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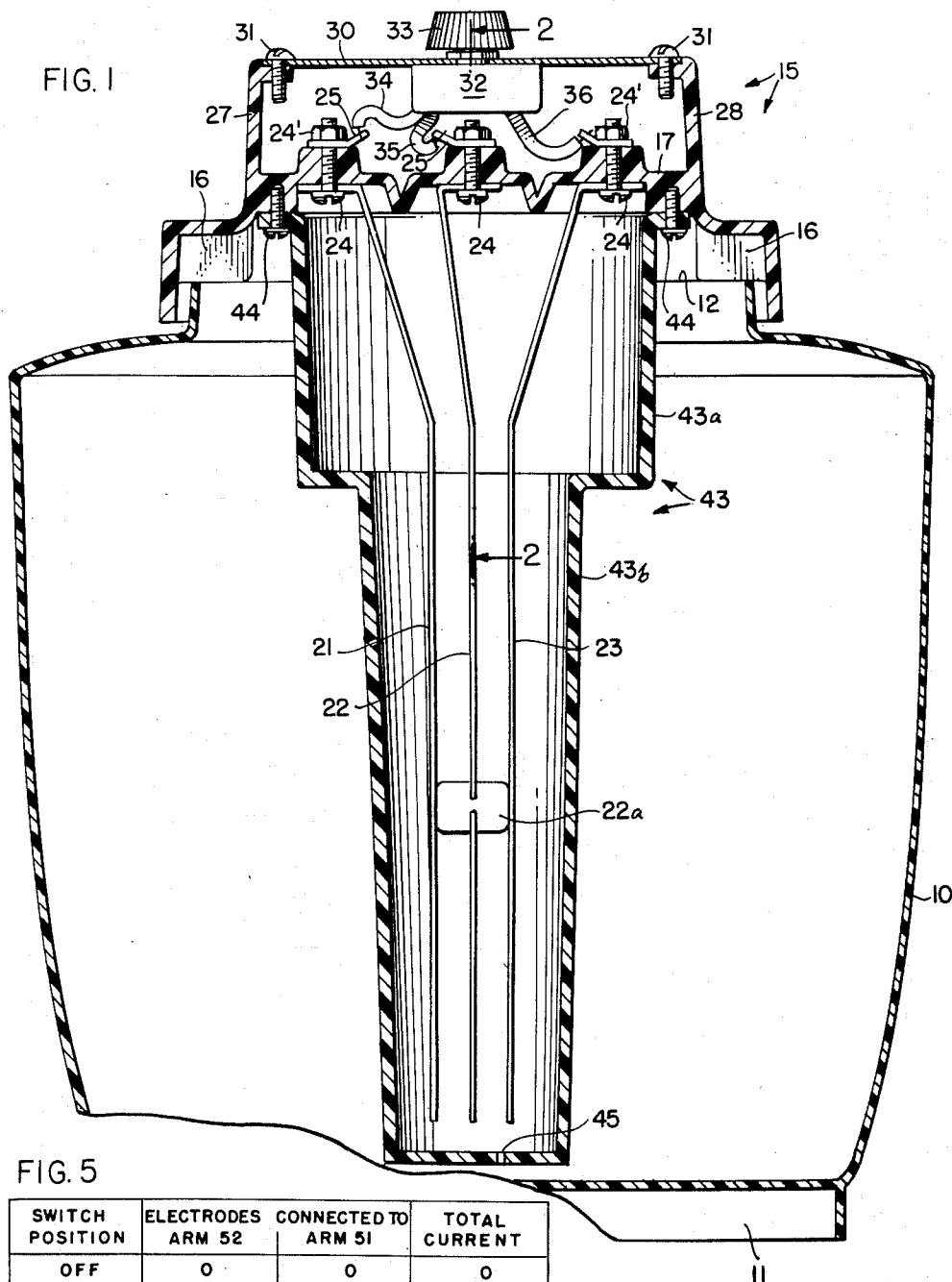
P. CONLIN ET AL

