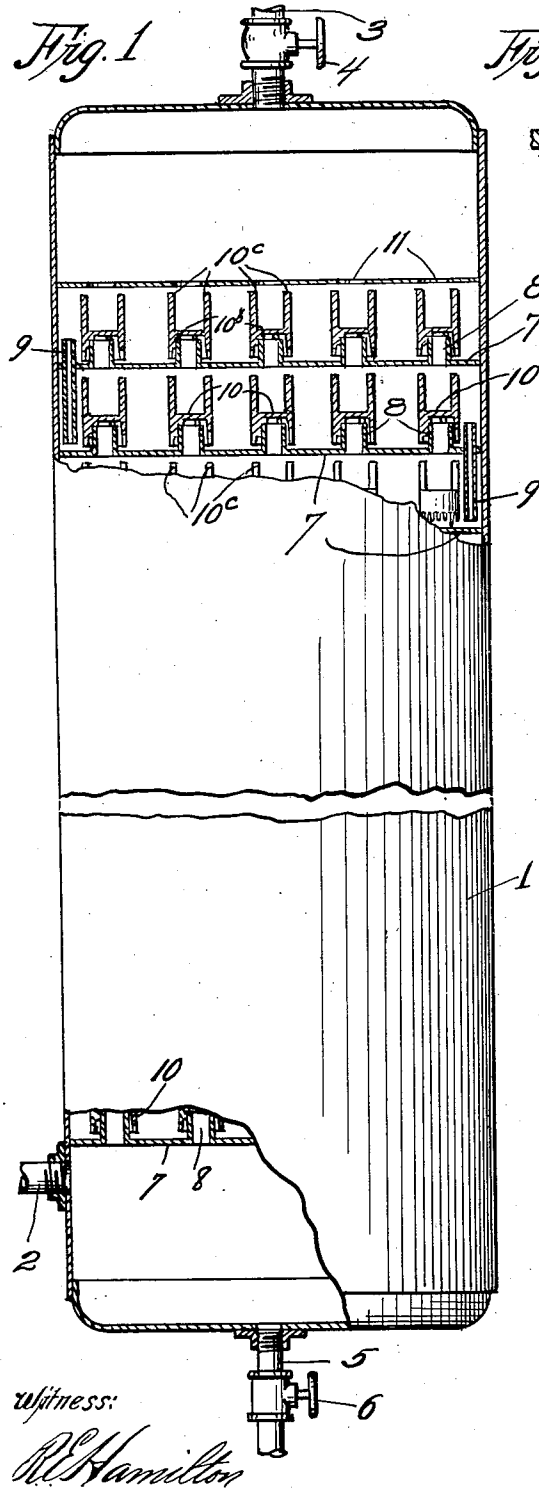
June 2, 1931. H. E. WIDDELL 1,808,276

BUBBLE TOWER CAP

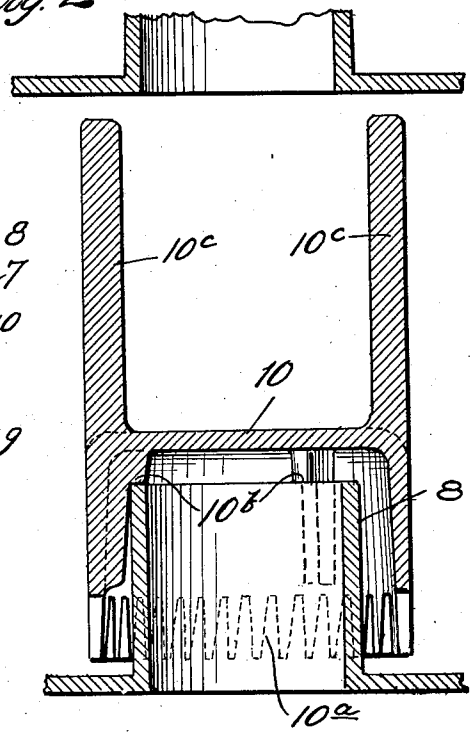
Filed Dec. 21, 1923

Fig. 1



Witness:
R. C. Hamilton

Fig. 2



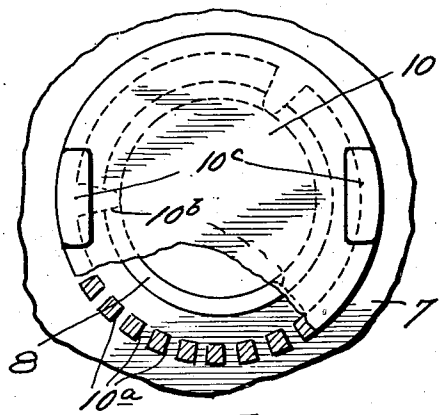


Fig. 3

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Patented June 2, 1931 1,808,276

