

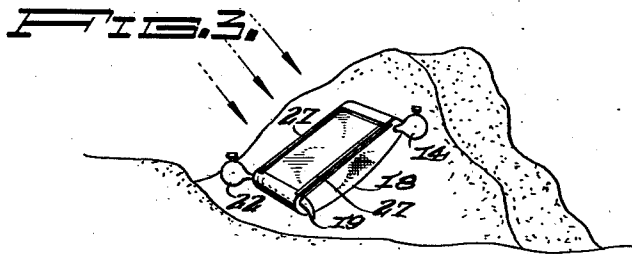
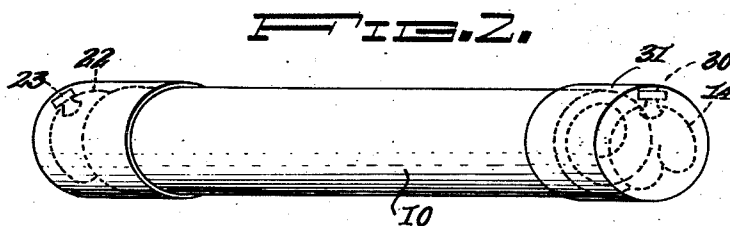
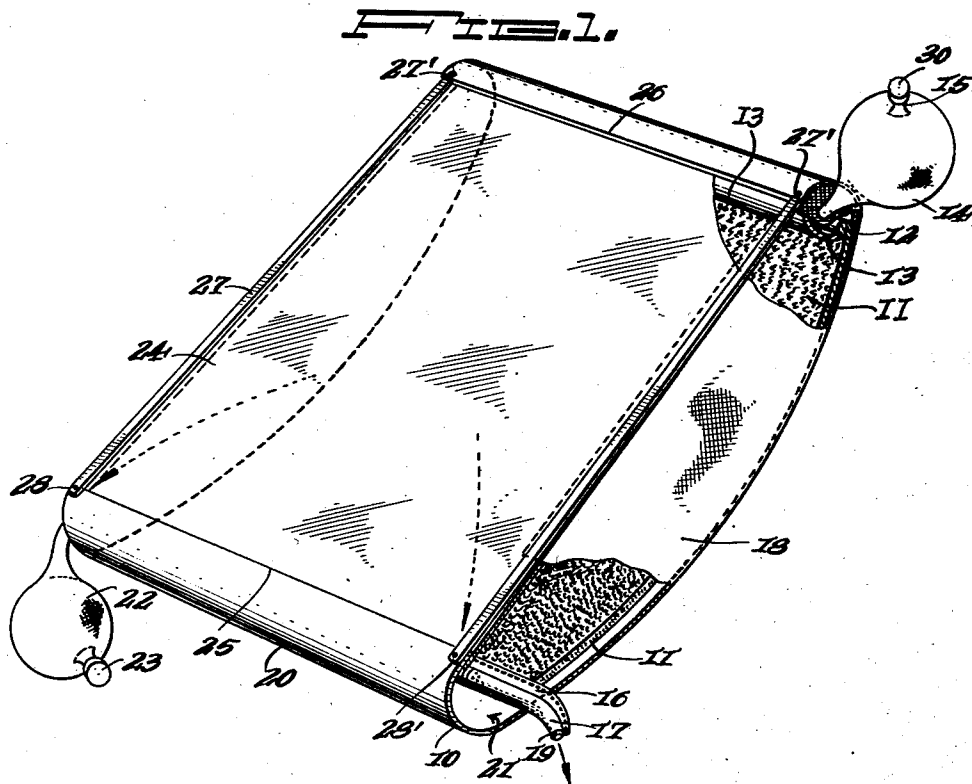
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COLLAPSIBLE DISTILLATION APPARATUS

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COLLAPSIBLE DISTILLATION APPARATUS

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6 Claims. (Cl. 202—234)

This invention relates in general to distillation and in particular to an apparatus for distilling liquids, in particular sea water, and to correlated improvements designed to render such an apparatus collapsible and portable.

