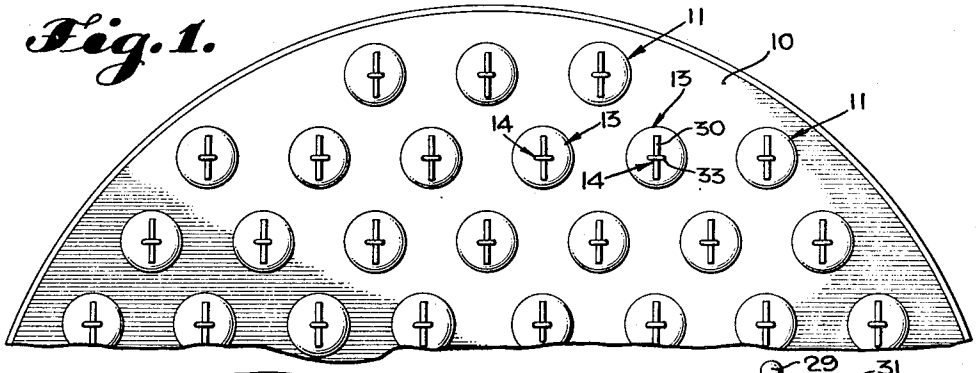
July 8, 1952 C. L. HAYNES 2,602,652

BUBBLE CAP

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Fig. 1.



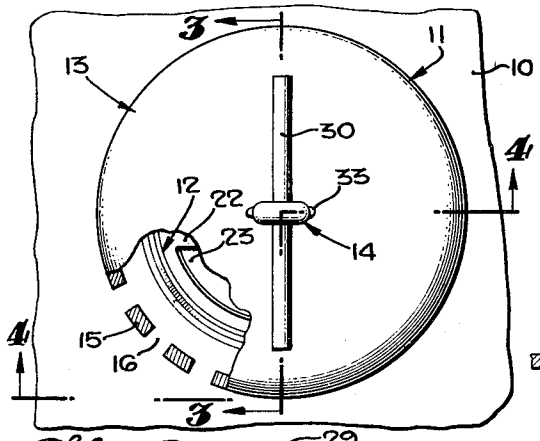


Fig. 2.

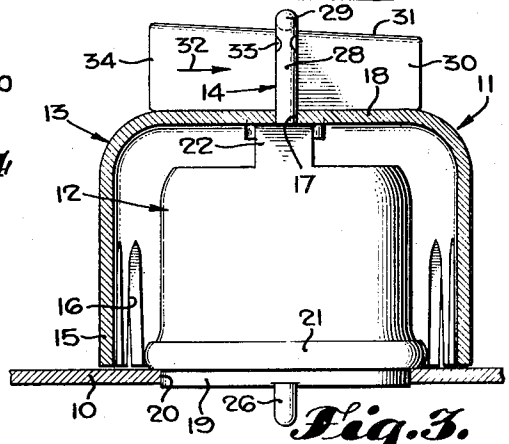


Fig. 3.

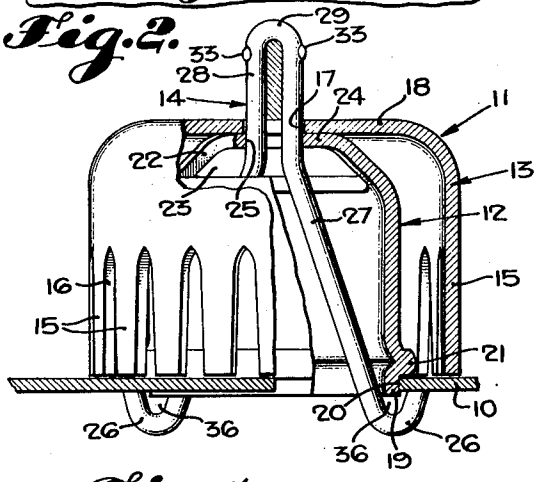


Fig. 4.

