Jan. 4, 1944. P. LAMBERT 2,338,446

BUBBLE CAP SHIELD

Filed June 22, 1942

Fig. 1.

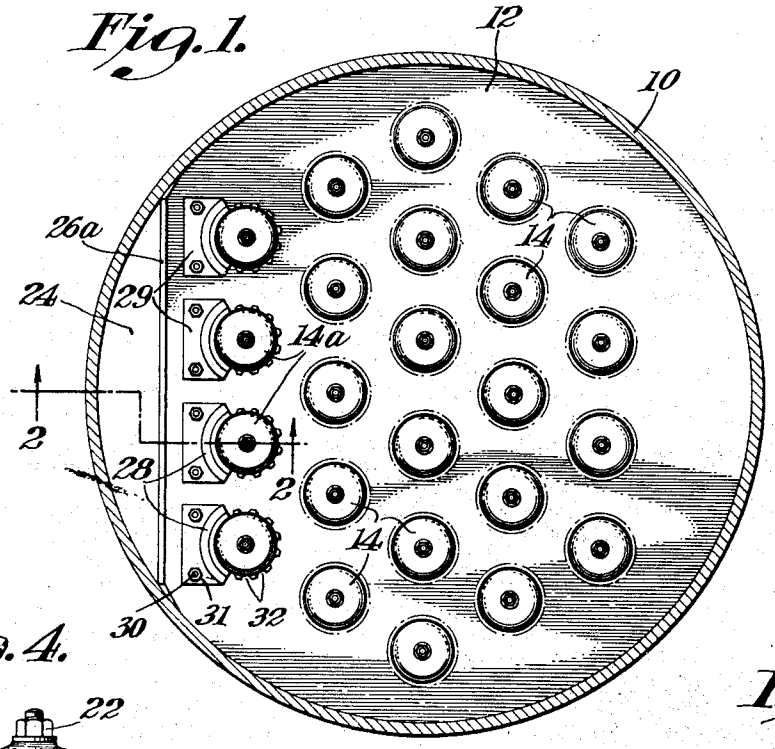



Fig. 4.

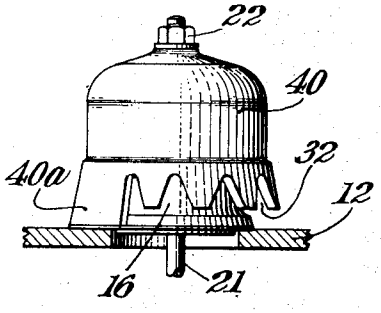



Fig. 3.

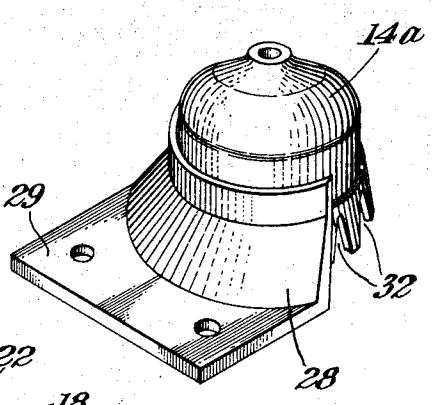
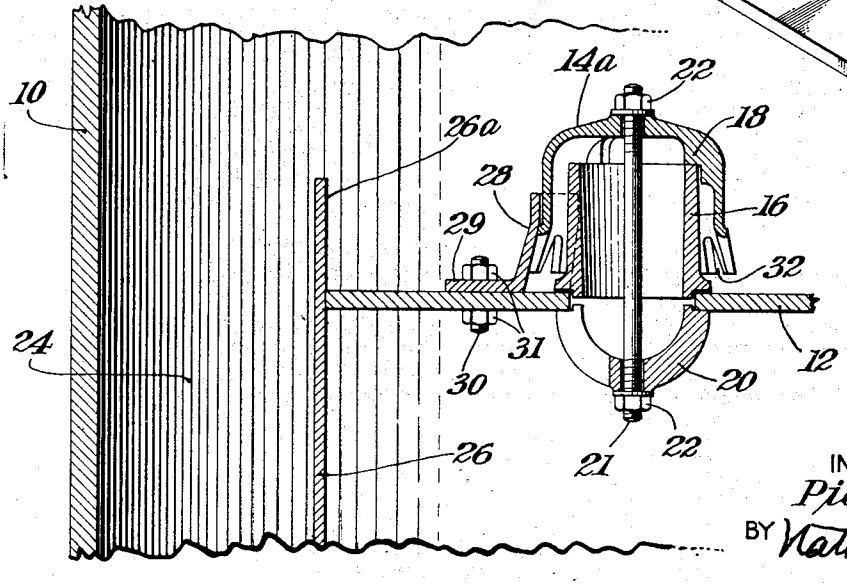



Fig. 2.




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2,338,446

## BUBBLE CAP SHIELD

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Application June 22, 1942, Serial No. 447,949

11 Claims. (Cl. 261—114)

This invention relates to liquid-vapor contact devices and particularly to an improved bubble cap assembly.

