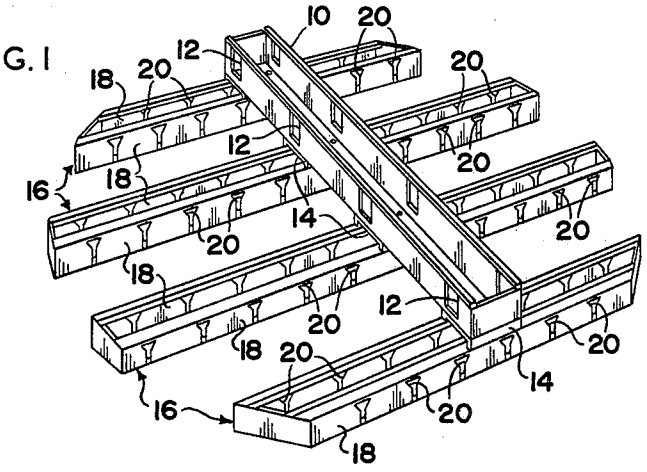
Jan. 27, 1970 J. S. ECKERT 3,491,792

WEIR CONSTRUCTION AND LIQUIDS DISTRIBUTOR EMBODYING THE SAME

Filed Feb. 2, 1968

FIG. 1



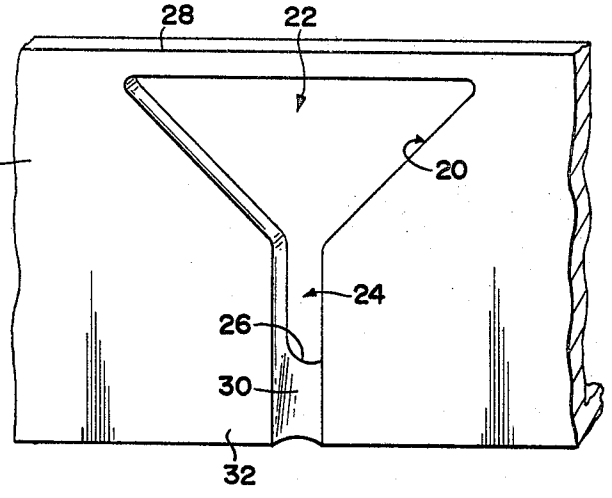


FIG. 2

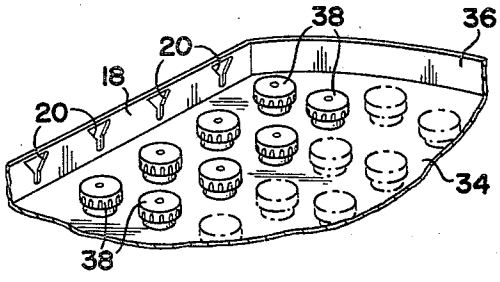


FIG. 3

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WEIR CONSTRUCTION AND LIQUIDS DISTRIBUTOR EMBODYING THE SAME

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U.S. Cl. 137—561 8 Claims

ABSTRACT OF THE DISCLOSURE

A weir construction adapted to regulate liquid flow in fluids treating equipment comprising a generally vertical wall member having an opening therethrough extending longitudinally down the wall, the opening having an upper portion of gradient width along its longitudinal extension down the wall, and a lower portion of substantially constant width along its longitudinal extension down the wall.

This invention relates to the art of fluids treating equipment, and more particularly to an improved weir construction.

The present invention is particularly applicable for use in conjunction with liquids distributors in fluids treating equipment, and it will be described with particular reference thereto; however, it will be appreciated that the invention has broader applicability and may be used to advantage in regulating liquid flow to and liquid level on, packing support plates, bubble cap trays, valve trays, and the like.

It is generally recognized that fluids treating equipment, such as liquid-gas contact apparatus will operate over wide ranges of liquid and gas throughputs. In many instances such equipment is designed to operate with reasonable efficiency over liquid throughput rates within the range of 1 to 60 gallons per minute per square foot. To meet these demands, the various tower internals must be designed with the capability of uniformly distributing liquid and maintaining liquid levels on packing support plates, valve trays or the like, at predetermined optimum values.