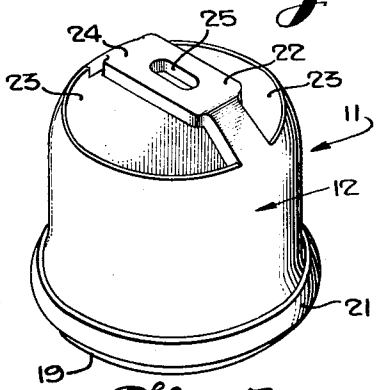


Fig. 5.

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BUBBLE CAP

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Fig. 6.

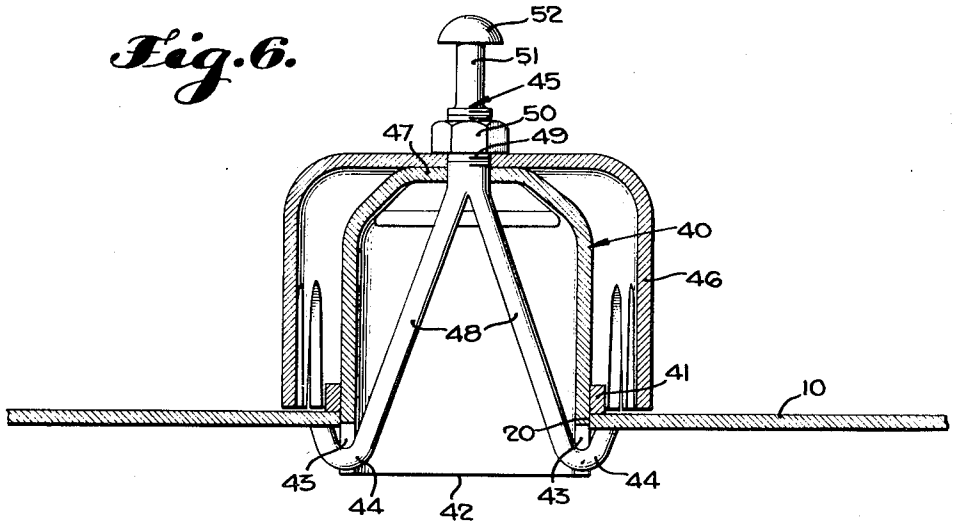
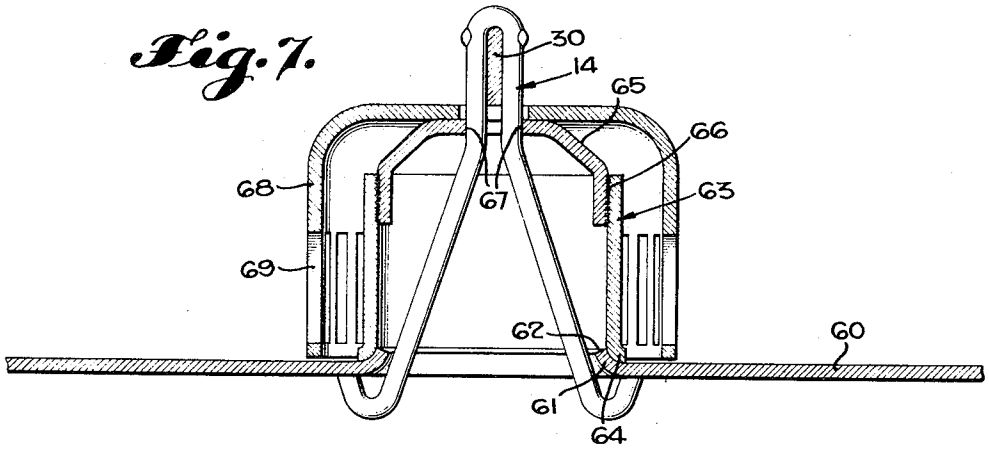


Fig. 7.



