United States Patent

[11] 3,530,879

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[54] **PARTITIONED VALVE TRAY**
2 Claims, 7 Drawing Figs.

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137/516.11, 137/533.17
[51] Int. Cl. F16k 15/06
[50] Field of Search 137/512.1,
516.11, 533.17; 261/124

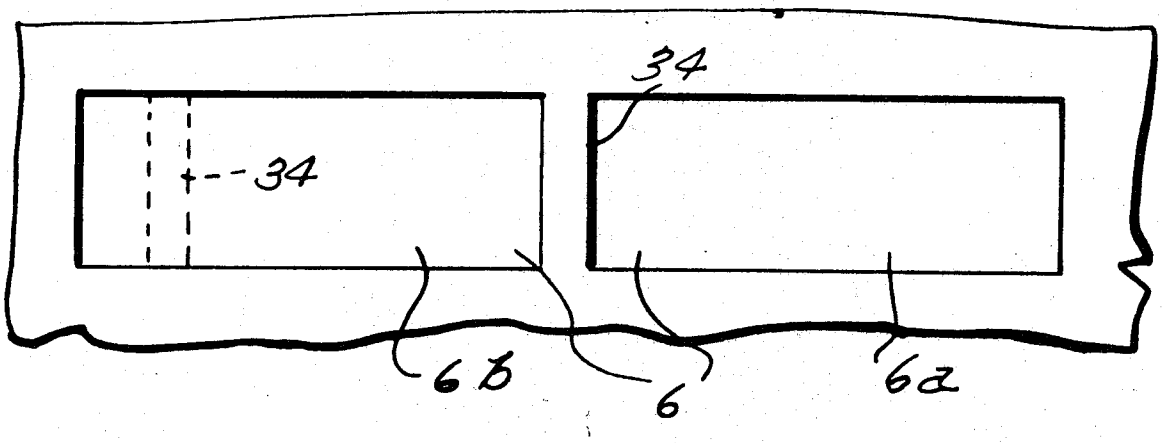
[56] **References Cited**

UNITED STATES PATENTS

2,718,900	9/1955	Nutter	137/516.11X
2,951,691	9/1960	Nutter	137/533.17X
2,959,404	11/1960	Eld	137/533.17X
3,245,669	4/1966	Huggins	137/533.17X

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ABSTRACT: A fluid contact tray provided with partitioned apertures to prevent an overlying valve member from falling through an associated tray aperture.



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Fig. 1.

