

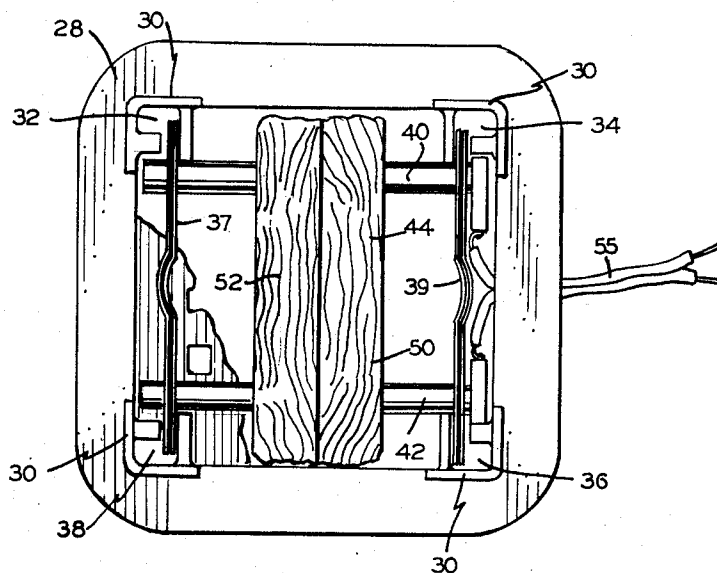
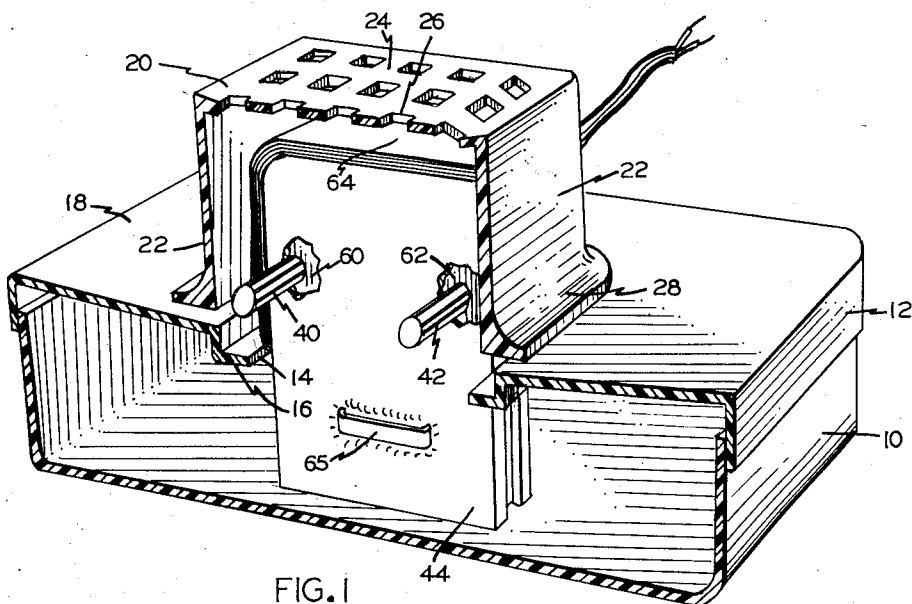
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F. G. REICK
ELECTRODE-WICK

