

Nov. 7, 1961

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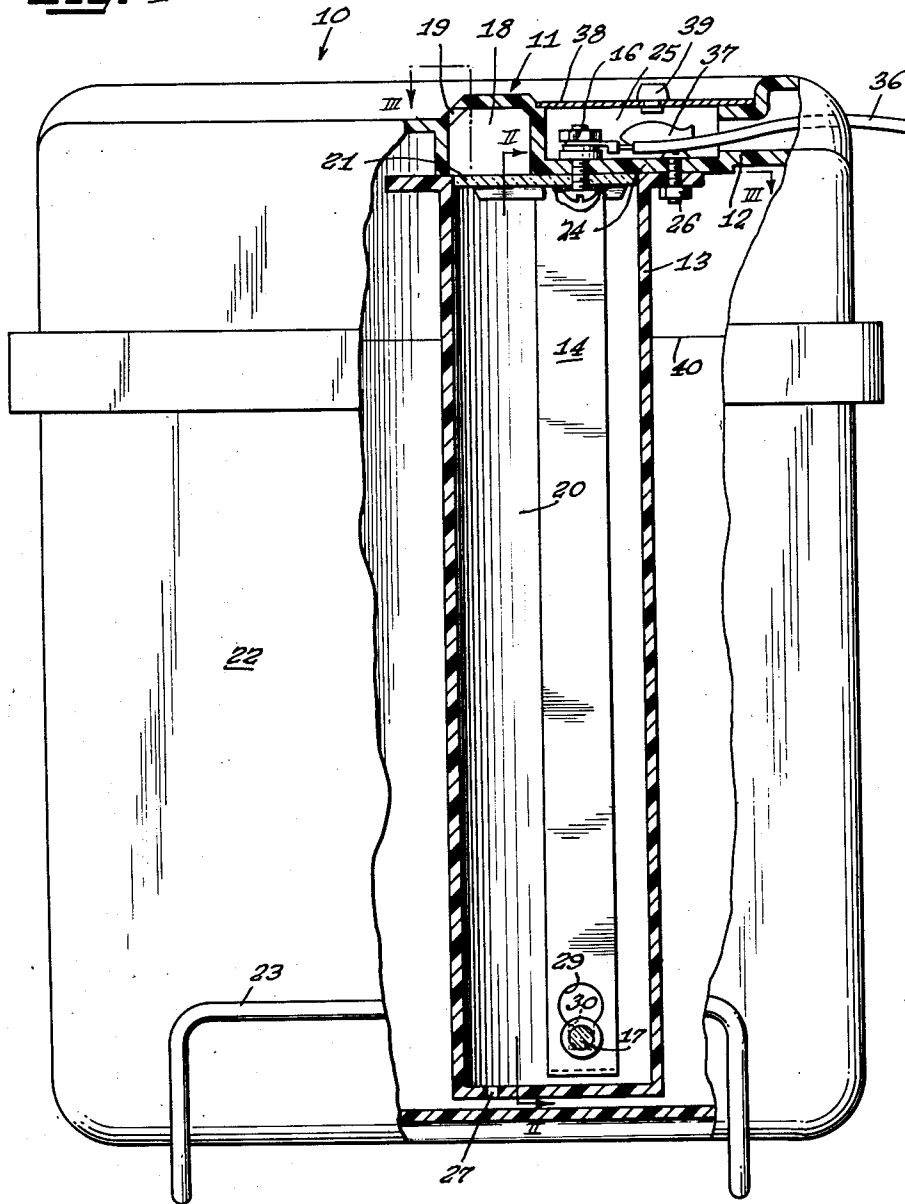
3,008,031

