

April 7, 1936.

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 APPARATUS FOR VAPORIZING LIQUIDS AND CONTROLLING
 THE IONIC CONTENT OF THE VAPORS AND GASES
 Filed May 15, 1933

2,036,533

3 Sheets-Sheet 1

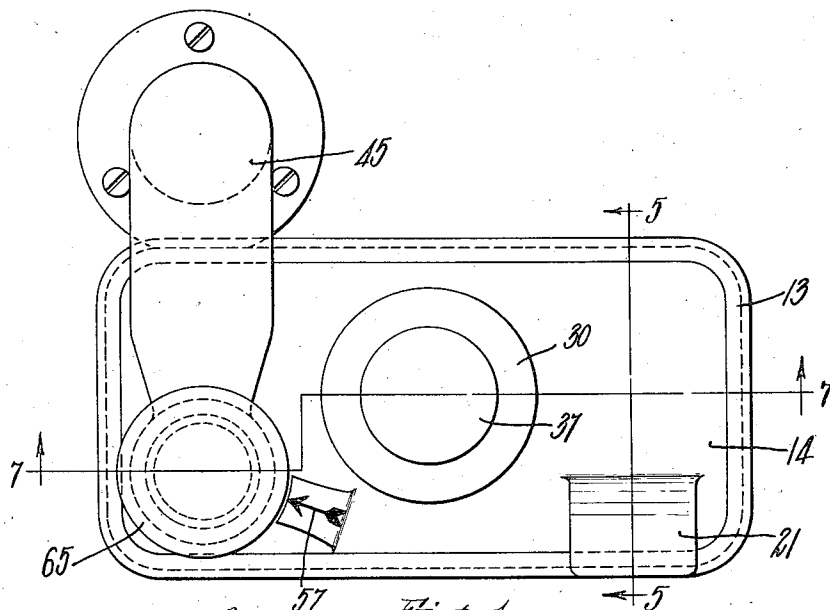


Fig. 1.

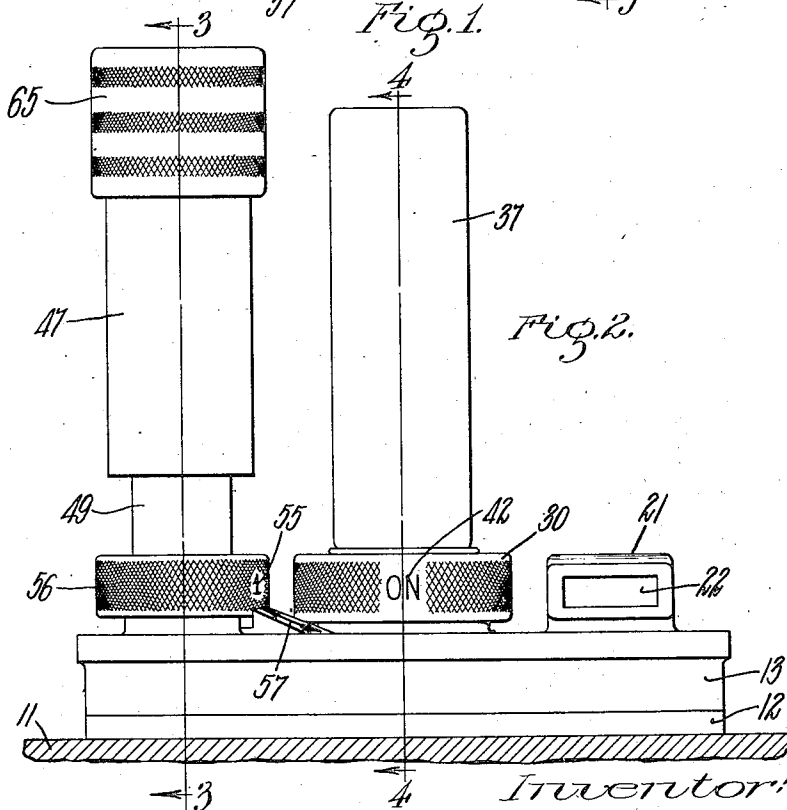


Fig. 2.