The need of a simple and convenient method of distilling impure water, such as sea water, for the production of fresh water for drinking and the like has long been recognized, but this need becomes increasingly important during times of war when the destruction of ships and airplanes at sea forces the crews to take to lifeboats, rafts and floats. Accordingly, any apparatus for distilling sea water to produce fresh water for drinking on lifesaving craft must meet, inter alia, the following stringent requirements:

1. The device must have a relatively low weight per unit of capacity.
2. The device must be compact and occupy a small space when not in use.
3. The device must be resistant to corrosion by sun, air, water and the action of the salts contained in sea water.
4. The device should be easy to erect and simple to operate.
5. The apparatus should be capable of being fabricated without the use of critical or scarce war material.
6. The device should operate upon a source of cheap, plentiful fuel without the use of an open flame which would create a fire hazard.
7. The fresh water produced should be free of salts, of harmful bacteria and should be substantially odorless and tasteless.

Accordingly, it is the general object of the present invention to provide an apparatus for the distillation of liquids, in particular sea water, which will satisfy the objects above described and meet the specifications recited.

It is a further object of the invention to provide a simple means for distilling sea water which is adapted for use on small lifesaving craft.

It is a further object to provide an apparatus for distilling sea water which will be collapsible, compact and light in weight, so that it can be carried in airplanes and installed as regular equipment in small lifesaving craft.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

According to the present invention, there is provided an apparatus for distilling liquids, especially for distilling sea water for the production of fresh water, comprising, the combination of, a sheet of spring metal adapted to coil about itself, a layer of absorbent material united to

the inner surface of the metal sheet, means extending from the ends of the coiled sheet for saturating the layer with the liquid to be distilled, a window comprising a transparent flexible sheet attached at opposite ends to the ends of said coil sheet, and means for temporarily maintaining the coiled sheet of metal in an uncoiled position whereby the transparent sheet is disposed above and spaced from the absorbent material, and means to close the sides so as to increase an air space within said structure. In other words, the apparatus may be considered as a closed container formed of flexible sheet materials, the back wall of the container being formed of a sheet of metal which is adapted to coil upon itself.

For a more complete understanding of the nature and the objects of the invention, reference should be had to the accompanying drawing in which:

Fig. 1 is a side elevation, perspective view, partly in section, of one embodiment of the distillation apparatus of the invention;

Fig. 2 is a view of the apparatus of Fig. 1 in a coiled condition;

Fig. 3 is a view of the apparatus of Fig. 1 in position for use.

In that embodiment shown in Figs. 1, 2 and 3, the apparatus comprises a thin sheet 10 of spring metal adapted normally to coil upon itself to form a compact roll as shown in Fig. 2, there being attached to the inner surface of the sheet 10 a layer 11 of liquid absorbent material, the upper end 12 of such layer extending through and being secured in the longitudinal seam of a tubular member 13 which is attached to the upper end of the metal sheet as shown in Fig. 1. There is attached to this tube and communicating therewith a water tight reservoir 14 having an inlet 15 by which liquid may be supplied to the tube 13 and the absorbent layer 11. The liquid seeps from the tube 13 by capillary flow or wicking action so that the entire layer 11 is saturated with the liquid to be distilled. The tube 13 is conveniently formed of a waterproof flexible sheet material, such, for example, as a synthetic resin, rubber, a cellulose derivative or a textile fabric impregnated or coated with one of these substances. The lower end of the layer 11 extends into and is secured in the longitudinal seam 16 of a tubular member 17 which may be formed of the same waterproof material as the tube 13, one end of the tube 16 extending through the flexible side wall 18 to form a spout 19 by which excess liquid contained in the layer 11 is permitted to drain

