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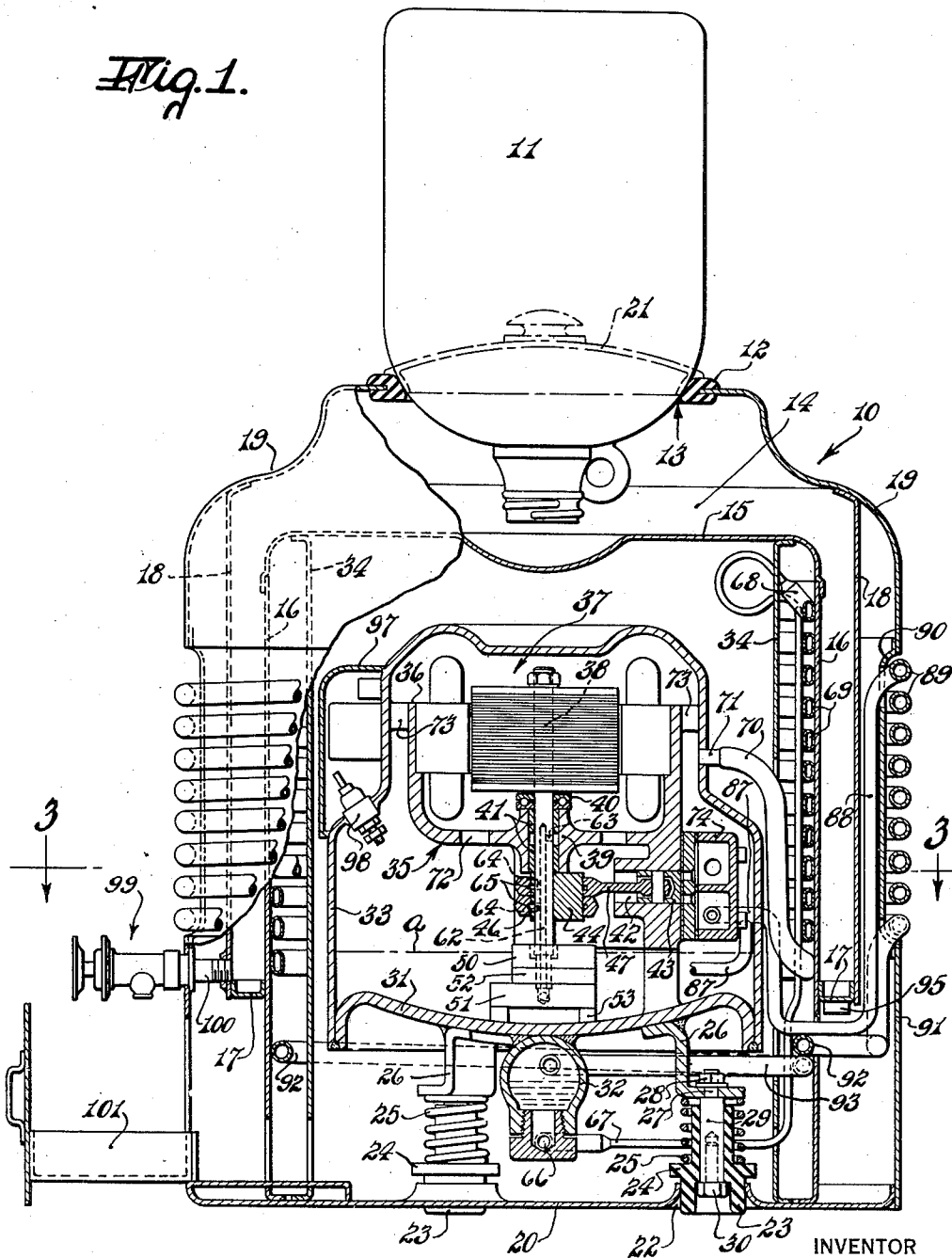
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PORTABLE SELF-CONTAINED LIQUID COOLING APPARATUS

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Fig. 1.



