March 19, 1940. A. L. SCHWANDT 2,194,126

BUBBLE CAP FOR REFRACTIONATING TOWERS

Filed July 11, 1938

Fig. 4

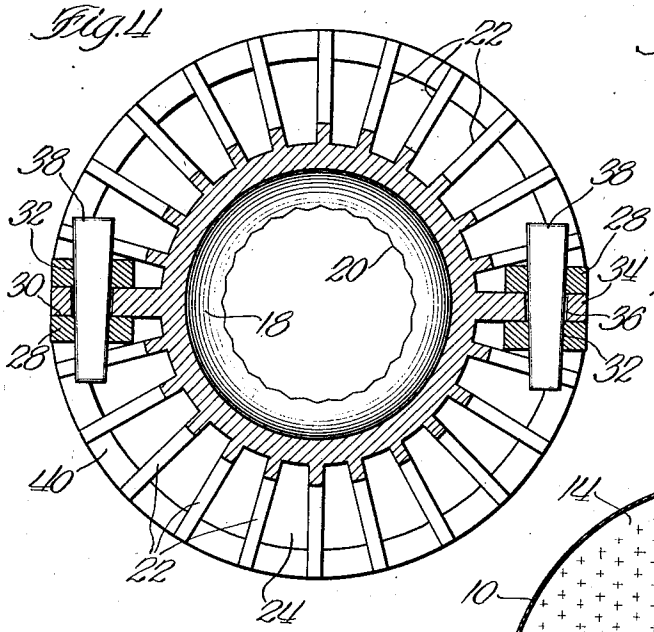


Fig. 1

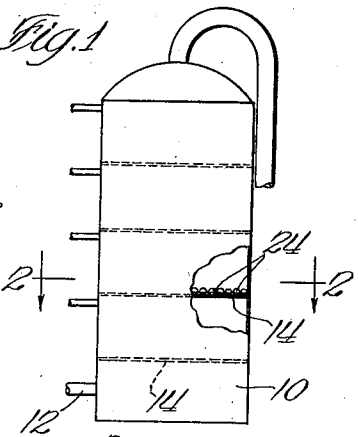


Fig. 2

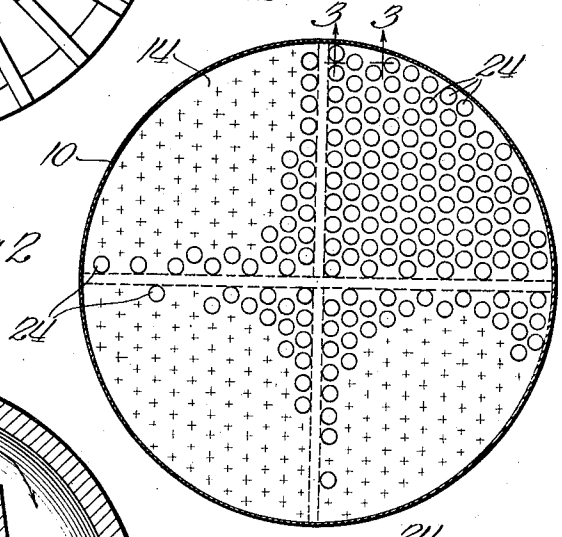


Fig. 3

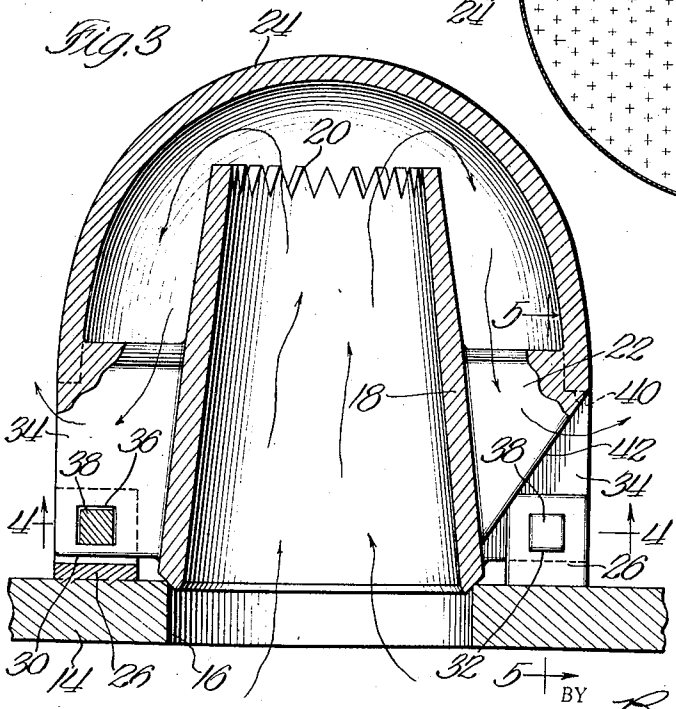
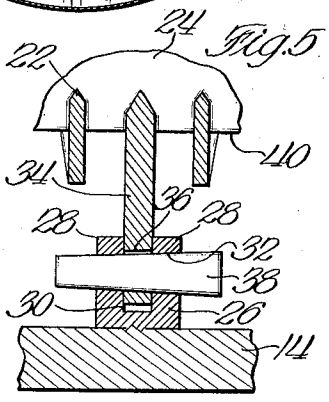


