

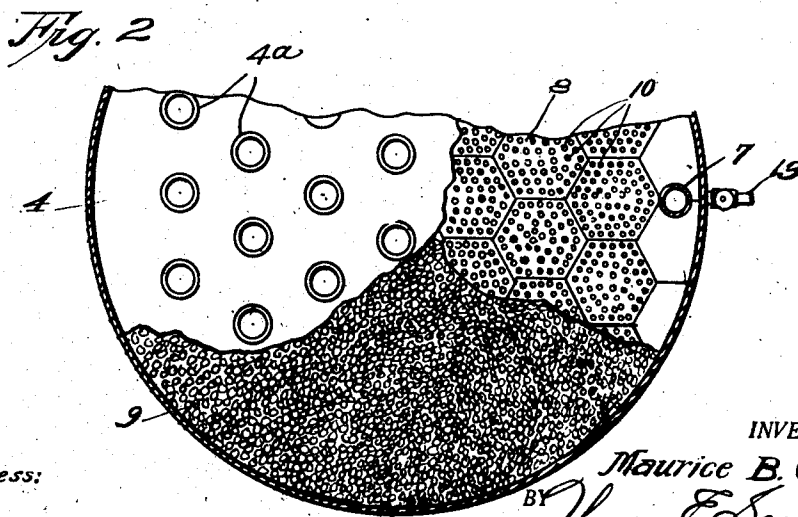
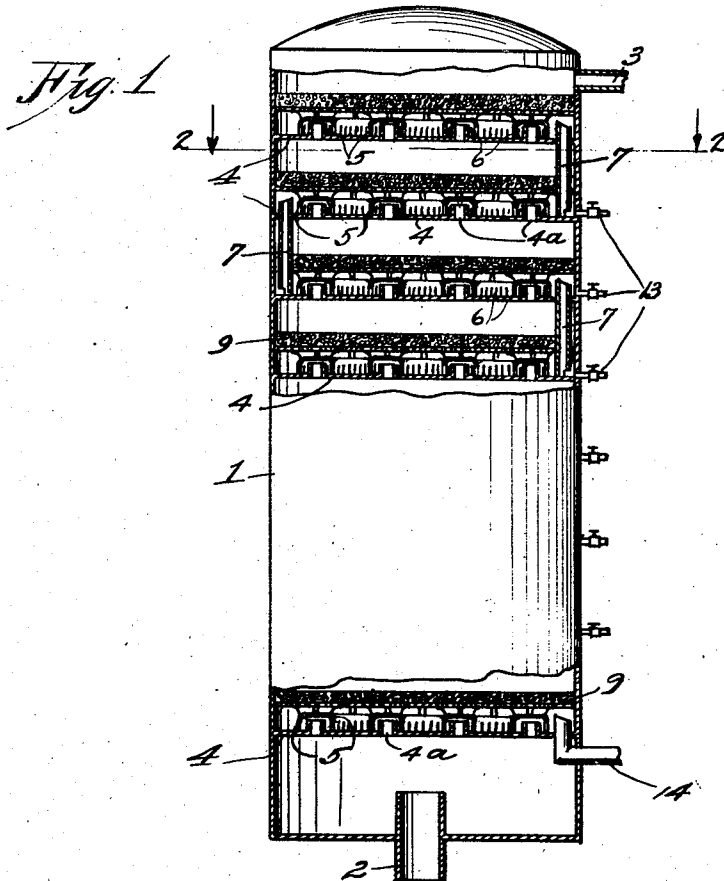
Feb. 25, 1930.

M. B. COOKE

1,748,411

FRACTIONATING SYSTEM

Original Filed July 24, 1925 2 Sheets-Sheet 1



Witness:

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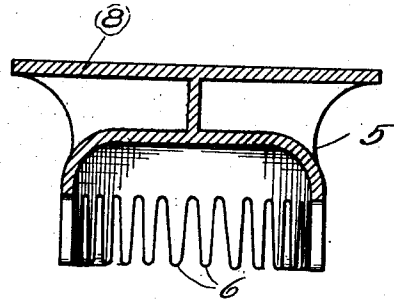
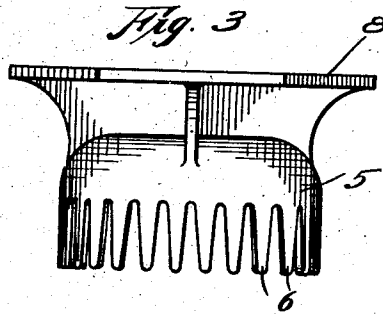


