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FLUID STERILIZER

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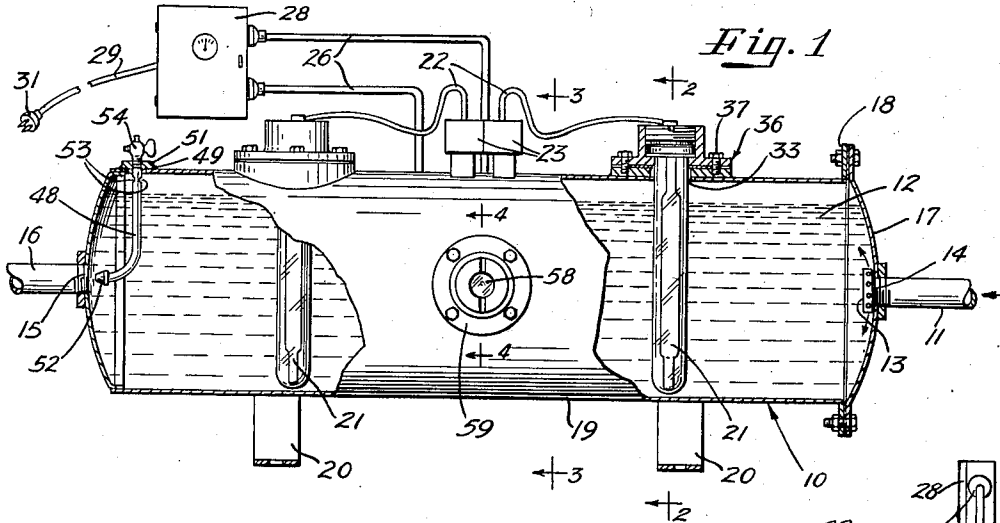
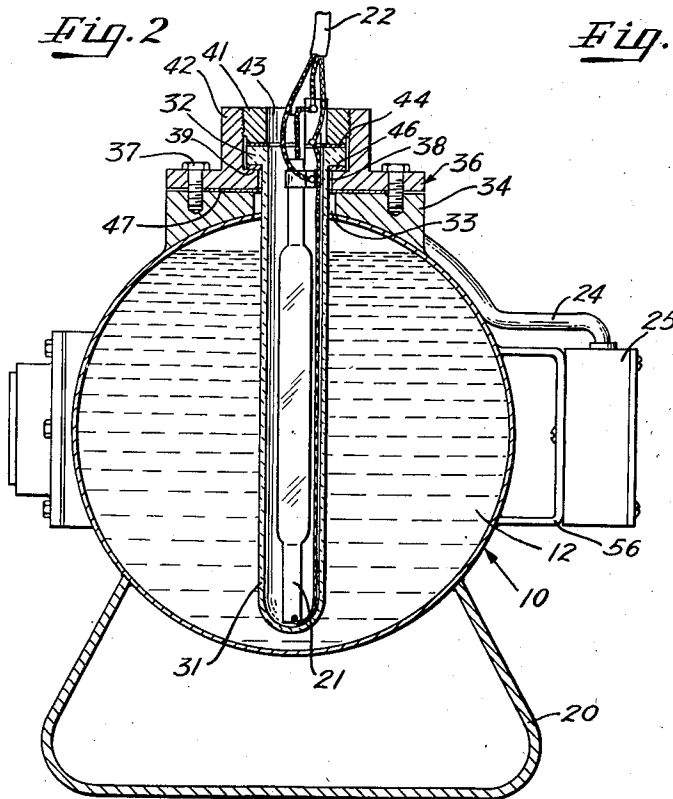
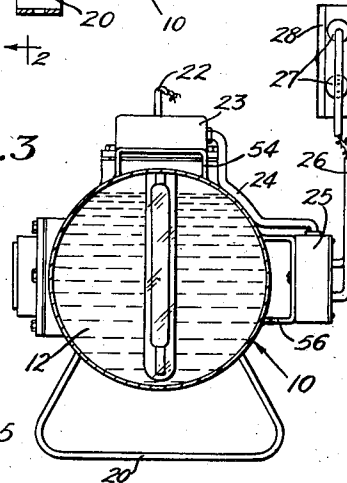
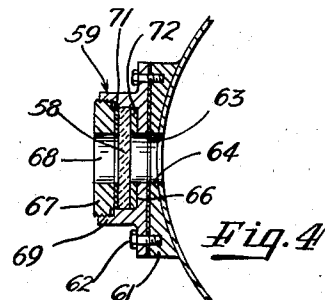


Fig. 3



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FLUID STERILIZER

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This invention relates to sterilizers and particularly to sterilizers for water, beverages and the like.

