

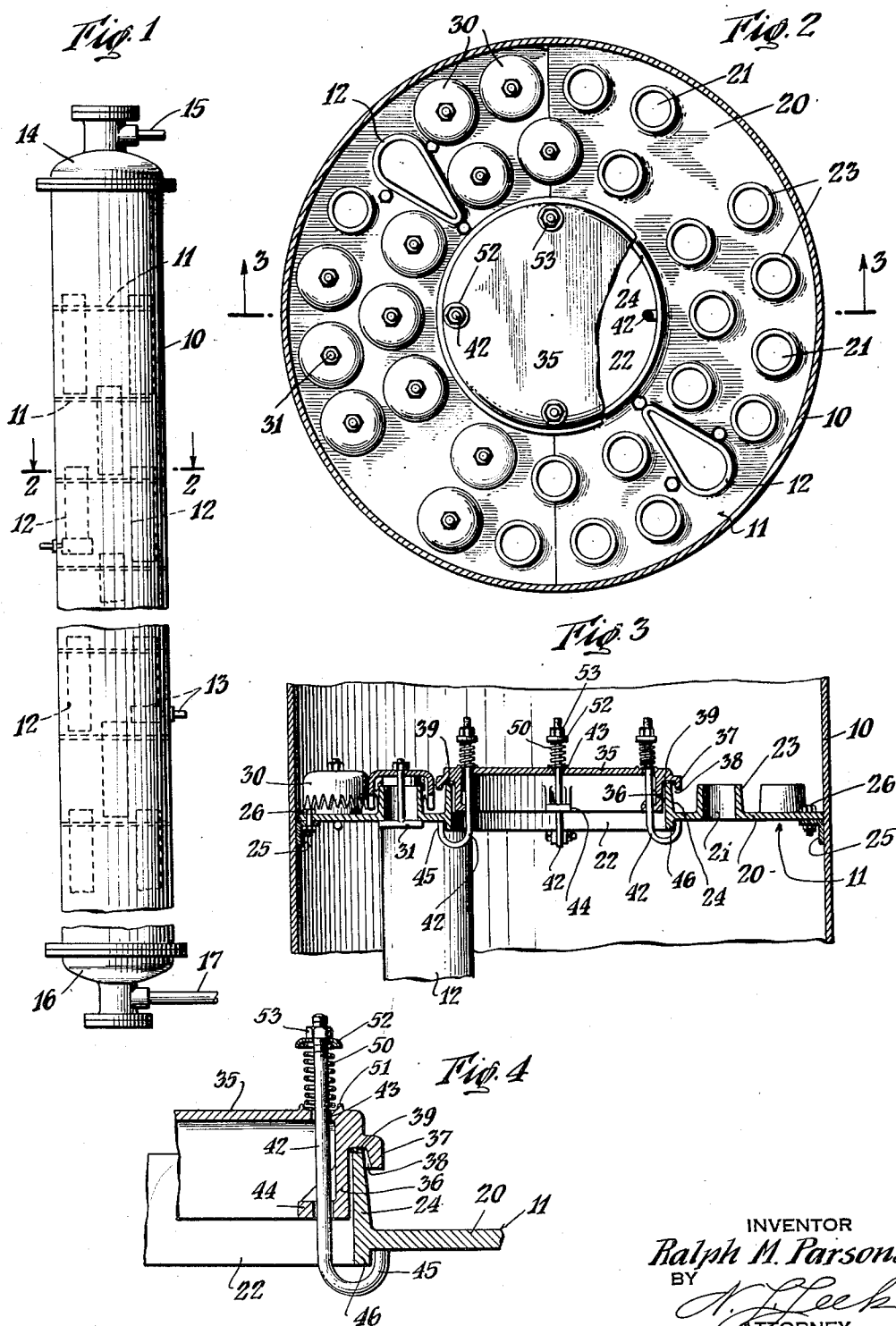
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BUBBLE COLUMN

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BUBBLE COLUMN

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This invention relates to bubble columns and more particularly to columns of the type used in oil refineries and oil cracking plants.

One difficulty frequently encountered in bubble columns of the above type is due to the development in the column of sudden high pressures which are commonly called explosions and are caused by the sudden physical explosion of the gases therein. Such expansion may result in dislodging all of the bubble trays and depositing them at the bottom of the tower or in some cases may injure the tower itself. In any event, the operations must be interrupted while the proper repairs or replacements are being made.

An object of the present invention is to prevent such explosions from damaging the tower or the trays.

Another object is to provide a bubble column in which the operation is only interrupted momentarily should an explosion take place.

Another object is to provide a column which may be readily entered for purposes of inspection or repair.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

A feature of the invention consists in the provision of an automatic pressure relief means associated with each of the bubble trays. In one embodiment, as applied to a large tray having a central manhole, the above results are accomplished by so mounting the manhole cover that the cover remains in place during normal operation of the column, but is automatically unseated or elevated in response to an excessive pressure, whereby it constitutes a combination manhole cover and pressure relief valve. In a bubble column having a plurality of trays formed in the above manner, the pressure is progressively reduced at each of the trays and is dissipated without injuring the trays or the tower.