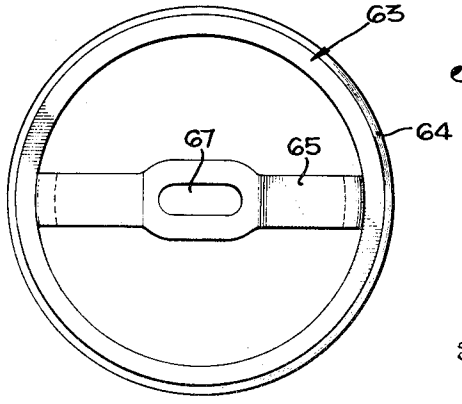


Fig. 8.

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2,602,652

BUBBLE CAP

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Application July 6, 1948, Serial No. 37,234

13 Claims. (Cl. 261—114)

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This invention relates to bubble cap and riser assemblies of the type employed in liquid-gas contact apparatus such as, for example, as used in connection with the processing of hydrocarbons.

A particular object of this invention is to provide a new and improved form of bubble cap and riser assembly which may be conveniently installed and removed from a tray plate of a bubble column by a single operator working on one side of the plate.

Another object is to provide a device of this type having an improved form of hold-down yoke.

A further object of this invention is to provide a bubble cap and riser assembly having a novel form of riser.

A more detailed object is to provide a device of the character described in which the hold-down yoke serves as a means to center the bubble cap on the upstanding riser.

Other objects and advantages will appear hereinafter.

In the drawings:

Figure 1 is a partial plan view of a bubble column tray showing a number of bubble cap and riser assemblies in position on the tray.

Figure 2 is a plan view on an enlarged scale partly broken away showing a cap and riser assembly embodying my invention mounted in position on the tray.

Figure 3 is a sectional elevation taken substantially on the lines 3—3 as shown in Figure 2.

Figure 4 is a side elevation partly in section taken substantially on the lines 4—4 as shown in Figure 2.

Figure 5 is a perspective view of the riser.

Figure 6 is a sectional elevation showing a modified form of my invention.

Figure 7 is a sectional elevation showing a further modification.

Figure 8 is a top plan view of the riser shown in Figure 7.

Referring to the drawings, the bubble column tray 10 may support a large number of bubble cap and riser assemblies 11. Each of these assemblies includes a riser 12 and a bubble cap 13 maintained in assembled relation on the tray 10 by a hold-down element 14. The cap 13 may be provided with the usual fingers 15 extending circumferentially around the lower portion of the cap 13 and defining between them a plurality of slots 16. The cap 13 and fingers 15 are adapted to be formed as a metal stamping, fabricated from a flat sheet of material. A central opening

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17 is provided in the upper flange 18 of the cap 13.

The riser 12 is also adapted to be formed from a metal stamping, fabricated from a flat sheet, and includes a downwardly extending circular pilot rim 19 which is adapted to extend into a circular opening 20 provided in the tray plate 10. A radial shoulder 21 extends outwardly from the wall of the riser 12 at a location adjacent the pilot rim 19. This shoulder 21 may be provided by a separate ring secured to the riser or, as shown in the drawings, may be integrally formed by upsetting the riser in an axial direction to provide an integral shoulder. As clearly shown in Figure 5 the riser 12 is formed as a cup element with the bottom of the cup including the bridge 22. Segments are removed from the bottom of the cup to form the openings 23 on each side of the bridge 22. The central upper surface 24 of the bridge 22 provides a supporting abutment for the under side of the flange 18 of the bubble cap 13. An elongated opening 25 in the bridge 22 is positioned to register with the opening 17 in the bubble cap flange 18.

Means are provided for securing the bubble cap and riser assembly in position on the tray plate 10, and as shown in the drawings this means includes the hold-down element or yoke 14. This element may be formed from a single length of metal having a pair of oppositely directed hooks or feet 26 at the lower end. The feet 26 are carried on downwardly extending shanks 27 which diverge from parallel vertical sections 28 forming part of the upper end of the hold-down yoke 14. The sections 28 are joined by the integral curved bent section 29 to form a loop. The upper part of the yoke element 14 is thus conduplicate in shape and forms the leg of an inverted Y, the diverging shanks forming the arms thereof. The preferred form of hold-down element as shown in Figure 4 is thus shaped after the manner of a wishbone. A wedge-shaped key 30 extends through the space defined between the sections 28. The lower edge of the key 30 rests on the flange 18 of the bubble cap 13 and the upper sloping edge 31 engages under the bent section 29. From this description it will be understood that lateral movement of the key 30 in the direction of the arrow 32 as shown in Figure 3 serves to raise the hold-down yoke 14 and effect engagement of the feet 26 with the under side of the tray plate 10. The parallel sections 28 of the yoke 14 extend through the elongated opening 25 in the riser bridge 22 and through the opening 17 in the bubble cap flange 18. Accord-

ingly, the yoke 14 acts to center the bubble cap 13 with respect to the riser 12.

