Oct. 13, 1936. C. H. LEACH 2,057,437

BUBBLE TOWER APPARATUS

Original Filed April 13, 1932 2 Sheets-Sheet 1

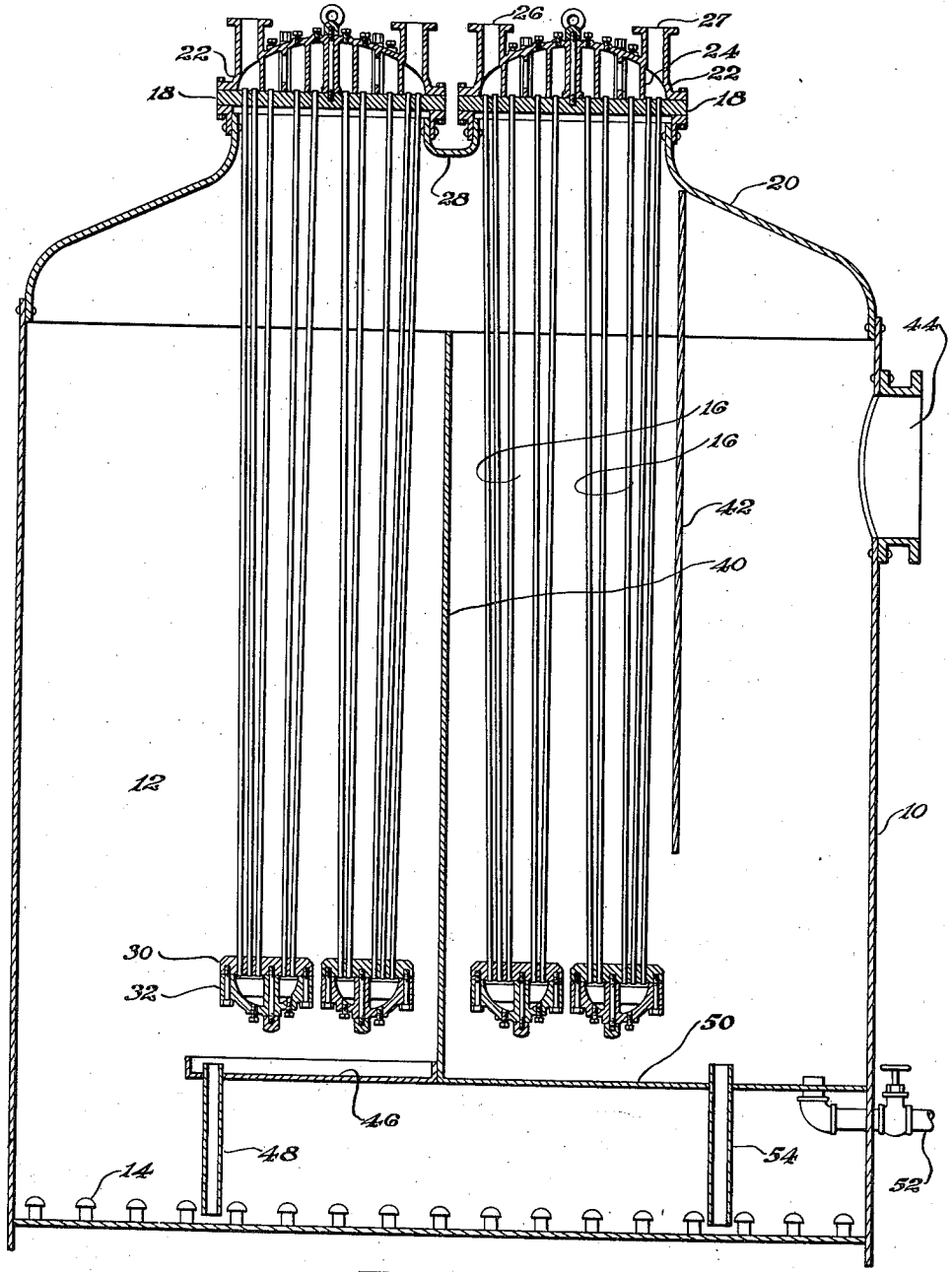


Fig. 1

Witness
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Fig. 3

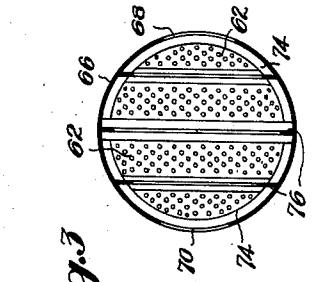


Fig. 2

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BUBBLE TOWER APPARATUS

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Renewed June 6, 1936

8 Claims. (Cl. 257—34)

The present invention relates to improvements in bubble tower apparatus, and more particularly to means for condensing vapor generated therein.

