

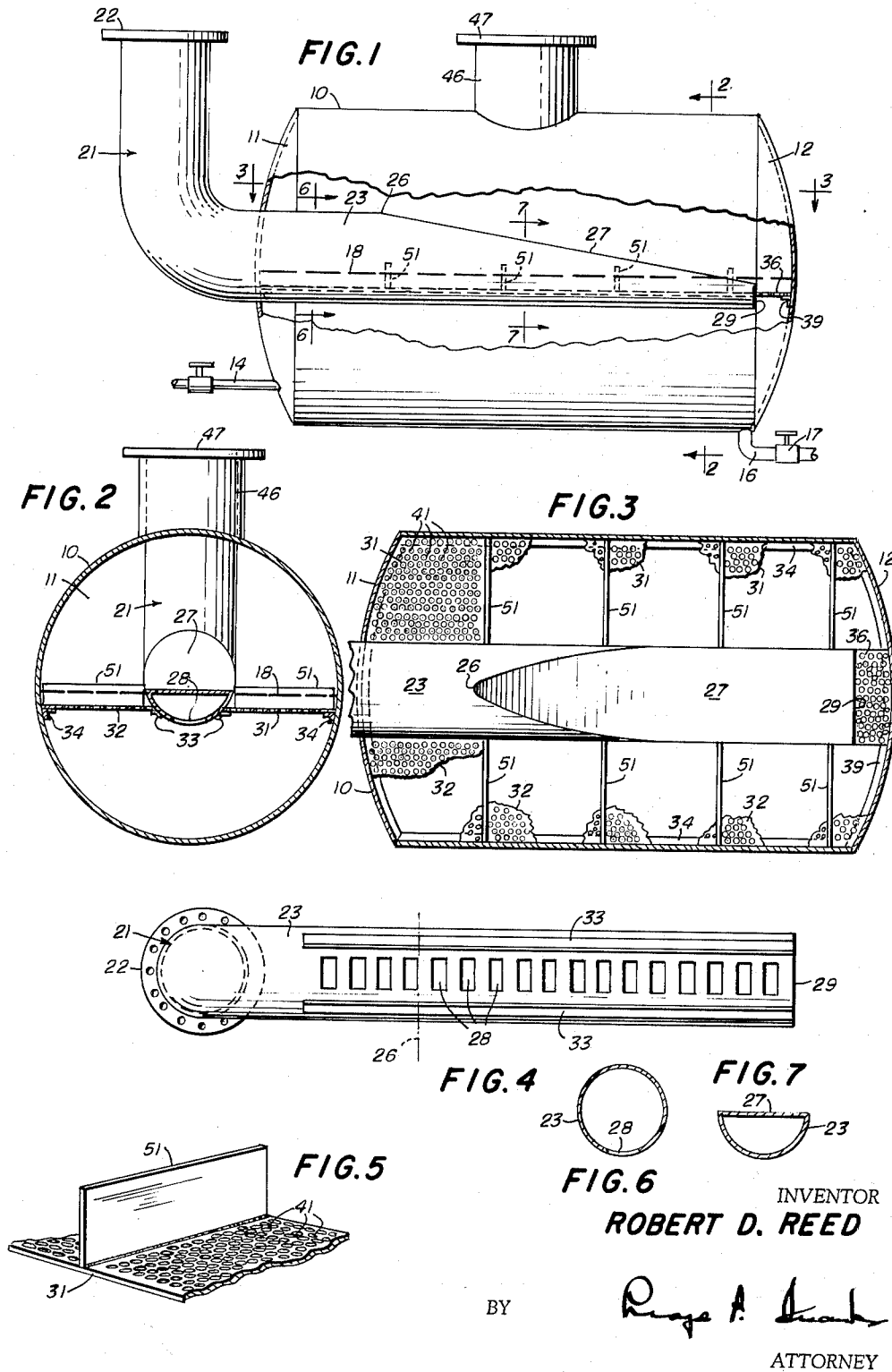
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APPARATUS FOR GUIDING GAS THROUGH LIQUID

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3,231,252 APPARATUS FOR GUIDING GAS THROUGH LIQUID

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1 Claim. (Cl. 261-123)

The present invention pertains to apparatus for controlling the flow of a gaseous medium and more specifically pertains to a housing containing a supply of liquid with means associated with the housing for delivering a gaseous medium into the housing below the surface of the liquid including means for disbursing the gaseous medium below the surface of the liquid for bubbling movement upwardly at an infinitely large number of points through the liquid.

Apparatus for delivering a gaseous medium for upward movement through a liquid has been employed and is known in the art. Such apparatus usually includes a few tubes which depend into a liquid with the open lower ends of the tubes arranged at different depths below the surface of the liquid. There have been improvements in such devices which limit surging upstream and downstream of the device. Such devices are useful in maintaining a desired back pressure and prevent reverse movement of the gaseous medium through the apparatus. Under full flow conditions there is continuous flow of the gas from the lower open ends of the depending tubes. Under such operating conditions there is a substantially continuous uninterrupted flow of gas as distinguished from separate individual bubbles interrupted by resurging liquid between the gas bubbles when the prior devices are operated under conditions approaching maximum flow. Such apparatus does not provide positive interruption of the gas flow so that a flame front may retreat through the device to cause an explosion upstream of the device.