2,899,532

Filed June 28, 1957

2 Sheets-Sheet 1



INVENTOR.
FRANKLIN G. REICK

BY

J. P. Keiper

ATTORNEY

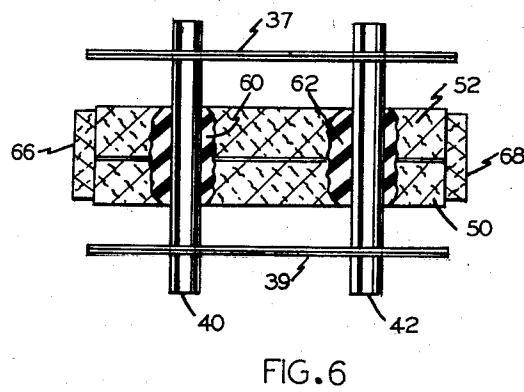
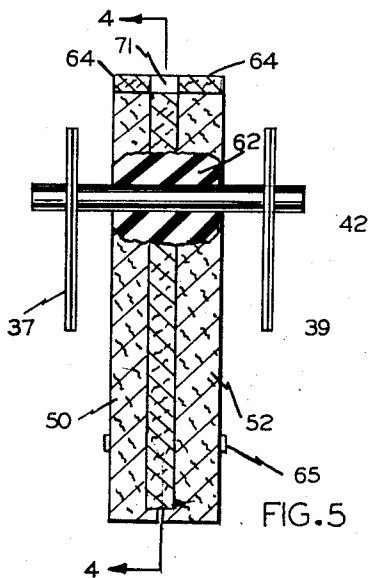
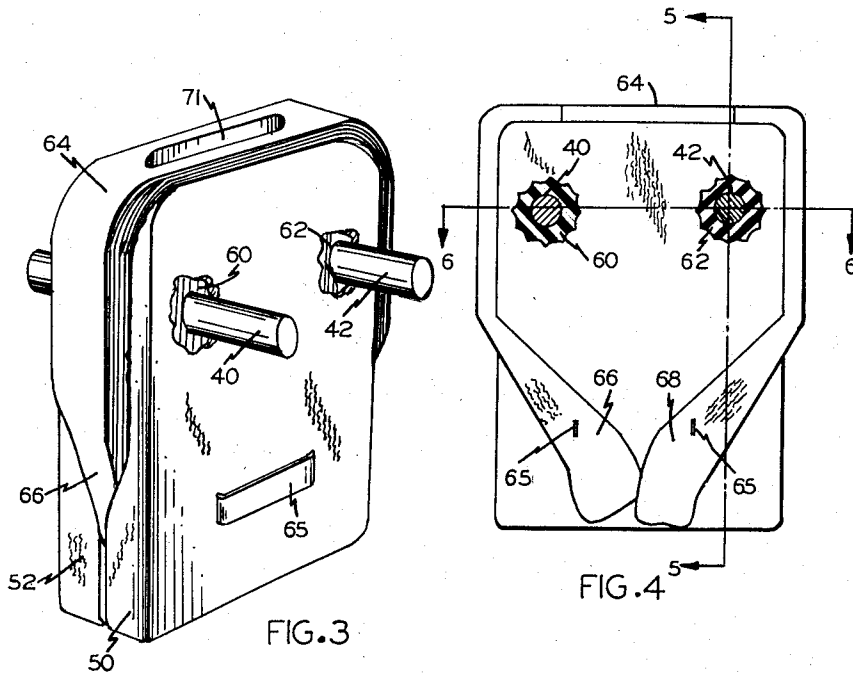
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INVENTOR.
FRANKLIN G. REICK

BY *J. P. Keiper*

ATTORNEY

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ELECTRODE-WICK

Franklin Gerald Reick, Jamesville, N.Y.

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9 Claims. (Cl. 219—40)

This invention relates to electric vaporizers, and more particularly to a vaporizer wherein resistance to direct conduction through the liquid is utilized to generate steam vapor.

Electric vaporizers have generally been provided with a resistance heating unit assembled with a reservoir adapted to hold a supply of liquid for vaporization, the heat being applied to the liquid indirectly, or by electrodes totally immersed in a reservoir where conduction is through a large volume of water. Such devices are generally not highly efficient since it is not possible to concentrate all of the heat on a small quantity of the water supply undergoing vaporization at any one time. In the operation of such devices the entire reserve supply of water becomes heated. Such devices do not efficiently convert electrical energy directly and substantially simultaneously into effective vaporizing heat, upon a small increment of the reservoir supply. Such devices show a lag in the initial production of vapor and should the reserve water supply become exhausted, the electrical consumption continues with those using resistance heaters, while the electrode type may leave the electrodes dangerously exposed.

