

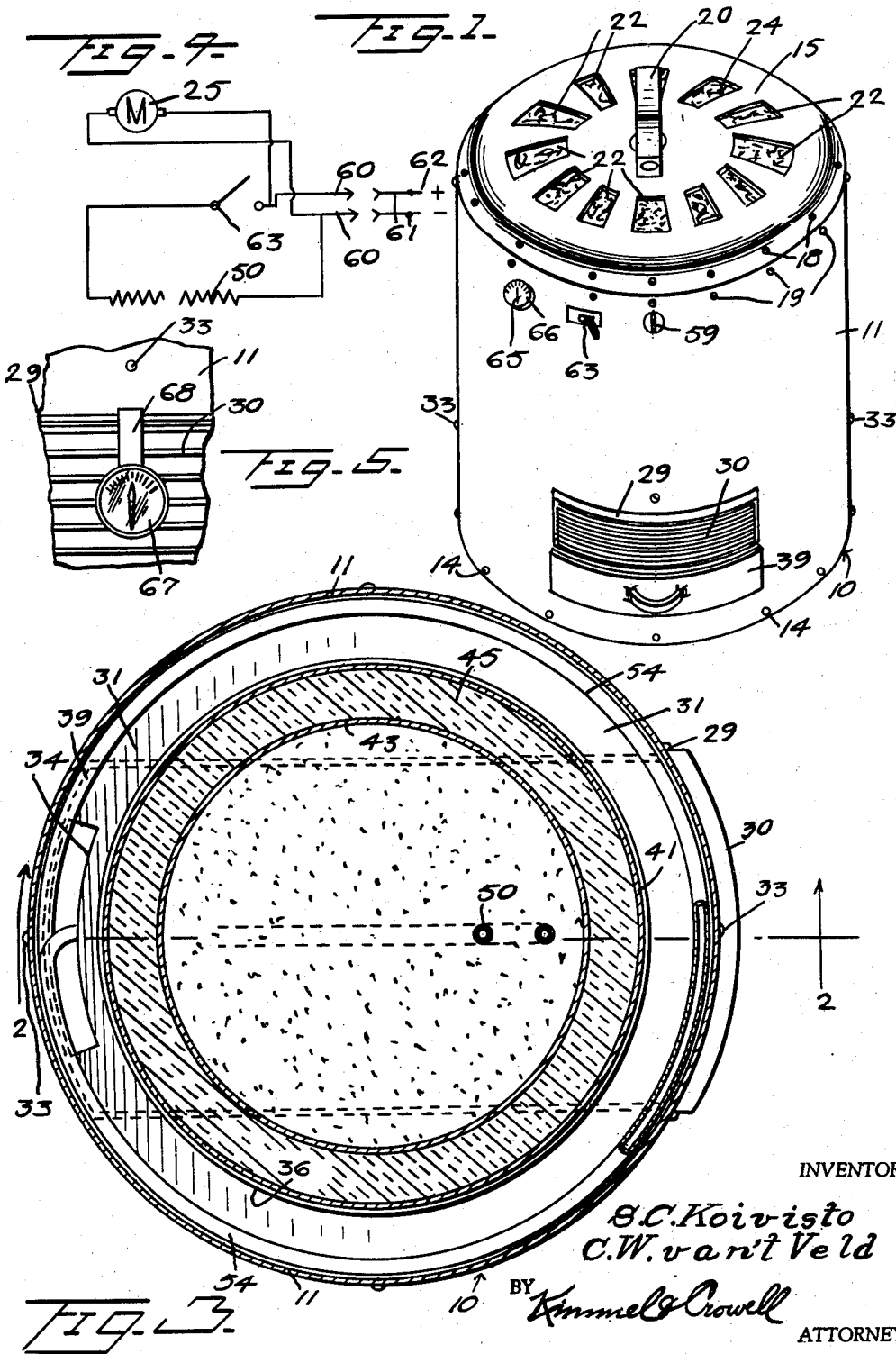
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S. C. KOIVISTO ET AL
PORTABLE REFRIGERATION UNIT