A primary object of the invention is to provide a sterilizer of the above character which is reliable in operation, which can be used continuously, which can be readily and conveniently installed, which is relatively inexpensive to manufacture, and which uses electric sterilizing lamps having high intensity ultra-violet radiations.

Heretofore in sterilizers utilizing electric lamps, the lamps have been of the type that extended through the sterilizer from one end thereof to the other and have been in direct contact with the fluid passing through the sterilizer. This construction has not been satisfactory. One of the defects has been that seals, usually of the lock nut type, have to be provided at both ends of the lamp, between the lamp and the sterilizer. Any undue pressure in establishing this seal as by tightening the lock nut a little too tight, effects a breakage of the lamp. If the seal is loose, the sterilizer of course leaks. During the operation of a sterilizer of this construction the lamps being exposed to the fluid receive a coating of sediment and the like on the outer surface of the lamp. This coating greatly decreases the efficiency of the lamp as a sterilizing lamp and consequently it is necessary to frequently clean the outer surfaces of the lamps. With the above construction which utilizes relatively long tubular sterilizing lamps, it is relatively difficult to clean the lamps without breaking them either in disassembling or assembling because of the two critical seals or in the cleaning process itself. Another disadvantage with the above construction is that the lamps do not stand limited mechanical shock. Thus, when the lamps were initially mounted in the factory where the seals can be made effectively, the lamps frequently break during shipment of the sterilizer unit.

Accordingly, it is an object of the invention to provide a sterilizer of the above character with means for mounting a lamp which together with the lamp can be readily removed as a unit from the exterior of the sterilizer for maintenance purposes, and which supports the lamp in the tank so that the lamp is not in direct contact with the fluid in the sterilizer yet the fluid flowing through the sterilizer is exposed to the rays of the lamp in the most efficient and advantageous manner.

Another object of the invention is to provide a lamp mounting which is rugged, which will withstand mechanical shock and which is fluid tight under all operating conditions.

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Another object of the invention is the provision in a sterilizer of the above character that minimizes the damaging effect of moisture condensation on the electrical operating and control auxiliaries of the sterilizer.

Another object of the invention is the provision in a sterilizer of the above character with means for automatically venting air and gases from the interior of the sterilizer.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which—

Figure 1 is an elevational view of a sterilizer embodying my invention having cutaway portions to expose the respective parts of the unit;

Fig. 2 is an enlarged sectional view taken substantially along the line 2—2 of Figure 1;

Fig. 3 is a transverse sectional view taken substantially along the line 3—3 of Figure 1, and

Fig. 4 is a sectional view taken substantially along the line 4—4 of Figure 1.

Referring now to the drawings, my invention is concerned with constructing a sterilizer for destroying bacteria, yeasts, algae, and the like found in liquids. For purposes of illustration the sterilizer shown herein is of the type used for sterilizing water used in the manufacture of beverages. The sterilizer comprises a tank 10 disposed in a service line 11 so that fluid enters the chamber 12 formed on the interior of the tank through a distributor 13 disposed in an inlet opening 14 and having annularly spaced radially arranged outlets to direct the fluid outwardly from the inlet opening to insure a uniform flow pattern past preselected cross sections of the tank and is discharged from the tank through an exhaust port 15 to a continuation 16 of the service line 11 to a point of use. As shown the tank 10 is cylindrical in form and is provided at one end with a removable head 17 secured as by bolts to an annular flange 18 integral with the cylindrical body portion 19 of the tank 10. The inlet and outlet ports 14 and 15, respectively, are formed at opposite ends of the tank. Brackets 20 are secured at spaced positions on the bottom of the tank as by welding to form suitable mounting brackets for the sterilizer.

While the fluid is flowing through the tank it is subjected to rays of sterilizing lamps 21. Herein two lamps 21 are utilized and are arranged to be suspended at spaced positions from the top of the tank 10. Preferably the lamps are spaced so that fluid passing through the tank passes through two fields having positions in which the ultra-violet rays are of maximum intensity. The

lamps are connected to a suitable electric circuit by conventional cables 22, control boxes 23, cables in conduit 24 between the control box 23 and a control box 25, the control box 25, cables in conduit 26 between the control box 25, and fittings 27 plugged into a control box 28, the control box 28 and a conductor 29, having a plug attachment 31 for connection to the power circuit.