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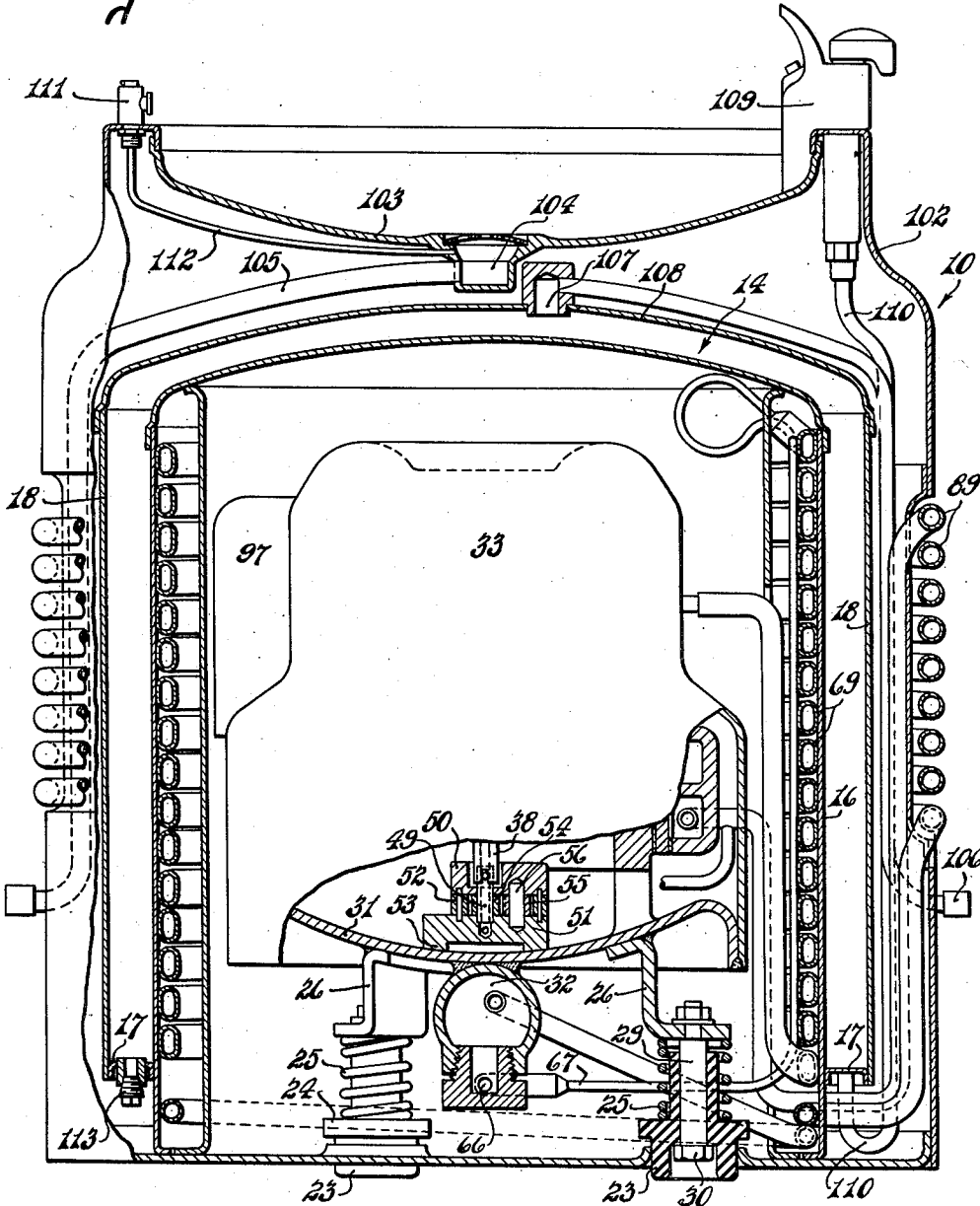
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Fig. 2.



