United States Patent

Folke

[15] **3,637,977**

[45] **Jan. 25, 1972**

[54] VAPORIZER FOR DISINFECTION CHAMBERS

[72] Inventor: **Carl Tage Evert Folke,** Hagersten, Sweden

[73] Assignee: **AB Vibrasug,** Johanneshov, Sweden

[22] Filed: **Apr. 8, 1970**

[21] Appl. No.: **26,601**

[30] **Foreign Application Priority Data**

Apr. 9, 1969 Sweden.....5003/69

[52] **U.S. Cl.**.....**219/272,** 21/119, 219/362, 219/370

[51] **Int. Cl.**.....**H05b 1/02**

[58] **Field of Search**.....219/271, 272, 275, 273, 362, 219/364, 369–371; 21/91–93, 108–110, 117–119

[56] **References Cited**

UNITED STATES PATENTS

3,298,674	1/1967	Gilbertson	21/117 X
1,446,994	2/1923	Sieben	34/222
2,201,389	5/1940	De Give	34/46
1,035,676	8/1912	Baruch	21/110
2,662,332	12/1953	McIntire	21/119 X
2,244,180	6/1941	Williams et al.	219/273

FOREIGN PATENTS OR APPLICATIONS

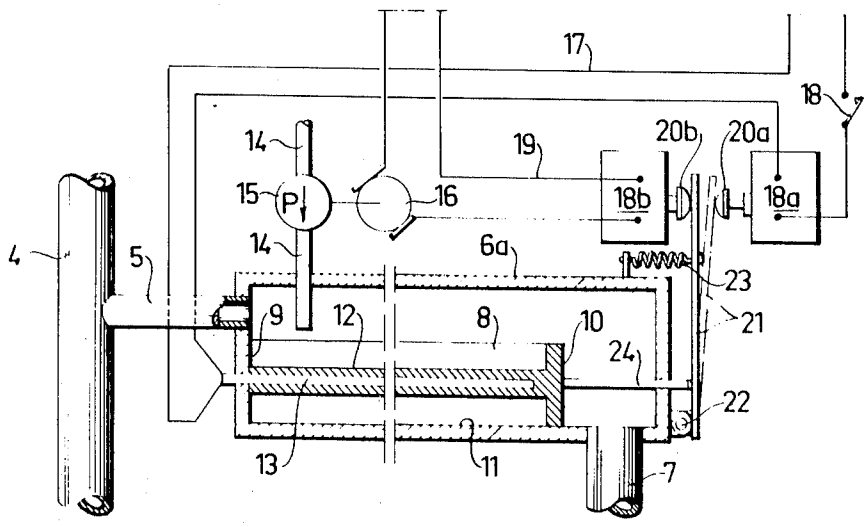
937,912	1/1956	Germany	219/272

Primary Examiner—C. L. Albritton
Attorney—Albert M. Parker

[57] **ABSTRACT**

This invention relates to means for vaporizing disinfection liquid such as formation by mixing air with said liquid or vapor therefrom. Said vaporizing means comprises a feedback air conduit defining an elongate vaporizing channel secured at one end to a vaporizing chamber and being free to expand at its opposite free end as a result of electrical heating of said channel so as to actuate electric switch means for breaking and closing the electric heating current, respectively, at a predetermined temperature of said channel.