VAPORIZER

Filed Nov. 24, 1959

2 Sheets-Sheet 1

FIG. 1



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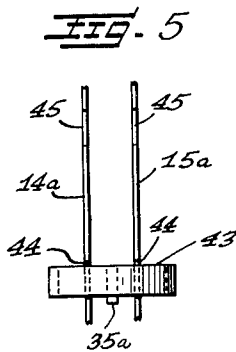
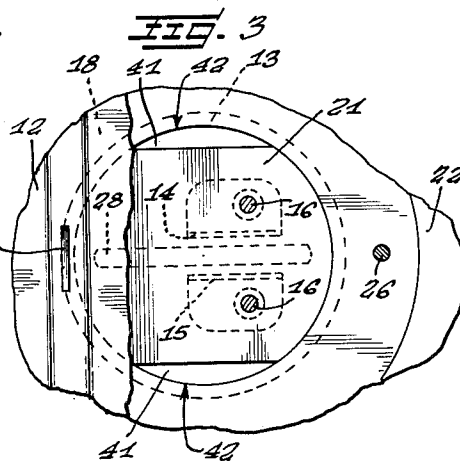
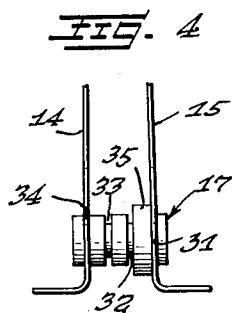
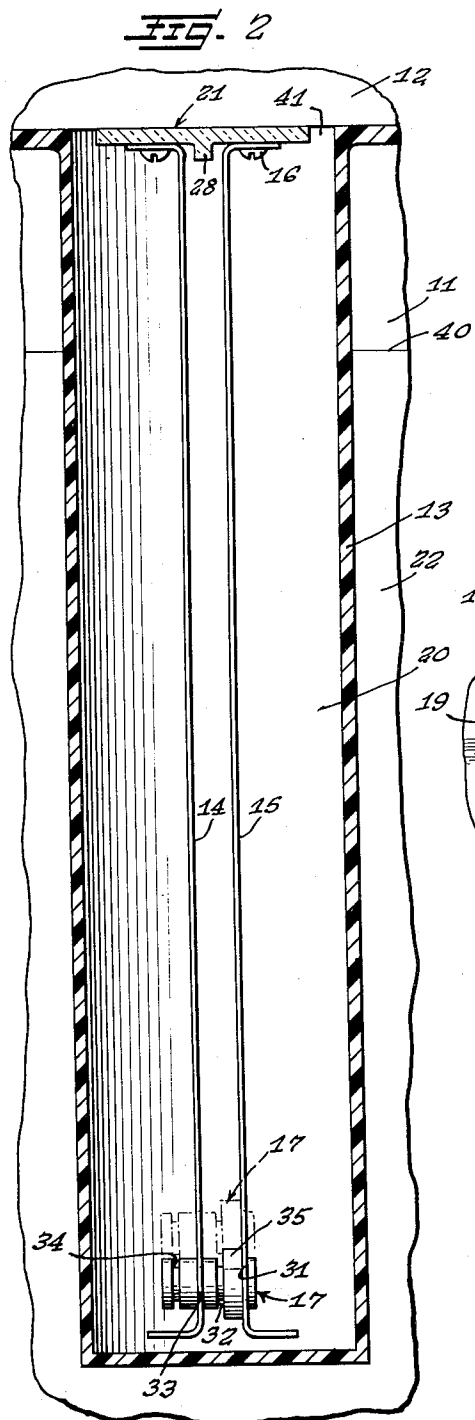
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3,008,031

VAPORIZER

Filed Nov. 24, 1959

2 Sheets-Sheet 2



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3,008,031
VAPORIZER

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Filed Nov. 24, 1959, Ser. No. 855,094
12 Claims. (Cl. 219-40)

This invention relates generally to vaporizers, and more specifically to a vaporizer structure which is especially adapted to be able to be operated at a high rate of water evaporation.

Although the principles of the present invention may be included in various vaporizers or humidifiers, a particularly useful application is made in vaporizers of the type which discharge water vapor across a quantity of medicant. It is frequently desired to operate such a device at a relatively high evaporation rate. When the conductivity of the water is a constant and the applied voltage does not vary from a predetermined value, it is possible for the vaporizer designer to construct vaporizers which deliver water vapor at a desired rate. However, as a practical matter, such as in impossibility, because even in one location, a considerable amount of voltage variation may be expected, and the amount of impurities in the heated water will vary from time to time. Moreover, the cleanliness of the device as a whole, the amount of salt which may have been deliberately added, the extent to which the vaporizer is then filled, and the like, can cause further variations. Apart from these factors, there is an additional factor of personal preference which is difficult to predict. Accordingly, heretofore it has been commonplace to construct devices of this type with a compromise value selected for the various variables. This approach is less than ideal, because if the evaporation rate is excessive, the boiling will be quite violent, and if the rate is too slow, the addition of salt will not be entirely satisfactory since the percentage of salinity and hence conductivity increases as the water level in the humidifier decreases.