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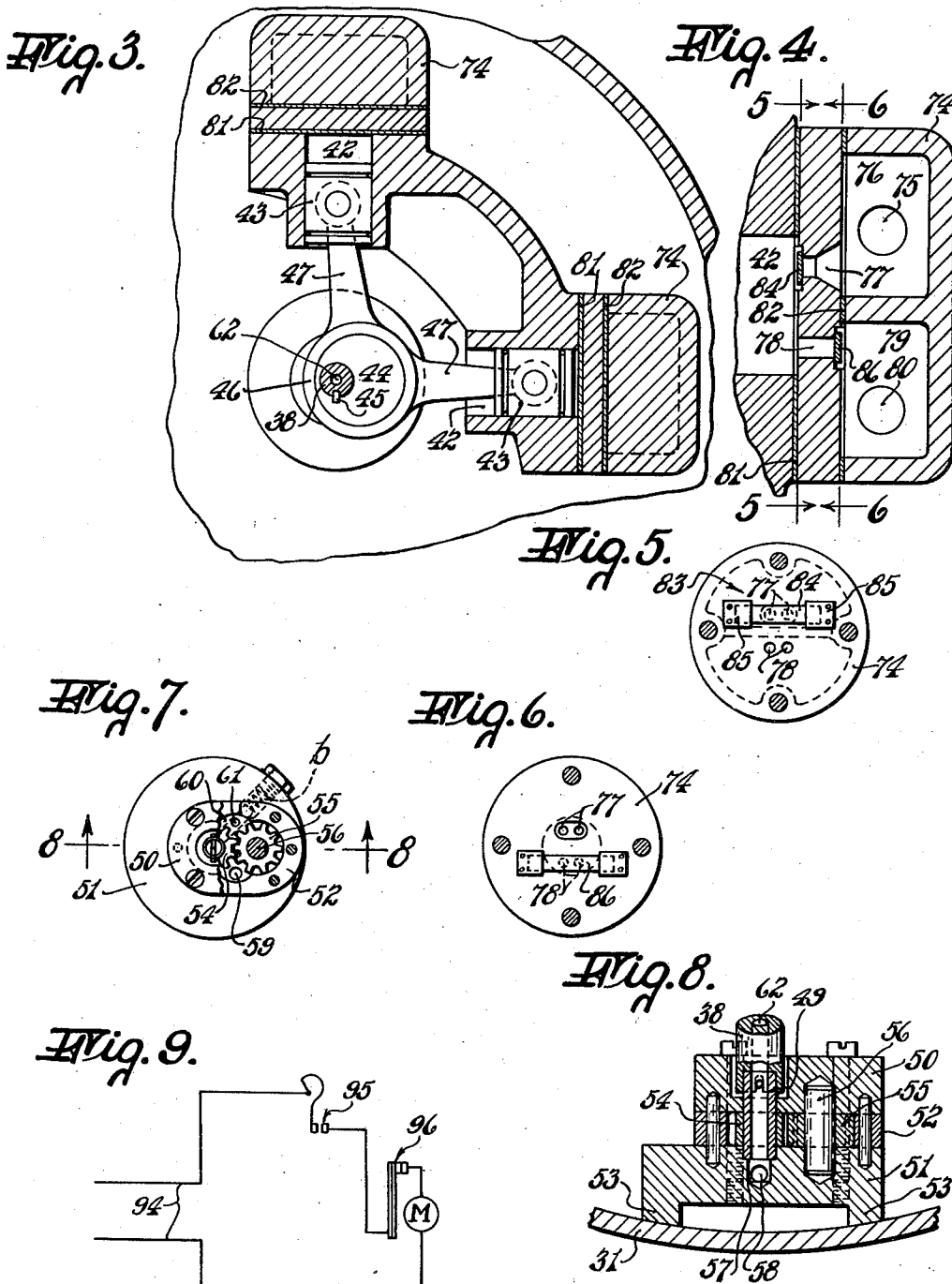
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PORTABLE SELF-CONTAINED LIQUID
COOLING APPARATUSFrederick G. Riedel, Holyoke, Mass., assignor of
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3 Claims. (Cl. 62—141)

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This invention relates to mechanical refrigerating apparatus and particularly to a portable unit for cooling drinking water or other beverages.