7 Claims, 7 Drawing Figures



PATENTED JAN 25 1972

3,637,977

SHEET 1 OF 3

Fig.1

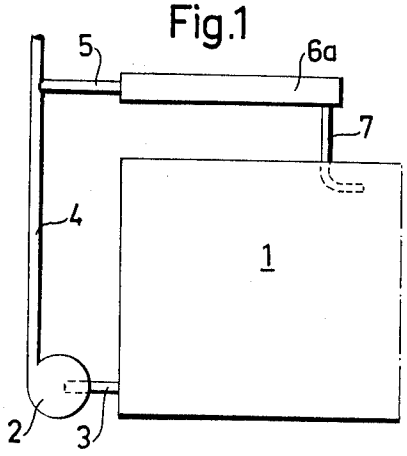


Fig.2

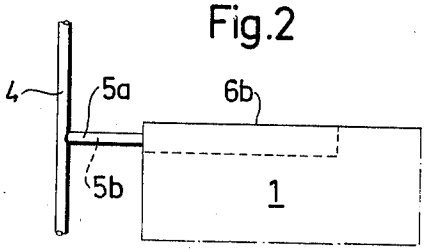
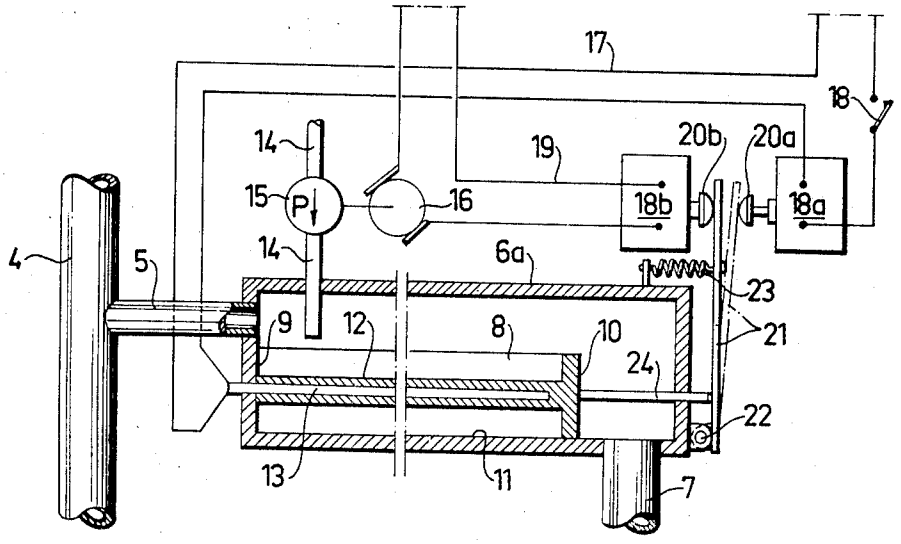


Fig.3



CARL TAGE EVERT FOLKE
INVENTOR.
BY Albert M. Parker
ATTORNEY.

Fig.4

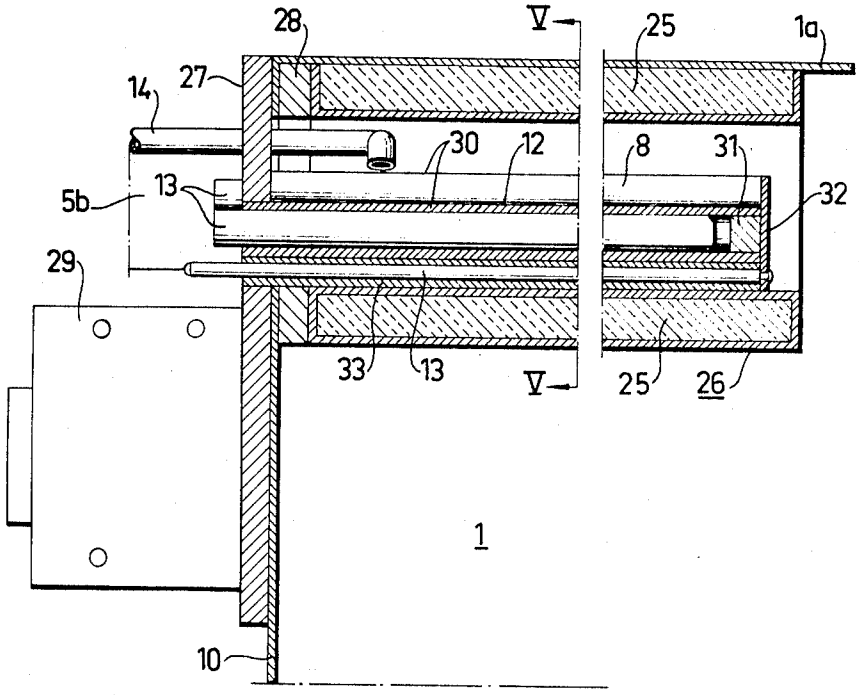
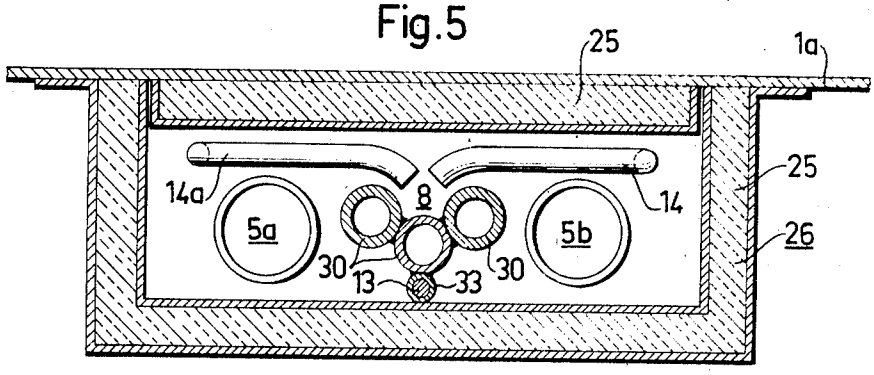


