

[54] COMBINATION SOLAR AND MANUAL DISTILLER AND RAIN CATCHER

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[51] Int. Cl. B01d 3/08

[58] Field of Search 202/234, 83, 236; 203/DIG. 1; 73/171

[56] References Cited

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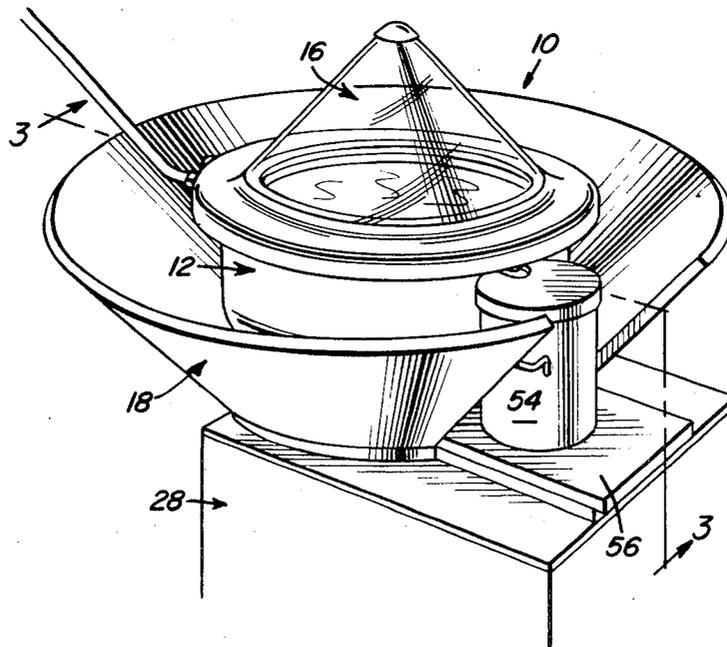
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[57] ABSTRACT

A distilling and rain catching apparatus has a base including a planar portion provided with a hole, and a wall extending from the planar portion. A fluid container is selectively arrangeable on the planar portion of the base so as to be over the hole in the planar portion and receive heat therethrough as desired. This container is also arranged partially surrounded by the wall in heat receiving relationship therewith. A conical cover is selectively arrangeable over an opening at the top of the container for forming a condensation surface, and is selectively arrangeable in the hole of the base to form a surface for guiding rain water into a vessel arranged beneath the base.