To accomplish this, the weir constructions incorporated in fluids treating equipment are designed to permit the orderly evacuation of liquid over a wide range of throughput velocities. According to one commercial practice, this is accomplished by providing the weir constructions with V-shaped notches, whereby the width of the opening in the weir increases as a function of the head of liquid behind the weir construction. This arrangement operates satisfactorily over a fairly wide range of higher liquid throughput rates, but operates less satisfactory at lower liquid throughput rates, within the range of about 1 to 10 gallons per minute. At these lower rates, liquid tends to flow discontinuously in surges through the V-shaped notches, rather than drip or flow through at a uniform rate. As a consequence,, the mass transfer efficiency of the equipment tails off at low liquid throughputs.

Accordingly, there is a need for an improved weir construction which overcomes certain disadvantages of the constructions known to the prior art. The present invention is addressed to satisfying this need.

In accordance with the present invention there is provided a weir construction adapted to regulate liquid flow in fluids treating equipment, comprising a generally vertical wall member having an opening therethrough extending longitudinally down the wall, the opening having an upper portion of gradient width along its longitudinal extension down the wall, and a lower portion of substantially constant width along its longitudinal extension down the wall.

In accordance with another aspect of the present invention there is provided in a liquids distributor useful in fluids treating equipment, a generally trough-shaped element having elongated, opposed, substantially vertical sidewalls, a plurality of spaced openings extending through and longitudinally down at least one sidewall, each such opening having the novel configuration described hereinabove.

It is therefore an object of the present invention to provide an improved weir construction.

A further object of the invention is to provide a weir construction which permits the orderly uniform evacuation of liquid over wide ranges of liquid flow rates.

Another object of the invention is to provide a weir construction which operates especially well at very low liquid flow rates.

Yet another object of the invention is to provide a liquids distributor useful in fluids treating equipment, which incorporates a plurality of weir constructions of the present invention.

These and other objects and advantages will become apparent from the following detailed description of a preferred embodiment of the invention when read in connection with the accompanying drawings, in which;

FIGURE 1 is a schematic, pictorial view of a distributor assembly formed with the weir construction of the present invention;

FIGURE 2 is a greatly enlarged schematic elevation of a weir construction of the present invention; and

FIGURE 3 is a fragmentary schematic pictorial view of a weir construction of the present invention installed on a bubble cap tray.

Referring now to the drawings wherein the showings are for the purposes of illustrating preferred embodiments of the invention only, and not for the purpose of limiting the same, FIGURE 1 shows a distributor assembly, useful in fluids treating apparatus, such as liquid-gas contacting equipment, comprising a parting box **10** having a plurality of rectangular openings **12**, the box being mounted on spaced bridge members **14**, which interconnect an array of generally trough-shaped elements **16**.

Each trough-shaped element **16** comprises elongated, opposed, substantially vertical sidewalls **18**, having a plurality of spaced openings **20**, which together with surrounding walls **18**, define a weir construction in accordance with the present invention. In the embodiment illustrated, each trough-shaped element **16** is shown as having openings **20** in both of its opposed side walls **18**. It will be appreciated however, that in certain circumstances it may be desirable to provide only one of the sidewalls with such openings.

As is well known in the art, a distributor assembly of the type illustrated in FIGURE 1 is generally placed at or near the top of a treating tower. A source of liquid, forming no part of the present invention and not illustrated, communicates with the interior of parting box **10**, and the liquid is subdivided into streams emanating from rectangular openings **12** in the parting box, which in turn communicate with the interiors of trough-shaped elements **16**. The streams of liquid are then further subdivided and uniformly distributed throughout the cross sectional area of the tower by passage through openings **20** in trough-shaped elements **16**.

Parting box **10** and trough-shaped elements **16** may be formed from a variety of structural materials such as plastics and ceramics, however in the preferred embodiment illustrated, these elements are formed from sheet metal.

FIGURE 2 shows a detailed elevation of the weir construction in accordance with the present invention. In considering this figure, it will be understood that the direction of liquid flow is out of the plane of the drawing in the direction of the viewer.