Fig. 5



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BUBBLE CAP FOR REFRACTIONATING TOWERS

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6 Claims. (Cl. 261—114)

An object of my invention is to provide a bubble cap for refractionating towers which can be easily and cheaply manufactured.

A further object of my invention is to provide such a construction for a bubble cap as will enable it to be easily installed, removed for cleaning, and replaced.

Another object is to provide a cap which performs its function with a minimum of resistance to the flow of fluid through it.

Still a further object is to provide a cap of such design that the sediment and other deposits which accumulate in the operation of a refractionating tower shall have a minimum effect in obstructing the flow of fluid through the cap.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is an elevation of a refractionating tower, a portion thereof being broken away to show a portion of the horizontal partition in which the bubble caps are mounted.

Figure 2 is a plan view of such a partition showing how the bubble caps are arranged and disposed therein.

Figure 3 is a vertical sectional view through a bubble cap embodying my invention.

Figure 4 is a horizontal view partly in section on the line 4—4 of Figure 3.

Figure 5 is a vertical sectional view partly in section taken on the line 5—5 of Figure 3.

In the accompanying drawing I have employed the reference numeral 10 to indicate a refractionating tower as used in the process of refining petroleum. In this process the fluid or gas enters the tower through the pipe 12 and passes upwardly through vertically spaced horizontal partitions 14. These partitions are punched or pierced to form many perforations, such as 16, of which there may be perhaps 400 or more in each partition. Over each such perforation 16 is mounted a bubble cap. In the form taken by my invention this bubble cap includes a truncated conical tube portion 18, having a serrated top edge 20. In the form of bubble cap used heretofore in refineries, the member 18 is customarily referred to as the "candle". In my structure I provide, preferably formed integrally with the candle 18, a number of radially disposed fins or webs 22. Disposed over and about the end 20 of the candle 18 is the cap proper which I shall refer to as the dome 24. This dome is also preferably formed integrally with the fins 22 and the candle 18.

It will now appear that when the bubble cap is mounted in the perforation 16 of the partition 14, the path of fluids through the tower must be through the bubble caps. More specifically, the gases flow upwardly through the inside of the candle 18, over the serrated edge 20, downwardly between the inner surface of the dome 24 and the outer surface of the candle 18, as indicated by the arrows in Figure 3, and finally out between the fins 22 and below the lower edge 40 of the dome 24.

To fasten the bubble cap in position with relation to the perforation 16 I provide lugs such as 26, having bifurcated portions 28 forming a slot 30. The lugs 26 may be electric welded to the partition 14 or attached in any other suitable manner. A hole 32 is provided in each of the portions 28. On the bubble cap and formed integrally therewith I provide two ears, 34, adapted to be received in the slots 30 of the lugs 26. Holes 36 are formed in the ears 34 in such a manner as to line up with the holes in the portions 28 of the lugs 26 when the bubble cap is placed in position. A taper pin 38 is driven through the holes when they are lined up, and the cap is thus maintained in position with relation to the partition 14. The pin 38 may be of rectangular cross section, as shown in my drawing, or of circular cross section, as desired.

My cap can be easily fastened in place simply by locating it over the perforation 16 with the ears 34 in the slots 30 and driving the taper pins 38 into place. Conversely, the cap can be removed with even greater ease simply by knocking out the pins and lifting out the cap.

In the type of cap previously used in the industry, the candle and the dome portion have been made in separate pieces, the conical candle being inserted through the perforation 16 from below and fastened to the dome above by a through bolt which passed through the apex of the dome and was attached to a bridge which spanned the end of the candle. Assembly or disassembly of the old type structure required two men, one to work above the partition 14 and the other to work below, and obviously the assembly by means of a bolt was a wasteful, time-consuming operation.