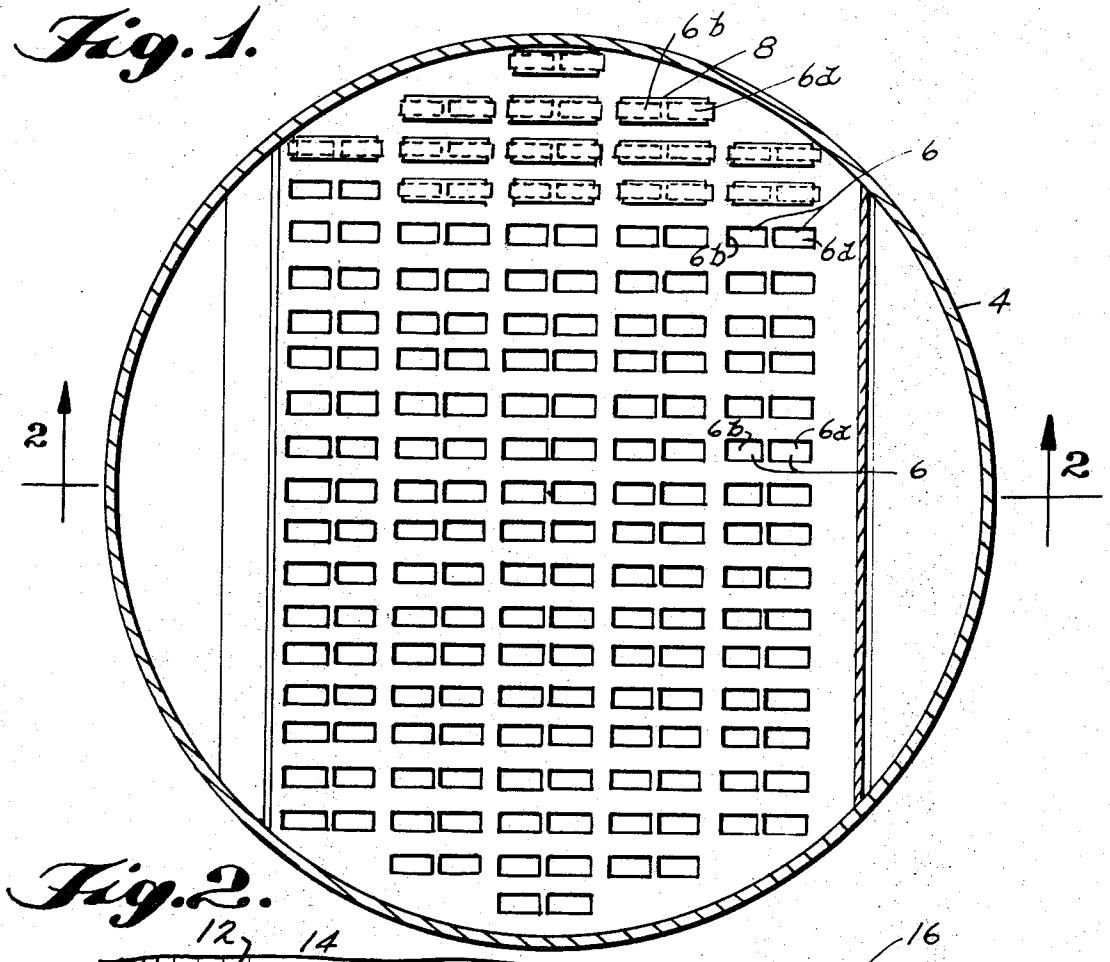
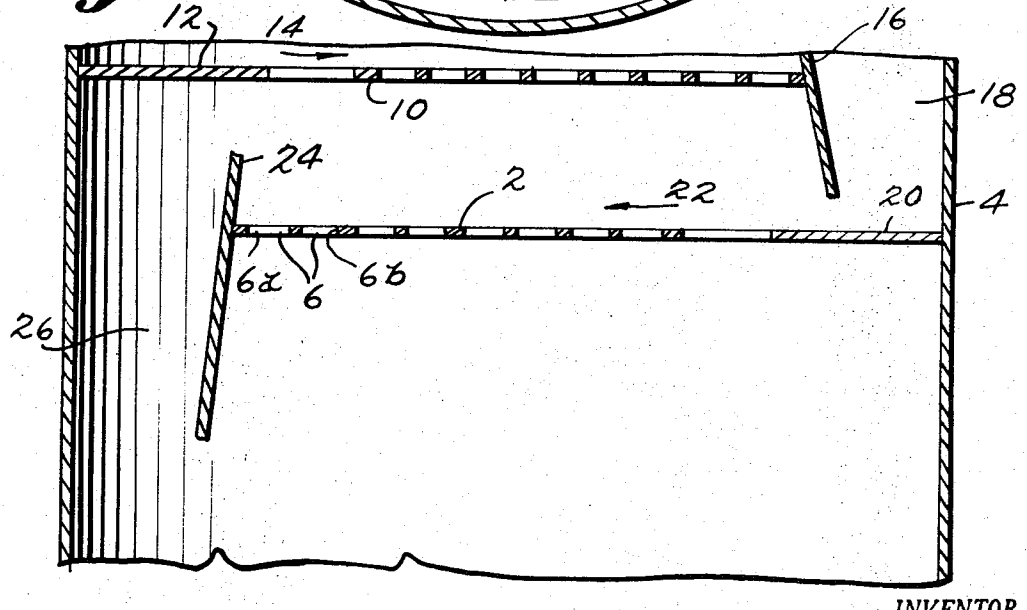


Fig. 2.



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Fig. 3.