The present invention contemplates the utilization of heating electrodes spaced from each other, the spacing therebetween being adjustable so that the operator or user can vary the effective spacing between the electrodes to compensate for the various local factors then existing. The invention preferably includes structural features for precluding the possibility of one electrode coming into direct contact with the other electrode as a result of either adjustment or handling. The invention further preferably includes a baffle feature which prevents the discharge of hot water droplets through the water vapor discharge opening under conditions of rapid boiling or high evaporation rate.

Accordingly, it is an object of the present invention to provide an improved vaporizer unit.

Another object of the present invention is to provide a vaporizer unit wherein the evaporation rate may be readily adjusted.

Yet another object of the present invention is to provide a vaporizer unit which may be operated at a relatively high rate of water evaporation.

A still further object of the present invention is to provide a vaporizer unit which may be operated at a rela-

2

tively high rate of water evaporation without the discharge of water droplets with the water vapor.

A still further object of the present invention is to provide a vaporizer unit wherein the electrodes are adjustable with respect to each other and wherein means are provided for precluding direct engagement between the electrodes as a result of either adjustment or handling.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheets of drawings in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example.

On the drawings:

FIGURE 1 is a side view of a vaporizer equipped with a vaporizer unit provided in accordance with the principles of the present invention, the view being broken away and shown partly in cross-section;

FIGURE 2 is an enlarged cross-sectional view of a portion of the structure shown in FIGURE 1 and taken along line II-II thereof;

FIGURE 3 is a fragmentary view taken along line III-III of FIGURE 1, and drawn to the scale of FIGURE 2;

FIGURE 4 is a fragmentary portion of the structure shown in FIGURE 2 adjusted to produce a different rate of water evaporation; and

FIGURE 5 is a fragmentary showing of a modified form of adjustment means for the structure shown in FIGURE 2.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in an electrical vaporizer such as illustrated in FIGURE 1, generally indicated by the numeral 10. In the vaporizer 10 there is a vaporizer unit 11 which includes a casing 12 supporting a casing extension 13 within which there is disposed a pair of electrodes 14, 15. The electrodes 14, 15 are secured to the casing 12 by supporting means 16 disposed at one end thereof, the effective spacing between the electrodes 14, 15 being adjustable by means of an adjustment member 17 disposed remotely from the supported end. The casing 12 is formed to define a water vapor discharge chamber 18 having a water vapor outlet 19 which is preferably directed to discharge water vapor over a medicant supported on the casing 12, in a tray (not shown). The casing extension 13 is elongated, hollow and generally vertically directed to define a heating chamber 20 within which the electrodes 14, 15 are disposed. A baffle 21 is supported by the means 16 and is disposed to nearly fully isolate the discharge chamber 18 from the heating chamber 20, which otherwise would be in direct communication with each other. The details of the structure and function are set forth more fully below.

In the disclosed vaporizer 10, the vaporizer unit 11 comprises a cover-like structure for a jar or container 22 supported on a rack 23. In this embodiment, both the casing 12 and the water container 22 comprise plastic of the thermal setting variety.

A portion 24 of the upper wall of the casing is shaped to define a terminal cavity 25, the wall defining the terminal cavity 25 also cooperating to define part of the discharge chamber 18, and to provide a support surface

on its lower side for the casing extension 13, for the baffle 21, and for the electrodes 14, 15.

The casing extension 13 is thus secured to the wall 24 such as by a group of readily removable bolt and nut assemblies 26 which hold the casing extension 13 beneath and adjacent to the water vapor discharge chamber 18. At its opposite end, the casing extension 13 is provided with a water inlet opening 27.

As seen in FIGURES 2 and 3, the electrodes 14, 15 are each vertically directed elongated conductors which are supported at the upper end, the electrodes 14, 15 being disposed within the heating chamber 20. In this embodiment, the baffle 21 is disposed intermediate bent upper ends of the electrodes 14, 15 and the support surface 24, the baffle 21 here comprising porcelain. Thus the electrodes are supported in insulated spaced relation to each other. Preferably the baffle 21 has a downwardly extending rib 23 disposed intermediate the electrodes which serves to increase the electrical creepage distance between the electrodes. In accordance with this invention, at least one of the electrodes is movable at its free or opposite end toward and away from the other electrode. In this embodiment, this concept is effected by providing at least one of the electrodes 14, 15 in resilient material. In this embodiment, both of the electrodes 14, 15 comprise resilient material. Preferably, the electrodes have a free position wherein they are not parallel to each other. While it is within the broad concept of the instant invention to have the electrodes so shaped that they are in engagement with each other when in a free position, a more preferable and specific form of the invention is here disclosed wherein the electrodes have such a free position that there is greater spacing between the electrodes at the free end than there is at the upper fastened or supported end.