Sufficient clearance 36 is provided adjacent the feet 26 to clear the lower extending edge of the pilot rim 19 so that the feet engage the under side of the tray plate 10.

The upper portions of the parallel sections 28 of the yoke 14 may be laterally crimped or deformed as shown at 33 after the upper end of the yoke has been extended through the opening 25. These lateral projections 33 prevent the yoke 14 from dropping through the opening 25, but since the opening 17 is larger than the opening 25 the projections 33 do not prevent installation or removal of the bubble cap 13. The projections 33 serve to provide a lost-motion connection between the riser 12 and yoke 14 which permits a limited degree of relative sliding movement between them while preventing their complete separation.

The bubble cap and riser assembly may be installed from the upper side of the tray plate 10 without requiring any assistance from a man positioned below the tray plate. The riser 12 and yoke 14 comprise a unitary assembly. The feet 26 of the yoke may be inserted through the opening 20 by tilting the yoke and riser 12 before the riser is seated on the tray plate 10. The lateral projections 33 prevent the yoke from falling through the opening 25. The pilot rim 19 on the riser is then inserted into the opening 20, and the bubble cap 13 is installed over the upwardly projecting end of the yoke 14. The bubble cap 13 is then automatically centered by the upper portion of the yoke 14 and rests on the bridge 22 of the riser 12. The key 30 is then inserted between the parallel segments 28 and moved laterally by any convenient means such as, for example, by a hammer applied to the large end 34 of the key 30. The bubble cap 13 and riser 12 are then confined against upward movement relative to the plate 10. When thus installed, gases passing upwardly through the interior of the riser 12 flow outwardly through the openings 23 and downwardly around the outside of the riser 12 and out through the slots 16 between the fingers 15.

When it is desired to remove the assembly for inspection, cleaning, or repair, or for other reasons, the key 30 is removed by moving it in a direction opposite to that indicated by the arrow 32. The bubble cap 13 is removed upwardly and the riser 12 is moved upwardly away from the tray plate 10 and then tilted to permit the feet 26 of the yoke 14 to pass upwardly through the opening 20 in the tray plate 10. Both installation and removal of the bubble cap and riser assembly are accomplished from the upper side of the tray plate 10.

While the riser 12 and cap 13 have been shown and described as being cylindrical in form, it will be recognized that other shapes may also be used. For example, a rectangular opening may be provided in the tray plate to receive a rectangular box-shaped riser and the shape of the cap 13 may be modified accordingly.

In the modification shown in Figure 6 the riser 40 is provided with a separate ring 41 which rests on the tray plate 10. The ring 41 may be attached by any convenient means such as, for example, by brazing or by welding. A pilot rim 42 projects downwardly through the opening 20 in the tray plate 10 and may be provided with diametrically opposed notches 43. The lower ends 44 of the yoke member 45 extend through

these notches 43 so that relative rotation of the yoke 45 and riser 40 is prevented. The bubble cap 46 rests on the riser bridge 47 in the same manner as described in connection with Figures 1 to 4. The yoke 45 may be formed from a round bar and is split at one end to form the shanks 48 and feet 44. A portion of the yoke above the split is threaded as shown at 49 to receive the nut 50.