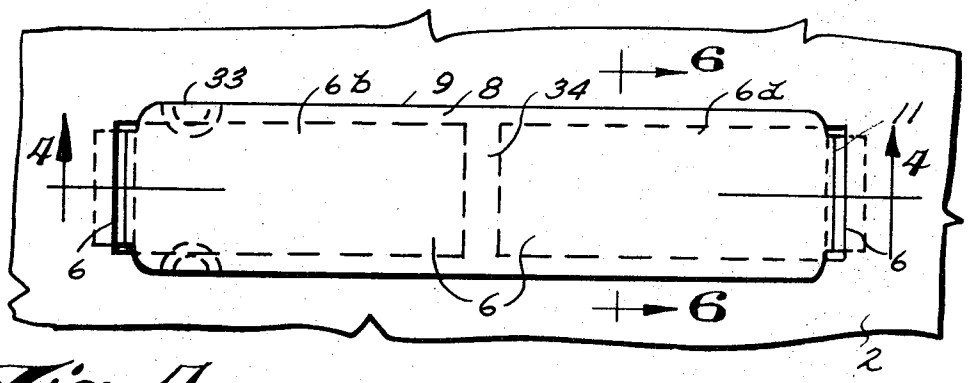


Fig. 4.

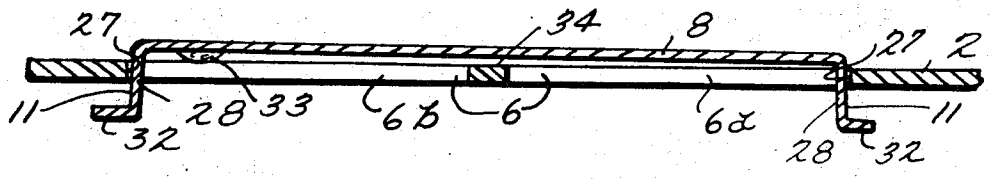


Fig. 5.

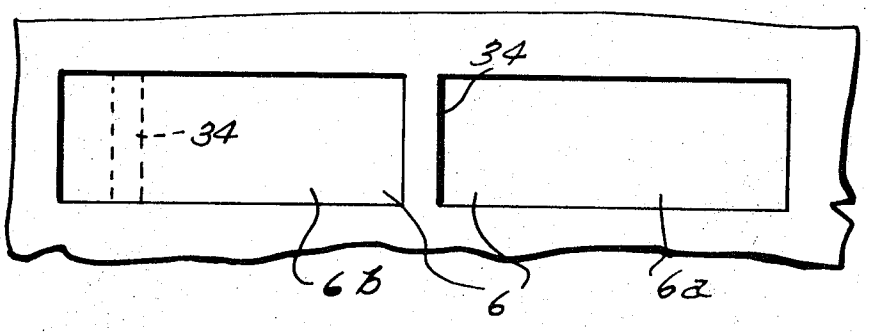


Fig. 6.

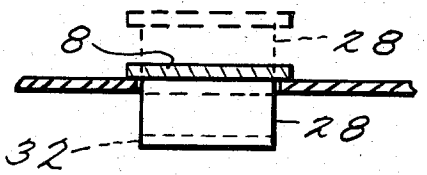
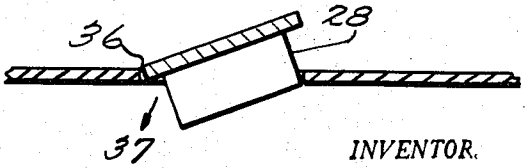


Fig. 7.



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PARTITIONED VALVE TRAY

BACKGROUND OF THE INVENTION

This invention relates to a valved fluid contact tray of the type having valves provided with depending legs which extend through the tray apertures to guide the valve and limit its movement. The fluid contact tray of this invention has partition means in the tray deck beneath each valve to prevent the valve from falling through the tray after the tray, the valve or both have deteriorated due to abrasion or corrosion.

In the particular type of valve tray to which this invention relates, each of the valves is generally rectangular in outline and is used in association with a rectangular aperture in the tray deck. The valve is of sufficient width to overlie the marginal side edges of the aperture, but the ends of the valve have a reduced width in order to form legs which depend through the aperture. The legs terminate in outwardly extending flanges which limit the upward travel of the valve. Lateral movement of the valve is limited by the engagement of the depending valve legs with the walls at the sides and ends of the aperture.

The valves are usually made of a corrosion resistant alloy which is relatively light so that the vapor pressure drop across each tray will not be excessive. The tray deck containing the aperture in which the valve is applied may be of thicker material such as carbon steel, a low grade material which is subject to corrosion.

