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WEIGHTED SPRAY NOZZLE

Filed Jan. 13, 1967

Figure 1

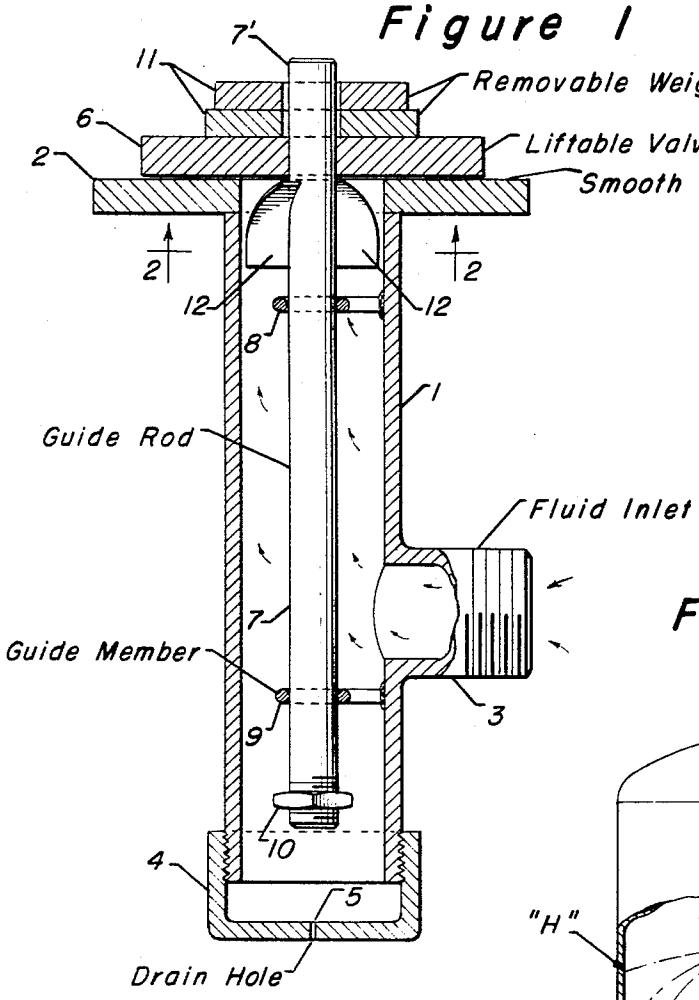


Figure 3

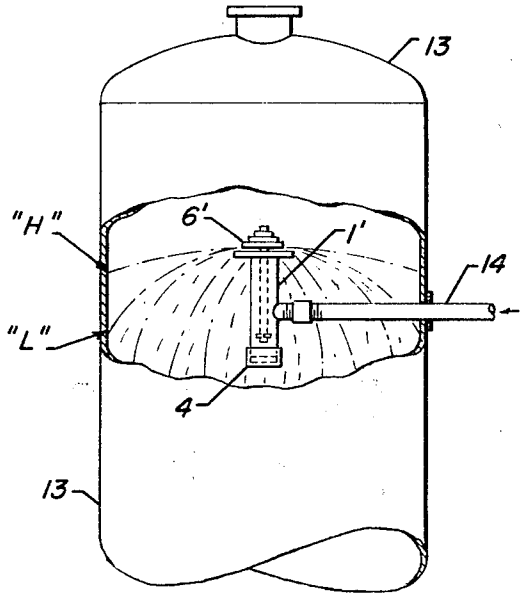
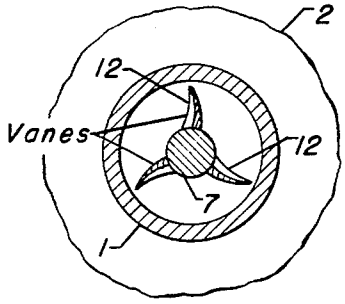


Figure 2



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WEIGHTED SPRAY NOZZLE

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ABSTRACT OF THE DISCLOSURE

A weighted spray nozzle having a liftable flat valve plate extending across the top of an open-topped housing section so as to permit projecting a sprayed fluid stream through a full 360° circle. A plurality of vanes are positioned below the valve plate and around a depending guide rod so as to provide for rotation of the plate and rod by the outgoing fluid stream.