A section 51 of reduced diameter is provided above the threaded portion 49 and the extreme upper end of the yoke is enlarged to form an abutment 52 which prevents the nut 50 from being withdrawn from the yoke 45. The nut 50 is installed after the threaded portion 49 and reduced section 51 have been formed, and the abutment 52 is upset to the shape illustrated after the nut is in position on the threads 49. The abutment 52 provides a lost-motion connection similar to that afforded by the projections 33 described above. The bubble cap and riser assembly as shown in Figure 6 may be assembled and removed from the upper side of the tray plate 10. Assembly is accomplished by positioning the nut adjacent the abutment 52 so that the threaded portion 49 may extend below the riser bridge 47 and so that the feet 44 extend below the lower limit of the pilot rim 42. The assembly may be then tilted sufficiently to move the yoke feet 44 through the tray opening 20 and into position under the tray plate 10. The riser pilot rim 42 is then inserted within the opening 20 to allow the ring 41 to rest on the upper surface of the tray plate 10. During this assembly operation the yoke 45 cannot fall through the bubble cap 46 and riser 40 because the nut 50 engages the abutment 52. When the riser and bubble cap are in position the nut 50 is threaded on the yoke portion 49 to bring the feet 44 into engagement with the lower surface of the tray plate 10. Turning of the nut does not rotate the yoke 45 because such rotation is prevented by the notches 43.

In the modified form of my invention shown in Figures 7 and 8 the tray plate 60 is flanged upwardly as shown at 61 around the tray opening 62. The riser 63 is flared at its lower end 64 and rests on the upturned flange 61 around the tray opening. The riser bridge 65 is formed as a separate piece and is attached to the upper portion of the riser 63 by any convenient means such as, for example, by spot welding 66. The slot 67 in the riser bridge 65 receives the yoke 14. The yoke 14 and wedge 30 may be substantially the same as those described in connection with Figures 1 to 4. The bubble cap 68 may be provided with fingers and open-ended slots as shown in Figure 4, and may be provided with a series of slots 69 closed at their lower ends as shown in Figure 7. This modified form of my invention may also be assembled and removed from the upper side of the tray plate 60, and the manner of assembly and removal is substantially the same as that described in connection with Figures 1 to 4.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. In a bubble cap and riser assembly for an apertured tray plate, the combination of a riser adapted to rest on the tray plate and having a pilot rim extending downwardly into an aperture provided in the tray plate; an apertured bridge

formed integrally on the upper end of the riser; a bubble cap having an apertured flange resting on the riser bridge; a hold-down yoke comprising a single length of material doubled at a midpoint to form a loop, the loop extending upwardly through the bridge and flange to center the bubble cap on the riser, the yoke having diverging shanks provided with hook-shaped contacts adapted to engage the underside of the tray plate; and a wedge cooperating with the loop for clamping the riser and bubble cap with respect to the tray plate.

2. In a bubble cap and riser assembly for an apertured tray plate, the combination of a riser adapted to rest on the tray plate and having a pilot rim extending downwardly into an aperture provided in the tray plate; an apertured bridge formed integrally on the upper end of the riser; a bubble cap having an apertured flange resting on the riser bridge; a hold-down yoke comprising a single length of material doubled at a midpoint to form a loop, the loop extending upwardly through the bridge and flange to center the bubble cap on the riser, the yoke having diverging shanks provided with hook-shaped contacts adapted to engage the underside of the tray plate; means adapted to prevent disassembly of the yoke and riser; and a wedge cooperating with the loop for clamping the riser and bubble cap with respect to the tray plate.

3. In a bubble cap and riser assembly for an apertured tray plate, the combination of: a riser adapted to rest on a tray plate and to communicate with an aperture formed therein, the riser having an upstanding wall and a supporting bridge extending diametrically across the riser at the upper end thereof, the bridge having a central opening, pilot means on the riser extending into the aperture to center the riser with respect to the aperture; a hold-down element slidably extending through the opening in the riser bridge; projecting means on the upper portion of the hold-down element engageable with the riser bridge to prevent separation of the riser and hold-down element, said hold-down element being insertable downwardly through said aperture and having legs provided with laterally spaced contacts engaging the underside of the tray plate; a bubble cap supported on the riser bridge; and means engaging said hold-down element and bubble cap for clamping the riser and bubble cap downwardly onto the tray plate.