10 Claims, 16 Drawing Figures



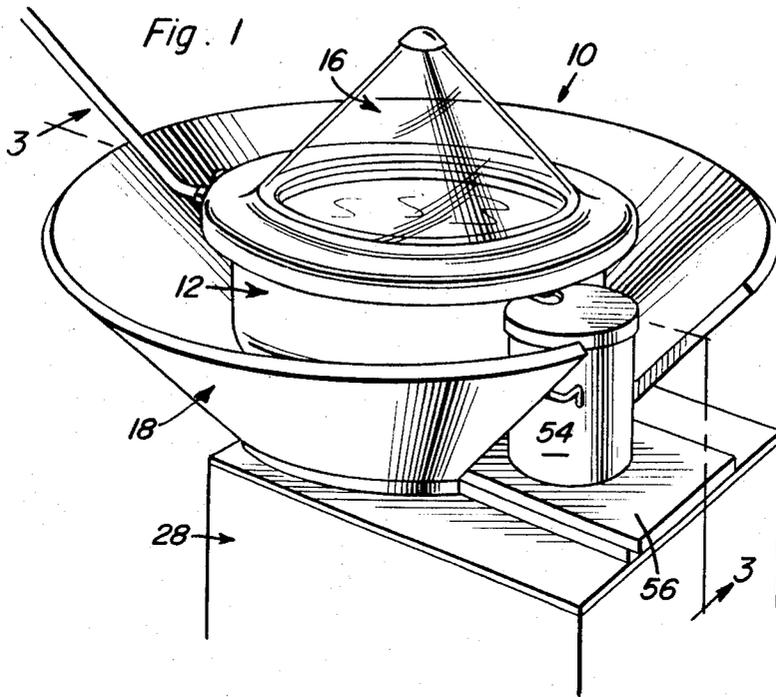


Fig. 2