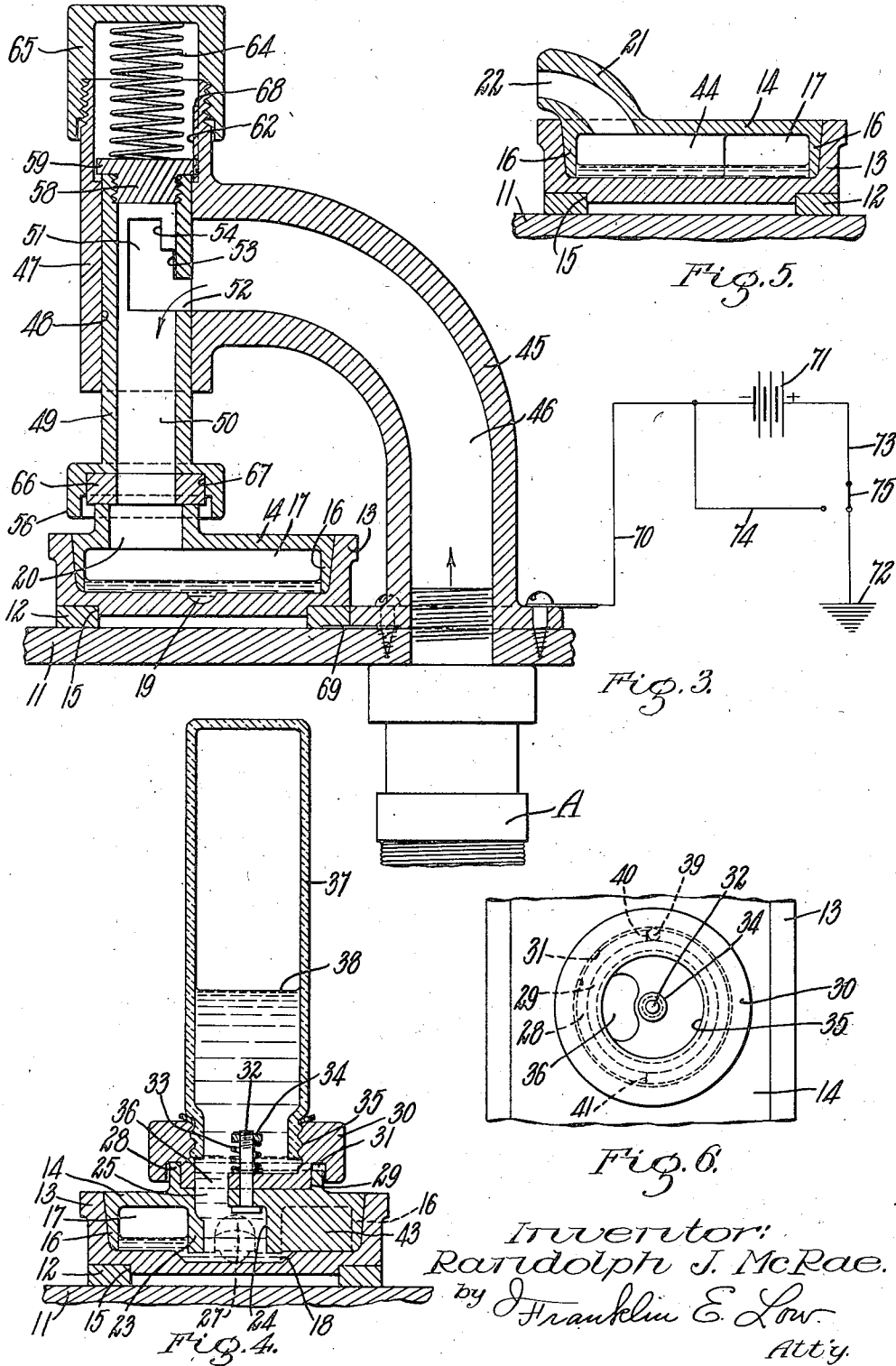
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3 Sheets-Sheet 3