Fig.5



CARL TAGE EVERT FOLKE
INVENTOR.
BY Albert M. Parker
ATTORNEY.

Fig.6

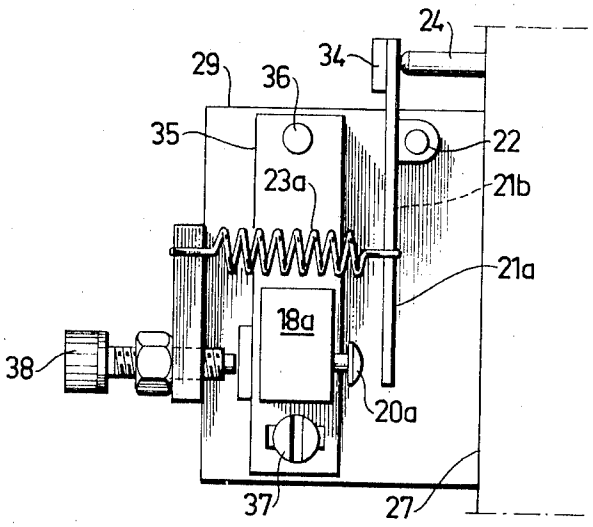
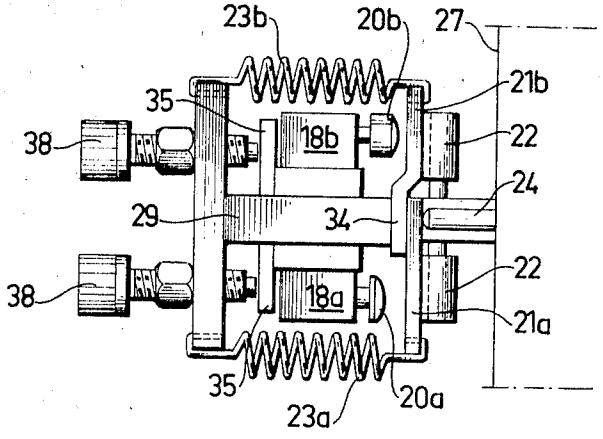


Fig.7



CARL TAGE EVERT FOLKE
INVENTOR.
BY Albert M. Parker
ATTORNEY.

VAPORIZER FOR DISINFECTION CHAMBERS

In hospitals and other institutions disinfection of bedding, clothing and the like normally is carried out on a large scale in such a way that the objects to the disinfected are placed in a closed disinfection chamber where air containing disinfectant, for example formalin, is allowed to pass through them in vaporized form.

In this case it is of particular importance that the liquid is intimately and homogeneously mixed with the air as otherwise it easily becomes separated and forms patches of moisture on the objects to be disinfected. Apart from the fact that disinfection is thus deteriorated, an unpleasant odor arises which cannot be removed from the objects within a reasonable time by subsequent airing.