The present invention relates to an adjustable type of spray nozzle using a weighted and liftable valve plate and more particularly to a design providing for the lateral spraying of a fluid stream therefrom for a full 360° circle. In addition, the improved nozzle means provides for effecting a rotation of the liftable valve plate so that there will be less chance of the sticking or "hanging-up" of the valve member during operation.

Background of the invention

There are of course many types of spray nozzles used to effect a fluid stream distribution, including those providing hollow-cone or solid-cone spray patterns. However, a unit designed to effect a fine spray or atomization of the particular fluid stream is not necessarily a requirement in all instances. For example, one embodiment of the present invention has been utilized in connection with flash chambers within hydrocarbon processing systems, wherein it is desired in each instance to spray a heated oil stream laterally and uniformly into a large vertical chamber and have it wash down along the inside wall of such chamber. Light hydrocarbon fractions are vaporized or "flashed" out of the stream and carry overhead, while the heavier oil fractions carry on down the wall into the lower end of the chamber. However, in such operations where wall washing is inadequate under the high temperature conditions involved, it has been found that there is an undesirable excessive coking on the chamber wall.

It may therefore be considered a principal object of the present invention to provide an improved design for a fluid distribution nozzle which provides an adjustable range, full 360° spray pattern, as well as means for aiding free rotatability of the valve plate and a guide rod depending therefrom.

It is also an object of the present invention to provide a spray nozzle design using a horizontally projecting flange section at the top of the housing section and below a liftable valve plate such that the fluid flow sprayed from the device is given an initial outward projection rather than a downward flow.

Summary of the invention

In a broad aspect, the present invention is directed to a weighted spray nozzle device that is adapted to provide a laterally projecting spray fluid stream for a full 360°, and such device comprises in combination, an open-topped housing section with a side fluid inlet thereto, a liftable valve plate positioned over the open top of said housing section, with such valve plate having a depending rod member vertically positioned within said housing, rod guide means extending laterally within the interior of said housing section and encompassing said rod member

in a sliding fit therewith, and vane means positioned below the underside of the valve plate whereby upward fluid flow lifting said valve plate and being sprayed peripherally therefrom will, in addition, provide a rotation to such valve plate and its depending rod member.

The design of a preferred embodiment of the present invention makes use of a flat laterally projecting flange around the upper edge of the housing as a support for the liftable valve plate and, in addition, such flange section shall be sized such that it extends beyond the edge of the valve plate member, whereby the sprayed fluid stream will be initially projected laterally outward, rather than in any downward direction. As is noted hereinbefore, it is desirable that the liquid stream provide a substantially constant wash of the chamber wall to preclude the coking of heavy oil materials on the inside wall thereof. The upper face of the flange and the lower face of the weighted valve plate should be machined or otherwise smoothed so as to permit a free flow of liquid therebetween as the valve plate is lifted by the pressure of the stream flowing into the housing.

In the improved design, there will be utilized a depending shaft or rod member from the underside of the liftable valve plate so that it extends downwardly through the open interior portion of the housing section. Such depending rod will serve as added weight to the valve plate member, although there may be provision on the top of the liftable valve plate member to add additional weights for adjustability of spray nozzle action. In addition, suitable guide means may be provided inside the housing section and extending around the depending rod such that the liftable valve plate member and the rod will be maintained in proper axial position. A still further feature of the present invention embodies use of suitable vanes or fins on the underside of the valve plate or around the depending guide rod and below the valve plate, such that the velocity of the incoming fluid stream passing upwardly through the housing section to the open top thereof will provide impact on the faces of the vanes in a manner to cause rotation to the entire valve plate member and its depending rod section. The rotation of the movable and liftable valve plate member is is of value in precluding the coking and sticking of the latter within the guide means or along the top of the housing section. In other words, at all times it is desired to have the weight of the valve plate member and the depending rod, weights, etc., be counteracting the upward force of the fluid stream so as to insure the lateral spraying of such stream outwardly through the narrow gap remaining between the underside of the valve plate and the top face of the housing flange. Generally, there will be a presetting of the valve plate member with sufficient weights thereon to insure an adequate spraying action of the fluid stream, under low flow conditions, that will cause an impingement of the sprayed stream against the inside wall of the chamber in which the spray nozzle is positioned. Thus, if the sprayed stream is capable of reaching the inside wall during low flow rates, there will of course be adequate spraying of the inside wall of the particular chamber during instances of high flow rates.