During the normal operation of such a valve, it opens in two phases. During the first phase, the valve is inclined with one side edge resting on the tray deck and the other side edge of the valve elevated from the tray deck to permit the discharge of vapor into the fluid which passes over the tray deck. The degree of inclination of the valve is limited by the outturned flanges on the depending valve legs. An increase in vapor flow will cause the valve to move to its fully opened position where the outturned leg flanges will lie in contact with the underside of the tray deck. During this movement, the vertically moving side edge of the depending leg will be frictionally contacting the aperture wall. The valve and the tray then define a pair of oppositely directed slot openings for introducing vapor to the area above the tray.

In some services where severe corrosion of the deck material prevails and where design requires frequent movement of the valves, accelerated wear has been experienced at the points of frictional contact of the edges of the valve legs and the tray deck. Usually the total wear is in the carbon steel tray deck metal, but sometimes, where extremely severe corrosion exists, both the edges of the valve legs and the tray deck material wear at these points of contact and movement.

Whenever this described wear prevails, the valve can shift laterally so that one side edge of the valve no longer overlies the marginal area of the tray adjacent the aperture. This permits the valve to fall through the aperture. When this failure occurs, the complete tray assembly is beyond repair and expensive total replacement is required.

SUMMARY OF THE INVENTION

This invention involves a modification of the conventional tray aperture to prevent a valve from falling downwardly through the aperture after the assembly has been subjected to excessive wear. More accurately, the aperture is stamped from the deck and comprises two adjacent aperture segments or portions for each associated overlying valve member.

In the preferred embodiment illustrated in the specification, the "aperture" beneath each of the valve members is essentially a pair of elongated rectangular openings separated by a web or partition which lies in the plane of the tray deck or plate. It is desirable but not essential that the partition extend entirely across the aperture.

This invention is also directed to apertured valve trays in which a partition extends entirely across the aperture intermediate the depending legs to prevent downward passage of the associated valve member.

The particular embodiment disclosed in this specification relates to partitioned rectangular apertures formed in the valve tray and associated rectangular valve members which have downwardly extending guide legs which pass through the related tray apertures with outturned retaining feet or flanges. The rectangular valve members are shaped and dimensioned so that the smaller sides thereof are spaced inwardly of the edges of the aperture, while the longer sides extend laterally beyond the edges of the aperture and overlie a portion of the tray surrounding the aperture.

A primary object of the present invention is to prevent the passage of a valve through the tray aperture.

DRAWINGS

The drawings accompanying the specification are provided solely for the purpose of illustrating but one specific embodiment of the invention, while variations therefrom may be made without departing from the spirit of this invention.

FIG. 1 is a plan view showing a valve tray mounted in a fluid contact tower with a majority of the valves removed for clarity of illustration;

FIG. 2 is a vertical sectional view taken along line 2–2 in FIG. 1 showing the relative disposition of valve trays therewithin;

FIG. 3 is a plan view on an enlarged scale taken from FIG. 1 of a portion of the valve tray including an aperture and associated overlying valve member;

FIG. 4 is a sectional view taken along the line 4–4 of FIG. 3;

FIG. 5 is a plan view of an apertured portion of the tray, showing an alternative location in broken lines for the partition which extends across the aperture;

FIG. 6 is a view taken along the line 6–6 in FIG. 3 with open position of valve in broken lines; and

FIG. 7 is a view similar to FIG. 6 showing the manner in which a valve assembly of the prior art of valve trays are susceptible to failure.

DESCRIPTION OF THE INVENTION

As shown in FIGS. 1 and 2, valve tray 2 is located in an upstanding cylindrical housing 4 and contains a plurality of apertures 6 which are subdivided into two adjoining segments 6*a* and 6*b*. Pressure responsive valve members 8 are disposed on the tray so that each unit overlies adjoining portions 6*a* and 6*b* of the same aperture 6. For clarity of illustration, some of the valve members have been omitted in FIG. 1 and only the apertures are shown in FIG. 2.

Referring to FIG. 2, a plurality of horizontally disposed, vertically spaced trays are mounted within the housing 4. The upper tray 10 receives a liquid at its upstream end 12 which flows in the direction indicated by arrow 14 transversely across the tray until it reaches the overflow weir 16 where it is directed downwardly through the downcomer conduit 18 onto the upstream end 20 of the lower tray 2. Movement of the liquid continues along the path indicated by arrow 22 until it passes across the overflow weir 24 and descends through downcomer conduit 26 onto another tray or to a discharge point of the tower.