Fig. 4

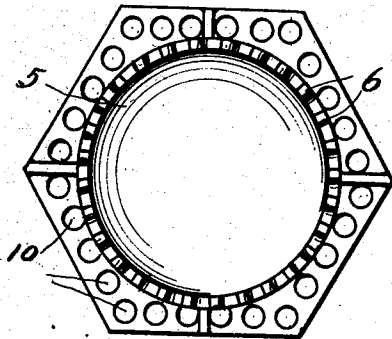
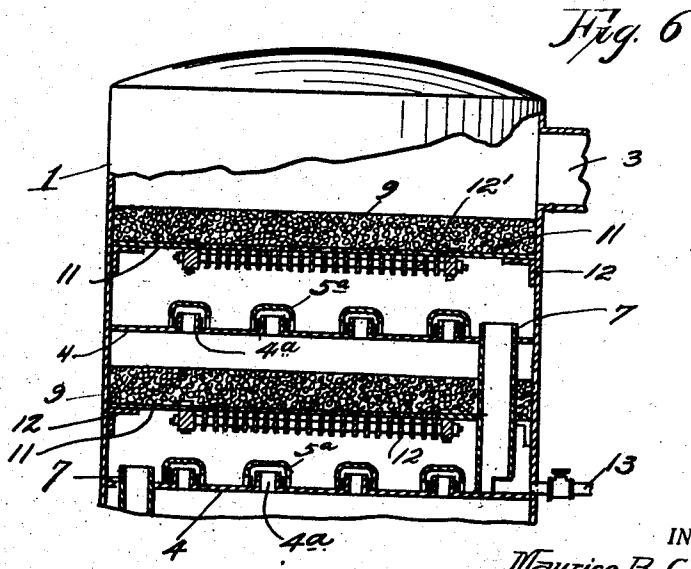


Fig. 5



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UNITED STATES PATENT OFFICE

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FRACTIONATING SYSTEM

Application filed July 24, 1925, Serial No. 45,796. Renewed February 20, 1929.

This invention relates to improvements in fractionating towers and refers more particularly to a tower of the bubble type and the treating of vapors such as oil vapors, acid vapors, or any type of vaporous material in which a close fractionation or restricted range of boiling points is desired.

One aspect of novelty of the invention lies in a combination type of bubble tower which is equipped not only with the bubble pools through which the vapors are caused to percolate, but also with a series of packed zones, which zones contain an inert or catalytic material which serves as an obstruction to the vapors, and separate out any mechanically entrained liquid material carried along with the vapors and supported in the form of a mist or minute liquid particles. However, it is to be understood that the invention is not limited to said combination type tower.

My invention resides in apparatus of the character hereinafter described and claimed.

As specific examples of some of the forms my apparatus may take, reference is had to the accompanying drawing, in which:

Fig. 1 is a sectional side view of a preferred type of tower.

Fig. 2 is a plan view taken on line 2-2 of Fig. 1, in the direction indicated by the arrows, with parts broken away to disclose the details of the bubble caps.

Fig. 3 is a side elevational view of one of the caps.

Fig. 4 is a sectional view taken through the bubble cap shown in Fig. 3.

Fig. 5 is a view of an inverted cap as in Fig. 3, showing the shape of the hood or upper plate.

Fig. 6 shows a tower of a slightly modified type of construction.

Referring to the drawings, at 1 is shown the usual type of fractionating tower which is preferably cylindrical in form. Vapors are introduced into the tower through a vapor inlet line 2 at the bottom of the tower and discharged at an upper vapor outlet designated as 3. Within the tower are positioned a plurality of trays 4 equipped with risers 4^a which conduct the vapors introduced at the bottom of the tower upwardly. Sur-

mounting these risers are caps 5, such as that shown in Figs. 3, 4, and 5, which direct the vapors through the several pools of liquid upon the trays 4. These caps have preferably a serrated lower edge as shown at 6, which serves to break up and more evenly distribute the vapors whose flow is reversed upon being discharged from the risers by means of the cup-shaped domes of the caps. The vapors passing through the toothed or serrated edges of the caps, percolate through the several pools of liquid supported upon the trays, the depth of each pool being determined by the height of the downcomer or overflow standpipes 7 above the bottom of the respective tray. With the accumulation of condensate in the pools, the excess material overflows through the top of the standpipes to the next succeeding pool below. Thus the reflux material is gravitated downwardly against the passage of the rising vapors.