Reference to the accompanying drawing and the following description thereof will serve to more clearly set forth the improved features of the present invention as well as certain operating advantage obtained in connection therewith.

Description of drawing

FIGURE 1 of the drawing is a sectional elevational view of one embodiment of a weighted spray nozzle with a liftable flat valve plate over a flanged and open-topped housing section.

FIGURE 2 of the drawing is a cross-sectional view

through the upper part of the housing and spray nozzle vanes, in accordance with the line 2—2 shown in FIGURE 1.

FIGURE 3 of the drawing is a diagrammatic elevational view, partially in section, showing a liquid spray issuing from an improved weighted spray nozzle of the present invention so as to reach the chamber wall.

Referring now particularly to FIGURES 1 and 2 of the drawing there is shown a spray nozzle housing section **1** having an upper outwardly projecting flange section **2** and a side positioned fluid inlet nozzle **3**. The lower portion of the housing section is closed with a removable bottom section **4** that has only a small drain hole **5**. As a result all fluid flow must necessarily pass upwardly through the interior portion of the housing and out the open upper end portion to in turn contact and lift a vertically movable valve plate member **6**. Preferably, the underside of the liftable valve plate **6** is machined to have a smooth face and at the same time the upper face of the flange section **2** is provided with a smooth surface such that there is an unobstructed free flow of liquid permitted between the two surfaces in a full 360° circular pattern. When there is no liquid flow through the device, there will be a supporting of the valve plate **6** on the upper surface of flange section **2**; however, during all operating conditions there will be a lifting of the valve plate **6** from the flange and an outward uniform fluid distribution therefrom, with the amount of lifting being dependent upon the flow rate of the incoming fluid stream through nozzle **3**.

In the present embodiment, there is shown a depending guide rod member **7** extending axially from the center of the valve plate **6** and down into the housing **1**. Also, in order to maintain proper alignment of the guide rod **7** and the valve plate **6**, there are suitable upper and lower guide rings, **8** and **9** respectively. The latter attach to and extend from the inside wall surface of housing section **1** in a manner to provide an easy slip-fit around the guide rod **7** without unduly blocking fluid flow through the housing itself. A suitable stop member **10** may also be threaded, welded or otherwise attached ot the lower end of the guide rod **7** whereby the latter will not be pulled upwardly through the lower guide member **9**.

The present design also has the upper end portion **7'** of guide rod **7** extending above the upper face of valve plate member **6** such that suitable removable weights, such as **11**, may be positioned above the surface of the liftable valve plate **6**. It should of course be realized that other equivalent methods may be provided for adding weights to the liftable valve plate member **6** and the depending rod section **7**; however, the extension of such rod up through the plate member **6** merely provides one convenient method of obtaining a short column or stub member, such as **7'**, capable of retaining removable washer-like or donut shaped weights.

Also, in accordance with a preferred embodiment of the invention, as hereinbefore noted, the underside of the valve plate member **6**, or alternatively at a level below the plate **6** and around the rod member **7**, within the interior of the housing **1**, there are provided suitable curved or slanting vane means **12** which will serve to cause rotation to the valve plate member **6** and its depending rod member **7** by reason of the fluid flow through the unit. It is not intended to limit the improved design to any predetermined number of vanes **12** or to any particular configuration. Such vanes may be of a straight slanting nature or may be of a curved spiraling design capable of giving rotational impetus to the valve plate member and depending rod in a relatively slow manner. It is not deemed necessary that there be any rapid rotation of the liftable valve plate member or the depending guide rod **7** but, there shall be some manner of movement and rotation so as to preclude any sticking or "hanging-up" of the valve plate **6** and guide rod **7** from the desired merely vertical movement. Also, there appears to be less of a problem from deposition or coking of the guide rod **7** which will tend to cause it to stick within the guide member means **8** and **9**. On the other hand, it has still further been found that a slight amount of spiral liquid flow provided by the vane means **12** will do no harm and can perhaps enhance obtaining a uniform fluid distribution through a full 360° circle from the outer periphery of flange section **2**.