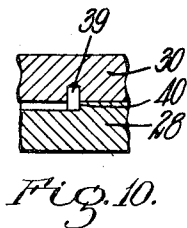
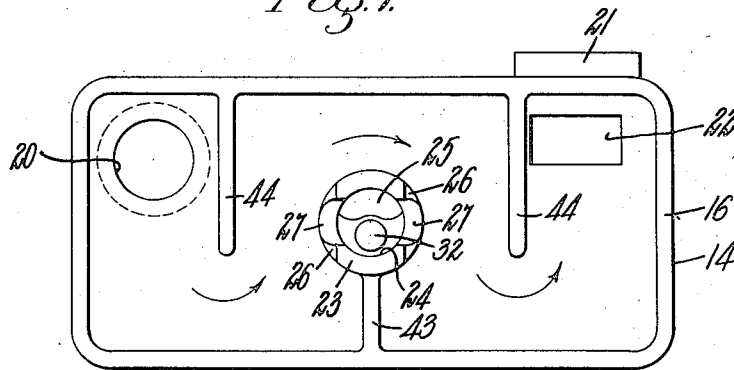
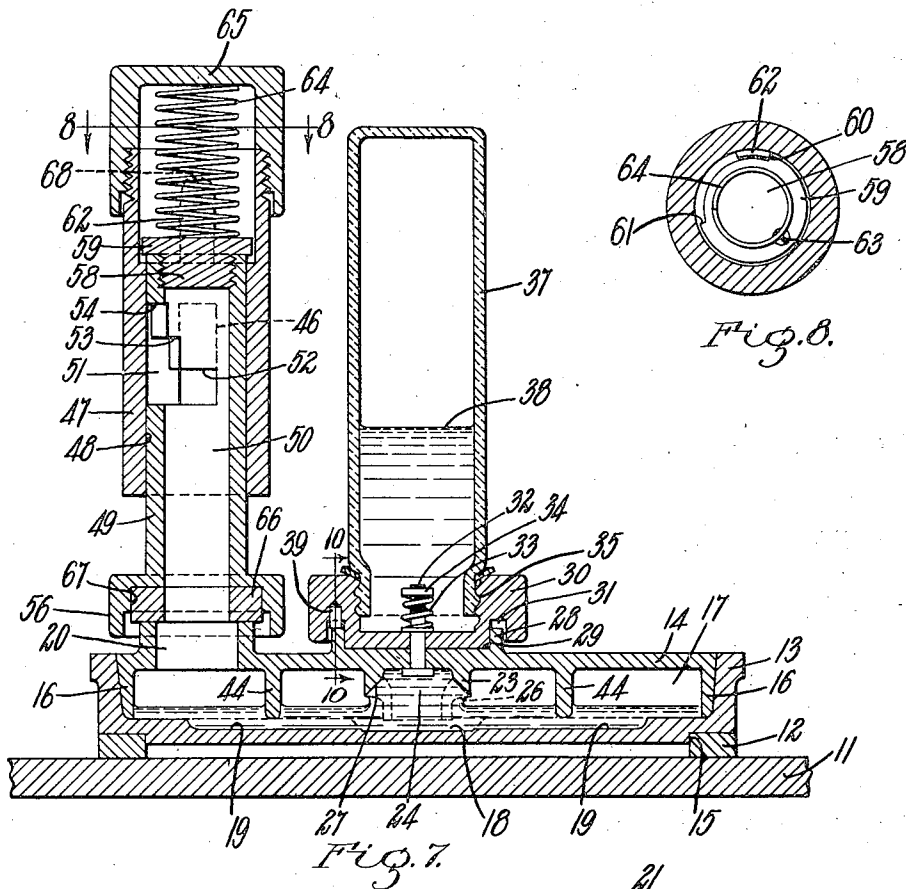


Fig. 9.