UNITED STATES PATENT OFFICE

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BUBBLE TOWER CAP

Application filed December 21, 1923. Serial No. 681,970.

This invention relates to improvements in bubble towers, and refers more particularly to the particular construction of the caps or hoods which are used over the vapor risers in the towers for diverting the course of the vapors rising through the tower to cause them to percolate through the liquid pools, maintained in the tower, for separating and extracting the high boiling point fractions from the vapors.

Among the objects of the invention are to provide a bubble tower construction for the treatment of vapors such as hydrocarbon vapors in the production of motor fuel oil such as gasoline and the like, whereby automatic provision is made for accommodating an excess volume of vapors passing through the tower without causing them to surge or blow over the liquid material; to provide a construction whereby the relatively higher boiling point hydrocarbons may be most effectively separated from the hydrocarbon vapors in order that only the lighter fractions or gasoline-like products may pass over and be finally condensed as distillate, and, in general, to provide a construction of the character referred to.

In the drawings:

Fig. 1 is an elevational view partly in section of the tower with parts broken away to show the internal construction.

Fig. 2 is an enlarged sectional view taken through one of the hoods or caps.

Fig. 3 is a plan view partly in section of the construction shown in Fig. 2 with a portion of the cap broken away.

Referring to the drawings:

At 1 is shown a tower which is provided with a vapor inlet pipe 2 and a vapor outlet line 3 controlled by a valve 4. At the bottom of the tower is provided a liquid draw off line 5 regulated by a valve 6. Within the tower are arranged a plurality of shelves or pans 7 which are equipped with short standpipes or risers 8 which serve as passageways for the vapors rising successively from the lower partitions or pans to the top of the tower. The pans are also equipped with vertical standpipes 9 which serve to maintain a liquid level on the respective pans and direct the overflow or excess liquid to the next lower pan below. In this connection it will be noted that the lower end of each of these standpipes is immersed in the pool of liquid below in order that the vapors shall not be diverted through the standpipes, thus preventing the downflow of excess liquid and proper functioning of the tower. The risers on the separate pans are hooded by caps 10 which serve to reverse the flow of the vapors downwardly about the outside of the risers and cause them to percolate or bubble up through the liquid which is maintained at a constant level by the standpipes 9. These caps consist of a dish portion which is preferably serrated along the lower edge, as shown at 10*a*. They are supported on the risers by shouldered lugs 10*b* which mount the caps on the risers so as to leave an annular space between the top of the risers and the inside top of the cap and also between the sides of the risers and the interior surface of the caps. Thus a passage is provided for the vapors rising from the pool below to pass downwardly around the outside of the risers and be discharged through the serrated edges of the caps into the liquid pools wherein the separation and absorption of the higher boiling point fractions takes place. On the top of the caps are two horn-like members, shown at 10*c*, whose function is to limit the vertical movement of the caps in case an excess of vapors are discharged through the risers and have sufficient pressure to raise the caps. These limiting horns contact the pan above and prevent the caps from being displaced from the risers. This vertical movement of the respective caps is an important function, as it greatly increases the capacity of the risers for a limited period of time during the sudden evolution or accumulation of vapors, at the same time, materially reducing the possibility of surging and puking of the tower. A sudden excess pressure is often caused by the presence of moisture in the oil and the presence of steam in the vapors.

In the normal types of construction, the caps are fixedly held on the tops of the risers, thus giving a relatively fixed capacity to the risers and the tower as a whole, and in case

of an emergency, such as that explained, the excess vapors will cause the tower to surge and liquid to pass over with the vapors to the condensing apparatus. Surging or puking of the tower is undesirable, as it contaminates the distillate with objectionable fractions which must be subsequently separated or extracted by retreatment before the product is marketable.