The flow of fluid through the tower 10 in the operation thereof causes the deposit of large amounts of dirt and sediment which are thrown down on the partitions 14 by the fluid in its

downward course as it comes out from under the edges of the bubble cap, as at 40. In time the deposit of sediment obstructs the flow of fluid through the tower and causes such a loss of head that the tower must be put out of operation for cleaning. This is accomplished by removing all the bubble caps from their position, so that they may be individually cleaned and the accumulated sediment on the partitions 14 may be flushed out. A tower such as 10 may contain several thousand caps and cleaning may be necessary as often as once a month. It may be readily seen, therefore, that any improvement which cuts down the labor and handling cost in this operation is of great significance. The unitary structure and the simple, convenient fastening means operable entirely from the top side of the partition represent two such significant economy features of my device.

A third feature should also be noted. In previous forms of construction it has been customary to continue the dome 24 down to the top surface of the partition 14 in the form of a number of supporting legs, leaving slots between through which the fluid might pass out from the dome. In my construction I discontinue the dome proper at the lower edge 40, which is a substantial distance above the partition 14. As previously pointed out, the dome 24 is supported on the candle 18 by the fins 22. I incline the lower edges of the fins 22 from the lower edge 40 of the dome 24 to the candle 18 as shown at 42 in Figure 3. This construction gives much more freedom of passage for the fluids out of the bubble cap. Sediment may collect over a greater area of the partition 14 and also to a greater depth than in previous forms of construction before the flow through the tower is sensibly impeded. This means that the tower may be operated through much longer cycles before cleaning becomes necessary, and consequently the periodic expenses in connection with the cleaning operation may be materially reduced in the long run. This means a saving not only in the direct labor costs involved in the cleaning operation but in the heavy overhead costs which must be met even when the unit is not in productive operation.

With proper cores my structure can readily be cast in malleable iron or other suitable materials. It is also adaptable to being formed of pressed coke or similar substances according to methods now being used in the industry. While a one piece construction is desirable from the standpoint of handling costs my bubble cap may be cast somewhat more simply in two or more pieces. The candle or riser may be made in one piece with the dome 24, the webs 22 and the ears 34 formed integrally as the other piece. In this case the conical shape of the candle 18 gives a bearing for the webs 22 whereby the candle will be held in place adjacent the perforation 16 in the partition or tray 14. Or alternatively, the candle and webs can be made integrally, and the dome and ears as an integral coacting piece. The candle may have a serrated top edge as at 20 or may be made with a plain edge. The lugs 26 and the pins 38 I make preferably of steel but any suitable material may be so employed.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a bubble cap, a central tube, support members thereon, a dome supported thereby, bifurcated lugs adapted to be attached to a supporting surface, extended ears formed on said tube, said tube, support members, dome and ears being formed integrally, each of said ears being adapted to fit between the bifurcations of one of said lugs, perforations formed in said ears and in said lugs, and pins adapted to position through said perforations for maintaining the bubble cap in position relative to the supporting surface.

2. In a bubble cap structure, a central tube, a dome member, support members inside said dome member for maintaining said dome member in position about one end of said tube, bifurcated members adapted to be attached to a supporting surface, extensions formed on said dome member and adapted to extend between the bifurcations, perforations in said extensions and tie means adapted to position through said perforations and to coact with said bifurcated members for maintaining the bubble cap in position relative to the supporting surface.

3. In a bubble dome structure, a central tube, a dome member, support members inside said dome member for maintaining said dome member in position about one end of said tube, bifurcated members adapted to be attached to a supporting surface, extensions formed on said cap member, perforations in said bifurcated members and tie means adapted to position through said perforations and to coact with said extensions for maintaining the bubble cap in position relative to the supporting surface.

4. In a bubble cap for a bubble tower, a central tube, a dome, support members for maintaining said dome in position about one end of said tube, bifurcated lugs adapted to be attached to a supporting surface, extended ears formed on said dome, each of said ears being adapted to fit between the bifurcations of one of said lugs, perforations formed in said ears and in said lugs, and pins adapted to position through said perforations for maintaining the bubble cap in position relative to the supporting surface.

5. In a bubble cap structure, a body portion comprising a central tube, a dome member, and supporting members inside said dome member for maintaining said dome member in position about one end of said tube; bifurcated members adapted to be attached to a supporting surface, extensions formed on said body portion, perforations in said extensions and tie means adapted to position through said perforations and to coact with said bifurcated members for maintaining the bubble cap in position relative to the supporting surface.

6. In a bubble cap structure, a body portion comprising a central tube, a dome member, and supporting members inside said dome member for maintaining said dome member in position about one end of said tube; bifurcated members adapted to be attached to a supporting surface, extensions formed on said body portion and adapted to fit between the bifurcations, perforations in said bifurcated members and tie means adapted to position through said perforations and to coact with said extensions for maintaining the bubble cap in position relative to the supporting surface.

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