid overflow passageways. Spaced above each upwardly extending short pipe 10 is a spaced cap member designated as a whole 12 which may comprise a horizontal imperforate plate 13 and upwardly and downwardly extending flanges 14 and 15, respectively. The latter flange 15 preferably extends around and slightly below the upper end of the corresponding pipe 10, as illustrated in the drawings. The caps are mounted above each corresponding pipe 10 by means of the spiders or other suitable elements 16.

The arrangement is such that a pool of liquid collects in each cap above the imperforate plate 13 overflowing the top of the flange 14 and flowing downwardly over the exterior of flanges 14 and 15 in the form of films. The lower end of each overflow pipe 11 extends below the upper edge of the corresponding flange 14, thus delivering the overflow liquid in the pool collected in said cap and preventing vapors from passing up through the pipes 11. It is to be understood, of course, that the pipes 11 in the lowermost deck may merely extend into the dephlegmator, as illustrated in the drawing, and the foregoing description relates to all of the pipes 11 in the plates mounted above the bottom one.

Cooling liquid may be introduced to the dephlegmator if desired directly in contact

with the vapors by means of the feed pipe 17 extending into the dephlegmator and terminating in a horizontally disposed coil 18, the lower side of which is perforated as illustrated at 19. Each of said perforations 19 is preferably directly above a corresponding cap 12 of the uppermost plate 3.

If desired for the purpose of securing maximum reboiling efficiency, the side walls of the caps designated as flanges 14 and 15 may taper outwardly from the top to the bottom. Other obvious advantages will also accrue from tapering of these side walls.

In operation the vapors introduced through line 4 ascend through the dephlegmator passing first through the lowermost pipes 10 and thence outwardly and downwardly, as shown by the arrows *a* (Fig. 3), and thence upwardly through the pipes 10 in the plates above. The descending condensate or other liquid overflowing through the pipes 11 first forms the pools *b* thence overflowing the upper edges of the flanges 14 and down the sides of the caps in the form of films dropping onto the plate 3 where it may form the pool *c* by reason of the fact that the lower ends of pipes 11 are sealed in pools *b* and project below the top of flanges 14, thus causing accumulation of a sufficient head of liquid on plates 3 to force the liquid in pools *b* over the upper marginal edges of flanges 14. The vapors cannot pass through the caps but must pass into the cap and around the lower flange 15 as indicated by the arrows. The liquid collecting in the pool *b* and overflowing down the side of the cap is subjected to reboiling due to the heat of the vapors coming in contact with the imperforate plate 13 and inner surface of the walls of the flange 15.

As another feature of the present invention, the velocity of the vapors existing from pipes 10 are decreased relative to the velocity of the vapors entering the bottom of said pipes. This velocity is decreased as the vapors pass down under the flanges 15. As the vapors sweep past the liquid body *c* on the tray 3, these vapors will carry upwardly entrained therewith particles of condensate from this body *c*. This is very desirable and due to the decrease in velocity in the large open space below the tray next above, efficient fractionation will take place, the heavy fractions or those picked up from the liquid body *c* continuously dropping back to said body. This provides for an efficient reboiling of the condensate and separation of the heavy fractions from the light vapors at each step of the column. It is to be noted that the tapering of the side walls of each cap permits a gradual decrease in the velocity of the vapors from the bottom to the top of the deck, although it is to be pointed out that the invention contemplates that the velocity may be decreased by steps.

I claim as my invention:

1. In a dephlegmator, the combination with a casing, of a plurality of spaced apart superimposed plates mounted therein, each of said plates having upwardly projecting open ended pipes, cap members mounted thereabove and spaced therefrom, said caps comprising an imperforate plate and flanges projecting above and below said imperforate plate to accumulate liquid pools above the plate and impart a downward movement of the vapors as they pass out of the open ended pipes.

2. A dephlegmator comprising in combination, a vertically disposed column, a plurality of spaced apart superimposed plates mounted within said column, each of said plates having a plurality of upwardly projecting, open-ended pipes and a plurality of downwardly projecting, open-ended pipes, the downwardly projecting, open-ended pipes of one plate being staggeredly disposed with respect to the downwardly projecting, open-ended pipes of the next adjacent plate, cap members mounted one above each of the upwardly projecting open-ended pipes and spaced therefrom, each of said caps comprising an imperforate plate and flanges projecting both above and below said imperforate plate, the flange projecting above said imperforate plate adapted to accumulate a pool of liquid above the plate.

3. A dephlegmator comprising in combination, a cylindrical, vertically disposed casing, a plurality of spaced apart, superimposed plates dividing said casing into compartments, a plurality of separate pipes extending upwardly from each plate into the compartment positioned above such plates, a plurality of independent pipes extending downwardly from each plate into the compartment below said plate, a plurality of independent cap members spaced one above each of the upwardly projecting pipes of each plate, means for passing a film of liquid down the outside surfaces of said cap members, means for admitting vapors to said casing, means for removing condensate from said casing, and means for removing uncondensed vapors from said casing.

4. A dephlegmator comprising in combination, a cylindrical vertically disposed casing, a plurality of spaced apart, superimposed plates dividing said casing into compartments, a plurality of separate pipes extending upward from each plate into the compartment positioned above such plate, a plurality of independent pipes extending downwardly from each plate into the compartment below such plate, a plurality of independent cap members spaced one above each of the upwardly projecting pipes of each plate, the lower side of each of said cap members being adapted to pocket ascending vapors, and the upper side thereof being adapted to pocket descending liquid to be heated by the vapors

trapped therebelow, a plurality of said cap members being respectively in alignment with the downwardly extending pipes from the plate above, whereby said pipes deliver into the pools of said caps.

- 5 5. A dephlegmator comprising in combination, a cylindrical vertically disposed casing, a plurality of spaced apart, super-imposed plates dividing said casing into compartments, a plurality of separate pipes extending upward from each plate into the compartment positioned above such plate, a plurality of independent pipes extending downwardly from each plate into the compartment below such plate, a plurality of independent cap members spaced one above each of the upwardly projecting pipes of each plate, the lower side of each said cap members being adapted to pocket ascending vapors, and the upper side thereof being adapted to pocket descending liquid to be heated by the vapors trapped therebelow, a plurality of said cap members being respectively in alignment with the downwardly extending pipes from the plate above, whereby said pipes deliver into the pools of said caps, said cap members having downwardly and outwardly flaring conical sides, whereby the overflow from said pools form a film over said conical surfaces, which is also subjected to reboiling by the vapors trapped therebelow.

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