In this embodiment, the electrodes are provided with axially aligned apertures such as shown in FIGURE 1, each aperture having such a configuration that it is wider at the top 29 thereof and narrower at the bottom 30 thereof. An example of such a combined aperture is thus shown to comprise a keyhole aperture.

The adjustment member 17 comprises insulative material, such as porcelain, and is operative to effect desired spacing adjustment between the electrodes 14, 15. To this end, the spacing adjustment member 17 is carried by and acts between the electrodes 14, 15, and is selectively receivable in either of at least two positions wherein the free ends of the electrodes are spaced a selected distance from each other to thereby alter the effective spacing therebetween. To this end, in the instant embodiment, the spacing adjustment member 17 has been provided with a first groove 31, a second groove 32, a third groove 33, and a fourth groove 34. These grooves are peripheral in nature and are disposed generally parallel to each other. The sectional configuration defined by each of the grooves is such that that portion of the spacing adjustment member is receivable in the narrow portion 30 of the electrode aperture. The ungrooved portions of the spacing member 17 or portions between the grooves are of such size as to be movable in the wider portion 29 of the electrode apertures. Further, the spacing member 17 preferably includes an enlarged spacer portion 35 disposed between the grooves 31 and 32 which enlarged spacer portion is of such sectional configuration that it is larger than the wider portion 29 of the electrode apertures, whereby the portion 35 cannot pass therethrough. It is the function of this enlarged spacer portion 35 to preclude the electrode 14 from ever engaging the electrode 15. As shown in broken lines in FIGURE 2, the spacing member 17 may be raised out of the narrow portion 30 of the aperture into the wider portion 29 thereof under which condition the electrode 14 may be realigned with either of the grooves 32, and 34 for increasing and decreasing respectively the rate of water evaporation.

Because of the relative configurations between the electrodes 14, 15 and the spacing member 17, the spacing member 17 when properly engaged opposes movement of the electrodes to hold them out of their free position. The tension thus applied by the electrodes to the member 17 tends to hold it by friction so that it will not fall out of position, even if it were inverted in handling. When the electrodes 14, 15 have free positions with a substantial divergence, the spacing member 17 will act to oppose movement by one electrode away from the other electrode, even when the electrodes 14, 15 are adjusted to a divergent position such as shown in FIGURE 4. It is thus apparent that the spacing member 17 is effective to position the free end of the electrodes a selected distance from each other to alter the effective spacing therebetween, and that in the instant structure, the electrodes are selectively positionable in converging, substantially parallel and in diverging relation to each other.

As best seen in FIGURE 1, the supporting means 16 comprise a conductive screw which is in electrical contact with the upper end of one of the electrodes 14, 15. A lead wire 36 is also secured to the means 16 and is adapted to be connected to a source of current, there being a conductor for each of the screws. If desired, a small light bulb 37 may also be connected electrically across the electrodes 14, 15 at the supporting means 16, which light will glow whenever the device is energized. The terminal recess 25 is closed by a cover 38 which has a transparent colored jewel 39 through which light from the bulb 37 may pass.

When water has been filled into the container 22 to a level below the top 40 thereof it will have flowed through the inlet 27 to a corresponding level within the casing extension 13. When a potential is applied to the electrodes 14, 15, current will flow from the one electrode to the other and will heat the water therebetween which will rise in the form of a convection current, cooler water from within the casing extension 13 taking its place to become heated. Eventually this produces steam or water vapor which flows from the heating chamber 20 into the discharge chamber 18 and out the outlet 19.

When a high rate of water vapor production is desired, or is obtained, such being possible because of the presence of the spacing adjustment means, the baffle 21 being located intermediate the space between the electrodes 14, 15 and the outlet 19 is operative to deflect droplets moving from the electrodes toward the outlet. To insure that this function is carried out well, the baffle 21 in this embodiment nearly closes off the upper end of the heating chamber 20 with respect to the discharge chamber 18. As seen in FIGURE 1, there appears to be a flow close-off, but as better seen in FIGURE 3, the baffle 21 of this embodiment defines a zone of clearance 41, 41 at each side thereof intermediate a relatively short edge portion thereof and the inner surface of the casing extension 13. The support wall 24 of the casing blocks that portion of the openings shown to the right of the arrows numbered 42 whereby the effective size of each of the clearance zones 41 is approximately the same as the effective size of the outlet 19. Stated otherwise, the baffle 21 defines a path of communication between the heating chamber 20 and the discharge chamber 19 which has an effective flow area slightly greater than the outlet 19, and which is disposed at a point in the plane in the baffle 21 remote from any line extending from the outlet 19 to the space between the electrodes 14, 15. It can thus be seen that any vapor formed between the electrodes will have to move generally radially of the casing extension 13 to clear the electrodes, thence toward one of the relatively small openings 41 and thence in a secant-like fashion to the outlet 19. This path is relatively tortuous and cannot be followed by a droplet so that only water vapor will be discharged from the outlet 19 even though the vaporizer is being operated at a high rate of evaporation. The