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UNITED STATES PATENT OFFICE

2,036,533

APPARATUS FOR VAPORIZING LIQUIDS
AND CONTROLLING THE IONIC CONTENT
OF THE VAPORS AND GASES

Randolph J. McRae, New York, N. Y.

Application May 15, 1933, Serial No. 671,170

4 Claims. (Cl. 204—32)

This invention relates to an apparatus for vaporizing liquids and controlling the ionic content of the vapors and gases.

Certain materials, for example, molecules of oils, when vaporized by an ionized gas under controlled conditions, yield vapors intimately associated with the ions in said gas and produce an atmosphere wherein the characteristics of molecules of the materials and ions of said gas are substantially preserved until coming into proximity of reactive substances. Reaction may then take place between such reactive substances and the molecules of the material, or the ions of said gas, or both.

The term "reaction" as used herein, is meant to include the neutralizing of the electric charge carried by the ion.

In some instances it is desirable to vaporize the material with an ionized gas containing a greater number of ions per unit of volume than may be desirable in other instances. Likewise it is preferred that either positively charged or negatively charged ions be removed from the ionized gas under certain desired conditions of operation. For example, in ionizing air, ions of nitrogen and oxygen are produced. The nitrogen ion rarely, if ever, is found as a negative ion and accordingly carries a positive charge. It is therefore possible to remove the nitrogen ion and positive oxygen ions while preserving the negative oxygen ions which may be utilized commingled with the evaporated material by the use of this invention.

The primary object therefore of this invention is to provide a device for delivering ionized gases into contact with a suitable material to be evaporated, whereupon the commingled vapors of the material and ionized gases may be treated and then allowed to disperse through the atmosphere for disinfecting, deodorizing, therapeutic, or for other healthful purposes, or may be applied to reactive substances.

Another object of the invention is to provide a means for maintaining a liquid to be vaporized at a substantially constant or predetermined level within the vaporizer.

Another object of the invention is to provide a means whereby the volume of ionized gases delivered to the vaporizing chamber may be varied, said means also functioning to shut off entirely the ionized gases from the vaporizing chamber when in non-operative position.

Still another object of the invention is to provide a means for controlling the proportion of positive to negative ions in the ionized gases

and also in the commingled ionized gases and vapors of the material.

Another object of the invention is to so construct the casing in which the liquid is vaporized that the liquid within the vaporizing chamber will seal said chamber.

Still another object of the invention is to provide a novel means for closing or shutting off the liquid reservoir from the vaporizing chamber, especially when it is necessary to refill the reservoir or replace an empty container of liquid for one that is filled.

Still another object of the invention is to so construct the vaporizer casing and the chamber provided therein that the liquid will be effectively distributed within the chamber and that the ionized gases as they pass through the chamber will be brought into close and effective association with the liquid therein.

Finally, the invention consists in a vaporizer as set forth in the following specification and particularly as pointed out in the claims thereof.

Referring to the drawings:

Fig. 1 represents a plan view of a vaporizer embodying my invention.

Fig. 2 is a front elevation of the vaporizer.

Fig. 3 is a vertical transverse section taken on the line 3—3 of Fig. 2, looking in the direction of the arrows on said line, and including an electrical diagram illustrating the means by which a voltage potential is placed upon the vaporizer.

Fig. 4 is a vertical transverse section taken on the line 4—4 of Fig. 2, looking in the direction of the arrows on said line.

Fig. 5 is a vertical transverse section taken on the line 5—5 of Fig. 1, looking in the direction of the arrows on said line.

Fig. 6 is a plan view of the valve provided for the oil reservoir.

Fig. 7 is a vertical longitudinal section taken on the line 7—7 of Fig. 1.

Fig. 8 is a detail horizontal section taken on the line 8—8 of Fig. 7.

Fig. 9 is an underneath plan view of the cover for the vaporizer casing.

Fig. 10 is a detail vertical section taken on the line 10—10 of Fig. 7, looking in the direction of the arrows on said line.

