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A. SCHRANER ET AL

2,490,547

METHOD OF AND APPARATUS FOR EVAPORATING LIQUIDS

Filed Feb. 26, 1948

2 Sheets-Sheet 1

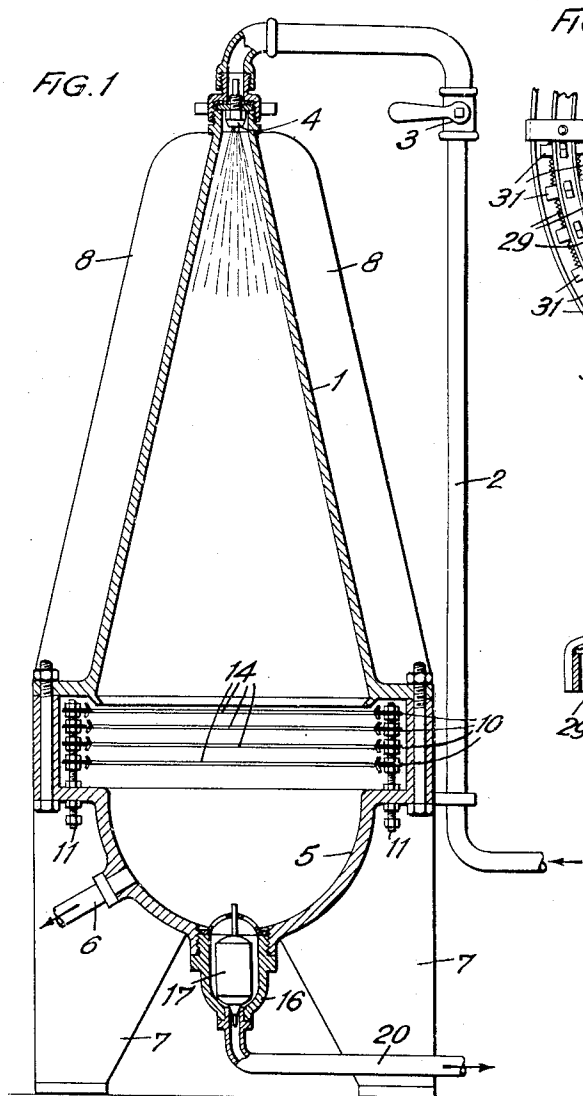


FIG. 5

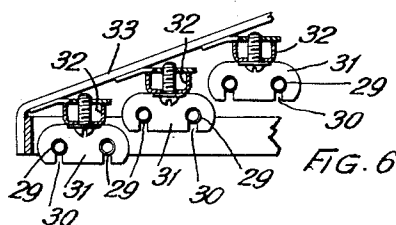
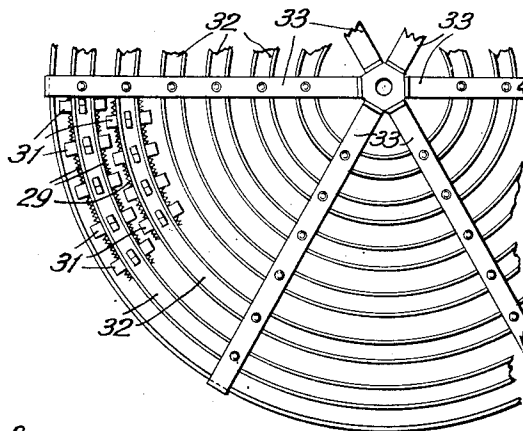


FIG. 6

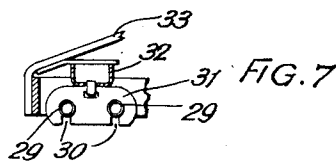


FIG. 7

FIG. 3

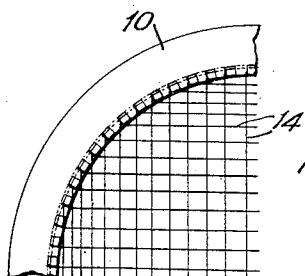
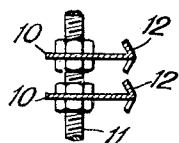