In the operation of a distillation column or the like provided with a plurality of bubble decks, the liquid contained on each tray is brought into contact with the rising vapors. The effect of such contact is to create a more or less turbulent condition in the liquid and, in many cases, to create a foam which may seriously interfere with satisfactory operation. In order to obtain the desired operating efficiency, it is necessary to effect a settling or breaking of the foam whereby the entrapped vapor bubbles can disengage themselves from the liquid. Since the foam tends to be carried across each deck and down the corresponding downpipe with the liquid, it is apparent that this foam-breaking must take place substantially completely before the liquid is discharged onto the next lower deck for optimum performance.

The foam, of course, begins to break as soon as it is formed; but in customary operation the continuous passage of the rising vapors through the liquid causes interference with the settling of the foamy liquid which continues until it enters the downpipe. Even if the downpipe is designed for a low velocity to assist the freeing of the vapors, it is sometimes found that foam carries over. I have now found that the settling of this foam can be substantially accelerated by eliminating such interference as the foamy liquid approaches the downpipe on each deck, and I have also determined that the velocity of liquid through the downpipe can be increased without adversely affecting the breaking of the foam.

The primary object of my invention is to provide means in conjunction with a bubble cap, particularly those caps located near the downpipe on a bubble deck, whereby settling of foamy liquid formed on the deck can be accelerated.

A particular object of my invention is to provide a shield for those bubble caps adjacent the downpipe on a bubble deck for the purpose of restricting the discharge of vapors on the side thereof next to the downpipe whereby interference with the breaking of the foam on the side of such caps facing the downpipe is substantially eliminated.

A still further object of my invention is to provide an improved method for increasing the liquid flow through a bubble plate downpipe by reducing the vapor discharge from the bubble caps adjacent the downpipe, in which area the foaming effect is normally most critical.

Further objects and advantages of my invention will be apparent from the following description of a preferred form of embodiment thereof taken in connection with the attached drawing illustrative thereof, in which:

Fig. 1 is a plan view of a bubble deck provided with my improved bubble cap assembly;

Fig. 2 is a detailed vertical cross-sectional view of one of my improved bubble caps taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view of one of my improved bubble caps; and

Fig. 4 is a detailed elevation view partly in section of a modified form of my improved bubble cap.

In the drawing, reference numeral 10 designates a distillation column or the like provided with a plurality of spaced bubble decks 12 to effect a contact between the downflowing liquid and the rising vapors within the column. Each deck is provided with a plurality of bubble caps 14, each of which surmounts a riser 16 in communication with a suitable aperture in the deck. Each bubble cap is supported on its corresponding riser by means of a supporting member 18, which rests on the upper edge of the riser and which may be made integral with the cap. Clamping member 20 is provided so that the bubble cap can be fastened in position as by means of stud 21 and nuts 22. Each deck is also provided with a suitable downpipe 24 for the passage of the downflowing liquid to the next lower deck. In the form of embodiment shown, this downpipe comprises an apron downpipe formed by a portion of the column wall and the apron 26. This apron extends a short distance above the deck as shown to form a weir 26a that maintains the desired depth of liquid on the deck.

In accordance with my invention, the bubble caps 14a adjacent the weir 26a are modified so as to allow the foam to begin to break before it passes over the weir into downpipe 24. To accomplish this purpose, I provide a baffle or shield 28 that surrounds each cap 14a on the side thereof facing weir 26a. This shield 28 is desirably provided with a flange 29 whereby it can be fastened to deck 12 as by means of the stud 30 and the nuts 31. The construction of this flanged shield is such that the flange is vapor-tight with the deck.

The baffle is preferably arranged so that it rests against the side of the bubble cap in substantially vapor-tight relation therewith and extends part way around the bubble cap so that the bubble cap slots 32 facing the weir 26a are blanked off. The

upper edge of baffle 28 extends above the slots in the bubble cap so that the slots on one side are completely covered, without blocking off the passage of vapors through the remaining slots.

With this construction substantially no vapors can issue from the bubble cap on the side thereof facing weir 26a. At the same time, however, the effectiveness of bubble caps 14a is not greatly diminished since more than one-half of the slot area of each cap is still available to distribute the rising vapors in the liquid on deck 12. Interference with the settling or breaking of the foam in the space between bubble caps 14a and weir 26a is thus substantially prevented inasmuch as the rising vapors can not pass through the bubble cap on the weir side thereof. Accordingly, the wall of rising vapors normally adjacent weir 26a, through which the liquid flowing across deck 12 to downpipe 24 ordinarily must pass, is thereby eliminated.

In this manner, for a given velocity for the downflowing liquid, an increased time for settling or breaking of the foam is provided; or, for a column of fixed size, the velocity of the down-flowing liquid, particularly through downpipes 24, can be increased since a preliminary settling or breaking of the foam is accomplished before the foamy liquid enters downpipes 24.

It will be apparent that my invention is equally applicable to a deck provided with individual circular, rectangular, or the like downpipes as distinguished from an apron downpipe. Furthermore, although the use of the shield 28 has been disclosed in connection with a circular bubble cap, it will be appreciated that a rectangular, hexagonal, or otherwise shaped bubble cap may also be provided with a shield for the above purpose. It is necessary, however, that the shield be substantially tight against the bubble cap and the bubble deck on the side of the cap facing the downpipe weir so that passage of vapors through the bubble cap on such side thereof is substantially prevented.