The present invention is directed to a vaporizer wherein vaporization commences practically the instant electrical energy is supplied to the vaporizer. The invention is further directed to a vaporizer in which vaporizing is effected by the heating effect of electrical conduction directly through the liquid to be vaporized and in which vaporization by such conduction is effected at a point safely isolated from the main supply of reserve water. The invention is further directed to a vaporizer in which a fiber glass mat wick is employed and in which vaporization is effected within the fiber glass mat comprising the wick, at a point well above the water level of the water reserve and at a point sufficiently isolated therefrom for safety.

The invention is further directed to a vaporizer of the electrolytic type, wherein the electric resistance heating action on the liquid is effected wholly within a protective blanket of a fiber glass or other mineral fiber wick.

The invention is still further directed to a vaporizer of the electrolytic type, which is high in efficiency, practically instantaneous in its action, economical to manufacture, and safe for home use. The reservoir is always at room temperature. Further, the invention is directed to a vaporizer which consumes electrical energy so long as the supply of water for vaporization lasts, and in which the electrical energy consumed corresponds proportionately to the vapor produced, and in which the rate of consumption of energy at any instant corresponds proportionately to the heat of vaporization being generated at the instant. In addition, the life of the vaporizing element is limited only by the mineral content of the water. Salts precipitate in the wick and slowly diminish its effectiveness. The element is inexpensive and easily replaced, like a worn out light bulb.

The above and other novel features of the invention

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will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

Figure 1 is a perspective transverse sectional view of the vaporizer;

Figure 2 is a view from the underside of the removable wick holder;

Figure 3 is a perspective view of the wick assembly;

Figure 4 is a sectional view of the wick assembly taken on the line 4—4 of Figure 5;

Figure 5 is a sectional view of the wick assembly taken on the line 5—5 of Figure 4; and

Figure 6 is a sectional view of the wick assembly taken on the line 6—6 of Figure 4.

In Figures 1 and 2 there is shown a vaporizer in which there is provided a covered square bowl or reservoir formed of plastic or other material and comprising a bottom portion 10, and a cover 12, such cover having a central aperture 14, substantially rectangular or square in configuration, and bounded by a depressed offset flange 16. The deck 18 of the cover slopes inwardly and downwardly toward the center so that the bowl can be filled by pouring water on the deck at any point, without spillage.

The bowl is provided with a vaporizer head 20 comprising a square hat shaped plastic shell, the shell having side walls 22, a top 24 having a series of perforations 26 for the escape of vapor, a flange or flaring skirt 28, and corner feet 30 adapted to nest in and rest on the offset 16 of the cover 12 and provide fixed spacing between the deck 18 and flange 28 whereby the head acts as a "chimney." Cold, dry air is drawn in the bottom and helps to evaporate more water as it travels over the wick and out the top perforations, 26. Within the head are corner slots 32, 34 and 36 and 38, adapted to receive stiff thin plastic supporting sheets 37 and 39 of polyester mylar, through which extend the ends of a pair of spaced carbon terminals 40 and 42, each of such sheets having a pair of spaced apertures for the purpose.

The vaporizer comprises a wick 44 formed from glass fiber matting of needled rovings, the material being similar to that used for making reinforced plastic items, the glass mat being composed of a mass of glass fibers extending in three directions to form a spacial network of capillary bundles. Needled fibers extend through the mat at right angles to the random distribution of fibers in the plane of the mat. The mat thus contains interstitial voids through which steam may escape, and acts as a wick to lift the water to the vaporizing region. As shown in Figures 3, 4, 5 and 6, the vaporizer element comprises one or more rectangular layers of such fiber glass matting 50 and 52, through which extend the spaced carbon terminals 40 and 42. Such terminals pierce the mats, and extend from either side for a distance sufficient to form supports, the ends of the terminals extending through apertures in the stiff sheets 37 and 39 which latter are inserted in the pairs of opposed slots 32—38, in slightly buckled form to hold the parts in place.