As clearly shown, generally vertical wall member **18** is provided with opening **20** therethrough extending longitudinally down the wall. Opening **20** has an upper portion **22** of gradient width along its longitudinal extension down the wall, and a lower portion **24** of substantially constant width along its longitudinal extension down wall **18**. In the preferred embodiment illustrated, the narrowest width of upper portion **22** is equal to the constant width of lower portion **24**.

Lower portion **24** of opening **20** terminates in a meniscus **26**, in the plane of rear face **28** (as viewed in the drawing) of wall member **18**. Extending forwardly and downwardly from meniscus **26** is gouge **30** which terminates in front face **32** (as viewed in the drawing) of wall member **18**.

For purposes of a specific illustration only, and without intending to limit the scope of the invention, the following dimensions may be used for opening **20** when applied to a distributor of the type illustrated and described in connection with FIGURE 1:

Longitudinal length of upper portion **22**: 2¾ inches.
Gradient angle of upper portion **22**: 55°.
Longitudinal length of lower portion **24**: ¾ inch.
Constant width of lower portion **24**: ¼ inch.

It will be seen from FIGURE 2 that at high liquid flow rates, the head of liquid behind the weir construction will extend into upper portion **22** of opening **20**, whereat the width of the opening increases as the head of liquid is raised. However, at low liquid throughputs, the liquid head will extend upwardly only into lower portion **24** of opening **20**, whereat the width of the opening remains constant over the range of liquid heads corresponding to the longitudinal length of lower portion **24**. This has the effect of maintaining continuity of a liquid stream at low liquid throughput rates.

The continuity of low rate liquid streams is further enhanced by the provision of meniscus **26** and gouge **30**, which assist in reducing the resistance to flow of low velocity liquid streams.

FIGURE 3 illustrated the incorporation of a weir construction of the present invention in another type of fluids treating equipment. This figure illustrates a bubble cap tray **34** having an upstanding peripheral lip **36**, and provided with an arrangement of bubble caps **38**. The liquid level on the upper surface of tray **34** is maintained over a wide range of liquid throughput rates by wall member **18** provided with a plurality of openings **20** having the configuration illustrated in detail in FIGURE 2.

The present invention has been described in conjunction with certain structural embodiments; however, it is to be appreciated that various structural changes may be made in the illustrated embodiments without departing from the intended scope and spirit of the present invention.

Having thus described my invention, I claim:

1. A weir construction adapted to regulate liquid flow in fluids treating equipment comprising a generally vertical wall member having an opening therethrough extending longitudinally down said wall, said opening having an upper portion of gradient width along its longitudinal extension down said wall, a lower portion of substantially constant width along its longitudinal extension down said wall, said lower portion terminating in a meniscus disposed in the plane of one of the faces of said wall, and a gouge extending forwardly and downwardly therefrom to the other face of said wall.

2. A weir construction adapted to regulate liquid flow in the fluids treating equipment comprising a generally vertical wall member having an opening therethrough extending longitudinally down said wall, said opening having an upper portion of gradient width along its longitudinal extension down said wall, and a lower portion of constant width along its longitudinal extension down said wall, the narrowest width of the upper portion of said opening being equal to the constant width of said lower portion.

3. In a liquids distributor useful in fluids treating equipment, said distributor comprising a generally trough-shaped element having elongated, opposed, substantially vertical side walls, a plurality of spaced openings extending through and longitudinally down at least one sidewall, each said opening having an upper portion of gradient width along its longitudinal extension down said one side wall, and a lower portion of substantially constant width along its longitudinal extension down said one side wall.

4. The liquids distributor as defined in claim **3** wherein the lower portion of each said opening terminates in a meniscus.

5. The liquids distributor as defined in claim **4**, wherein said meniscus is in the plane of one of the faces of said one sidewall, and further comprising a gouge extending forwardly and downwardly therefrom to the other face of said one sidewall.

6. The liquids distributor as defined in claim **3**, wherein the width of said lower portion is constant and the narrowest width of the upper portion of each of said openings is equal to the constant width of said lower portion.

7. The liquids distributor as defined in claim **3** comprising an interconnected array of generally trough-shaped elements.

8. The liquids distributor as defined in claim **7** wherein said openings are present in both sidewall of each of said array of generally trough-shaped elements.

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