One phase of my invention is directed to means for mounting the lamps 21 that permits the lamps to be disposed in the tank for maximum effectiveness in transmitting rays to the fluid and that can be readily removed from the exterior of the tank for maintenance and service without the necessity of removing the lamp 21 from the mounting means. To this end the lamps are disposed in an envelope 31 permitting a relatively high transmission of the ultra-violet rays of the lamps 21, and which in turn is removably mounted in a fluid tight relation on the tank 10 so that the envelope 31 extends inwardly of the tank to a point short of the opposite wall of the tank. Inasmuch as both lamps 21 are mounted in the same manner only one mounting will be described in detail hereinafter.

In this instance (see Fig. 2) the envelope 31 is in the form of an elongated circular tube fashioned from fused quartz having a relatively high ultra-violet ray transmission coefficient. At one end the tube is closed and at its opposite end the tube is fashioned with an annular collar 32. Preferably, the opposite axial faces of the collar are substantially parallel and are substantially at right angles to the longitudinal axis of the tube.

As shown in Figure 1, the tube 31 extends through an opening 33 in the tank 10 permitting a clearance between the tube and the tank and formed herein in a pad 34 secured to the top of the tank. The tube is retained in position by a flange 36 secured to the pad 34 as by bolts 37, herein four annularly spaced bolts accessible from the exterior of the tank. The flange is formed with an opening 38 in register with the opening 33 in the tank 10. Surrounding the opening 38 is an annular shoulder 39 which when the tube 31 is inserted through the opening in the flange 36 supports the collar 32 of the tube 31. A nut 41 threaded into an outwardly extending sleeve portion 42 of the flange 36 substantially concentric with the opening 38, is disposed on the opposite side of the collar 32 for securing the collar 32 and the tube 31 in an assembled relation with the flange 36. The nut 41 is formed with an opening 43 of such dimension as to permit the ready insertion and removal of the lamps 21 from the tube 31 and through which the cable 22 passes in effecting connection with the respective lamp 21 when the latter is in an operative position in the tank.

In tanks of this type wherein the pressure of the fluid varies, it is to be understood that pressure exerted on the lamp mounting assembly will also vary. To prevent leakage of fluid between the respective joints of the lamp mounting assembly under all operating conditions, gaskets 44 and 46 are provided between the collar 32 and the nut 41 and between the collar 32 and the annular shoulder 39. In the present instance the gasket 44 between the nut 41 and the collar 32 is in the form of an annular ring of relatively thin gasket material. The gasket 46 between the collar 32 and the shoulder 39 is also in the form of an annular ring but is constructed of relatively thick gasket material. Thus if the

pressure in the tank builds up, pressure will be applied to the tube 31 including the collar 32 which tends to move the collar outwardly into tighter engagement with the gasket 44. It is to be understood that since the latter gasket is relatively thin, the axial displacement thereof will be relatively small. The lower gasket 46, however, is relatively thick, and as the collar 32 is urged outwardly the gasket 46 automatically expands to insure that there is a fluid tight seal between the collar 32 and the shoulder 39. A suitable gasket 47 is also disposed between the flange 36 and the pad 34 for preventing leakage of fluid therebetween.

With the foregoing construction, it is to be understood that to clean the envelopes 31 it is only necessary to remove the four bolts 37, securing the flange 36 to the pad 34 and the lamp 21, flange 36, envelope 31 and the nut 41 holding the envelope in the flange can be quickly and readily removed as a complete assembly. The gaskets 44 and 46 need not be disturbed by the user. Thus the possibilities of a leakage from the tank 10 are minimized.

Means is provided for automatically venting air and gases from the tank 10 during the flow of fluid therethrough. To this end an ejector 48 is disposed in the chamber 12 having one end in communication with the upper part of the chamber and having its other end disposed in the discharge opening of the tank. With liquid in the tank at a level above the outlet 15 so that water is being discharged therethrough, in accordance with Bernoulli's theorem, the pressure in the upper part of the tank will be greater than that at the outlet opening by the amount lost to the velocity head. Thus by Venturi action air and gas are removed through the ejector 48 and discharged into the outlet opening 15.

Herein the ejector 48 is formed by a tube having one end 49 secured, as by welding, to a boss 51 formed on the upper part of the tank 10. At its opposite end the tube is fashioned to form a nozzle 52 which is disposed in the outlet port 15. Apertures 53 formed in the tube adjacent the connection with the boss 51 provide communication between the chamber 12 and the tube 48. To vent the chamber to atmosphere a pet cock 54, threaded into the boss 51, is provided at the top of the tank 10. Herein the pet cock is in communication with the end 49 of the tube 48 welded to the boss 51.