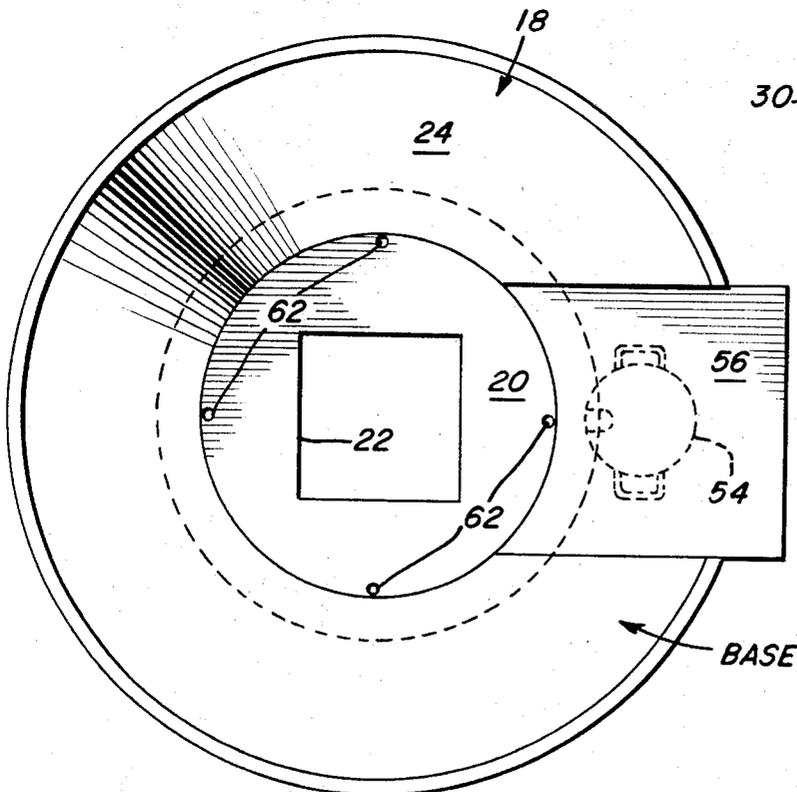
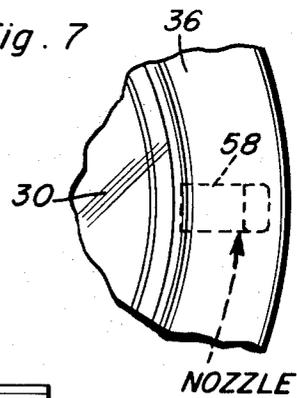
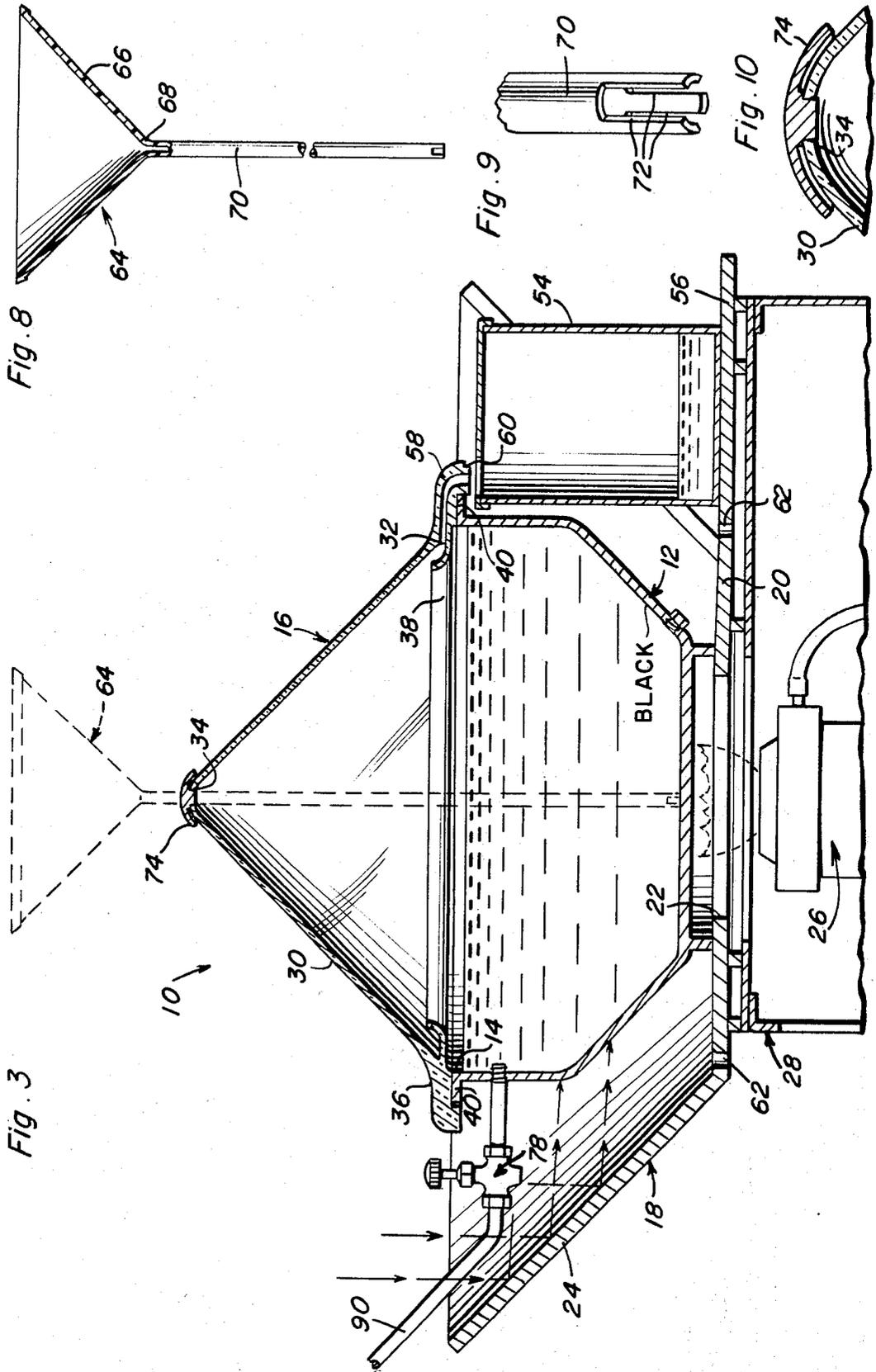