away. The tube 16 is spaced a short distance from the lower arcuate end 20 of the coiled sheet 10 so as to provide a lower liquid reservoir in the space 21. At one side this reservoir communicates with a secondary liquid container 22 of waterproof material which is provided with an outlet 23. A sheet 24 of waterproof transparent flexible material is attached at its sides to the side sheets 18 and 18' and is attached at its upper and lower ends to the underside of the ends 25 and 26 of the metal sheet 10. To maintain the metal sheet in an uncoiled shape such as that shown in Fig. 1 whereby the transparent sheet is stretched taut and spaced from the absorbent layer 11, there is provided temporary supporting means comprising the bars 27 which are pivoted by means of the pins 28 to one end, for example, the lower end 25, of the sheet 10. The upper ends of the bars 27 terminate in pins 27' which fit into slots in the upper edge 26 of the sheet 10.

To operate the apparatus shown in Fig. 1 for distilling liquid, the sheet 10 is uncoiled and maintained in the uncoiled position shown in Fig. 1 by means of the bars 27. The liquid to be distilled is fed into the reservoir 14 through the inlet 15 from which it passes into the tube 13 and saturates the layer 11. By regulating the amount of air which seeps in through the inlet 15 by means of the screw cap 30, the flow of liquid from the tube 13 down the layer 11 may be regulated as desired. The apparatus is then positioned so that the transparent window is normal to the sun's rays as indicated in Fig. 3. Advantageously, the metal back may be supported upon the chest of a person or upon a sand dune whereby the metal back is heated. The liquid in the layer 11 may be vaporized and the vapor will condense on the inner surface of the transparent sheet 24 down which it will run and drain into the lower space 21, from which the distilled liquid may be run into the container 22 and drawn therefrom through the outlet 23. Any excess liquid in the layer 11 will drain into the tube 17 and run out through the spout 19.

When it is desired to compact the apparatus, the rods 24 are folded against the base as shown by the broken arrows and the sheet material is allowed to coil upon itself as shown in Fig. 2. The flexible containers 14 and 22 may then be collapsed against the end of the coiled device and protected from injury by means of the removable caps 31 which are slipped over the ends of the coiled device as shown in Fig. 2. These caps may be formed of any rigid material such as paper, pressed wood pulp, plastics, metal, stiffened fabric, and the like.

It will be apparent from the above detailed description that the apparatus comprises three main elements and several optional but desirable elements. The essential elements are (1) the transparent window, (2) the absorbent material, and (3) the shaping means, i. e. the means by which the article is given form and rigidity and proper disposition of the absorbent layer with respect to the window. Each of these elements will be described in detail hereinafter.

The transparent window

The sheet of transparent material shown in the apparatus of Fig. 1 should be a flexible but form-retaining sheet of any suitable transparent material, such, for example, as a cellulose ester, a cellulose ether, or a synthetic resin. Preferably, there is employed for this sheet material a transparent plastic which is permeable to visi-

ble and infra-red radiation such, for example, as cellulose acetate and cellulose aceto-butyrates. It is obvious that evaporation can take place from both the front and rear surfaces of the absorbent layer 11.

Since the transparent window divides the warm moist air of the interior from the cool dry air on the outside of the window, there will be normally a tendency of the window to become fogged by the condensation of droplets of water on the inner surface. Such droplets diffuse the light and decrease the radiation absorbed by the layer of absorbent material. Accordingly, it is desirable to retard or prevent fogging of the transparent window. This may be accomplished by forming the window of a transparent material combined on one or both sides with a layer of water-absorbent, that is hydrophilic material, which absorbs the condensed water and prevents it from remaining as individual droplets, as described in my co-pending U. S. applications Serial Nos. 500,882 filed September 2, 1943 and 501,219 filed September 4, 1943.