Another important feature of my sterilizer is the arrangement of the electrical operating and control auxiliaries that minimize the damaging effect of moisture condensation thereto. As shown in the drawings, the connection boxes 23 and 25 are mounted on the tank 10 by brackets 54 and 56, respectively, formed herein by strap members which space the respective boxes outwardly from the exterior of the tank 10. With this construction a layer of air will be disposed between the exterior of the tank 10 and the respective control boxes. This layer of air acts as an insulator which prevents the lower temperatures of the tank due to the flow of cool liquid therethrough from being conducted to the respective control boxes. It will be noted that the cross-section area of the respective straps is such that no appreciable conduction is effected therethrough. Thus, the control boxes will be at a temperature above the dew point and of course condensation of moisture on the boxes is avoided.

During the operation of the sterilizer it fre-

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quently is desirable to observe the interior of the unit to determine whether the lamps are burning and whether the sterilizer needs cleaning due to deposits of sediment forming on the envelopes 31 and the interior of the tank 10. For this purpose an observation window 53 is formed in the tank 10. As shown in Fig. 4, the window is in the form of a circular piece of plate glass mounted in a flange 59. The flange is bolted to a pad 61 mounted on the side of the tank as by bolts 62 and is formed on its interior with an opening 63. The latter is in register with an opening 64 formed in the pad 61, in communication with the interior of the tank 10. The circular disc is supported between an annular shoulder 66 integral with the flange 59 and a nut 67, having an opening 68 to expose the glass, threaded into a sleeve portion 69 of the flange and extending outwardly thereof. A suitable relatively thin gasket 71 is disposed between the glass disc 58 and the unit 67 and a suitable relatively thick gasket 72 is disposed between the disc 58 and the shoulder 66 to prevent leakage of fluid between the joints of the assembly in the manner heretofore described for the respective lamp mountings.

I claim:

1. A sterilizer utilizing a sterilizing lamp comprising, a tank having ports for connection to a relatively high pressure fluid service line and having an opening for said lamp, a flange having an opening in registry with said tank opening, means accessible from the exterior of the tank for securing said flange thereto, said flange having a shoulder in spaced relation with said opening, a relatively thick resilient gasket disposed on said shoulder, an envelope for receiving said lamp having one end closed and disposed in said tank and having the opposite end formed with a radial flange forming a collar, said collar at its face toward the closed end of the envelope engaging said gasket, a second relatively thin gasket disposed to engage the opposite side of said collar, and means mounted on said flange and abutting said second gasket to secure said collar and said first and second gaskets in assembled relation whereby above atmospheric pressures in said tank force said collar to compress said relatively thin gasket and permit expansion of said relatively thick gasket to insure a fluid tight assembly.

2. In a liquid sterilizer, the combination of, a tank having a chamber formed on the interior, liquid sterilizing means in said chamber, said tank having an inlet opening for the inflow of liquid to said chamber disposed below the top of the chamber and an outlet opening for exhausting liquid from said chamber disposed below the top of the chamber, a conduit having an opening in communication with the upper part of said chamber and having an end in the form of a nozzle disposed in said outlet opening so that the discharge of liquid therethrough bleeds

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air and other gases in the upper part of said chamber through said conduit by Venturi action.

3. In a fluid sterilizer, the combination of, a tank having a chamber formed therein, fluid sterilizing means in said chamber, said tank having an inlet for admitting fluid to said chamber and having an outlet for exhausting fluid from said chamber disposed below the top of the chamber, a tube in said chamber having an opening spaced at a level in said chamber above the outlet and an end in the form of a nozzle disposed adjacent said outlet so that said nozzle is disposed at a pressure level differing from that at said opening in the tube by the difference in velocity head between the levels of said opening and said nozzle when fluid flows through said tank, whereby the pressure at the higher level forces air to the lower pressure level to be discharged through said nozzle.

4. In a liquid sterilizer comprising a tank having a chamber formed on the interior, liquid sterilizing means in said chamber, said tank having an inlet opening for the inflow of liquid to said chamber and an outlet opening for exhausting liquid from said chamber disposed below the top of the chamber, a conduit having an opening in communication with the upper part of said chamber and having an end in the form of a nozzle disposed in said outlet so that the discharge of liquid therethrough bleeds air and other gases from the upper part of said chamber through said conduit by Venturi action, and means mounted on said tank in communication with said conduit for venting said chamber to atmosphere.

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