In order to effect such intimate mixing it has been proposed to permit air to take up or to absorb the disinfectant in vaporized state and to effect the vaporization by providing heating means in a container in which this disinfectant is stored. Such a vaporizing method is, impractical for the following reasons: the disinfectant is usually a liquid in which water is the solvent, as is the case with formalin, for example, which consists of formaldehyde dissolved in water. Although the formaldehyde itself is easy to vaporize, the water requires considerably more heat to reach this state. It is obviously uneconomic and time-consuming to heat the entire quantity of disinfectant only to use a small quantity thereof on each occasion. Neither is it possible to force the heating process usually, among other things because the disinfectant vapor is flammable and combustion of the entire quantity might have catastrophic results. The vaporization must therefore be carried out in limited doses for each disinfection occasion, with absolutely no risk of combustion.

The main object of the invention is to provide a vaporizer having such effect combined with rapid vaporization.

The invention will be further described with reference to the accompanying drawings in which

FIG. 1 and 2 illustrate different alternatives for arranging a vaporizer according to the invention in a disinfection chamber system,

FIG. 3 illustrates a vaporizer and its control means applied in accordance with FIG. 1, seen in section from the side,

FIG. 4 shows a vaporizer arranged in accordance with FIG. 2, seen in section from the side,

FIG. 5 shows the same vaporizer in section along the line V—V in FIG. 4 and

FIGS. 6 and 7 reveal control means for this vaporizer, seen from the side and from above, respectively.

The Figures are diagrammatical and intended to serve as examples only. Identical parts in the different Figures have the same designations.

According to FIG. 1 the device comprises a closed disinfection chamber 1 and a fan 2 with suction conduit 3 and pressure conduit 4, the latter leading to the open air and through a branch conduit 5, communicating with one end of the vaporizer 6 located outside the disinfection chamber. At its other end the vaporizer has an outlet 7 to said chamber. When the fan draws air from the chamber and forces this air out through the pressure conduit 4 a vacuum is produced in the chamber, thus causing a considerable quantity of this air to be drawn back again through the conduit 5, vaporizer 6*a* and its outlet 7. Thus, the vaporizer is under vacuum to a certain extent also. An elongate vaporizing channel 8 is arranged in the vaporizing chamber and is firmly attached at one end to one end 9 of the vaporizer defining said channel 8. The other end 10 of the channel is slidable along the bottom 11 of the vaporizing chamber to permit adjustments of its length. The bottom 12 of the channel contains at least one electric heating element 13. Liquid disinfectant, for example, formalin, is supplied to the channel from a container not shown in the drawings, through a conduit 14 by means of a dosing pump 15 with driving motor 16. The heating element 13 is connected to a first electric circuit 17 including switches 18 and 18*a*; the motor 16 is connected to a second electric circuit 19 including

switches 18*b*. The latter switches break the current when a pressure pin 20*a*, 20*b*, is pressed in and close the circuit when the pressure ceases. A lever 21 is pivotable in a link 22 and actuated by a spring 23 so as to maintain pressure pin 20*b* in press-in position. The current to the pump motor 16 is broken by the switch 18*b*. The switch 18*a*, however, is closed so that the current to the heating element 13 is broken only at the switch 18.

The vaporizer is started and operated in the following way: when the fan 2 is started the switch 18 closes, whereupon the vaporizing channel 8 is heated quickly so as to expand. The, via a pressure rod 24, it will press the lever 23 which steps up the movement of the pressure rod in the direction away from the pressure pin 20*b* (the position shown in dotted lines) so that finally the switch 18*b* will close. The dosing pump 15 starts when the channel has acquired sufficient length, at the required temperature for effective vaporization. The capacity of the dosing pump is thus adjusted to correspond as closely as possible to the quantity of disinfectant which per time unit is calculated to be vaporized in the channel at this temperature. The balance must be maintained between the heat supplied through the heating element and the heat which is absorbed in the vaporizer by the disinfectant being heated and vaporized and also be the air flowing through which is heated and will absorb the vaporized disinfectant. Disturbances in this balance result in temperature fluctuations and consequently in alterations of the length of the vaporizing channel. It is extremely important that the temperature is not permitted to exceed a certain value, and most of all that it will not reach the ignition temperature of the disinfectant. This high temperature is prevented from being attained due to the fact that before the vaporizing channel has been able to reach the length corresponding to said temperature, said channel will press the arm 21 against the pressure pin 20*a* through the intermediary of the pressure rod 24 so that the switch 18*a* temporarily will break the current to the heating element 13 until as a result of this action the temperature has dropped so far as to cause the switch 18*a* again to be closed by the return of the lever 21. If, however, the temperature has a tendency to fall below that required for effective vaporization, a shortening of the length of the channel will immediately result in an interruption of the current to the pump motor 16 and the supply of disinfectant until, as a result, the temperature of the channel has again risen to that required for vaporization.