Like numerals refer to like parts throughout the several views of the drawings.

In the drawings, 11 represents a support preferably constructed in the form of a shelf, which constitutes a portion of a cabinet, and 12 is a metallic positioning ring preferably rectangular in form which is secured to the shelf 11 in any

suitable manner. A metallic receptacle 13 provided with a metallic cover 14 rests loosely upon the metallic positioning member 12, the bottom of said casing having a downwardly projecting shouldered portion 15 formed thereon which projects into the member 12 and thereby positions the casing upon said member. The cover 14 has a downwardly projecting marginal flange 16 extending therearound which fits loosely within the receptacle 13 with the outer periphery of the flange 16 abutting against the inner surface of the receptacle and with the lower edge of said flange resting upon the bottom surface of the receptacle. The top surface of the cover 14 is flush with the top edge of the receptacle 13. The space within the receptacle 13 beneath the cover 14 constitutes a vaporizing chamber 17 for a liquid hereinafter to be more fully described. The bottom surface of the receptacle 13 has a depression or well 18 formed therein from which channels 19 also formed in the bottom surface of the receptacle radiate. The well and channels facilitate the distribution of the liquid to be vaporized over the bottom of the evaporating chamber.

The cover 14 has an inlet passage 20 formed therein at one end thereof adjacent to a corner thereof. At the other end of the cover 14 adjacent to a corner thereof is a nozzle 21 having a discharge passage 22 provided therein through which vapors generated in the vaporizing chamber 17 are discharged therefrom. The cover 14 also has a boss 23 projecting downwardly from its under surface in which a recess 24 is provided. A port 25 extends through the cover 14 and communicates with the recess 24. The boss 23 is slotted and undercut at 26 upon its under surface and the upper surfaces of the opposite sides of said slot are arched and bevelled at 27. These undercut and bevelled surfaces are important in the operation of the device and will be hereinafter more fully described in the operation of the mechanism.

Projecting upwardly from the upper surface of the cover 14 is an annular flange 28 having a valve seat 29 provided therewithin. A valve member 30 is rotatably mounted within the flange 28 and has an annular groove 31 formed upon its under surface into which the flange 28 projects. The valve member 30 is yieldingly secured to the cover 14 by means of a pin 32, spring 33 and nut 34. A screw-threaded recess 35 is provided in the upper surface of the valve member 30 and a port 36, similar in size and form to the port 25 previously described, is provided in the valve member 30 and communicates with the recess 35. A reservoir 37 in the form of a vial and containing a liquid to be evaporated is mounted in an inverted position in the screw-threaded recess 35 of the valve member 30 and communicates with the vaporizing chamber 17 through the ports 36 and 25 and recess 24. The liquid 38 in certain instances is preferably a substantially non-reactive oil such, for example, as a refined vegetable oil the molecules of which when vaporized by ionized gases, as will be hereinafter more fully described, will accompany the ions and act as a carrier and preserver thereof.

A stop pin 39 is mounted upon the valve member 30 and projects downwardly into the annular groove 31 thereof and said pin is adapted to engage abutments 40 and 41 formed upon the annular flange 28 and thereby limit the rotative movement of the valve member 30 upon the cover 14. When the pin 39 is in engagement with the

abutment 40 the valve member 30 is located in its on position and the word "On" illustrated at 42 in Fig. 2 is visible at the front of the apparatus. When the pin 39 is in engagement with the abutment 41 an off designation, not visible in the various figures of the drawings, is then visible at the front of the device. When the valve member 30 is positioned in its off position the cover 14 may be removed from the receptacle 13 without spilling any of the liquid from the reservoir 37. Preferably, the valve member 30 turns to the off position and the valve closes under the rotative force applied to the valve member when screwing the container or reservoir 37 into the screw-threaded recess 35.