5

baffle 21 thus substantially isolates the discharge chamber 18 from the interior of the casing extension 13 but defines a path of communication therebetween at a point in the plane of the baffle 21 remote from a straight line path between the point where droplets may form and potentially otherwise be discharged.

It will be appreciated that minor details may be varied without departing from the broad inventive concept of the instant invention. Illustrative of this fact there is shown in FIGURE 5 a modified form of spacing adjustment means employing an insulative spacing-adjustment ring-like member 43 which extends about the electrodes 14a, 15a. At least one of these electrodes is provided with a plurality of longitudinally spaced notches 44, 45 which can receive the ring-like member 43, at least one of the electrodes 14a, 15a being resilient and having a free position more divergent than that illustrated. Thus as the ring member 43 is moved to the notches 45, there will be a slight increase in the spacing between the electrodes 14a, 15a, and as the ring member 43 is moved to lower positions, further increase of evaporation rate will take place. The ring member 43 thus constrains the electrodes 14a, 15a together or toward each other, their natural resilience acting to keep them apart.

Preferably, the ring member 43 is provided with a spacer portion or diametrically extending rib 35a disposed between the electrodes 14a, 15a, which rib functions in the manner of the enlarged portion 35 of FIGURE 2 to prevent possible engagement between the electrodes 14a, 15a. The rib 35a may be flush with the ring member 43 as shown at the upper surface and may extend axially beyond the main portion of the ring member 43 as shown at the lower surface.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being movable at the other end toward and away from the other electrode; said electrodes having axially aligned apertures disposed remotely from said one end; and an insulative spacing adjustment member carried by and acting between said electrodes, said member being received in said apertures and having a first groove receiving said other electrode, and at least two additional grooves for selectably receiving said one electrode so that said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween.

2. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being movable at the other end toward and away from the other electrode; said electrodes having aligned apertures which have a narrow portion at the bottom and a wider portion at the top, said apertures being disposed remotely from said one end; and an insulative spacing adjustment member, said member having a first, a second, and a third groove substantially parallel to each other, each of said grooves defining a portion having a sectional

6

configuration receivable in said narrow portion of one of said apertures, said member being movable in said wider portion of said apertures, whereby said member may be selectably positioned to effect positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween.

3. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being movable at the other end toward and away from the other electrode; said electrodes having aligned apertures which have a narrow portion at the bottom and a wider portion at the top, said apertures being disposed remotely from said one end; and an insulative spacing adjustment member, said member having a first, a second, and a third groove substantially parallel to each other, each of said grooves defining a portion having a sectional configuration receivable in said narrow portion of one of said apertures, said member being movable in said wider portion of said apertures, said member having an enlarged spacer portion intermediate said first and second grooves, said enlarged portion having a sectional configuration larger than said wider portion of said aperture in each of said electrodes to preclude said electrodes from engaging each other, whereby said member may be selectably positioned to effect positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween.

4. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resilient, the other end thereof having a free position with respect to the other electrode; a plurality of stop formations disposed along the length of at least one of said electrodes remotely from said one end; and an insulative spacing adjustment member carried by and acting between said electrodes and selectively receivable in one of said stop formations so that said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween, and opposes movement of said one electrode to hold said other end thereof out of said free position.

5. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resilient, the other end thereof having a free position with greater spacing between the other ends than between said one ends; a plurality of notches disposed along the length of at least one of said electrodes remotely from said one end; and an insulative spacing adjustment ring-like member carried by and acting between said electrodes, and selectively receivable in one of said notches, to constrain said electrodes out of said free position toward each other so that said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween, and opposes

movement of said other end of said one electrode away from said other electrode toward said free position.