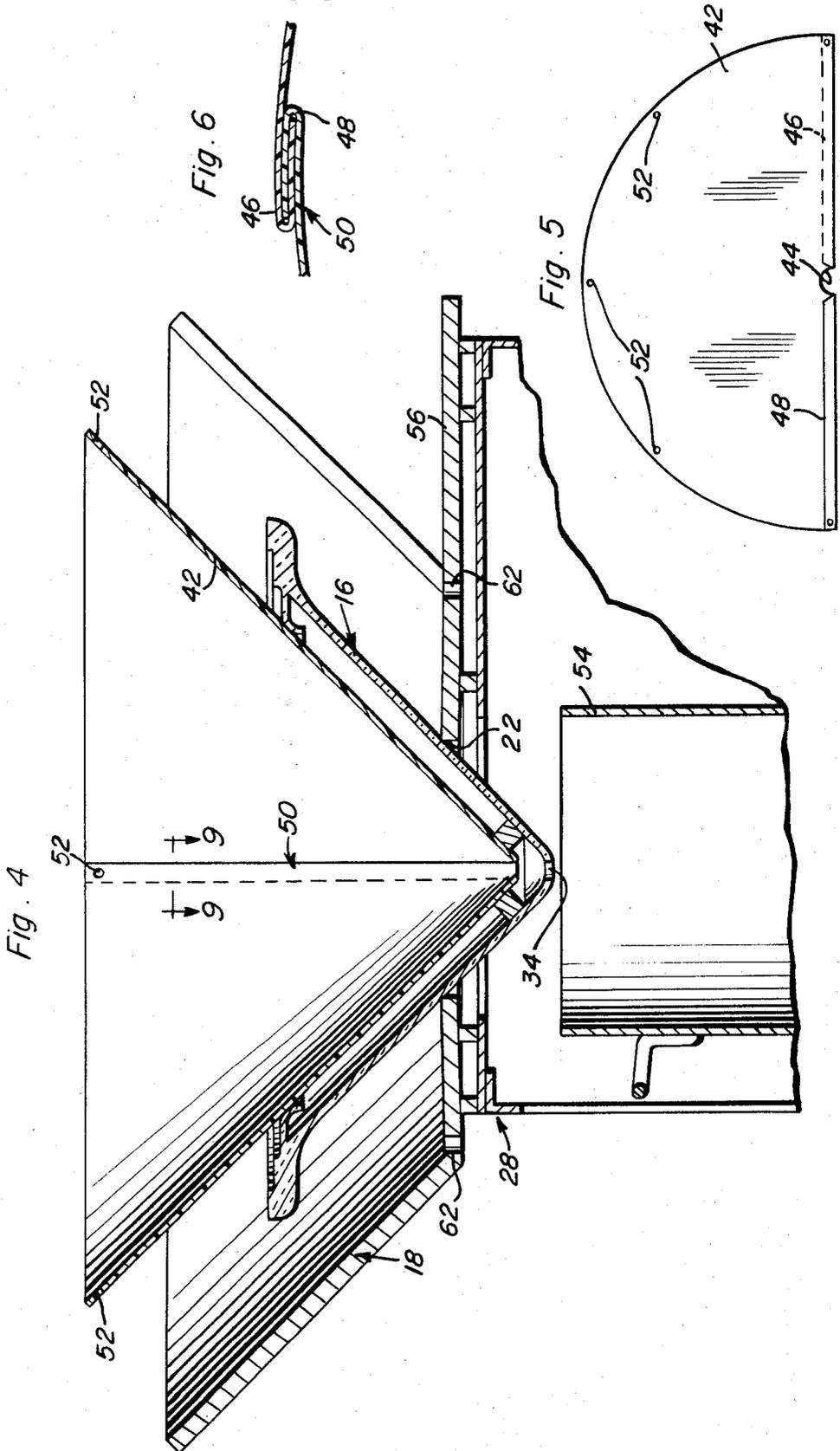
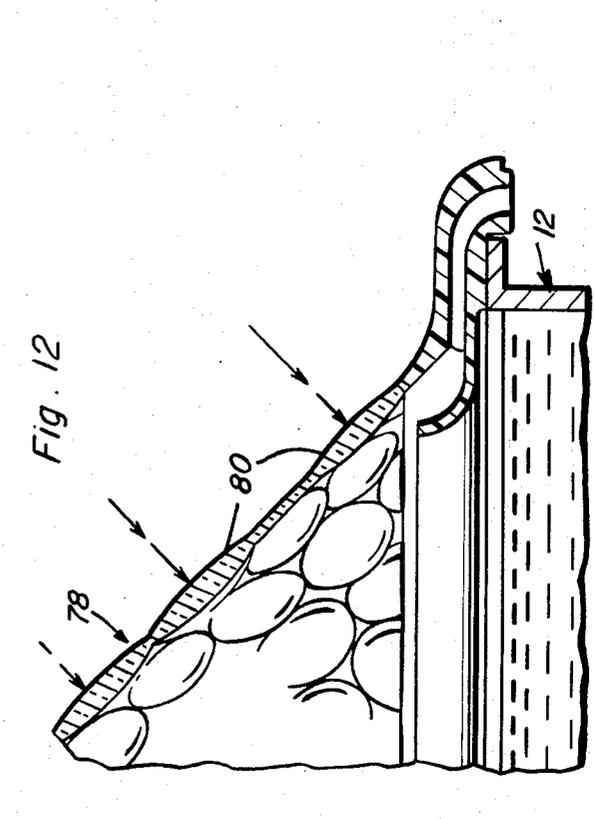
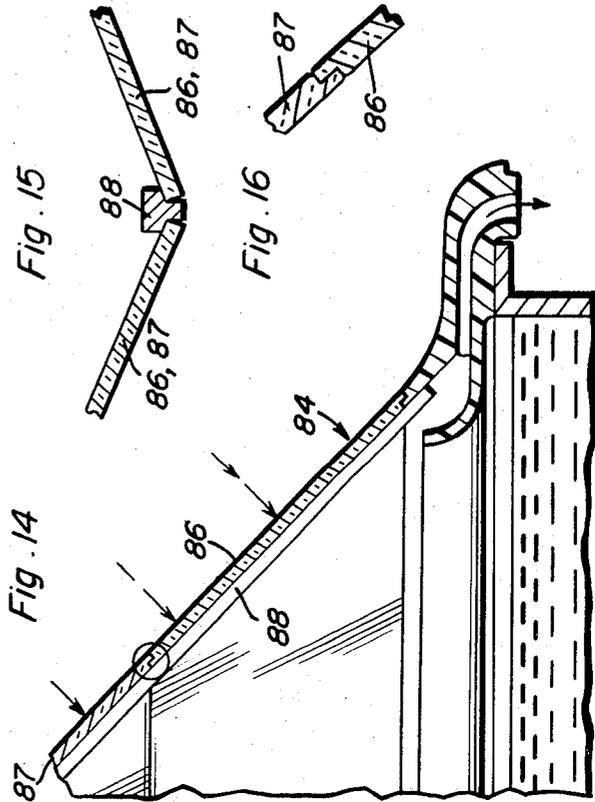