A flange 43 is provided upon the under surface of the cover 14 and extends between the flange 16 thereof and the boss 23, while other flanges 44 project from the opposite side of the cover 14 from that from which the flange 43 projects, said flanges 44 terminating at an intermediate point upon said cover. The flanges 43 and 44 are of sufficient depth to project into the liquid which is located within the vaporizing chamber 17, said liquid in said chamber being maintained at a substantially constant level in said chamber as indicated by the various sectional views.

Mounted upon the support 11 beside the casing 13 is an arcuate conduit member 45 having a passage 46 provided therein. The passage 46 is connected to an ionizing device A of well-known type for ionizing air or other gases, the gases ionized in said device being discharged therefrom into the passage 46. At its upper extremity the inlet member 45 terminates in a vertical bearing portion 47 having a cylindrical bore 48 extending therethrough. A sleeve valve member 49 is rotatably mounted in the bore 48 and is also adapted to be moved axially therein. A passage 50 is provided in the sleeve valve member 49 and communicates at its lower end with the passage 20 provided in the cover 14. At its upper end the passage 50 communicates with the passage 46 of the conduit member 45 through an opening 51 provided in the valve member 49. The opening 51 is formed to present openings of different sizes to the inlet passage 46 and to this end said opening 51 has stepped-up portions 52, 53 and 54 embodied therein which, when aligned with passage 46, will cause variable volumes of ionized gases to be discharged from the ionizing device A through the passage 46, opening 51 and passages 50 and 20 into the vaporizing chamber 17.

Suitable indicia 55 are located upon the periphery of a knurled finger portion 56 of the valve member 49 and when aligned with an indicating point 57 provided upon the cover 14 enables said valve member to be positioned so that the operator of the device may definitely choose the volume of gas which will be permitted to enter the vaporizing chamber.

Mounted at the top of the valve member 49 is a screw plug 58 having a flange 59 embodied therein. Stops 60 and 61 are formed upon the periphery of the flange 59 and are adapted to contact with a stop member 62 provided upon the interior of the bearing portion 47, see Fig. 8. The stops 60 and 61 and stop 62 limit the rotative movement of the valve member 49 when the latter is located in its lowered position in operative engagement with the cover 14, so that the ionized gases cannot be entirely shut off. After the screw plug 58 has been positioned upon the valve mem-

ber 49 rotative movement between said parts is prevented by means of a locking screw 63, see Fig. 8. The valve member 49 is yieldingly held in its lowered position in engagement with the cover 14 by means of a compression spring 64, the lower extremity of which bears against the upper surface of the screw plug 58 and the upper extremity of which engages the under surface of a cap 55 which has screw-threaded engagement with the upper portion of the bearing portion 47 of the inlet member 45. A washer or gasket 66 seated in the recess 67 is interposed between the upper surface of the top of the cover 14 and the under surface of the finger portion 56 of the valve member 49 and forms a tight connection therebetween.

In disconnecting the valve member 49 from the cover 14 the valve member 49 is lifted and rotated into a position to entirely close the inlet passage 46 and when in this position the under surface of the flange 59 of the plug 58 is caused to rest upon the top edge 68 of the projection 62, thereby holding the valve member in its raised and closed positions, at which time the ionized gases will be prevented from being discharged from the passage 46 into the passage 50 and thereby from escaping to the atmosphere.

Positive or negative ions may be selectively removed from the ionized gases and vapors as follows:—The positioning ring 12 and conduit member 45 are electrically connected together by means of a contact plate 69, see Fig. 3. The inlet member 45 is connected by means of a wire 70 with the negative pole of a battery 71. The positive pole of the battery 71 is grounded at 72 by means of a wire 73. A wire 74 and switch 75 connected to the wires 70 and 73 permits of connecting the receptacle 13 and conduit member 45 directly to the ground through the member 73, thereby removing the battery 71 from the circuit.