4. In a bubble cap and riser assembly for an apertured tray plate, the combination of a riser adapted to rest on a tray plate and having pilot means extending into an aperture provided therein, the riser having an upstanding wall and a supporting bridge extending diametrically across the riser at the upper end thereof, the bridge having a central opening; a bubble cap having an apertured flange resting on the riser bridge; a hold-down yoke having an upper portion slidably received in said opening and acting to center the bubble cap on the riser; projecting means on said upper portion of the yoke engageable with the riser bridge to prevent separation of the riser and yoke, the yoke being insertable downwardly through the tray plate aperture while the riser is connected to the yoke, said yoke having legs provided with laterally spaced contacts adapted to engage the underside of the tray plate; and means cooperating with the upper portion of the yoke for clamping the riser and bubble cap with respect to the tray plate.

5. In a bubble cap and riser assembly for an apertured tray plate, the combination of a riser adapted to rest on a tray plate and communicate with an aperture formed therein; a bubble cap supported on the riser; a hold-down yoke having downwardly diverging legs and an upwardly extending stem portion; said yoke extending through said riser and bubble cap with the stem portion thereof projecting upwardly above said bubble cap, means guiding said stem portion for vertical sliding movement relative to said bubble cap and riser; stop means adjacent the upper end of said stem portion and fixed thereto to limit downward sliding movement of said yoke and prevent removal thereof from said riser; the lower ends of said legs being shaped to extend through said aperture and engage the underside of said tray plate; and moveable means engageable with the upper surface of said bubble cap and with the projecting portion of said stem portion to draw said yoke upwardly and clamp said assembly to said tray plate.

6. An assembly as defined in claim 5 wherein said moveable means comprises a camming element.

7. An assembly as defined in claim 5 wherein said stem portion is of inverted U-shape having spaced apart legs, said moveable means comprising a wedge-shaped camming element extending between said spaced apart legs and engaging the bight of said U-shaped stem portion and bearing on said bubble cap.

8. An assembly as defined in claim 5 wherein said yoke comprises a single length of material doubled at its midpoint to form a loop, the loop comprising said stem portion and said moveable means comprising a wedge extending through said loop above said bubble cap.

9. An assembly as defined in claim 5 wherein said yoke comprises a bar element split for a portion of its length to form said diverging legs, the portion of the bar which is not split constituting said stem portion and having a threaded section above said bubble cap, said moveable means comprising a nut engaging said threaded section.

10. An assembly as defined in claim 5 wherein the lower end of said riser extends into said aperture, and a shoulder means on said riser abutting the upper surface of said tray plate adjacent said aperture.

11. An assembly as defined in claim 5 wherein said tray plate is provided with an upwardly directed flange about the periphery of said aperture, said flange extending into said riser and serving to center the same over said aperture.

12. An assembly as defined in claim 5 wherein said riser is provided with a bridge extending diametrically across the upper end thereof, said bubble cap being supported on said bridge, said means guiding said stem portion comprising an opening through said bridge with said stem portion extending therethrough.

13. In a bubble cap and riser assembly for an apertured tray plate, the combination of a riser adapted to rest on a tray plate and communicate with an aperture formed therein; a bubble cap supported on the riser; a hold-down yoke having downwardly diverging legs and an upwardly extending stem portion; said yoke extending through said riser and bubble cap with the stem portion thereof projecting upwardly above said bubble cap; means guiding said stem portion for vertical sliding movement relative to said bubble cap and riser; shoulder means adjacent the upper end of said stem portion and fixed thereto; the lower ends of said legs being shaped

to extend through said aperture and engage the under side of said tray plate; movable means engageable with the upper surface of said bubble cap and having a first portion engageable with the projecting portion of said stem to draw said yoke upwardly and clamp said assembly to said tray plate; said movable means having a second portion engageable with said shoulder means when said movable means is moved to yoke-releasing position to thereby limit downward sliding movement of said yoke and prevent removal thereof from said riser.

CHARLES L. HAYNES.

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