The absorbent layer

For the layer 11 of absorbent material, there may be employed a layer of a viscose sponge, a pile fabric, a layer of inter-felted fibres, such, for example, as textile felt or a soft, porous paper which has been sized with a water-insoluble substance such, for example, as casein, a resin or a cellulose ester which does not disintegrate when wet. Since the layer should be capable of being washed and wrung out, it is preferably formed of a material having a sufficient tensile strength for this purpose, that is, a textile fabric or felt, or sponge.

The absorbent layer is preferably colored black to render it more heat-absorbent and this may be done by dyeing or pigmenting the absorbent material with a suitable black dye or carbon black. To insure that the fresh water is free of harmful bacteria, the absorbent layer is advantageously rendered bacteriostatic or fungistatic and germicidal by combining it, e. g. by impregnation or coating, with a suitable water-insoluble germicide such, for example, as a phenyl mercury compound, finely divided ionized heavy metals, such as silver, copper or gold, or by means of an organic substantially water-insoluble germicide such, for example, as copper naphthenates, phenyl mercury chloride, phenyl mercury hydroxy quinoline, and dichlorodihydroxymethane.

The shaping means in the present apparatus comprises the collapsible sheet 10 and the rods 27. The sheet 10 may be made of any metal or alloy showing resistance to distortion so that it will have a normal tendency to remain coiled. Instead of metal, the sheet 10 may be formed of an organic plastic material, in particular materials such as polystyrene, cellulose acetate butyrate and vinylidene chloride polymers which can be given sufficient rigidity to form a collapsible sheet.

All other sheet materials used in the apparatus may be formed of any flexible non-porous sheet material such, for example, as an organic plastic, textile fabrics, felt or paper. Such fibrous materials should be stiffened and rendered waterproof by impregnating or coating them with a hydrophobic cellulose ester, cellulose ether, synthetic resin, rubber, and the like. In general, all such sheet materials should be water-impermeable.

Since most organic plastic materials contain residual volatile solvents or volatile plasticizers, they tend to undergo changes in dimension when subjected to such temperatures as are generated by the sun's rays. Therefore, in the now preferred embodiment, the sheet materials, before or after being incorporated in the device, are pre-heated to shrink them, as described in my co-pending U. S. applications Serial Nos. 500,882 filed September 2, 1943, and 501,219 filed September 4, 1943.

This application is a continuation-in-part of my co-pending application Serial No. 465,366 filed November 12, 1942.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an apparatus for distilling liquids, the combination of, a layer of absorbent material, means for saturating the layer with the liquid to be distilled, a closed container formed of flexible material in which the absorbent layer is disposed, a transparent window in the container, the back of said container being formed of a thin sheet of spring metal having a normal tendency to coil upon itself, means to temporarily maintain said coiled back in an uncoiled condition whereby the window is rendered taut and spaced from said absorbent layer and a reservoir communicating with said container for receiving liquid distilled off from said layer of absorbent material.

2. An apparatus according to claim 1 in which the lower end of the absorbent layer communi-

cates with a waterproof tube having one end extending through a wall of said container.

3. An apparatus according to claim 1 in which the upper end of said absorbent layer communicates with a waterproof tube, one end of which communicates with a liquid reservoir disposed outside of said container.

4. An apparatus according to claim 1 in which the base of the container is formed by the lower end of the metal sheet, said end forming a reservoir for the distilled liquid, one end of said reservoir communicating with a secondary reservoir located outside of said container.

5. An apparatus according to claim 1 in which the transparent window is formed of a sheet of hydrophobic plastic material having a layer of hydrophilic material on the inner surface thereof.

6. In an apparatus for distilling liquids the combination of a layer of absorbent material, means for supplying liquid to be distilled to said absorbent material, a closed container formed of flexible material in which said absorbent material is disposed, a transparent window in said container, a reservoir communicating with said container for receiving liquid distilled off from said layer of absorbent material, the back of said container being formed of spring metal capable of being coiled upon itself into a form for storage and capable of being uncoiled to a form in which it will hold said window extended, said spring metal normally tending to assume one of said forms; and means for holding said spring metal in the other of said forms.

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