A tower, such as that herein described, provided with the movable caps or hoods, furnishes a certain amount of flexibility, the construction being such as to accommodate an excessive evolution or accumulation of vapors within a relatively wide range without materially hindering the tower operation. Where an excess volume of vapors suddenly rise through the tower and are accommodated in the manner described by the automatic lifting of the vapor caps, while the efficiency of the tower will be somewhat reduced, the objectionable surging and puking will be eliminated. Above the top of the caps in the upper pool is a perforated plate 11 which limits the movement of these caps.

As the operation of these towers is well known in the art, a brief explanation of their use and functioning will suffice.

Vapors are introduced to the bottom of the tower, through the line 2, from a still or any suitable type of treating apparatus, such as a common type of atmospheric still or a cracking system in which pressures are used. The vapors introduced into the lower part of the tower rise upwardly through the successive stages comprising a plurality of pools which are maintained on the pans designated as "7" in the drawings. In each of these pans, certain of the liquid products are separated out, as each of the successive pools is cooler as the vapors rise toward the top of the tower. As explained, liquid levels are maintained by the standpipes while the vapors, passing up through the risers successively from one pool to the next above, are diverted by the caps downwardly and caused to percolate through the pools where there is a certain amount of absorption taking place in addition to the normal separation due merely to the cooling or condensing action. From the top pool the vapors pass off through the perforated plate 11 and the vapor line into condensing and cooling stages not shown.

The particular feature of the invention herein disclosed is the provision made for the vertical movement of the caps which permits an automatic enlargement of the vapor passages from one pool to another which will accommodate an excess of vapors, without hindering the tower operation and reducing, and substantially eliminating any tendency which the tower may have to blow over the liquid with the vapors into the condensing stage of the system. As described, this surging or puking of the tower is particularly frequent where moisture is present in the oil. It is appreciated that the construction may be varied in numerous ways to accomplish this result, namely, in place of the limiting horns mounted on top of the caps, other means, for permitting a vertical movement of the caps by preventing displacement of the caps from the risers, may be employed.

It is understood that in addition to the treatment of hydrocarbon vapors, this type of apparatus may be used in any process in which the vapors are treated in a tower of this character.

I claim as my invention:

1. Caps for vapor risers for use in towers of the bubble type having trays spaced apart sufficiently to permit vertical movement of the caps on the risers, comprising cap units having serrated lower edges, vapor risers upon which the caps are mounted, means on the caps for automatically limiting the upward movement of the caps and enlargement of the vapor passage.

2. Caps for vapor risers for use in towers of the bubble type in which the distance between the trays would permit vertical movement of the caps on the risers, comprising cap units movably mounted on the risers, means on the caps for limiting the automatic enlargement of the vapor passage therebeneath with the excess flow of vapors through the tower.

3. Caps for vapor risers for use in towers of the bubble type in which the distance between the trays would permit vertical movement of the caps on the risers, comprising cap units movably mounted on said risers, extensions on the tops of the caps for limiting their vertical movement, said extensions adapted to prevent dismounting of the cap from the risers, the movement of the caps relative to the risers compensating for the changes in volume of the vapors passing through the risers.

4. Caps for vapor risers for use in towers of the bubble type in which the distance between the trays would permit vertical movement of the caps on the risers, comprising cap units movably mounted on said risers, extensions on the tops of the caps for limiting their vertical movement to a predetermined degree, said extension adapted to prevent dismounting of the caps from the risers, the movement of the caps relative to the risers compensating for the changes in volume of the vapors passing through the risers.

5. A bubble tower cap comprising a dish portion adapted to be mounted on a vapor riser and having serrated edges and vertical extensions projecting from the top of the cap for the purpose described.

6. A cap for use in bubble towers comprising a dish portion adapted to be mounted on

a vapor riser in spaced relation thereto, and means carried by the cap to limit its upward movement.

7. A cap for risers in bubble towers comprising a dish portion adapted to be mounted on a vapor riser, and integral diametric vertical extensions.

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