Other features consist in the various details of construction and combination of parts hereinafter more fully set forth.

Although the novel features which are believed to be characteristic of this invention will be more particularly pointed out in the claims appended hereto, the broader aspects of the invention will be better understood by referring to the following description taken in connection with the accompanying drawing in which a preferred embodiment thereof has been set forth for purposes of illustration.

In the drawing:

Fig. 1 is a side elevation of a bubble column illustrating the present invention;

Fig. 2 is an enlarged horizontal section taken on the line 2—2 of Fig. 1 showing the construction of a typical tray;

Fig. 3 is a vertical section of the tray taken on the line 3—3 of Fig. 2; and

Fig. 4 is an enlarged detail view of the securing means for the manhole cover.

In the following description and in the claims certain specific terms are used for convenience in referring to various details of the invention. It is to be understood however that these terms are to be given as broad an interpretation as the state of the art will permit.

Referring to the drawing more in detail, the invention is shown in Fig. 1 as applied to a bubble column comprising a tower 10 having a plurality of bubble trays 11 disposed therein in vertically spaced relationship. A plurality of downcomers 12 are associated with each tray to discharge the liquid from each tray to the tray below. Side-cut buckets 13 are associated with certain of the downcomers 12 for removing side cuts from the tower in a manner which is well known in the art. The tower may be provided with a top closure 14 having a vapor discharge pipe 15, and with a bottom closure 16 having a liquid discharge pipe 17.

The general construction of the tower and the operation thereof is well known in the art and only so much thereof has been set forth herein as is necessary to an understanding of the present invention.

The various bubble trays 11 are of similar construction. One of these trays is illustrated in Figs. 2 to 4 as comprising a deck 20 which may be made of any suitable material such as cast iron and is provided with a plurality of bubble openings 21 and a central manhole 22 surrounded respectively by raised flanges 23 and 24. The deck 20 is secured to the walls of the tower 10 by suitable means, such as angle irons 25 and bolts 26. It is to be understood that the deck 20 may be of any desired size and may contain any selected number of bubble openings 21. A specific form has been disclosed only for purposes of illustration.

The bubble openings 21 are covered by suitable bubble caps 30 which are seated on the flanges 23 and are held in place by T-bolts 31 which extend through the caps 30 and engage the underside of the deck 20.

A manhole cover 35 is seated over the flange 24 surrounding the manhole 22 and provides a

closure therefor. For this purpose the manhole cover 35 is provided with a depending rim 36 which is adapted to loosely seat within the flange 24 with an external rim 37 which extends over the outside of the flange 24 to form a channel 38 in which said flange is seated. A seal 39 of suitable resilient material may be disposed between the flange 24 and the channel 38 of the manhole cover for normally sealing the same and preventing escape of fluids.

For releasably securing the manhole cover in place on the flange 24 and permitting the cover to be elevated in response to an excess of pressure developed beneath the deck 20, there are provided a plurality of J-bolts 42 which extend through suitable apertures 43 in the cover 35 and through internal bosses 44 which are formed in said cover in alignment with the apertures 43. The curved ends 45 of the J-bolts 42 engage the underside of the deck 20 and are positioned by a lip 46 which is formed on the deck 20 as a downward continuation of the flange 24. The lip 46 may extend entirely around the manhole 22 or at least over the portion thereof adjacent the various bolts 42. The lip 46 accordingly provides locking means which prevent displacement of the bolts 42 with respect to the deck 20.

The cover 35 is held in position by springs 50 which are seated between a washer 52 carried by the bolts 42 and a lip 51 formed on the top surface of the cover. A nut 53 is threaded on the top of each bolt for holding the washer 52 in place and adjusting the tension of the spring 50. The springs 50 are preferably calibrated to apply a predetermined pressure to the covers 35 so that the covers will be adapted to be elevated for acting as a relief valve when a predetermined pressure is developed in the tower.

It is to be noted that in this construction the bubble column operates in the normal manner when no excess pressure occurs, the vapors rising through the various bubble openings 21 and the liquid being discharged downwardly from tray to tray by means of the downcomers 12. The manhole cover 35 is normally tightly sealed upon the flange 24 surrounding the manhole 22 and prevents escape of gases except through the bubble openings 21. When an excess pressure occurs which would normally constitute an explosion or a blow-out, the pressure raises the manhole covers 35 against the tension of the springs 50 and permits the high pressure gases to pass upwardly through the tower from tray to tray, the pressure being progressively reduced at each tray by the pressure reducing characteristics of the various relief valves. The pressure is thus reduced and retarded to a point such that it can be handled by the vapor line 15 in the usual manner. After the pressure has been thus relieved, the various manhole covers 35 will again seat and the normal operation of the column may continue.