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2 Sheets-Sheet 1



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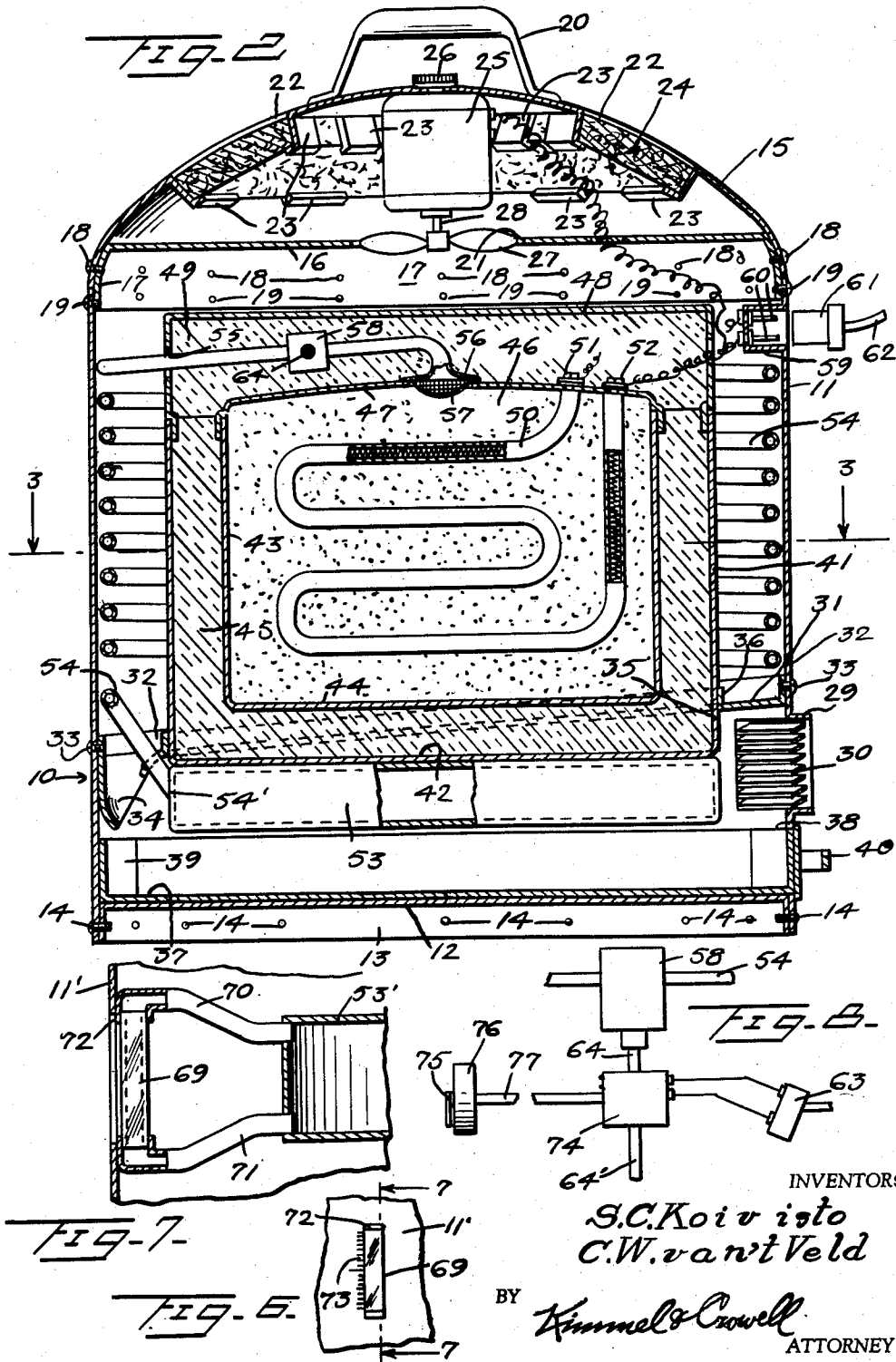
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PORTABLE REFRIGERATION UNIT

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The present invention relates to portable refrigeration units, and more particularly to refrigeration units having a cooling storage capacity.