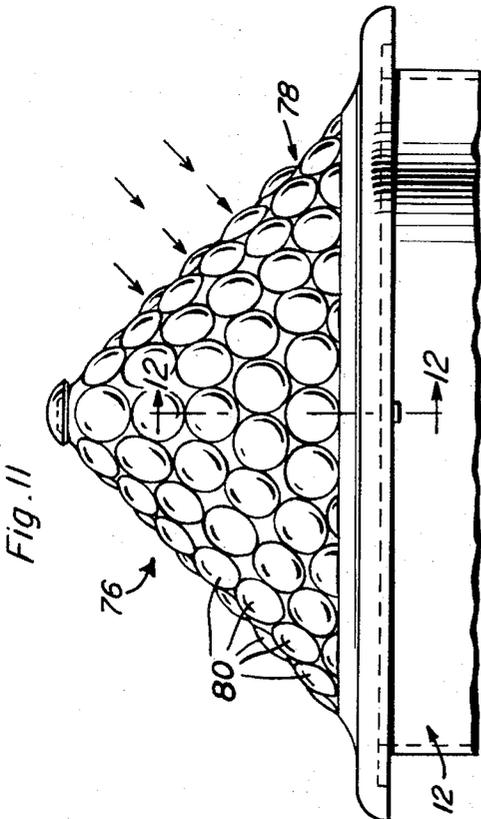
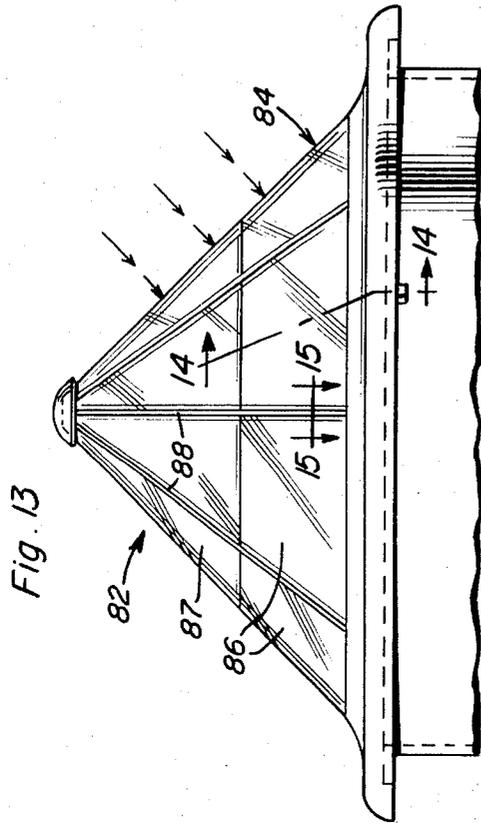