A further embodiment of the vaporizer according to FIG. 2, operating in principle in a similar manner and built into a top corner of the disinfection chamber 1, is illustrated in FIGS. 4–7. The vaporizing chamber is included between a part of the top 1*a* of the disinfection chamber, covered by an insulating layer 25, and a U-channel 26 having heat-insulating walls. The vaporizing chamber is closed at its inlet end by means of an attachment plate 27 for the vaporizing channel 8 for preventing air and disinfectant from escaping at the end wall 1*b* of the disinfection chamber. The end wall engages this attachment plate 27 as well as an opposite plate 28. At its outlet end the vaporizing chamber is completely open to the disinfectant chamber so that the outlet 7 (FIG. 3) may be omitted. However, difficulties may then be encountered in arranging all the control means at this end in the same way as in FIG. 3. Instead, these control means may be arranged at the inlet end on a flange 29 projecting from the attachment plate 27, as will be further described with reference to FIGS. 6 and 7. The vaporizing channel 8 comprises three horizontal tubes 30 of steel welded together longitudinally side by side so that two tubes at the same level will define the sides of the channel while a tube at a lower level between them will define the bottom 12 of the channel. Each tube is open at one end and welded to the attachment plate in a boring therethrough. At its other free end the tube is closed by a plug 31 and an end plate 32 for the channel. In each tube there is a heating element 13. Provided inside another, small tube 33 welded to the lower tube 30 is the pressure rod 24, attached at one end to the end plate 32 and at the opposite free end projecting from the at-

tachment plate 27. In this case the pressure rod is made of a material, for example invar, which in relation to the steel in the channel has very little coefficient of thermal expansion. As a result, when the channel acts to adjust its length due to temperature fluctuations, the free end of the pressure rod will follow the movement of the end plate 32 so that it will move towards and away from the attachment plate 27 as the temperature increases or decreases, respectively, in the vaporizing channel. In principle, this effect is made use of in the same way as in the previous embodiment in cooperation with the control means located at the inlet end of the vaporizer. Two inlet conduits 5*a*, 5*b*, respectively, lead from the pressure conduit of the fan through the attachment plate 27 to the vaporizing chamber. The conduit 14 for the disinfectant also passes through this plate. A similar conduit 14*a* is intended to supply an odor-neutralizing substance, for example ammonia to neutralize formalin, after completion of the disinfection process.

The control means according to FIGS. 6 and 7 comprise at one side of the flange 29 the breaker 18*a* and members cooperating therewith to control the electric circuit 17 for the heating elements, and at the opposite side of the same flange the switch 18*b* and the means cooperating therewith to control the electric circuit 19 of the pump motor (see FIG. 3). For operating the switch 18*a*, a lever 21 is pivotable about a peg 22 attached to the flange, one end of said lever being urged against the pressure rod 24 by means of a spring 23*a*, whereas the other end of the lever is spaced from the pressure pin 20*a* of the switch, which thus will be closed as described in connection with FIG. 3. On the other hand, in this case the switch, 18*b* operates in the opposite way. When the pressure pin 20*b*, having an elevated head, is in its extended position it will break the current and it will close the current when the pin is pressed in. For this purpose a lever 21*b* is maintained urged against the lever 21*a* at one end with a lip 34, opposite to the pressure pin 24 by means of a spring 23*b*, while the other end of the lever is at a shorter distance from the pressure pin 20*b* than the distance of the lever 21*a* to the pressure pin 20*a*.

The arrangement operates as follows: when the switch 18 (FIG. 3) closes and the temperature of the vaporizing channel increases so that the pressure rod 24 moves towards the attachment plate 27, both levers initially will follow this movement. Thus, the first lever 21*b* will press in the pressure pin 20*b* so that the dosing pump will start and the lever will remain in this position even if the movement of the pressure rod continues, the lever 21*a* continuing alone until the pressure pin 20*a* is also pressed in by this lever so that the current to the heating elements 13 is interrupted. If in this position the current also is interrupted by the switch 18, the procedure will be reversed and the parts will return to the starting position. Thus, the device operates in the same way as according to FIG. 3.