A modified form of construction is shown in Fig. 4, in which the bubble cap 40 is provided with an integral shield member 40a engaging the bubble deck 12 in vapor-tight relation. This form of construction likewise prevents the discharge of vapors from the bubble cap on the weir side thereof and, thus, substantially eliminates interference with the settling of the foam in this area of the bubble deck.

My invention is also applicable to that type of bubble cap having the slots in its side wall, the bottom edge of which rests on the deck. In such case, when a separate shield is used, it need only be in vapor-tight relation with the cap wall. Where the shield is made integral with the cap, the cap wall facing the downpipe weir is imperforate like that in Fig. 4.

It will be appreciated that the extent of the shielded portion of each cap is determined by the proximity thereof to the downpipe weir. Ordinarily, however, approximately one-quarter to one-third of the periphery of each cap adjacent the weir is shielded. The extent of this shielded portion may also be expressed in terms of the subtended chord of the angle thereof on the weir, which angle is sufficient to prevent vapors from discharging from the cap on the weir side thereof.

Although I have described a preferred form of embodiment of my invention, I am aware that modifications may be made thereto; therefore, only such limitations as appear in the claims appended hereinafter should be applied.

I claim:

1. In a device of the type described, including a deck supporting a bubble cap and weir, a shield for shielding one side only of said bubble cap, and means mounting said shield adjacent said bubble cap on the side thereof towards said weir, said shield extending from the lower edge of the cap to the deck and around the major portion of the side of the cap toward the weir, for the purpose set forth.

2. In a device of the type described, including a deck supporting a bubble cap, and a weir, a partially cylindrical shield adjacent the side of said bubble cap towards said weir and constructed and arranged to prevent direct passage of fluid from beneath the cap to the weir, for the purpose set forth.

3. In combination, a bubble cap having outlet openings around the side wall thereof, a shield substantially complementary with a portion of said side wall and surrounding a portion only of said bubble cap, and means for mounting said shield adjacent said bubble cap side wall to prevent fluid from escaping from certain portions of said cap while leaving certain of said openings unbaffled.

4. In a device of the type described, including a deck, a bubble cap having an annular side wall and outlet means around the lower portion thereof, an arcuate shield closely adjacent said side wall extending upwardly from said deck for baffling fluid escaping from said outlet means on one side of said bubble cap.

5. A device for surrounding one side of a bubble cap, comprising a base portion adapted for securement to a deck and a semi-cylindrical shield portion extending upwardly from said base portion, said shield portion being adapted to lie adjacent the side wall of a bubble cap.

6. In a device of the type described, including a deck, a bubble cap, and a weir extending upwardly from said deck, a shield extending upwardly from said deck adjacent the side of said bubble cap towards said weir and extending around the major portion of said side of the cap, the top edge of said shield lying below the top of said weir, the side of said bubble cap away from said weir being unshielded.

7. In a device of the type described, including a deck, a plurality of bubble caps distributed over said deck, and a weir, individual shield means for the bubble caps relatively near said weir, said shield means being mounted on the sides of their respective bubble caps towards said weir and being semi-cylindrical in internal form whereby to surround only a portion of their respective bubble caps.

8. In a device of the type described, including a deck, a bubble cap supported over said deck, a downpipe for said deck and a weir extending upwardly from said deck and located between said bubble cap and said downpipe, an imperforate shield for the bubble cap extending laterally around the major portion of the side of the bubble cap directed toward the weir and extending vertically the entire distance between the lower edge of the cap and the deck to prevent direct passage of fluid from beneath the cap to the weir, for the purpose set forth.

9. In a device of the type described, including a deck, a plurality of bubble caps distributed and supported over said deck, a downpipe for the deck and a weir extending upwardly from the deck and located between said bubble caps and said downpipe, imperforate shields individual to

the bubble caps nearest said weir, each of said shields extending laterally around the major portion of the side of its respective bubble cap directed toward the weir and extending vertically the entire distance between the lower edge of the cap and the deck to prevent direct passage of fluid from beneath the cap to the weir, for the purpose set forth.

10. In a device of the type described, including a deck, a bubble cap thereon, a downpipe for said deck and a weir extending upwardly from the deck and located between said bubble cap and said downpipe, a shield having a base flange secured to the deck adjacent to said bubble cap and an imperforate shield body extending upwardly from said flange and laterally around the major portion of the side of the cap directed toward said weir and fitting against the lower edge margin of the cap to prevent direct passage of fluid from beneath the cap to the weir, for the purpose set forth.

11. In a device of the type described and including a deck, a bubble cap thereon, a downpipe for said deck and a weir extending upwardly from the deck and located between said bubble cap and said downpipe, an imperforate shield integral with said cap and extending laterally around the major portion of the side of the cap directed toward said weir and extending downwardly from the lower edge of the cap to the deck, to prevent direct passage of fluid from beneath the cap to the weir, for the purpose set forth.

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