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VAPORIZER

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2 Sheets-Sheet 1



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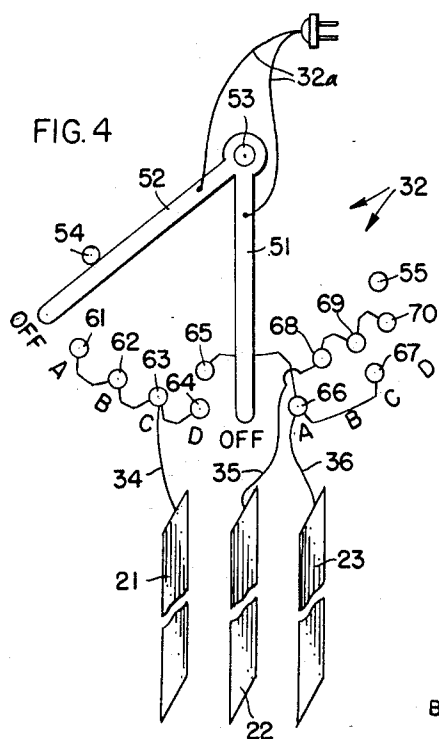
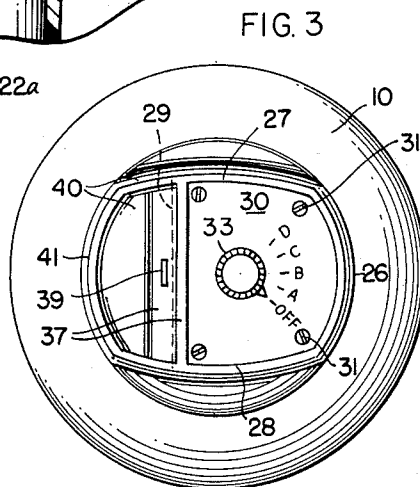
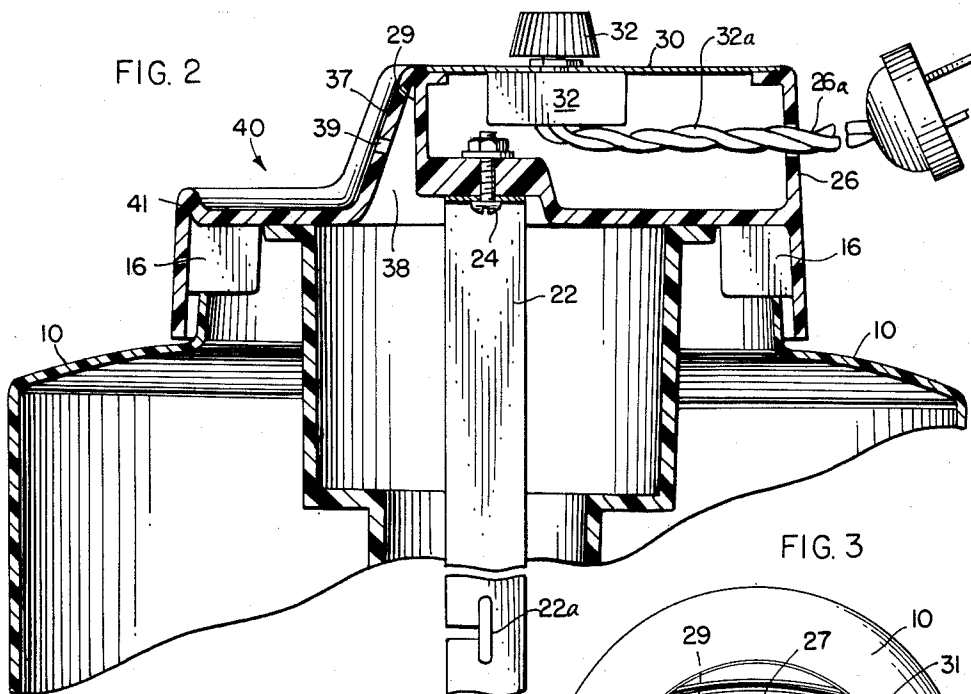
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3,020,385 VAPORIZER

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This invention relates to a vaporizer, and it is an object of the invention to provide improved apparatus of that character.