An object of the invention is to provide a small self-contained liquid cooler of novel and attractive appearance which can be conveniently placed on a flat surface as a desk or table top.

Another object is to provide an electrically operated refrigerating system for liquids in which the motor and compressor unit are hermetically sealed and completely housed within the cooling tank.

A further object of the invention is to provide an efficient and compact structure which will automatically cool and keep a fluid at a uniform low temperature.

These and other objects and advantages of the invention will be apparent from the following description of the apparatus in connection with the accompanying drawings.

In the drawings:

Fig. 1 is a sectional elevation drawn to slightly less than half scale of a preferred form of the apparatus with a gravity fed water supply;

Fig. 2 is a similar view partly in section of another form of the apparatus using a pressure feed;

Fig. 3 is a horizontal cross sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a fragmentary vertical cross section to show details of the compressor valve construction;

Figs. 5 and 6 are views on lines 5—5 and 6—6 respectively of Fig. 4;

Fig. 7 is a detail view showing oil gear pump structure;

Fig. 8 is a sectional view on line 8—8 of Fig. 7; and

Fig. 9 is a simplified wiring diagram for the controls of the apparatus.

Referring to the drawings, the apparatus as shown by Figs. 1 and 2 is enclosed in a casing 10 with the refrigerating apparatus completely housed therein. In Fig. 1 a water bottle or demijohn 11 is inverted to lie supported on a circular rubber gasket 12 at the edge of a top opening 13 for a tank 14 of the device.

Tank 14 is in the form of a bell shaped structure with a circular plate 15 horizontally disposed slightly below the outlet of the demijohn. The peripheral edge of plate 15 is downwardly turned, being at the edge portions mounted on the upper edge of a cylindrical jacket casing wall 16. The bottom of tank 14 consists of an annular bottom ring plate 17 fixed to the outer side wall of cylinder 16 in the lower portion thereof.

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The outer edge of plate 17 is joined to the lowermost edge of a vertically disposed hollow cylinder 18 of greater diameter than cylinder 16. The upper end of cylinder 18 is attached to a circular top cover portion 19 of the outer side wall of casing 10.

Immediately below the outlet of demijohn 11, the circular plate 15 is dished downwardly in the central portions thereof to insure proper flow from the demijohn. Thus the deeper cylindrical skirted portion of the bell shaped tank 14 may be quickly filled on placing the demijohn reservoir supply in the position shown.

The bottom end of the cylindrical wall 16 abuts a base plate 20 of the casing 10. Plate 20 as shown is spaced below the annular bottom plate 17 of tank 14 and forms the bottom support for the side walls of casing 10 and the supports for the compressor as will be described. A top cover 21 shown in dotted line as resting on gasket 12 is provided for closing the top of tank 14 for hygienic reasons when the demijohn is removed.

In the bottom plate 20 of the casing are spaced triangularly disposed flanged openings 22 through which hard rubber base supports 23 are mounted.

Rubber base supports 23 are outwardly flanged as at 24 and supported thereby are shock absorbing compression springs 25 embracing said supports. An upwardly extending flanged bracket 26 rests on springs 25 being held thereon as by studs 27 and nuts 28, studs 27 extending through the flange of the bracket and being integral with spacers 29. The head of a tie bolt 30 is recessed in the lower end of rubber support 23.

The brackets 26 are flanged at the top and fixed as by welding to a base member 31 of a compressor housing of the device. Also fixed to the bottom of the base 31 as by welding is a cylinder 32 forming the liquid refrigerant receiver vessel of the apparatus as will be described.

The base 31 is a dish shaped plate with a downwardly turned peripheral flange, the edges of which are brazed or welded to the lower edge portions of a bell shaped casting or compressor and motor housing 33. The housing 33 and base 31 form an hermetically sealed unit in which is mounted the motor, the compressor and an oil pump, the unit being resiliently supported on the rubber base supports 23.