The carbon rods are connected by metal clips to the ends of a twin conductor wire 55 adapted for connection to the usual alternating current house supply. Colloidal graphite is painted on the portion of the rods to provide good contact with the metal clips.

The region of the glass fiber mats through which the carbon terminals extend are provided with integral electrodes, which are produced by injecting a mixture of phenolic resin, talc (or similar inorganic fillers such as

diatomaceous silica, infusorial earth or short asbestos fibers) and calcined petroleum coke, the mixture being slightly diluted with alcohol and being sufficiently fine to permit the mixture to be injected into the mass of glass fibers adjacent each terminal, as by use of a standard hypodermic needle.

In practice, the mix may comprise one part, by weight, of 160 mesh talc with one part, by weight, of 200 mesh calcined petroleum coke. The foregoing mix is in turn mixed with 60%, by weight, of phenolic resin, and a trace of diethylene triamine as a catalyst. The mix is thoroughly mixed and diluted with alcohol and filtered.

A quantity of the mix is injected into the filter glass mats in the region adjacent each terminal so that the injected mix spreads through the fiber glass mat over a distance from $\frac{1}{8}$ " to $\frac{1}{4}$ " from the carbon rod terminal. The mix forms a plastic mass adapted to bind the glass fibers to the carbon rod. After injection of a like quantity into each of the regions adjacent each of the carbon rod terminals, the mats are heated to polymerize the resin to bind the mass. The polymerized assembly is then heated, in the absence of air to approximately 900° C., and then suddenly exposed to atmosphere, whereupon the incandescent mass is oxidized slightly as it cools to room temperature. The talc blankets the surface to protect the parts from burning up, by shielding them from oxygen.

Each of the quantities of mix injected into the mass of fibers are thus converted to form a highly conductive and porous carbon glob adjacent each carbon rod that is bonded to the respective rods, and to the glass fibers within a region radially not greater than $\frac{1}{8}$ " or $\frac{1}{4}$ " from each of the rods. The regions 60 and 62 thus prepared around each of the rods become the electrodes and are insulatingly spaced from each other, there being present intervening glass fibers having no carbon residue.

The assembly as thus completed is dipped in water in which a salt has been dissolved, preferably sodium sulphate (Glauber's salts), although sodium phosphate, sodium or lithium chloride or the like may be used. The assembly when mounted within the head is of sufficient length to depend into the reservoir almost to the bottom thereof. The assembly is suspended through the aperture 14, out of contact with the cover 12. Upon filling the reservoir with tap water, and energizing the carbon terminals, the electrodes embedded in the fibers conduct electrical energy to the electrolyte present in the mass of fibers, conduction being by ions from the disassociated sodium sulphate salts. The water is thus heated and converted to steam in the region between the electrode globules 60 and 62 practically instantaneously and with high efficiency.

A feeder wick 64 composed of random glass mono-filaments tightly packed, may be draped over the top of the mats of needled rovings, and have its ends 66 and 68 tucked in between adjacent mats below the terminals and electrodes, the purpose being to assist in wicking the water to the electrode containing mats. The top portion is spread apart as at 71 to provide a clear path for vapor to rise from the mats 50, 52. Such a wick of tightly packed mono-filaments should not be used in the region of electrolytic action or the path of current flow, since the lack of porosity as compared to the porosity of the needled rovings of mats 50—52, would result in steam pressure being generated within the bundle with the effect of exploding and destroying the bundle. The several layers of needled rovings 50 and 52 and the tucked in ends of the feeder wick 64, may be tied together by a loop of mylar or glass thread 65.

The vaporizer will be seen to effectively act upon water within the mat, which water is blanketed from the reservoir supply except for the wick feed. The salts are concentrated in the vaporizing assembly, and are concentrated therein by the electrolytic action. When the reservoir becomes empty, the wick dries up and the terminals

and their embedded electrodes become electrically isolated to cut off the flow of liquid. Substantially all the parts excepting the carbon rods and embedded electrodes are insulators, and the electrical conduction is carried on at a point sufficiently isolated from the reservoir supply so as to afford safety and protection from shock, when in operation or after operation ceases, due to exhausting of the water supply.