Concurrently with the somewhat sinuous flow of liquid, there is an upward flow of vapor through the apertures 6 so that the vapor will ascend through the body of liquid traversing each tray.

A principal purpose of the pressure responsive valve members 8 is to prevent downward passage of liquid through the tray 2 as well as to regulate or distribute the flow of vapor through the apertures 6 of the entire tray area. Turning to FIGS. 3 and 4, it will be seen that each of the valve members 8 is generally rectangular in outline with its longer sides 9 extending laterally beyond the edges of the underlying aperture 6 to prevent the valve from falling through the aperture. The shorter ends 11 of the valve member 8 are spaced inwardly from the ends 27 of the aperture 6 to permit the integral depending legs 28 of the valve 8 to extend through the associated aperture portions 6*a* and 6*b* in cooperative registry therewith.

At the lower end of each of the legs **28** there is an outturned retaining flange or foot **32** which underlies the plate of the valve tray to limit the upward movement of the valve member **8**. As shown in FIG. **4**, each valve member may be provided with identations **33** which rest on the surface of the tray plate in order to provide an initial preset opening of the valve. As will be noted in FIG. **3**, the lateral dimension of leg **28** (*i.e.*, that dimension which is parallel to the ends **27** of the aperture **6**) is only slightly less than the corresponding dimension of the aperture **6**, so that valve member **8** may tilt but will generally remain centered in cooperative registry with respect to the aperture **6**.

A significant aspect of this invention is the provision of an extension, web or partition **34** which separates the aperture into adjoining portions **6***a* and **6***b*. The partition **34** need not extend across the entire transverse extent of the aperture **6**. The importance of the partition **34** will be understood from an inspection of FIG. **7**. There, it is shown that the corrosive and abrasive action on the leg **28** or within the aperture **6** has progressed to a stage where the edge portion **36** of the valve member **8** may pass through the aperture, resulting in the loss of the valve from the tray as the valve moves in the direction indicated by the arrow **37**. Returning to FIG. **3**, it will be appreciated that the situation illustrated in FIG. **7** cannot occur due to the presence of the partition **34**.

In order to permit the upward passage of a maximum volume of vapor through the aperture **6**, it is preferable that the partition **34** be narrow so that its total cross sectional area will not exceed **25** percent of the total area of the aperture **6**.

An alternative location of the partition **34** is shown in broken lines in FIG. **5**, where it is located in alignment with the indentations **33** of the valve member **8**. This location is acceptable since it is at a point where the upward and outward flow of vapor is somwhat limited due to the presence of the indentations **33**.

From the foregoing description, it will be recognized that the subject invention is one which provides a simple and satisfactory solution to the problem of valve loss.

I claim:

1. An improved apertured valve tray provided with pressure responsive valve members respectively arranged to overlie and control the flow of fluid through associated rectangular tray apertures, each of said valve members having depending legs attached thereto and extending through its associated aperture and having opposite end portions located inwardly of underlying edges of its associated aperture, said legs being integral with the valves and depending from the opposite end portions of each of said valves at the ends of the associated aperture, said legs having dimensions in the plane of the tray which are equal in thickness to the valve and approximately equal to the width of the associated aperture, said legs having integral flange portions bent outwardly at their lower ends to underlie the tray and limit the extent of upward movement of the valve, said legs and the portion of the tray thereadjacent being subject to deterioration due to wear or corrosive action in the course of operation, said valve member being capable after excessive said deterioration of assuming an inclined position with respect to the tray wherein a major portion of the valve periphery lies inwardly of the underlying edges of the associated aperture so that the marginal portions of the tray surrounding the aperture offer no opposition to movement of the inclined valve downwardly through the aperture, and an obstructing partition extending transversely across said aperture at a location between the legs to prevent the valve member from passing therethrough, each of said valves having indentations which rest on the surface of the tray to provide an initial preset opening of the valve, said partition being located in alignment with said indentations.

2. The valve tray of claim **1** wherein the valve members are spaced apart in directions which are transverse and longitudinal with respect to the rectangular apertures.