In the accompanying drawings, Fig. 1 represents a section in elevation of a bubble tower embodying the features of the invention, certain portions of the apparatus being shown in diagrammatic form; Fig. 2 represents a similar section showing a vacuum installation; and Fig. 3 is a section of the tube bundles and surrounding shell and baffles upon the section line 3—3 of Fig. 2.

The shell of the bubble tower is indicated at 10, enclosing a vapor region 12 above the bubble caps 14. Projecting downwardly into the region 12 are a series of bundles of condenser tubes 16, depending from a flat tube plate 18, supported upon a reduced neck portion 20, connected to the upper portion of the shell 10. These tube bundles provide a condensing space centrally of the region 12, and about and through which vapors generated therein may freely circulate.

In the illustrated embodiment of the invention shown in Fig. 1, the condenser tubes are divided into two separate sections, each supported by a separate and independent head 18. Each head is provided with a demountable cover 22, provided with partitions 24 for forming cooling fluid passages, and each having nozzles 26 and 27 for directing fluid to and from the passages. Each head 18 may be relatively semi-circular in form, connected at the outer circumference to the neck portion 20 and along the opposing straight edges, by a U-shaped connector or flange 28. The individual tube bundles are separately connected at their lower ends to floating heads 30, closed by covers 32 to reverse the flow of cooling fluid through the tubes.

Vapor rising within the tower is caused to first traverse throughout the length of the tube section at the left of the drawings, by virtue of the longitudinal partition 40 and horizontal partition 50, and at the upper end of the tube section vapor passes across the top of the partition 40 and downwardly throughout the right-hand tube section, the vapor pass about this section being completed by the downwardly projecting baffle 42. After traversing throughout the length of the right-hand section, the vapor then reverses and passes upwardly and out through the vapor nozzle 44. A cooling fluid is circulated through the tube bundles and the vapor will accordingly be cooled and a portion of it will be condensed. Condensate formed by contact with the left tube section is collected in the basin 46, and thence discharged through a passage 48; condensate formed by contact with the right-hand tube section is collected in a basin 50, and either withdrawn completely from the tower through a passage 52, or discharged downwardly for re-evaporation through a passage 54.

It will be evident that due to the continuity of the partitions 40 and 50, the region encompassing the right-hand section of tubes is completely separated from the region 12 within the bubble tower except for the communicating opening above the partition 40, through which vapor passes from left to right.

The embodiment of the invention shown diagrammatically in Fig. 2 is somewhat more elaborate than that shown in Fig. 1, and comprises generally a bubble tower 60 of comparatively larger diameter having an initial section of condensing tubes 62 located in the upper portion of the bubble tower at the right of the drawing. Vapors rising from the bubble tower are caused to first pass upwardly lengthwise of the tubular section 62 by virtue of the transverse partition 64 extending across the bubble tower into proximity to the tube section. This tube section may be surrounded adjacent its upper portion by a shell indicated at 66, having openings 68 for the passage of vapors therethrough. At the opposite side the shell is provided with an elongated opening 70, which affords communication with a passage or chamber above the partition 64, the construction being designed to insure that all vapors rising from the bubble tower shall be compelled to pass through the inter-tubular region before discharge into the chamber 72. To insure a substantially equal contact between the vapor and tubes, and to prevent short-circuiting of the vapor, the inter-tubular space is provided with ring baffles 74 arranged transversely and with longitudinally extended wing baffles 76 projecting inwardly between the tube bundles and both designed to substantially confine the flow of vapor to the intertubular region and prevent vapor flow between the tubes and the shell. After passage through the first section, the vapor is discharged into the chamber 72 and substantial reversal of flow is compelled by a depending baffle partition 80, which reversal causes precipitation of any entrained condensate, the baffle 80 cooperating with an upwardly projecting baffle 82 for this purpose. The vapor is next intersected by a second condensing section 84, which projects partly into the chamber to a lesser extent than the first section 62. This second section accomplishes a further and additional removal of condensate at lower temperatures,

which condensate may be separately collected in a basin 86 and withdrawn from the bubble tower through a discharge pipe 88. From the condenser section 84 the remaining vapor is discharged through a conduit 90 into a condenser section 92 supported at the upper end of an elongated shell 94, having a vapor outlet 96 below the tube section, and a condensate drain 98 at the bottom, an inclined baffle 100 preventing entrained condensate from being discharged with the vapor through the outlet.