As the ionized gases enter the conduit member 45 and pass therethrough to and through the vaporizing chamber 17 positive ions are removed from the commingled ionized gas and vapors by reason of the fact that the conduit member 45, positioning ring 12, receptacle 13 and cover 14 are all connected to the negative pole of the battery 71 through the connection 70; the positive pole of the battery being grounded. This result is attained by reason of the fact that a negative voltage potential is placed upon the conduit member, receptacle and cover and positive ions in the gas passing through the vaporizing chamber will be attracted to the walls of the conduit, receptacle and cover and be neutralized. By reversing the charge on the conduit, receptacle and cover, negative ions will be attracted thereto and their charge removed, while positive ions will be repelled therefrom and continue on with the gas. In this manner it is possible to change the ratio of positive ions to negative ions in the ionized gas and also in the commingled gas and vapor. The switch 75 permits of connecting the receptacle and cover directly to the ground 72 and eliminating the battery from the circuit. While the battery aids the action it is not absolutely essential where positive ions are to be removed because the earth is normally slightly negative and the conduit, receptacle and cover would then have a similar potential.

The general operation of the device hereinbefore specifically described is as follows:—The liquid to be vaporized is placed in the container 37 which is then attached to cover 14 by screwing said container into valve member 30. The cover

14 is then placed in the receptacle 13 and the assembled cover and receptacle are placed on the positioning member 12. Valve 30 is then turned to on position which permits liquid in the container 37 to escape downwardly into the vaporizing chamber. The liquid will continue to flow until the predetermined level thereof in the vaporizing chamber has been attained, whereupon the flow will cease. Ionized gases generated in an ionizing device A well known to those skilled in the art are delivered from said device into the inlet passage 46 of the conduit member 45 and as said gases pass from said conduit member into the interior of the sleeve valve 49, through the opening 51 thereof, the volume of said gases which are permitted to pass into the vaporizing chamber 17 may be regulated by rotating the valve 49 to present either of the portions 52, 53 or 54 of the opening 51 into alignment with the inlet passage 46. In adjusting the valve 49 the indicia 55 are moved into alignment with the indicator 57 provided upon the cover 14. The ionized gases upon entering the vaporizing chamber 17 through the inlet passage 20 encounter the flanges 43 and 44 provided upon the under surface of the cover 14 and these flanges function as baffle plates and cause the gases to flow in a circuitous or serpentine path across the surface of the liquid located in the vaporizing chamber, causing said liquid to vaporize. The flanges 43 and 44, furthermore, cause a certain degree of turbulence in the vaporizing chamber and cause the ionized gases to commingle with the vapors as they are generated, and the commingled gases and vapors will finally be discharged from the vaporizing chamber through the nozzle 21 where they may be dispersed directly into the atmosphere to be utilized for disinfecting, deodorizing, or for other healthful purposes, or they may be conducted by any suitable conducting means into close proximity with reactive substances for therapeutic or other purposes.

In Fig. 3 of the drawings the various parts of the device are illustrated as being electrically connected to the negative pole of a battery 71. Under such conditions a negative voltage potential is placed upon the metallic conducting member 45, positioning member 12, receptacle 13 and cover 14 and positive ions are removed from the ionized gas and also from the commingled ionized gas and vapors as they pass through the vaporizing chamber. In other words, the ionized gas is first de-ionized of positive ions in the conduit member 45 and positive ions are further removed in the vaporizing chamber. Negative ions, therefore, remain in the ionized gas and in the vapor which is generated in the vaporizing chamber and pass outwardly from said chamber through the passage 22 in the nozzle 21.

By reversing the voltage charge on the various parts of the device as by connecting the wire 70 to the positive pole of the battery 71, negative ions will be attracted to the various parts and their charge removed, while positive ions will be repelled therefrom and continue on with the gases. In this manner it is possible to change the ratio of positive ions to negative ions in the ionized gas and also in the commingled gases and vapors. The switch 75 permits of connecting the various parts of the device directly to the ground 72 thereby eliminating the battery from the circuit.