A vaporizer constructed in accordance with the preferred embodiment of the invention is particularly adapted to the vaporizing of water, medically treated water, or other liquids for inhalation by persons suffering from respiratory ailments, although it will be apparent that the invention has other applications. Vaporization of the liquid is accomplished through an electric current flowing between spaced apart electrodes immersed in the liquid.

In prior art apparatus of this character, resort has been made to various devices for effecting a substantial number of vaporization rates, among which are movable electrodes and means for regulating the electric voltage applied to the electrodes. The apparatus necessary to these types of control is relatively expensive. In some instances, it is short lived and/or difficult to regulate.

In accordance with the present invention, the electrodes are arranged in such a manner that as many as four rates of vaporization may be obtained from as few as three electrodes, even though full line voltage is applied to the selected electrodes in each instance, and the electrodes are in fixed relative positions. An important feature of the invention is that one of three electrodes is arranged between two other electrodes whereby the one electrode serves as a barrier to ion flow between the other two electrodes.

Accordingly, it is another object of the invention to provide an improved vaporizer having a novel arrangement of electrodes whereby selective energization of a small number of fixed electrodes may effect a substantial number of vaporization rates.

It is a further object of the invention to provide an improved vaporizer having at least three electrodes, one of which is arranged between two others and serves as a barrier to ion flow between the two other electrodes.

It is a still further object of the invention to provide an improved vaporizer having various of the characteristics referred to above while being sturdy in construction, efficient and reliable in operation, and economical to manufacture.

Further features of the invention pertain to the particular arrangement of the elements of the vaporizer, whereby the above outlined and additional features thereof are attained.

The invention, both as to its organization and method of operation, together with further objects and advantages thereof, will best be understood by reference to the following specification, taken in connection with the accompanying drawings, in which:

FIGURE 1 is an elevational, cross-sectional view of a vaporizer constructed in accordance with the present invention;

FIG. 2 is a partial, elevational, cross-sectional view taken in the direction of the arrows along the line 2—2 of FIG. 1;

FIG. 3 is a top plan view of the vaporizer of FIGS. 1 and 2;

FIG. 4 is a diagrammatic illustration of switch means incorporated in the vaporizer of FIGS. 1—3; and,

FIG. 5 is a chart of operating characteristics of one

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specific embodiment of the vaporizer illustrated in FIGS. 1—4.

The vaporizer illustrated in the drawings includes an outer receptacle 10 which may be of any desired form and capacity, and of any suitable material, preferably plastic. Preferably, the outer receptacle 10 has a suitable base 11 and an open throat 12.

A cap generally designated 15 is arranged to fit loosely over the throat 12 of the receptacle 10. The cap 15 is preferably provided with a plurality of fins 16 for engaging the throat 12 of the receptacle 10 such that air may be drawn freely into the receptacle as the liquid therein is depleted. If preferred, the cap 15 may be secured to the receptacle as by screw threads or a bayonet mounting, in which case it is desirable that a suitable opening be provided for admission of air. The cap is preferably of plastic material and of such form as to permit its molding as a single, integral body.

The cap 15 includes a central portion 17 to which are secured three substantially identical electrodes 21, 22 and 23 as by screws 24 and nuts 24', lugs 25 being arranged under the nuts 24' for facilitating electrical connection. All three electrodes are preferably formed of sheet stainless steel and are of substantial width, for example 5/8", as may be appreciated upon reference to FIGS. 1 and 2. The electrodes are preferably bent as illustrated in FIG. 1 to permit convenient securing of the upper ends thereof to the cap. A spacer 22a of insulating material such as plastic is preferably secured to the center electrode 22 in any convenient manner and extends perpendicularly therefrom to engage the outer electrodes 21 and 23 to assure at least a minimum spacing between adjacent electrodes.