FIG. 2

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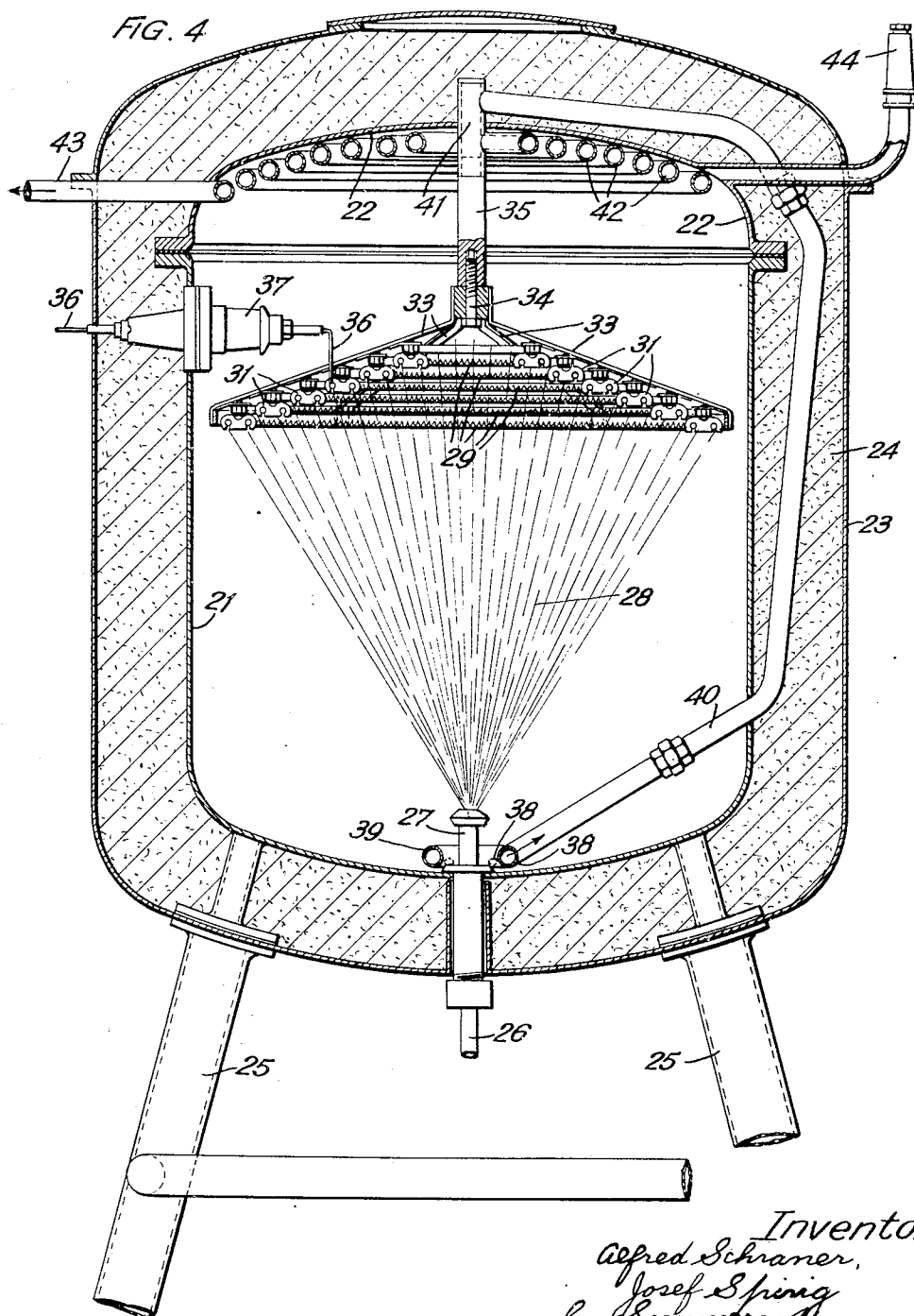
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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR
EVAPORATING LIQUIDS

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3 Claims. (Cl. 219—39)

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This invention relates to a method of evaporating liquids, in particular of water, and to an apparatus for carrying out such method.

It has been proposed before to squirt water in form of drops onto heated surfaces where it is evaporated.

The new method comprises conducting the atomized liquid over bare electrical metallic resistors which are heated to such temperature that they would melt, were they not constantly cooled by the atomized liquid. The evaporation may take place under a pressure higher than atmospheric pressure.

The apparatus for carrying out the method, suitably comprises a nozzle which atomizes the pressurized liquid and brings same, in such atomized state, into the range of electrical heating-resistors. The latter suitably are formed of metal wires disposed in a plurality of layers which may be series-connected in the direction of the flow so as to be covered, one after the other, by the atomized liquid, and, thereby, cooled. The wires of adjacent layers suitably are disposed obliquely to each other.

The metallic wires advantageously are disposed in individual replaceable elements which may be electrically connected in any suitable manner.

Two forms of invention, applying to an apparatus for carrying out the inventive method, are shown in the accompanying drawing, in which—

Fig. 1 shows a first form in vertical section,

Figs. 2 and 3 each a detail thereof, in plan view and cross section respectively,

Fig. 4 a cross-section through the second form,

Fig. 5 a portion of the metal-wire support in plan view, and

Figs. 6 and 7 show details of the wire attachment.