As the liquid in the vaporizing chamber 17 vaporizes, the level of the liquid in said chamber lowers slightly until eventually a bubble of gas

passes upwardly through the recess 24 and ports 25 and 36 into the reservoir 37, thereby causing a small amount of the liquid within the reservoir to pass downwardly into the vaporizing chamber to take the place of the liquid which has been vaporized and causing the liquid in the vaporizing chamber to maintain a substantially constant level in said chamber. It has been found that by providing the arc-shaped slot in the boss 23 and forming the bevelled edges 27 upon the upper surface of the slot that the bubbles of gas are not retarded as they leave the surface of the oil in the vaporizing chamber and pass upwardly through the recess 24 as is the case when this structure is not provided. Experiments have demonstrated that there is a tendency for bubbles to cling to the sides and top of the slot 26 unless constructed as shown. Similarly the undercut portions 26 facilitate the escape of the bubble through the slot and aids the maintaining of a substantially constant level of liquid in the vaporizing chamber.

When it is desired to replenish the liquid in the reservoir 37 the sleeve valve 49 is raised to disconnect the same from the cover 14 and to at the same time upon rotation close the opening 51 and prevent the ionized gases from being discharged directly to the atmosphere. After being raised, the sleeve valve is rotated until the flange 59 of the plug 58 overlies the upper extremity 68 of the projection 62 upon which it is supported until the valve is again lowered. The cover 14 is then removed from the receptacle 13 and a new vial of liquid inserted in the valve member 30 and when the latter has been rotated to close the port 25 in the cover, the latter may be again tipped to its normal upright position and reinserted in the receptacle 13 without permitting the escape of any of the liquid from the reservoir until the valve member 30 is turned to the on position.

I claim:

1. A vaporizer having, in combination, a receptacle, a cover for said receptacle and co-operating therewith to form a vaporizing chamber therein, a reservoir for a liquid communicating with said chamber, a valve for said reservoir upon which the latter is mounted and by which it is connected to the cover, means to maintain said liquid at a substantially constant level in the chamber, means to discharge ionized gases into contact with the liquid in the chamber, whereby said liquid is vaporized, means to cause the gases to flow in a circuitous path through the vaporizing

chamber, and means to place a voltage potential on said receptacle and cover, whereby ions of one polarity may be removed from the vapor and ions of opposite polarity may be discharged from the chamber commingled with the gases and vapor.

2. A vaporizer having, in combination, a receptacle provided with a vaporizing chamber therein, a reservoir for a liquid communicating with said chamber, a valve for said reservoir and by which the latter is attached to said receptacle, a conduit adapted to deliver ionized gases into said vaporizing chamber whereby said liquid is vaporized, and a combined valve member and coupling for said conduit whereby the conduit and vaporizing chamber are connected one to another and the flow of gases to the mixing chamber controlled.

3. A vaporizer having, in combination, a receptacle provided with a vaporizing chamber therein, a reservoir for a liquid communicating with said chamber, a valve for said reservoir, a conduit adapted to deliver ionized gases into said vaporizing chamber whereby said liquid is vaporized, a combined valve member and coupling for the conduit having yielding contact with said receptacle and adapted to simultaneously connect said conduit and vaporizing chamber one to another and regulate the flow of gases therethrough, and means to hold the valve member elevated under compression and out of communication with the vaporizing chamber.

4. A vaporizer having, in combination, a receptacle, a cover therefor and co-operating therewith to form a vaporizing chamber therebetween, a reservoir for a liquid communicating with said chamber, a valve for said reservoir and upon which the latter is mounted, means to maintain said liquid at a substantially constant level in the vaporizing chamber, said liquid co-operating with said cover to seal the chamber, a conduit electrically connected to the receptacle and adapted to deliver ionized gases into contact with the liquid in the vaporizing chamber whereby said liquid is vaporized, a valve for said conduit and yieldingly connecting the latter to the receptacle, means to create a turbulence of the ionized gases and vapors in the chamber, and means connected to the walls of the conduit and vaporizing chamber to neutralize ions in the ionized gases passing through the conduit and also in the commingled gases and vapors in the vaporizing chamber.

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