The cap 15 includes a switch housing which encloses the space immediately above the upper ends of the electrodes 21, 22 and 23. This housing includes walls 26, 27, 28 and 29 (see FIGS. 1, 2 and 3) which may be integral with each other and with the previously described portions of the cap. A plate 30, preferably of metal, is secured to suitable flanges on these walls as by screws 31 to complete the switch housing.

A switch 32 is mounted on the plate 30 within the switch housing, a control knob 33 being arranged outside the housing. Leads 34, 35 and 36 connect the switch 32 to the electrodes 21, 22 and 23 respectively. Electrical energy is supplied to the switch 32, and hence to the electrodes 21, 22 and 23, through conventional leads 32a extending through an opening 26a in the wall 26 of the switch housing.

The wall 29 in conjunction with a sloping wall 37 and the walls 27 and 28 (see FIGS. 2 and 3) form a recess or passage 38 which opens to the interior of the receptacle. The wall 37 defines a slit 39 through which vapor may escape from the receptacle by way of the recess 38. Immediately in front of the wall 37 and the slit 39 is a dish 40 defined by a wall or lip 41 and the wall 37. This dish may, if desired, receive a medicant which may be slowly vaporized by the heated vapor emerging from the slit 39.

An inner housing 43 preferably surrounds the electrodes 21, 22 and 23 and is secured to the cap 15 by suitable screws 44. A small opening 45 in the bottom of the inner housing 43 permits the liquid within the outer receptacle 10 to enter the inner receptacle 43. By reference to FIG. 2, it will be seen that the recess 38, which leads to the slit 39, opens into the inner receptacle 43. It will be appreciated by those skilled in the art that heat generated by energization of selected ones of the electrodes 21, 22 and 23 will be confined substantially within the inner housing 43. Accordingly, only the relatively small amount of liquid within the inner housing 43 need

be brought to vaporizing temperature before vaporization is initiated.

The upper portion 43a of the inner housing 43 is of substantially greater diameter than the lower portion 43b, the smaller diameter of the lower portion prevailing over most of the vertical length of the housing. This avoids interference with the upper portions of the electrodes and permits a vapor passage (recess 38) alongside the switch housing while providing a small enclosed volume.

A suitable form of the switch 32 is illustrated diagrammatically in FIG. 4. This switch includes contact arms 51 and 52 which are insulated from each other and are rotatable about the same axis 53, the arms 51 and 52 being maintained in fixed angular relationship, all in a manner well known in the art. It will be seen that the vaporizer leads 32a make connection with these switch contact arms.

The arms 51 and 52 are movable in unison from the illustrated position designated Off to successive positions designated A, B, C and D. A stop pin 54 prevents movement of the contact arms clockwise beyond the Off position, and a stop pin 55 prevents movement of the contact arms counterclockwise beyond the position designated D.

As the contact arms sweep through the positions designated A, B, C and D they make contact with various fixed contacts. Contacts 61, 62, 63 and 64 are successively engaged by the contact arm 52 as it moves through the positions designated A, B, C and D and are electrically connected to the electrode 21 by the lead 34. When the contact arm 52 is in the position designated D, it also contacts a fixed contact 65. This contact, along with contacts 66 and 67 which are engageable by the contact arm 51 when the latter is in the positions designated A and C, are connected by the lead 36 to the electrode 23. Contacts 68, 69 and 70 are engageable by the movable contact arm 51 in the positions designated B, C and D, and are connected by the lead 35 to the electrode 22.

In accordance with one specific embodiment of the vaporizer illustrated in FIGS. 1-4, the operating characteristics tabulated in FIG. 5 are obtained, the liquid being water. The circuits corresponding to the various switch positions are described in detail below.

When the contact arms 51 and 52 are in the Off position no power is supplied to any of the electrodes. When the contact arms move to the positions designated A, voltage is applied across the fixed contacts 61 and 66 and hence across the electrodes 21 and 23. Under these conditions, the electrode 22, which is not energized, acts as a barrier to the flow of ions between the energized electrodes 21 and 23. The current is thereby substantially smaller than it would be if the intermediate electrode 22 were not present. The current obtained in the specific embodiment referred to above is 1 ampere, as tabulated in FIG. 5.