The second or intermediate tube section 84 may be partially baffled as in the case of the first tube section by transverse baffles 102 to prevent short-circuiting of vapor into the outlet passage. Inasmuch as the pressure drop in this type of system from one condensing section to the next is designed to be small, complete baffling is not essential, and it suffices if the baffling tends to compel vapor flow through the inter-tubular region and prevents unrestricted flow of vapor thereabout or between the shell and the tubes. The tube bundles shown diagrammatically in Fig. 2 of the drawings are of the usual construction and may be similar to those shown in Fig. 1.

It will furthermore be noted that with this construction the first condenser section projects into the bubble tower throughout substantially its entire length to facilitate interception of vapors, and the second or intermediate condenser section is mounted well above the tower and projects thereinto a substantially lesser distance to promote convenience of vapor flow and reduce pressure drop between the condensing sections.

What is claimed is:

1. A distillation tower provided with a shell enclosing the vapor region in the upper portion, condenser tubes supported at their upper ends and located within the vapor region and spaced from the walls thereof, a partition for separating a portion of the tubes from the remainder of the vapor region, means for delivering vapor from the vapor region to the tubes confined by the partition, means for separately collecting condensate within and without the region enclosed by the partition, and means for introducing cooling medium within the interior of the tubes.

2. A distillation tower provided with a vapor region in the upper portion, condenser units supported above the tower and projecting thereinto, the region about the units communicating freely with the vapor region within the tower, and a partition separating the condenser units in a manner to insure a temperature head therebetween.

3. A distillation tower provided with a vapor region in the upper portion, condenser units supported in spaced relation at the upper portion of the tower and projecting into the vapor region, means for separating the vapor space surrounding each condenser unit, an intercommunicating vapor passage between the units, and means for precipitating entrained condensate in the passage from one unit to the next.

4. A distillation tower provided with a vapor region in the upper portion, a plurality of condenser units projecting into the vapor region in the upper part of the tower, means for forming separate and intercommunicating vapor spaces about the units, and means for separately withdrawing the condensate formed in each vapor space.

5. A condenser unit comprising condenser tubes, means for supporting the tubes from the upper ends, a shell surrounding the tubes and enclosing a vapor space for the passage of vapor thereabout, means below the tubes for collecting condensation from the vapor, a vapor outlet in the shell and below the tubes communicating with the vapor space above the collection point, and a baffle disposed adjacent to the vapor outlet and designed to intercept condensate falling by gravity from the region of the tubes and prevent its delivery through the vapor outlet.

6. In a distillation tower having a vapor space therein, oil refining apparatus comprising condensing units supported adjacent the upper end of the tower and having portions projecting downwardly into the tower and means providing a vapor passage between and around said condensing units communicating at one end with the vapor space in the tower and discharging at the other end externally of the tower, said means and condenser units being arranged so that one of said units is disposed adjacent the beginning of the vapor passage and has direct communication with the vapor space in the tower and another of said units is disposed in the passage beyond the first unit and is separated from direct communication with the vapor space in the tower.

7. In a distillation tower having a vapor space therein, oil refining apparatus comprising a plurality of heat exchange tubes supported adjacent the upper end of the tower and having portions projecting downwardly into the tower, and means providing a tortuous vapor passage between and around the tubes communicating at one end with the vapor space in the tower and discharging at the other end externally of the tower, said tubes and means being arranged so that some of the tubes are disposed adjacent the beginning of the passage and have direct communication with the vapor space inside the tower and other of said tubes are positioned beyond said first mentioned tubes and separated from direct communication with the vapor space in the tower.

8. In a distillation tower having a vapor space therein, oil refining apparatus comprising a plurality of heat exchange tubes, each being connected to a fixed head at its upper end and to a floating head at its lower end, said tubes being supported in a substantially vertical position adjacent the upper end of the tower and having portions including the lower ends thereof projecting downwardly into the tower, and means providing a vapor passage extending between and around said tubes communicating at its beginning with the vapor space in the tower and discharging at its end externally of the tower, said means being arranged so that the passage has two separate but intercommunicating portions, one of said portions being at the beginning of the passage and having communication with the vapor space in the tower, some of the tubes being located in the portion having direct communication with the vapor space in the tower and other of the tubes being located in the other portion of the passage and being separated from direct communication with the vapor space in the tower, and said means being formed so that condensate forming in both portions of the vapor passage may return to the tower.

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