6. In a vaporizer unit for a vaporizer, said unit including, a casing having a portion defining a discharge chamber, said discharge chamber having a water vapor outlet, a generally vertically disposed elongated hollow casing extension secured to said casing beneath said discharge chamber and adjacent thereto, a pair of vertically directed elongated electrodes each disposed in said casing extension, and conductive means supporting said electrodes at one end on said casing in electrically insulated spaced relation to each other, said means being adapted to be connected to a source of current for effecting a current flow between said electrodes when said electrodes are inserted in water, the improvement in combination therewith of an electrically insulative baffle clamped by said conductive means between and in direct engagement with said casing and said one end of said electrodes said baffle being operative to substantially isolate said discharge chamber from the interior of said casing extension and to define a path of communication therebetween at a point in the plane of said baffle remote from any line extending from said outlet to the space between said electrodes.

7. A vaporizer unit for a vaporizer comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resiliently flexible and thereby movable at the other end toward and away from the other electrode; and an insulative spacing member carried by both of and acting between said electrodes remotely from said one end, said member being selectively receivable by displacement into either of at least two relative positions with respect to said electrodes in which positions said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween.

8. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resiliently deflectable, the other end thereof having a free position with greater spacing between the other ends than between said one ends; and an insulative spacing-effecting member carried by both of and acting between said electrodes remotely from said one end, said member being selectively receivable by displacement into either of at least two relative positions with respect to said electrodes in which positions said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween, said member being operative to oppose movement of said other end of said one electrode away from said other electrode to hold said other ends thereof closer together than their spacing in said free position.

9. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resiliently flexible and thereby movable at the other end toward and away from the other electrode; and an

insulative spacing member carried by both of and acting between said electrodes remotely from said one end, said member being selectively mateable with said electrodes in any one of three relative positions by displacement with respect to said electrodes, in which positions said electrodes are disposed in one of converging, substantially parallel, or diverging spaced relation to each other to thereby alter the effective spacing therebetween.

10. A vaporizer unit for a vaporizer, comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, both of said electrodes being both resiliently flexible and deflectable at the other end thereof toward and away from each other, said electrodes each having a free position of diverging relation to each other; and an insulative spacing member carried by both of and acting between said electrodes remotely from said one end, said member being selectively receivable by and mateable with said electrodes in any one of three relative positions by displacement with respect to said electrodes, in which positions said member holds said electrodes closer together at said other ends than at said free position thereof, and disposes the same in any one of converging, substantially parallel, or diverging spaced relation to each other to thereby alter the effective spacing therebetween.

11. A vaporizer unit for a vaporizer comprising in combination: a casing having a water vapor outlet; a pair of generally vertically disposed elongated electrodes each secured at one end to said casing in electrically insulated spaced relation to each other, said electrodes being adapted at said one end to be connected to a source of current for effecting a current flow therebetween when said electrodes are inserted in water, at least one of said electrodes being resiliently deflectable, the other end thereof having a free position with greater spacing between the other ends than between said one ends; and an insulative spacing-effecting member carried by both of and acting between said electrodes remotely from said one end, said member being selectively receivable by displacement into either of at least two relative positions with respect to said electrodes in which positions said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween, said member being operative to oppose movement of said other end of said one electrode away from said other electrode to hold said other ends thereof closer together than their spacing in said free position, said member having a further insulative spacing-insuring portion disposed in a plane lying both between and substantially parallel to the secured ends of the electrodes, and which spacer portion by its presence positively precludes engagement between said electrodes at said other end.

12. A vaporizer unit for a vaporizer, said unit comprising in combination: a casing having a portion defining a discharge chamber, said discharge chamber having a water vapor outlet, a generally vertically disposed elongated hollow casing extension secured to said casing beneath said discharge chamber and adjacent thereto, a pair of vertically directed elongated electrodes each disposed in said casing extension, conductive means supporting said electrodes at one end on said casing in electrically insulated spaced relation to each other, said means being adapted to be connected to a source of current for effecting a current flow between said electrodes when said electrodes are inserted in water, at least one of said electrodes being resiliently flexible and thereby movable at the other end toward and away from the other electrode, an insulative spacing member carried by both of and acting between said electrodes remotely from said one end, said

member being selectively receivable by displacement into either of at least two relative positions with respect to said electrodes in which positions said member effects positioning of said other end of said one electrode a selected distance from said other electrode to thereby alter the effective spacing therebetween, and an electrically insulative baffle clamped by said conductive means between and in direct engagement with said casing and said one end of said electrodes, said baffle being operative to substantially isolate said discharge chamber from the interior of said casing extension, and to define a path of communication therebetween at a point in the plane of said

5

10

baffle remote from any line extending from said outlet to the space between said electrodes.

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