Fig. 7









COMBINATION SOLAR AND MANUAL DISTILLER AND RAIN CATCHER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to solar-humidification apparatus for converting salty or brackish water to fresh water, and particularly to distillation apparatus operating on either solar or other forms of energy and which can be converted to a rain catcher.

2. Description of the Prior Art

A well known technique for producing fresh water is the solar-humidification process which makes use of the evaporation of water from a free surface even when the temperature of the water is less than its boiling point. The rate of evaporation of water depends on: the temperature of the water; the pressure on the water surface; and the relative humidity in the space above the water surface. Apparatus constructed to carry out this conversion process is generally called a solar still. This apparatus uses the same principles that keep a greenhouse warm on winter days, and generally has a cover through which radiation from the sun may pass without giving up a significant amount of energy. This energy will raise the temperature of the water, thereby increasing the evaporation at the free surface of the water. The water vapors then rise away from the free surface until they contact the inner surface of the cover. Since this cover surface will be maintained at a lower temperature than the bottom of the water container, the water vapor will condense and run down the cover's inner surface into a trough arranged around the base of the cover. As some of the water vapor is condensed, the relative humidity of the space above the free surface of the water will decrease and the rate of evaporation will be increased accordingly.

Numerous devices have been proposed for carrying out solar-humidification processes. Some of these prior proposals, such as the solar still shown in U.S. Pat. No. 3,337,418, provide structure for catching rain in addition to water converted in the device. Further, the use of heat other than solar energy in a distillation apparatus is clearly shown in U.S. Pat. No. 1,419,008, while U.S. Pat. Nos. 3,351,536 and 3,390,056 show the use of lenses on the cover of a solar still in order to increase the intensity of the solar radiation.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a solar still which is simple of design, and efficient and trouble-free in operation.

It is another object of the present invention to provide apparatus which may be used either as a solar still, a still using other than solar energy, or a rain catcher.

These and other objects are achieved according to the present invention by providing apparatus having: a container provided with an opening, and a cover selectively arrangeable about the opening for forming a condensation surface. The cover may also be arranged in a hole provided in a base which usually supports the container for guiding a liquid into a vessel arranged beneath the base.

A preferred cover according to the present invention has a hollow cone with an open base, an open apex, and a rim arranged about the base. An arcuate collecting trough is arranged adjacent the base and within the

cone for receiving condensate which runs down the inner surface of the cone.

The container is advantageously constructed from a heat-absorbing material, and has at least its inner surface colored black. The opening is in the top of the container and extends over the entire side. A flange is arranged about the container opening for engaging with the rim of the cover when the cover is arranged with an inner surface of the cone forming the condensation surface; that is, when the base of the cone is arranged about the container opening. Condensate will run down the cover's inner surface under the influence of gravity and into the collecting trough.

A preferred base according to the present invention has a planar portion provided with a hole and a wall extending from the planar portion. The container is arrangeable on the planar portion over the hole and partially surrounded by the wall. The hole permits heat from any suitable source, such as a gas burner, to be applied to the bottom of the container.

When the cover is selectively arranged with its apex extending through the base hole, the inner surface of the cover forms a liquid guiding surface which will direct rain, and the like, into a vessel arranged beneath the base.

The rim of the cover is advantageously provided with a passage terminating in a lip and arranged for discharging condensate from the collecting trough. A vessel may be arranged on the base adjacent the terminal end of the passage for receiving condensate therefrom.

A funnel according to the present invention is designed specifically for feeding a fluid into the container. This funnel has a hollow cone provided with a vertex, a stem having spaced ends and connected at one end to the cone at its vertex, and slots formed in the other end of the stem for discharging a fluid when the other end is abutting a surface such as the bottom of the container. The stem is designed to pass through the apex of the cover, so that its other end may contact the bottom of the container.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary, perspective view showing a solar still according to the present invention.

FIG. 2 is a top plan view showing a base for a solar still according to the present invention.

FIG. 3 is a fragmentary sectional view, taken generally along the line 3—3 of FIG. 1.

FIG. 4 is a fragmentary, vertical sectional view, similar to FIG. 3 but showing apparatus according to the present invention in a rain catching mode.

FIG. 5 is a plan view showing an accessory for use with the present invention.

FIG. 6 is a fragmentary, sectional view showing the manner in which the accessory of FIG. 5 clips together to form a cone.