The primary object of the invention is to provide a cooling unit which can be electrically energized and which will cool for long periods after being disconnected from the source of electric energy.

Another object of the invention is to provide a portable refrigeration unit which is portable due to small size and lightness and which can be readily moved from point of energization to point of use.

A further object of the invention is to provide a portable refrigeration unit of the class described above which is inexpensive to manufacture, efficient in use, and which will provide a maximum amount of cooling for its relative size and weight.

Other objects and advantages will become apparent in the following specification when considered in the light of the attached drawings, in which:

Figure 1 is a perspective view of the invention.

Figure 2 is a vertical medial cross-section taken along the line 2-2 of Figure 3, looking in the direction of the arrows.

Figure 3 is a horizontal cross-section taken along the line 3-3 of Figure 2, looking in the direction of the arrows.

Figure 4 is a wiring diagram illustrating one of the electric circuits used with the invention.

Figure 5 is a fragmentary front elevation of a thermometer forming a modification of the basic invention.

Figure 6 is a fragmentary front elevation of a modification of the invention illustrating a sight gage.

Figure 7 is an enlarged fragmentary vertical cross-section taken along the line 7-7 of Figure 6, looking in the direction of the arrows.

Figure 8 is a semi-diagrammatic view of the control valve, manual switch, and time switches, utilized in a modification of the basic invention.

Referring now to the drawings in detail wherein like reference characters indicate like parts throughout the several figures, the reference numeral 10 indicates generally a portable refrigeration unit constructed in accordance with the invention.

The refrigeration unit 10 includes a cylindrical housing 11 having a bottom wall 12 extending transversely across the lower end thereof. The bottom wall 12 is provided with a depending annular flange 13 attached to the housing 11 by detachable securing elements 14.

A dome-shaped cover 15 rests on the top edge of the housing 11 and is provided with a flat transverse wall 16 having a depending annular flange 17 formed thereon. Detachable securing elements 18 secure the depending flange 17 to the lower edge of the dome-shaped cover 15 with the annular flange 17 projecting below the lower

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edge of the dome-shaped cover 15 engaging within the upper edge of the housing 11. Detachable securing elements 19 secure the upper edge of the housing 11 to the annular flange 17. A handle 20 is mounted centrally of the top of the dome-shaped cover 15 for moving the unit 10 from place to place.

The transverse horizontal wall 16 is provided with a central opening 21 and the dome-shaped cover 15 is provided with a plurality of openings 22 so that air might pass through the dome-shaped cover 15, the wall 16, into the housing 11. A plurality of depending ears 23 are integrally formed with the dome-shaped cover 15 and are positioned adjacent the openings 22 to support an annular air filter ring 24 arranged under the openings 22 so that air passing therethrough will pass through the air filter 24.

An electric motor 25 is secured centrally of the dome-shaped cover 15 by a securing member 26, and is provided at its lower end with a propeller blade 27 mounted on the shaft 28 of the motor 25. The propeller blade 27 is positioned within the opening 21 in the transverse wall 16 and when operating will pump air through the opening 22, the filter 24, and the opening 21, into the housing 11.

The housing 11 adjacent the lower end thereof is provided with an opening 29 having a louver baffle 30 positioned therein, as best shown in Figures 1 and 2. The louver baffle 30 may be of any conventional design, either adjustable or non-adjustable so that air passing outwardly therethrough may be directed as desired.

A sloping transverse wall 31 is provided with an annular flange 32 around the peripheral edge thereof and the annular flange 32 is secured to the housing 11 by detachable securing elements 33, as best seen in Figure 2. The transverse wall 31 is provided with a depending spout 34 adjacent its lowest end, for reasons to be assigned. The wall 31 is provided with a central circular opening 35 having an inner upstanding annular flange 36 integrally formed therearound.