A water supply line 2 is connected to a conical bell 1, and includes a stop valve 3. The line 2 opens, via an atomizer nozzle 4, into the bell 1. A cup 5 is secured to the bottom of the latter, and a steam discharge line 6 is connected thereto. The cup 5 and bell 1 rest on legs 7. A plurality of cooling-fins 8 is provided on the circumference of bell 1. A plurality of enameled metallic rings 10 are disposed, stackwise, in the upper portion of cup 5. The rings 10 are secured, readily detachable and replaceable, on two studs 11 which at the same time serve as current leads. On the inner circumference of each ring 10, lugs 12 are bent off from the ring material, each second lug pointing upward, while the intermediate lugs are bent downward (Figs.

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2, 3). Bare, i. e. noninsulated heating-wires 14, wound meanderlike, are secured to the lugs 12 of each ring 10 in such way that wires situated directly below each other stand obliquely or vertically to each other. The arrangement also may be such that all the wires of a ring are disposed parallel to each other, but at right angles to those of the adjacent ring. Each ring, therefore, comprises two systems of wire 14. One end of each system is conductively connected to one stud 11, and the other to the other stud 11. The full voltage applied across the studs 11, therefore, is applied to each wire system, i. e. all the wire systems are electrically parallel-connected. The rings are isolated from the studs by virtue of the above-mentioned layer of enamel. A float-chamber 16 is disposed in the bottommost portion of cup 5, and its drain is controlled by a float 17.

The liquid atomized in the nozzle 4 is injected between the heating-wires, where it evaporates. The said wires are heated to such a degree that they would melt, were they not continuously cooled by the atomized liquid.

The steam produced escapes through the line 6. Any water of condensation is trapped in chamber 16, and will raise the float 17 after having reached a certain level, thereby permitting such water to flow off through the line 20.

Instead of squirting the water, in the manner described, onto heating-wires disposed in planes in front of the nozzle, the latter also may be entirely or partly enveloped by heating-wires, e. g. in such a way that the nozzle is disposed inside of spherical, cylindrical or conical wire fabrics. The design also could be such that the cylindrical jacket extends coaxially to the direction of the jet and envelopes part of the jet. In the second form of invention, shown in Figs. 4 to 7, a cylindrical vessel 21 is provided with a cover 22 and disposed inside of an outer vessel 23. A heat-insulating layer 24 is provided intermediate of the vessels 21 and 23. The said vessels 21, 23 are supported on legs 25. The liquid to be evaporated is supplied through a line 26 which terminates in an atomizer nozzle 27. The liquid, for example water, impinges in form of an upwardly directed conical jet 28 onto the resistor wires 29 which are heated, as mentioned before, substantially to melting temperature. The atomized liquid cools the said wires so that they will not melt, and thereby evaporates. The said wires 29, which suitably are helically adapted, are inserted into downwardly narrowing slots 30 of insulating plates 31 and secured therein. As may

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be seen from Fig. 5, the said wires form individual rings, and two rings each are supported on the same plate 31. The latter are secured to metallic rings 32 of U-shaped cross-section, and all the metallic rings are secured to the arms 33 of a spider support which is connected, by means of a screw 34, to a stud 35 which is centrally secured in the cover 22 and projects downward therefrom. The arms 33 are arranged on a downward slope so that the rings of resistor-wire 29 carried thereby are disposed pairwise on top of each other and decrease in diameter in an upward direction. All the resistor-wires 29 together form an umbrella-like structure, in that the said wires are disposed on conical surfaces. Current is supplied to the resistor wires through leads 36 which pass through the wall of vessel 21 by means of an insulating-bush 37. A plurality of leads 36 are provided.

The steam produced when the atomized liquid impinges on the red-hot resistor wires 29, is discharged through the apertures 38 of a tubular ring 39 and flows into the riser 40 communicating with the upper hollow portion 41 of stud 35. A coiled tube 42 is connected to the hollow portion 41, in which the steam is further heated by the radiating heat of the resistor wires. At 43, the steam is delivered to a place of consumption. 44 is a safety valve.

What we claim as new and desire to secure by Letters Patent is:

1. In a vapor generator, a closed jacketed and lagged cylindrical vessel, pipe and nozzle means for supplying vaporizable liquid from the outside and atomizing the same in conical form inside the vessel, a conical screen structure suspended axially in said vessel to present its base to the atomizing liquid cone and serving as a mount for electrically conductive and resistant bare wires,

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a source of electrical current and leads carried in bushings through the wall of the vessel to connect with the said wires for the purpose of heating the latter to generate steam from the atomized liquid, an apertured annular steam receiving pipe disposed at the bottom of the vessel, pipe means for discharging the steam from the said annular pipe upwardly into the range of said screen structure, and a superheater pipe coil arranged in dome shape at the ceiling of the vessel and connected at one end to said pipe means and at the other end to a pipe carried through the wall of the vessel for carrying away superheated steam.

2. A vapor generator comprising parts and portions set out in claim 1, in which the said wires are circularly mounted in plural tiers in said screen structure.

3. A vapor generator set out in claim 2, in which the said wires are disposed pairwise in each tier.

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