FIG. 7 is a fragmentary, plan view showing a detail of a cover according to the present invention.

FIG. 8 is an elevational view, partly broken away and in section, showing a funnel for use with a solar still according to the present invention.

FIG. 9 is a fragmentary, elevational view showing a detail of the funnel of FIG. 8.

FIG. 10 is a fragmentary, vertical sectional view showing a detail of a cover according to the present invention.

FIG. 11 is a fragmentary, elevational view showing a modified cover according to the present invention.

FIG. 12 is a fragmentary, sectional view showing a detail of FIG. 11 taken generally along the line 12—12.

FIG. 13 is a fragmentary, elevational view showing yet another embodiment of a cover according to the present invention.

FIG. 14 is a fragmentary, sectional view showing a detail of FIG. 13 taken generally along the line 14—14.

FIG. 15 is a fragmentary, sectional view showing a detail of FIG. 13 taken generally along the line 15—15.

FIG. 16 is a fragmentary, sectional view showing in detail the area circled in FIG. 14.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1 to 3 show a distilling and rain catching apparatus 10 according to the present invention in its distillation mode. This apparatus 10 has a container 12 provided with an opening 14 (FIG. 3), and a cover 16 selectively arrangeable about the opening for forming a condensation surface. Container 12 is arranged on a base 18 having a planar portion 20 provided with a hole 22, and a wall 24 extending from the planar portion. Container 12 is so arranged on planar portion 20 that it is over hole 22 and is partially surrounded by wall 24. The purpose of hole 22 is to permit heat to be applied to the bottom of container 12 as by a conventional burner 26. It is to be understood that any suitable heating apparatus may be substituted for burner 26. A suitable stand 28 supports base 18 so that burner 26 can be arranged beneath hole 22.

Cover 16 has a cone 30 (FIG. 3) constructed from a suitable, known transparent material, such as glass, and having an open base 32 and an open apex 34. A rim 36 is arranged about base 32, while an arcuate collecting trough 38 is arranged within cone 30 adjacent base 32. Container 12, which is advantageously constructed from a heat-absorbing material such as cast iron and has at least an inner surface, and preferably both inner and outer surfaces, colored black, has a flange 40 which extends around opening 14. The latter extends over the entire top side of container 12. Flange 40 is arranged to engage with rim 36 when cover 16 is arranged with an inner surface of its cone 30 forming the condensation surface. This is the arrangement as shown in FIGS. 1 and 3 of the drawings, and will cause condensate to run down the inner surface under the influence of gravity and into collecting trough 38.

Referring now to FIGS. 4 to 6 of the drawings, when cover 16 is selectively arranged with its apex 34 extending through hole 22 in base 18, the inner surface of cone 30 forms a fluid catcher. So as to assist cone 30 in catching and guiding a fluid, which is particularly a liquid such as water and especially rain water, a semi-circular sheet 42 constructed from a suitable synthetic material, such as polyethylene, is arranged to be formed into a cone which lines cone 30. This sheet 42 has a cutout 44 arranged midway along its straight edge, and crimped portions 46 and 48 extending from the cutout to each end of the straight edges. These crimped portions 46 and 48 combine to form a clip 50

(FIG. 6), which holds the sheet in the form of a cone. Holes 52 are provided along the curved surface of sheet 42 for anchoring sheet 42 in cone 30 during rough weather.

A vessel 54 (FIG. 3) is advantageously arranged on an extension 56 of planar portion 20 for receiving condensate from a passage 58 (FIG. 7) in rim 36. This passage 58 terminates in a lip 60 arranged for discharging condensate from trough 38 in a consistent manner. As can be noted from FIGS. 3 and 4 of the drawings, base portion 20 slopes downwardly from opening 22 to a plurality of weep holes 62 which will drain moisture that condenses on the outer surface of container 12 and cover 16.

FIGS. 8 and 9 of the drawings show a funnel 64 according to the present invention specifically designed for feeding a fluid into container 12. This funnel 64 is formed from a hollow cone 66 having a vertex 68, a stem 70 having spaced ends and connected at one end to cone 66 at its vertex 68, and a plurality of slots 72, three being shown, formed in the other end of stem 70 for discharging a fluid when the other end is abutting the bottom of container 12 as is shown in FIG. 3 of the drawings. Stem 70 is arranged passing through apex 34 of cone 30.