A drawer 37 rests on the bottom 12 and extends outwardly through an opening 38 in the housing 11 below the opening 29 therein. The drawer 37 is provided with an inner arcuate end portion 39 for engagement under the spout 34 to collect water passing therethrough. The drawer 37 is provided with a handle 40 so that it may be easily removed from the housing 11 to dump any water collected therein.

A cylindrical vessel 41 extends through the opening 35 in the transverse wall 31 and is secured to the annular flange 36 by welding or any other suitable means. The cylindrical vessel 41 has a bottom wall 42 spaced substantially above the bottom wall 12 of the housing 11. A second cylindrical vessel 43 is arranged in spaced concentric relation within the cylindrical vessel 41 and has a bottom wall 44 spaced above the bottom wall 42.

Insulation material 45 completely fills the space between the cylindrical vessel 41 and the cylindrical vessel 43, for reasons to be assigned. An absorbent material 46, such as charcoal, silica gel, or any other suitable medium, completely fills the cylindrical vessel 43 which is closed by a top wall 47 sealed to the vessel 43.

A cover 48 extends upwardly from the cylindrical vessel 41 and is arranged in spaced relation to the cover 47 of the vessel 43. Insulating material 49 completely fills the space between the covers 47 and 48, as best seen in Figure 2. An electric heating coil 50 of the calrod type is arranged within the absorbent material 46 with its terminals 51 and 52 projecting outwardly of the vessel

43 through the cover 47. A sealed tank 53 is secured to the bottom wall 42 of the cylindrical vessel 41 and is positioned therebelow in vertically spaced relation to the drawer 37.

A metallic tubing 54 is secured at 54' to the tank 53 and is arranged in an upwardly spiraling coil along the inner face of the housing 11. The tubing 54 extends through an opening 55 in the cover 48 and is joined to the cover 47 of the cylindrical vessel 43 by a flaring mouth 56, as best shown in Figure 2. A screen 57 extends across the opening in the flaring mouth 56 to prevent the absorbent material 46 from entering the tube 54.

A control valve 58 is positioned in the tubing line 54 to control the flow of material therethrough in a manner to be described more fully below. A housing 59 is formed in the cylindrical housing 11 and is provided with electric contact prongs 60 to connect with a contact plug 61 on an extension cord 62. An electric switch 63 is interposed between the electric prongs 60 and the heating element 50 so that the heating element may be controlled separately from the motor 25 directly connected to the electric contact prongs 60, as shown in Figure 4.

The valve 58 is provided with an operating shaft 64 which extends through the housing 11 and terminates in a control handle 65 operated in conjunction with an indicating dial 66, as shown in Figure 1. The control valve 58, while of conventional design, is of a type which will freely pass material moving from the vessel 43 toward the tank 53 but will permit only a controlled reverse flow to occur. The control handle 65 serves to set the valve 58 to regulate the flow from the tank 53 to the vessel 43.

In the preferred form of the invention illustrated in Figures 1 through 4, the use and operation is as follows. A refrigerant gas, such as ammonia, sulfur dioxide, or any other suitable gaseous refrigerant medium, is absorbed into the absorbent material 46 until the vessel 43 is completely filled. The electric resistance heater 50 is then energized by connecting the plug 61 to the prongs 60 and moving the manually controlled switch 63 to on position. The heating of the resistance heater 50 expands the refrigerant gas absorbed in the absorbent material 46, driving it out of the vessel 43 through the tube 54. Air passing over the tube 54 driven by the propeller blade 37 cools the tubing 54 and liquefies the refrigerant gas contained therein which then collects in the tank 53.

When the gas has been liquefied and collected in the tank 53 the portable refrigerator unit 10 is moved into an area to be cooled and the valve 58 is set to permit refrigerant to flow from the tank 53 back to the vessel 43 during which time it returns to a gas and absorbs heat from the surrounding air. Obviously, the resistance heating element 50 is disconnected prior to moving the portable unit 10 into the area to be cooled. By varying the setting of the valve control handle 65, as indicated by the dial 66, the valve 58 can be set to permit a relatively fast or a relatively slow flow of refrigerant to pass from the tank 53 to the vessel 43 so that the cooling rate of the refrigerator unit 10 can be controlled.