The element itself may be used as an electric humidistat for automatically measuring the moisture content of the air, by connection in an arm of an A.C. bridge circuit and measuring the change in conduction as ambient moisture varies. Water is adsorbed on or evaporated off the salt laden fibers as atmospheric conditions change giving a variable conduction that can be calibrated on a meter as percent relative humidity.

While a single embodiment of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. An electric water vaporizer comprising an inorganic fibrous wick, having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising a polymerized and subsequently carbonized mixture of phenolic resin, talc and calcined carbon coke bonded to said rods and the fibers of the wick, said electrode means for each of said rods being a porous globule and being electrically spaced from each other by an intervening portion of the fibrous wick.

2. An electric water vaporizer comprising an inorganic fibrous wick comprising a spacial network of fibrous capillary bundles extending in a multiplicity of directions, having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising a carbonaceous material in bonding relation to the respective terminals and adjacent fibrous material.

3. An electric water vaporizer comprising an inorganic fibrous wick, having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising a carbonaceous material in bonding relation to the respective terminals and adjacent fibrous material.

4. An electric water vaporizer comprising an inorganic fibrous wick, comprising a spacial network of fibrous capillary bundles disposed substantially on an x, y and z axes, said wick having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising a carbonaceous material in bonding relation to the respective terminals and adjacent fibrous material.

5. An electric water vaporizer comprising an inorganic fibrous wick comprising fibrous capillary bundles disposed in random spacial directions, having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising a polymerized and subsequently carbonized mixture of phenolic resin, talc and calcined carbon coke bonded to said rods and the fibers of the wick, said electrode means for each of said rods being a porous globule and being elec-

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trically spaced from each other by an intervening portion of the fibrous wick, and a feeder wick comprising relatively fine inorganic capillaries composed of tightly packed fibers arranged about said wick in spaced relation from said terminals and electrodes and out of the path of conduction between said electrodes.

6. An electric water vaporizer comprising an inorganic fibrous wick comprising fibrous capillary bundles disposed in random spacial directions, having spaced carbon terminal rods extending thereinto, electrode means for each of said rods and surrounding the respective rods and filling the interstices of the inorganic fibers adjacent said respective rods, said electrode means comprising carbonaceous material in bonding relation to the respective terminals adjacent fibrous material, and a feeder wick comprising relatively fine inorganic capillaries composed of tightly packed fibers arranged about said wick in spaced relation from said terminals and electrodes and out of the path of conduction between said electrodes.

7. An electric vaporizer comprising a reservoir for water to be vaporized, said reservoir having a cover, an aperture in the cover, a housing adapted to be mounted upon said cover, means for supporting said housing above said cover in spaced relation to provide an opening between the cover and housing for circulation, said housing having aperture means in top thereof, a fiber glass electrode-wick supported within said housing and depending through said aperture into said reservoir, said housing, acting as a chimney for the circulation of air from between the housing and reservoir, up through the housing in contact with said electrode-wick and out through the top aperture means and means for vaporizing water within said wick solely in the portion thereof in said housing.

8. An electrode-wick comprising an inorganic fibrous

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wick comprising a spacial network of fibrous capillary bundles extending in a multiplicity of directions, spaced electrode means within said wick, each electrode means comprising a carbon terminal and a carbonaceous glob bonded to said terminal and the adjacent fibers of said wick.

9. An electric vaporizer comprising a reservoir for water to be vaporized, said reservoir having a cover, an aperture in the cover, a housing adapted to be mounted upon said cover, means for supporting said housing above said cover in spaced relation to provide an opening between the cover and housing for circulation, said housing having aperture means in top thereof, a fiber glass electrode-wick supported within said housing and depending through said aperture into said reservoir, said housing, acting as a chimney for the circulation of air from between the housing and reservoir, up through the housing in contact with said electrode-wick and out through the top aperture means, and means for vaporizing water within said wick in the upper portion thereof above said reservoir.

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