In assembling this column, it is to be noted that the manhole covers may be pre-assembled with the various J-bolts in place thereon and they may be readily secured in the tower by merely seating the cover over the flange 24 with the J-bolts turned to provide clearance for passage through the manhole 22. Thereafter the J-bolts may be turned to engage the bottom of the deck 20 and to seat in back of the depending lips 46 in the manner shown.

The manhole covers may likewise be readily removed for purposes of inspection or repair without the use of tools by merely applying sufficient force to compress the springs 50 and then turn-

ing the J-bolts out of engagement with the deck 20. The tower may thus be entered from the bottom and the various covers successively removed to permit passage of a workman for purposes of inspection or repair. This construction accordingly not only operates as an automatic pressure relief valve, but it also facilitates the assembly and maintenance of the bubble column.

The manhole cover is preferably formed of some light metal, such as aluminium alloy so that an excessive pressure is not required in order to raise the same. It is to be understood, however, that the construction of the cover and the tension of the springs 50 may be so correlated as to provide any desired pressure relief characteristics.

While a tray having two concentric rows of bubble openings has been illustrated, it is to be understood that the tray may be of any desired size depending upon its use and may be made in one or a plurality of sections.

The invention has been found particularly useful in re-run columns in oil cracking plants because trouble has been most frequently experienced in such columns due to periodic explosions or blow-outs. The invention, however, may be applied to various other types of columns and is useful in any bubble columns in which excessive pressures are likely to be developed.

Although only one specific means for mounting the manhole cover has been disclosed, it is to be understood that various changes and modifications may be made therein. For example, the J-bolt can be replaced by a member permanently secured to the deck or by a member rigidly secured to the cover and resiliently engaging the deck. In the latter case it would be unnecessary to provide a large aperture in the cover for the passage of the securing means and the maintenance of a tight seal would be facilitated in certain instances.

Although certain embodiments of the invention have been disclosed for purposes of illustration, it is to be understood that the invention is not to be limited thereto, but is only to be limited in accordance with the following claims when interpreted in view of the prior art.

I claim:

1. A bubble column comprising a tower having a plurality of spaced bubble trays therein, each tray having a central manhole opening and a plurality of bubble openings disposed therearound, a raised circular flange around said manhole opening to confine the liquid to the circular path around said bubble openings, and a manhole cover closing the manhole opening of each tray, said manhole covers normally seating on said raised flanges and having guide members cooperating with said flanges to guide the covers into seating position when the covers are raised vertically therefrom, and spring means releasably securing said manhole covers in place and permitting the same to be unseated in response to a predetermined pressure below said trays whereby said manhole covers serve as pressure relief valves for said column, and means accessible from below the tray for releasing said spring means.

2. A bubble column comprising a tower having a plurality of spaced bubble trays therein, each tray having a central manhole opening and a plurality of bubble openings disposed therearound, a raised circular flange around said manhole opening to confine the liquid to the circular path around said bubble openings, and a manhole cover closing the manhole opening of each tray, each manhole cover having a pair of

depending flanges forming a channel in which said first flange seats and serving to guide the covers into seating position when they are raised vertically therefrom, and spring means securing said manhole cover in place and permitting the same to be unseated in response to a predetermined pressure below said tray, whereby said manhole covers serve as pressure relief valves for said column, and means accessible from below the tray for releasing said spring means.

3. A bubble column comprising a tower having a plurality of spaced bubble trays therein, each tray having a central manhole opening and a plurality of bubble openings disposed therearound, a raised circular flange around said manhole opening to confine the liquid to the circular path around said bubble openings, and a manhole cover closing the manhole opening of each tray, said manhole covers normally seating on said raised flanges and having guide members cooperating with said flanges to guide the covers into seating position when the covers are raised vertically therefrom, and means releasably and resiliently holding each cover in place, comprising members extending through apertures in said cover and having offset portions releasably engaging the underside of the tray, and springs seated around said members above said cover to apply a predetermined pressure thereto, whereby the covers are adapted to slide upwardly on said members to serve as pressure relief valves for

said column and whereby said covers may be removed from below by turning said offset portions away from said tray.

4. A bubble column comprising a tower having a plurality of spaced bubble trays therein, each tray having a central manhole opening and a plurality of bubble openings disposed therearound, a raised circular flange around said manhole opening to confine the liquid to the circular path around said bubble openings, and a manhole cover closing the manhole opening of each tray, said manhole covers normally seating on said raised flanges and having guide members cooperating with said flanges to guide the covers into seating position when the covers are raised vertically therefrom, and means releasably and resiliently holding each cover in place, comprising members extending through apertures in said cover and having offset portions releasably engaging the underside of the tray, depending lips formed on said tray to cooperate with said offset portions to secure the same in place, and springs seated around said members above said cover to apply a predetermined pressure thereto, whereby the covers are adapted to slide upwardly on said members to serve as pressure relief valves for said column, and whereby said covers may be removed from below by turning said offset portions away from said tray.

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