The tops of the caps are shaped to form a flat surface or grid designated as 8 in the drawings. The tops of the caps shown are hexagonal in form in order that they fit together to form a continuous flat surface or grid upon which is placed the packing material diagrammatically shown at 9. The tops are perforated by holes 10 which serve to permit a free passage of the vapors which rise about the serrated edges of the caps and pass upwardly through the flat top grid and packing material carried thereupon.

In place of the caps described and shown in Fig. 1, the usual type of bubbler cap 5^a may be used as shown in Fig. 6. These bubbler caps serve the purpose of reversing the flow of the vapors and causing the same to percolate through the pools of liquid supported upon the separate trays in the tower. Between the trays is positioned an annular ring 11 carried by the angle support 12. To this annular ring is bolted a circular perforated grid 12'. This grid supports the packing material 9 in a manner similar to the supporting grid formed by the fitted tops 8 of the caps 5 shown in Figs. 3 and 4. It is understood that, if so desired, a grid such as that shown at 12' will be interposed below each of the bubble tower pools throughout the

length of the towers such as that partially shown in Fig. 6. Otherwise, the construction of the tower is identical in form to the usual type of bubble tower construction having the pools of liquid supported on trays 4, the overflow from the pools emptying into the pools below through the overflow standpipes 7, while the vapors rise through the successive trays by means of risers 4^a surmounted by bubble caps 5^a.

From the separate pools, if so desired, liquid condensates or fractions may be drawn off through the lines 13, the heaviest material passing off from the fluid delivery line 14. In actual operation, a bubble tower fractionator is recognized as one of the most efficient type of mechanism, as a relatively close fractionation is attained and a most complete and intimate contact of the condensate and vapors makes for a uniform final product as well as fractions of restricted boiling point range. It is, however, appreciated that there is a certain amount of mist or liquid carried along or entrained in the vapors as they percolate through the liquid pools. The bursting of the bubbles, caused by the vapors during their percolation through the pools, releases a considerable quantity of liquid mist which is readily taken up and carried along with the vapors. This entrained material is difficult of separation due to its light weight and a supporting movement or energy set up by the velocity of the vapors which readily carries this material along through the successive pools and overhead to the final condensing zone where it adds undesirable constituents to the final product. By interposing between the pools a vapor arrester of this character or a similar type which has the deentraining effect upon the vapors, and particularly effects removal of entrained liquid from the vapors to cause the same to be separated out and trapped back to the pool below, a much closer fractionation is effected and a more desirable final product produced as well as the intermediate fractions which may be drawn off from the individual pools. A zone built up of packing material such as inert ceramic substance or a catalytic material is shown as a possible type of vapor arrester although it is understood that any equivalent means which will effectively arrest this entrained mist to cause the same to separate out from the vapors and be returned to the pool below, is contemplated by the present invention.

A feature of particular importance is that the reflux liquid in passing downwardly through the column is not permitted to come into contact with the vapors from which the entrained liquid has been removed. This is of particular importance in that if the reflux liquid were permitted to come into contact with the disentrained vapors, reentrainment would take place and permit the vapors to pass to the next plate above carrying with

them substantial quantities of entrained liquid.

It shall be understood that my invention is not limited to specific details of structure, and that my invention comprehends the utilization of equivalent structures.

It shall further be understood that my invention is not limited to any particular type of fractionating tower or column, and includes the use in addition to those of the bubble type well-known equivalents such as those of the sieve or equivalent types.

I claim as my invention:

1. A fractionating tower of the bubble type, comprising a shell having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, capped risers forming vapor communication between the trays, means intermediate the trays for separating out entrained liquid and drying rising vapor; diametrically opposite overflow pipes for conducting reflux liquid from a higher tray to a lower tray out of contact both with said means and with the rising vapors.