It is an object of the present invention to provide apparatus for guiding a gaseous medium to a position below the level of a liquid including means for distributing the gaseous medium over a relatively large horizontal area under the level of the liquid and to release the gas at an infinitely large number of points below the level of the liquid to thereby provide individual small bubbles with resurging of the liquid between each bubble released at any one point and to thereby provide for the passage of a large volume of the gaseous medium while avoiding the development of a continuous upward flow of gas through any one portion of the liquid.

A more specific object of the invention is to provide a housing into which gas is guided through an inlet duct for release at a number of points within the housing below the level of liquid therein including apertured means having a multitude of relatively small openings therein arranged over the entire horizontal area of the housing and through which gaseous medium must pass in moving upwardly through the liquid for escape from the surface thereof and to provide means localizing any tendency of the liquid to surge horizontally as a consequence of the release of the gas therethrough.

Other objects and features of the invention will be appreciated and become apparent particularly to those skilled in the art relating to the flow of gases as the present disclosure proceeds and upon consideration of the following detailed description taken in conjunction with the annexed drawing wherein an embodiment of the invention is disclosed.

In the drawing:

FIG. 1 is a side elevational view of apparatus embodying the invention with a portion of the housing broken away.

FIG. 2 is a transverse sectional view taken on the line 2-2 of FIG. 1.

FIG. 3 is a sectional plan view taken on the line 3-3 of FIG. 1.

FIG. 4 is an inverted plan view of the inlet duct.

FIG. 5 is a perspective view of a fragment of the apertured screen plate and one of the baffles.

FIG. 6 is a transverse sectional view of the inlet duct taken on the line 6-6 of FIG. 1.

FIG. 7 is a similar view on the line 7-7 of FIG. 1.

An embodiment of the apparatus is shown in the drawing which includes a housing 10 which may be of generally cylindrical shape and supported in a substantially horizontal manner is illustrated in FIG. 1. The ends of the housing may be closed by bulged shaped end discs 11 and 12. A suitable liquid such as water is supplied into the housing through the inlet pipe 14 and a drain conduit 16 may be closed by means of a valve 17. The liquid may have any depth in relation to the inlet opening for the gaseous medium to provide the desired back pressure and in the embodiment illustrated the liquid is maintained at a level indicated at 18.

A conduit member 21 is provided for guiding a gaseous medium into the housing 10. This conduit member may be provided with a flange 22 for connection to a gas supply line. The conduit member 21 may be of any suitable construction but includes a horizontally disposed inlet duct portion 23 which is of a particular construction for carrying out the objects of the invention. The horizontal portion 23 extends through the end disc 11 in a fluid tight relationship. The perimeter of the duct portion 23 may be welded or otherwise joined to the end wall 11 to provide an impervious joint between the conduit member and the housing and to support the inlet duct in a substantially horizontal position extending lengthwise with the housing.

The inlet duct portion 23 of the conduit member is of cylindrical shape throughout the area where it passes through the end disc 11 of the housing as shown in FIG. 6. The cross sectional area of the inlet duct decreases from the point 26 to the free end thereof and this structural relationship is provided by a flat portion 27 which forms the upper face of the inlet conduit. The inlet duct as clearly shown in FIGS. 1 to 3 tapers from a cylindrical cross-sectional area to a semi-cylindrical cross-sectional area. The internal cross sectional area of the inlet duct thus becomes smaller in proceeding downstream thereof from the transverse plane 26 (FIG. 4) and the reduced area will be appreciated upon consideration of FIGS. 7 and 2.

The under side of the inlet conduit 23 is provided with relief ports 28 which are substantially equally spaced from each other throughout the length from the free end 29 of the inlet duct to that portion adjacent the end disc or wall 11. The relief ports 28 are spaced along the inlet duct substantially throughout the area between the end walls to the housing. The reduction in the internal cross sectional area of the duct 23 is at such a rate in proceeding towards the free end as to provide for substantially uniform discharge of the gaseous medium from each of the relief ports 28. The gas is discharged under the level 18 of the liquid as will be appreciated from a consideration of FIGS. 1 and 2.