It is also possible within wide limits to adjust the various stages control to correspond to different desired temperatures for the vaporization and protection against overheating. To this purpose the switches 18*a* and 18*b* comprise cradles 35 arranged to pivot about a peg 36 and to be locked by means of a locking screw 37. By means of a screw 38 they can be set in different pivoting positions setting different distances between the cooperating levers 21*a* or 21*b* and the pressure pins 20*a* or 20*b* in the starting position, i.e., when the vaporizer is cold.

The basic principle in the two examples illustrated is that the vaporizing channel is used directly as mechanical impulse means to control its temperature, thus providing a considerably more rapid and reliable impulse transmission to the switching system than a temperature impulse in heat-conducting contact with a limited part of the channel.

With the help of the examples given other constructional modifications of the devices in the system can be made within the scope of this invention.

I claim:

1. In a vaporizer for disinfectant liquid in disinfection plants comprising fan means for drawing air from a closed disinfection chamber and means for mixing said air with disinfectant during circulation of said air back to said disinfection chamber, the provision of an elongate vaporizing chamber being a part of a feedback conduit for the air end enclosing a similarly elongate vaporizing channel of heat-conducting material, electric elements for heating said channel, means for securing said channel firmly at one end into said vaporizing chamber while its opposite end is free to expand as a result of the electric heating means at said free end of the channel to actuate an electric switch connected in a normally closed electric circuit of said heating elements so as to break the current when during heating of said channel the temperature thereof reaches a predetermined value and to close the circuit again when the temperature falls below this predetermined value.

2. Vaporizer according to claim 1 comprising a dosing pump driven by an electric motor for the supply of disinfectant liquid to the vaporizing channel through a supply conduit for this liquid, the free end of said vaporizing channel being movable under the action of the heating process to actuate a normally open switch included in the electric circuit of the motor, in order to close this circuit when the channel, during heat thereof, reaches a temperature at which the vaporization of the disinfection liquid is to take place.

3. Vaporizer according to claim 1 wherein the movement of the free end of the vaporizing channel is transmitted to said switch by means of a pressure rod attached to this end, the movement of the rod being stepped up by a lever and transferred to the actuating means of said switch.

4. Vaporizer according to claim 3, which is closed in longitudinal direction at its outlet end at which the free end of the vaporizing channel and an outlet for the air are located, wherein said pressure rod extends as an extension of the vaporizing channel from the vaporizer to abut against said lever.

5. Vaporizer according to claim 3, of the type which is open in longitudinal direction at its outlet end at which the free end of the vaporizing channel is situated, but is closed at its opposite end at which inlet means for the air are situated and at which said vaporizing channel is attached said pressure rod extending in opposite direction to the direction of said channel extension, out of the vaporizer at the inlet end to about against said lever, said pressure rod consisting of a material, which has very small coefficient of thermal expansion in relation to the material of said vaporizing channel.

6. Vaporizer according to claim 1 wherein the vaporizing channel comprises tubes running in the longitudinal direction of the channel and being closely welded together so that at least one tube forms the bottom of the channel and at least two other tubes form each of the long sides of the channel and that each of the tubes contains an electric heating element.

7. In a vaporizer for use in disinfection plants, an enclosed, elongate vaporizing chamber with an inlet for air and an outlet for air mixed with disinfectant, an elongate channel of heat conducting material for holding liquid disinfectant, one end of said channel being fixed to a wall of said chamber and other end of said channel being free to move upon expansion of the material of the channel, electrical means for heating said channel to vaporize disinfectant therein, a rigid element mechanically secured to the free end of the channel for movement therewith upon expansion of the channel in response to heating of the channel, an electrical switch positioned for actuation by an end of said rigid element only when the channel has been expanded by heating to a predetermined temperature, said switch being effective upon actuation to shut off the flow of electricity to said electrical heating means, thereby thermostatically controlling the temperature of the channel of the disinfectant.

* * * * *