When the cooling cycle has been completed, the refrigerator unit 10 is removed from the cooled area and the heating cycle is begun again.

In the modification illustrated in Figure 5, a thermometer 67 is supported on the louvers 30 by means of a bracket 68 so that the temperature of the air flowing through the louvers 30 may be determined. With this information, it is relatively easy to determine the completion of the heating cycle since the air flowing over the tubes 54 will only be heated above normal so long as heated refrigerant is flowing therethrough. The thermometer 67 can also be used to determine the cooling effect of the air driven over the tubes 54 by the propeller blade 27 during the cooling cycle. Condensation

occurring within the refrigeration unit 10 will collect on the transverse wall 31 and flow through the spout 34 into the drawer 37 from which it can be removed in any convenient manner.

In Figures 6 and 7, there is disclosed a modification of the preferred form of the invention wherein the tank 53', corresponding to the tank 53, is provided with a sight glass 69 connected to the tank 53' by means of upper and lower connecting tubes 70 and 71, respectively. The housing 11' is provided with an opening 72 to permit the sight glass 69 to be viewed therethrough, and a plurality of level marks 73 are displayed on the housing 11' adjacent the opening 72 so that the height of the liquid refrigerant in the sight glass 69 may be measured.

The use of the sight glass 69 with the refrigerant unit 10 permits the user of the device to determine when the refrigerant in the tank 53' is exhausted, and also to determine when the tank 53' is full. Obviously, any intermediate condition of the refrigerant can also be determined. The modification illustrated in Figures 6 and 7 is particularly useful in estimating the time and/or cooling capacity remaining in the unit 10 after some of the cooling capacity has been utilized.

Of particular interest in this case is the fact that the valve 58 can be shut off completely so as to store the remaining liquefied refrigerant in the tank 53 until such time as additional cooling is desired.

In the modification illustrated in Figure 8, the valve 58 has its shaft 64 connected to a clock mechanism 74 controlled by a handle 75 associated with a dial 76 and a shaft 77 connected to the clock mechanism 74. A shaft 64' extends from the clock mechanism 74 to a handle 65 and a dial 66 in the same manner as described in the preferred form of the invention.

The clock mechanism 74 is of conventional construction and is adapted to close a circuit for a specific period of time preset by the handle 75 adjusted with relation to the dial 76. With the clock mechanism 74, the exact time that the heating element 50 is permitted to be energized is controlled so that the heating element 50 will be deenergized when sufficient time has elapsed to permit the refrigerant to be driven out of the absorbent material 46.

While several different controls and indicators have been shown, it should be understood that the unit 10, as described in the preferred form of the invention, can be used with any desired controls.

Having thus described the preferred embodiments of the invention, it should be understood that numerous other structural modifications and adaptations may be resorted to without departing from the scope of the appended claims.

What is claimed is:

1. A portable refrigeration unit having a condensing cycle and an evaporating cycle comprising a housing, a vessel in said housing, a second vessel surrounding said first vessel and spaced from said housing, insulation filling the space between said vessels, refrigerant gas absorbent material contained in said first vessel, a heating element extending through said absorbent material, a tank position below said second vessel, a pipe coil arranged spirally between said housing and said second vessel having one end connected to said first vessel and the other end connected to said tank, and means in said housing for circulating air over said coil, whereby during the condensing cycle said coil is cooled to liquefy the refrigerant therein and during the evaporating cycle the air circulating thereover is cooled as the refrigerant evaporates.

2. A device as claimed in claim 1 wherein a transverse wall is positioned in said housing in supporting relation to said second vessel.

3. A device as claimed in claim 1 wherein time controlled means are provided for regulating the length of

the heating cycle of the heating element in said first vessel.

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