FIG. 10 of the drawings shows a plug 74 which blocks apex 34 of cone 30 when stem 70 of funnel 64 is not arranged blocking same.

Referring now to FIGS. 11 and 12 of the drawings, a modified cover 76 is shown which has a cone 78 advantageously constructed from a transparent material such as glass with a plurality of lenses 80 formed over its surface. These lenses 80 will focus light energy received from, for example, the sun, and intensify its heating effect on the water in container 12.

FIGS. 13 to 16 show another embodiment of a cover according to the present invention. This cover 82 has a cone 84 constructed from a plurality of pieces or panes 86 and 87 of a transparent material, which again may be glass. It is to be understood that a transparent synthetic material such as plexiglass may be substituted for glass in all forms of covers according to the present invention. A plurality of ribs 88 are extended between panes 86 and 87 from the apex to the base of cone 84. FIGS. 15 and 16 show details of how panes 86 and 87 are placed in engagement with ribs 88 and with one another.

Referring again to FIG. 3 of the drawings, an advantageous feature of the present invention has a line 90 which may extend to a suitable, known source (not shown) of, for example, water, for selectively supplying container 12 as an alternative to using funnel 64. A conventional valve 92 is arranged in line 90 to control the quantity and flow fed into the container.

An apparatus 10 according to the present invention can be used to distill, for example, domestic water for home use, or to convert salt water and even polluted water to potable or fresh water. Further, apparatus according to the present invention may be used to catch and collect rain. It may be readily understood from the above description and the drawings that an apparatus 10 will perform these functions in a versatile, efficient, and convenient manner.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention

to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. Apparatus, comprising, in combination:

- a. a container provided with a fluid receiving and discharging opening;
- b. a base member having a planar portion provided with a hole, and a frusto-conical wall diverging from the planar portion and arranged partially around same; and
- c. a cover including a hollow cone having an open base and an open apex, the container being arrangeable on the base member over the hole provided therein, and the open base of the cover being arrangeable on the container about the opening of same for the cover forming a condensation surface over the container opening, the base member, cover, and container cooperating to form a still, and the apex of the cover arrangeable for fitting in the hole in the base member and forming a fluid tatcher in cooperation with the base member.

2. A structure as defined in claim 1, wherein the cover is provided with a rim arranged about the base of the cover and an arcuate collecting trough arranged within the cone adjacent the open base thereof.

3. An apparatus as defined in claim 2, wherein the container is constructed from a heat-absorbing material and has at least an inner surface, colored black, and the container opening extends over an entire side of the container, a flange is arranged about the opening for engaging with the cover rim when the cover is arranged with an inner surface of the cone forming the condensation surface, the condensate running down the inner surface under the influence of gravity and into the col-

lecting trough.

4. A structure as defined in claim 3, wherein the cover rim is provided with a passage terminating in a lip and arranged for discharging condensate from the collecting trough, and further including a vessel arrangeable on the base member for receiving condensate from the passage.

5. A structure as defined in claim 1, further including a funnel for feeding a fluid into the container, and this funnel including a hollow cone having a vertex, a stem having a pair of ends and connected at one end to the cone at the vertex, and slots formed in the other end of the stem for discharging a fluid when the other end is abutting the bottom of the container, the stem arranged for passing through the apex of the cover cone.

6. A structure as defined in claim 1, further including a vessel arrangeable on the base member for receiving condensate from the cover.

7. A structure as defined in claim 6, wherein the cover is constructed from a transparent material.

8. A structure as defined in claim 6, wherein the cover is constructed from a transparent material forming a plurality of lenses.

9. A structure as defined in claim 6, wherein the cover is constructed from a plurality of pieces of a transparent material.

10. A structure as defined in claim 4, further including a funnel for feeding a fluid into the container, and this funnel including a hollow cone having a vertex, a stem having a pair of ends and connected at one end to the cone at the vertex, and slots formed in the other end of the stem for discharging a fluid when the other end is abutting the bottom of the container, the stem arranged for passing through the apex of the cover cone.

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