A screen or perforated plate assembly is provided within the housing 11 through a substantially horizontal plane which is below the level 18 of the liquid. The screen may take any suitable form and in the embodiment shown in the drawing comprise elongated apertured plates or sections 31 and 32 which are supported at their inner edges by means of brackets 33 carried by the lower portion of the inlet duct 23 at opposite sides of the relief ports 28 (FIG. 2). Other brackets 34 may be provided

for supporting the outer edges of the apertured plates on the housing 10. A screen plate 36 is provided adjacent the end disc 12 which is supported by a bracket 39 (FIG. 1). There is at least five hundred perforations or holes 41 in each square foot of the entire screen assembly. There is at least two and one-half square feet of screen for a device having an inlet conduit of approximately two inches and the area of the screen is increased as the size of the apparatus is increased. In the device designed for twenty-four inch conduit there would be a minimum of sixth-seven square feet of the screen surface and such a screen assembly would be provided with about thirty-three thousand five hundred perforations or holes 41. An outlet pipe 46 provides for the escape of the gaseous medium after passing through the liquid. The pipe 46 may be equipped with a flange 47 for attachment to a conduit guiding the gaseous medium to a place of utilization.

In operation a gaseous medium is supplied into the conduit member 21 under pressure greater than the depth of the liquid above the exit ends of the relief ports 28. The gas escapes through all of the relief ports 28 in substantially equal volumes and is thus distributed substantially throughout the length of the housing 10. The gaseous medium after escape from the relief ports 28 is free to move upward through the liquid and around the inlet duct 23. The gaseous medium however cannot move upwardly until there is a bubble under one of the openings 41 of the screen plate assembly. The screen plate assembly thus distributes the gaseous medium over the under side of the screen. The gaseous medium then passes through the liquid and escapes therefrom at an infinitely large number of points. The quantity of gas escaping through each hole 41 is relatively small and there is no great mass of gas bubbling from the surface of the liquid of any one point. There is bubbling from each of the holes 41 and from the surface of the liquid and because of the volume of gas is spread throughout the entire under surface of the screen plate assembly there is repeated interruptions in the bubbles of gas. The apparatus thus serves to prevent a flame front downstream of the housing 10 from moving rearwardly therethrough to ignite the gaseous medium in the inlet duct 23 or conduit member 21. The apparatus is useful for other purposes such as the removal of liquid soluble substances or particulate matter from a gas and the apparatus may also serve to accelerate cooling of any gas moved through the liquid.

There is a repeating of the gas bubbles escaping from the surface of the liquid which then flows through the outlet pipe 46. There is virtually no surging upstream or downstream of the device. The screen assembly may be equipped with baffles 51 to prevent lateral displacement of the liquid. The baffles 51 serve to provide that the liquid above the screen is substantially uniform in depth in relation to the relief ports in all horizontal portions of the device. The baffles 51 extend above the liquid level 18 as shown in FIGS. 1 and 2 to limit liquid displacement as a consequence of the bubbling action of the gas passing therethrough. The baffles 51 may be welded to the screen plates and extend substantially at right angles therefrom. In operation there is a relatively general and uniform bubbling at the surface of the liquid and throughout substantially the entire surface of the liquid. The turbulence at the surface of the liquid is minimized to such an extent that there is substantially no "carrying out" of the liquid with the gas escaping through the pipe 46.

The apparatus may also serve to control the flow of gas and to prevent reverse flow through the housing 10. If the pressure of the gaseous medium in the conduit member 21 should fall below the pressure in the outlet pipe 46 liquid may be drawn back into the inlet duct 23 but there would be no reversal of the flow of the gas from the outlet 46 to the conduit member 21 until the pressure drop therein exceeds the head of the liquid drawn back towards the inlet duct 21.

While the invention has been described with reference to specific structural characteristics and with respect to a housing and an inlet assembly of one shape it will be appreciated that changes may be made in these elements as well as the overall organization. Such modifications and others may be made without departing from the spirit and scope of the invention as set forth in the appended claim.

What I claim and desire to secure by Letters Patent is:

Apparatus for dispersing a gaseous medium for upward movement through liquid at a multiplicity of points comprising, a housing having a side and opposite end walls and adapted to contain a quantity of liquid, a vertically disposed conduit member positioned outside said housing, a duct carried by the lower end of said conduit member extending through one end wall of the housing and substantially horizontally therewithin with a portion of the duct positioned below the level of said liquid, said duct having relief ports spaced therealong with exit ends positioned below the level of said liquid, apertured plate means extending throughout the interior area of said housing below the level of said liquid and above the exit ends of said relief ports, said plate means having a multiplicity of holes therethrough, said housing having an outlet opening above the level of said liquid, said conduit being adapted to receive a gaseous medium normally under pressure greater than the column of liquid above exit ends of said relief ports, said duct tapering from a cylindrical cross-sectional area to a semi-circular cross-sectional area and having a progressively less cross-sectional area proceeding towards the opposite end wall from the conduit member, said housing being elongated horizontally with said duct extending centrally of the housing, said conduit member extending to a position above the uppermost part of the housing, a plurality of spaced baffles mounted on said plate means substantially at right angles with respect thereto and extending outwardly from said duct to the side wall of the housing, and said baffles having a portion above and below the level of liquid in the housing, whereby the gaseous medium is substantially uniformly discharged through all of said relief ports into the liquid under said plate means.

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