Referring now particularly to FIGURE 3 of the drawing there is shown diagrammatically a processing chamber **13** with a fluid inlet line **14** in turn connecting with a suitable weighted spray nozzle unit **1'** in turn having a liftable valve plate number **6'**, all constructed substantially in accordance with that of the design set forth in FIGURES 1 and 2. Thus, where it is desired to maintain a fluid flow and spray of liquid from the unit **1'** in a manner to obtain interior wall washing, as set forth hereinbefore as a desired requirement for a hydrocarbon "flashing" operation, then the weight means on the valve plate **6'** shall be such as to cause a sprayed liquid stream to at least reach the inside of the chamber wall **13** for low flow rates, i.e. at a level such as L. In flash chamber operations, it is not unusual for the fluid stream to vary somewhat in nature in that there may be a varying mixture of vapor and liquid in the inlet line, such as **14**; however, as long as the liquid at low flow rates, will reach the chamber at L, then for higher liquid flow rates there will be a greater quantity of flow from the nozzle **1'** and a higher velocity more horizontal projectory for the sprayed liquid stream, whereby the fluid will tend to reach a higher point on the inside of the chamber wall **13**, such as at a level H. As a result, there will be obtained a constant down wash of hot hydrocarbon liquid flow along the inside wall of the chamber and the substantial preclusion of any undesired coking on the wall within the top portion of the flash chamber.

As a general rule, the periphery of flange **2** and the outer periphery of the valve plate number **6** are circular such that there will be a full 360° radial flow of liquid therefrom without interference; however, such flange and plate member **6** may be of a polygonal shape and still operable to permit radial fluid flow, although not necessarily to the same degree of efficiency as obtainable with the circular peripheries.

As a minor modification, a few holes may be provided in the central portion of the liftable valve plate **6** so that a minor amount of liquid can be sprayed through the plate and upwardly into the processing chamber. Also, it may be pointed out that the depending guide rod **7** may have a cross-section other than circular and may have a varying diameter or cross-sectional area at different levels where design considerations deem that there is an immovement attained. However, generally, a straight rod will permit the design and utilization of similar guide means in the top and bottom of the housing. Adjustable or removable weights may be provided on the underside of the valve plate member **6** and to the rod **7**, but from access aspects it is generally easier to provide for the external addition or removal of weight members at the top of plate **6**. In other words, internal weight adjustment would require that the lower plate or cap **4** be removed for each adjustment.

I claim as my invention:

1. A weighted spray nozzle adapted to provide a laterally projecting sprayed fluid stream through a full 360°, which comprises in combination, an open-topped housing section with a side fluid inlet thereto, a liftable valve plate positioned over the open top of said housing section, with such valve plate having a depending rod member vertically positioned within said housing, rod guide means extending laterally within the interior of said housing section and encompassing said rod member in a sliding fit therewith, and vane means positioned below the underside of said valve plate whereby upward fluid flow lifting said valve plate and being sprayed peripherally

therefrom will, in addition, provide a rotation to such valve plate and its depending rod member.

2. The spray nozzle of claim 1 further characterized in that said open-topped housing section has a projecting flange portion with a greater external diameter than said non-perforate liftable valve plate positioned thereabove, whereby laterally sprayed fluid will be projected in an initial outward horizontal projectory rather than in a downward manner.

3. The spray nozzle of claim 1 further characterized in that said depending rod member extends axially through said valve plate for at least a short distance thereabove whereby to provide means for holding removable weight member on top of said valve plate.

4. The spray nozzle of claim 1 further characterized in that said vane means are directly adjacent the underside of said valve plate and can be encompassed within the interior of said housing section.

5. The spray nozzle of claim 1 further characterized in that said vane means are spaced below the level of the underside of said plate means and are around said depending rod member within the upper portion of said housing section.

References Cited

UNITED STATES PATENTS

1,078,432	11/1913	Hadden	239—206
3,090,563	5/1963	Cheeseboro	239—206
3,335,959	8/1967	Lockwood	239—204

FOREIGN PATENTS

488,251	11/1952	Canada.

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