2. A fractionating tower of the bubble type, comprising a shell having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, capped risers forming vapor communication between the trays, drying means intermediate the trays for removing entrained liquid from the vapors, diametrically opposite overflow pipes for gravitating the reflux liquid both out of contact with said drying means and with the rising vapors.

3. A fractionating tower of the bubble type comprising a shell having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, capped risers forming vapor communication between the trays, drying means comprising packed material intermediate the trays for removing entrained liquid from the vapors, diametrically opposite overflow pipes for gravitating the liquid downwardly from tray to tray out of contact with said drying means.

4. A fractionating tower of the bubble type comprising a plurality of liquid supporting trays positioned one above the other, risers on each tray, forming vapor communication between adjacent trays, perforated caps surmounting said risers and forming a continuous foraminous grid between adjacent trays adapted to support inert ceramic material.

5. A fractionating tower having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, vapor risers for permitting vapors to pass through said trays, means intermediate the trays for separating out entrained liquid and drying rising vapors, and overflow pipes for conducting reflux liquid from higher trays to lower trays out of con-

tact both with said means and with the rising vapors.

6. A fractionating tower having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, vapor risers for permitting vapor to pass through the trays, drying means comprising inert packing material intermediate the trays for removing entrained liquid from the vapors, and overflow pipes for conducting the reflux liquid downwardly from tray to tray out of contact with said drying means.

7. A fractionating tower comprising a plurality of liquid supporting trays positioned one above the other, vapor risers for each tray, perforated caps surmounting said risers and forming a continuous foraminous grid between adjacent trays adapted to support inert ceramic material.

8. A fractionating apparatus comprising a column, a plurality of liquid supporting trays positioned one above the other, a vapor riser through at least one of said trays, means below at least said one of said trays for separating out entrained liquid and drying rising vapors, means for conducting liquid from said one of said trays to a point below said separating means without permitting the liquid to come into contact with the separating means.

9. In fractionating apparatus, the combination with a bubbler plate having vapor uptakes, of bubbler caps, each of said bubbler caps comprising a member adapted to extend over the associated vapor uptake, and a top on said member having perforations for the passage of vapors therethrough, the tops of said bubbler caps registering with each other to form a substantially continuous grid.

10. A bubbler cap comprising a member adapted to extend over a vapor uptake in a bubbler plate, a top on said member forming a flat surface, said top having sides registering with the sides of the tops of similar cap members when placed adjacent each other on a bubbler plate, said top having perforations adapted for the passage of vapors there-through.

11. A bubbler cap comprising a member adapted to extend over a vapor uptake in a bubbler plate, said member having a top forming a flat surface and extending laterally beyond said member, said top having such geometrical shape that the sides thereof fit snugly with sides of tops of similar caps when placed adjacent each other upon a bubbler plate, fins supporting said top upon said member, and said top having perforations adapted for the passage of vapors.

12. A fractionating tower having a lower vapor inlet and an upper vapor outlet, a plurality of liquid supporting trays positioned one above the other, vapor risers for permitting vapors to pass through said trays, means

above at least one of said trays for separating entrained liquid and drying rising vapors, and overflow pipes for conducting liquid from higher trays to lower trays.

13. In combination, a fractionating column, a bubbler plate having a downflow pipe and a plurality of fluid uptakes, caps covering said fluid uptakes, and structure above said caps providing numerous restricted fluid passages for separating entrained liquid from and drying rising fluid.

14. In combination, a fractionating column, a bubbler plate having at least one fluid uptake, means above said bubbler plate for separating entrained liquid from and drying rising fluid, and means for passing liquid so separated to a point below said bubbler plate while preventing contact thereof with rising fluid.

15. In combination, a bubbler plate having at least one fluid uptake, means above said plate for separating entrained liquid from the fluid, and means for passing liquid from a point above to a point below said separating means and out of contact therewith.

16. Fractionating apparatus comprising a column having a vapor inlet adjacent its lower end and a vapor outlet adjacent its upper end, a plurality of liquid supporting trays positioned one above another, vapor uptakes and overflow pipes associated with said trays, and means below at least one of said trays for separating entrained liquid from and drying rising vapors.

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