When the contact arms are moved to the positions designated B, voltage is applied across the electrodes 21 and 22 through the contacts 62 and 68. The current is then 2.5 amperes. When the switch is moved to the position designated C, the arm 52 connects to the electrode 21 through the contact 63, and the arm 51 connects to both of the other electrodes 22 and 23 through the contacts 67 and 69. The current flowing between the electrode 21 and the electrodes 22 and 23 is then 3 amperes.

Finally, when the switch is moved to the position designated D, the arm 52 connects to electrodes 21 and 23 through contacts 64 and 65 and the arm 51 connects to the electrode 22 through the contact 70. The current under these conditions is 5 amperes, twice that obtained with voltage applied across two adjacent electrodes as when the switch is in position B.

It will now be seen that the simple arrangement of three electrodes shown in the illustrated embodiment of the invention affords four different positive rates of vaporization. Of particular significance is the arrangement of

the electrode 22 in the path of ion flow between the electrodes 21 and 23. This substantially reduces the current, and hence the vaporization rate, when voltage is applied across the electrodes 21 and 23. Without intervention of the electrode 22, the current between the electrodes 21 and 23 would nearly equal that obtained when the voltage is applied across adjacent electrodes 21 and 22. The effect of intervention of the electrode 22 between the electrodes 21 and 23 is, of course, enhanced by the plate-like form of the electrode 22 with the principal faces thereof generally perpendicular to the normal line of ion flow between the outer electrodes.

Another feature of the invention concerns the electrode energization sequence wherein the polarity of one electrode is reversed, as by switching from position C to position D. Again because of the intervention of a central electrode between two outer electrodes, such reversal of polarity of one electrode results in a substantially different current flow and vaporization rate.

Accordingly, a vaporizer constructed in accordance with the present invention is capable of a substantial number of vaporization rates while employing a fixed voltage and a small number of fixed electrodes having substantially identical areas for immersion in the liquid to be vaporized. By virtue of these characteristics, the vaporizer is inherently sturdy and simple in construction, reliable in operation, and economical to manufacture.

While there has been described what is at present considered to be the preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended claims all such modifications as fall within the true spirit and scope of the invention.

The invention having thus been described, what is claimed and desired to be secured by Letters Patent is:

1. In a vaporizer, first, second and third substantially identical electrodes suspended in fixed, spaced apart relationship for immersion in a liquid to be vaporized, said second electrode being arranged between said first and third electrodes the area for liquid immersion of said second electrode being substantially identical to that of said first and of said third electrodes, and means including a selector switch for applying electric voltage to selected ones of said electrodes for effecting vaporization of said liquid at selected rates, said means being arranged to apply voltage only to said first and third electrodes, said second electrodes serving as a barrier to ion flow whereby vaporization is at a minimum rate, said means being arranged alternately to apply voltage only to said first and second electrodes to effect a greater vaporization rate, and said means being further arranged alternately to apply voltage between said second electrode and said first and third electrodes to effect a still greater vaporization rate.

2. In a vaporizer, first, second and third substantially identical electrodes suspended in fixed, spaced apart relationship for immersion in a liquid to be vaporized, said second electrode being arranged between said first and third electrodes, the area for liquid immersion of said second electrode being substantially identical to that of said first and of said third electrodes, and means including a selector switch for applying electric voltage to selected ones of said electrodes for effecting vaporization of said liquid at selected rates, said means being arranged to apply voltage only to said first and third electrodes, said second electrode serving as a barrier to ion flow whereby vaporization is at a minimum rate, said means being arranged alternately to apply voltage only to said first and second electrodes to effect a greater vaporization rate, said means being further arranged alternately to apply voltage between said first electrode and said second and third electrodes to effect a still greater vaporization rate, and said means being still further arranged alternately to apply voltage between said second

electrode and said first and third electrodes to effect a still greater vaporization rate.

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