Between the hermetically sealed housing and cylindrical wall 16 of tank 14 is interposed an insulating cylinder 34, the upper end of which is attached to the circular plate 15 of tank 14 adjacent its outer edge and the lower end of which abuts the bottom plate 20 of casing 10.

A motor supporting spider 35 disposed in the

upper central portion of the housing interior supports within its upwardly extending cylindrical wall 36 a motor 37. A shaft 38 of the motor is vertically positioned centrally of the housing 33 and extends downwardly into a crankcase through a motor shaft bearing 39 in the spider 35.

Between motor 37 and the bearing 39 of the spider is a ball bearing and race 40 to take the thrust of the motor. Spaced sleeve bushings 41 keep motor shaft 28 in vertical alignment.

Referring now to Figs. 1 and 3 two horizontally disposed open ended cylinders 42 are formed in the side wall of the crankcase and are spaced at ninety degrees. Pistons 43 are mounted in the cylinders, and are reciprocated by an eccentric 44 fixed off center on motor shaft 38 as by a key 45. Freely mounted on eccentric 44 are surrounding eccentric collars 46 with integral connecting rods 47. The outer ends of rods 47 are connected to pistons 43.

With this structure the circular motion of shaft 38 is converted into reciprocating rectilinear motion to reciprocate pistons 43 in cylinders 42.

The lower end of motor shaft 38 (see Figs. 1, 7 and 8) is connected to a central shaft 49 of a gear pump having two cover plates 50 and 51 with a ring housing 52 between them. Lower cover plate 51 has short supporting legs 53 (Fig. 2) resting on the base support 31. On shaft 49 of the gear pump is a gear 54 which meshes with and drives a gear 55 in the pumping chamber within housing 52. Gear 55 is on a stub shaft 56 the ends of which are freely rotatable in openings of cover plates 50 and 51.

Central gear drive shaft 49 is freely rotatable in openings of the cover plates and below the end of shaft 49 in the lower plate 51 is a chamber 57 connected with the outlet side of the pump as by a passage 58.

The pump is immersed in a supply of oil which is provided therefor at the bottom of the motor and compressor housing 33, an oil level being indicated by line *a*, as in Fig. 1. Oil is pumped (see Fig. 7) through an inlet passage 59 to the outlet chamber 60 of the pump and through its outlet passage 61 to the passage 58 to chamber 57 (Fig. 8). A suitable pressure relief valve is provided as at *b* (Fig. 5).

Shaft 49 is hollow and motor shaft 38 has an axial passage 62 extending upwardly beyond the spacing between sleeve bushings 41 of crankcase spider bearing 39. A lateral opening at 63 leading from axial opening 62 at the top supplies oil to bushings 41. Lateral openings at 64 supply oil to grooves 65 of the collars 46 of the connecting rods.

The cylindrical liquid refrigerant vessel 32 is provided at the bottom with an outlet 66 and is connected by a capillary tube 67, which leads through an opening in the insulating cylinder 34, to an expansion chamber 68. Chamber 68 at the top of the wall 16 is in turn connected with the upper end of flattened cooling coils 69 which abut the inside surface of vertical cylinder 16 along that portion of the cylinder wall which forms the inner wall of cooling tank 14. Cooling coils 69 are flattened to present a relatively large area of contact with the wall of tank 14.

At the lower end of the cooling coils is connected a tube 70 leading to an inlet 71 in the upper portion of the housing 33.

Fluid from inlet 71 is permitted free access to all portions of the housing interior, as will be described, by openings as at 72 in the crankcase,

and as at 73 in a web positioning the top of walls 36 with respect to the wall of housing 33.

On the side of the crankcase housing and closing the ends of cylinders 42 (Fig. 3) are twin chambered cups 74 bolted to the housing. As shown by Fig. 4 one of the chambers is provided with an inlet 75 for a suction chamber 76 leading to the cylinder 42 through suction ports 77. Discharge ports 78 lead from the cylinder to the other chamber, an exit or pressure chamber 79. Chamber 79 is provided with discharge outlet 80. Gasket seals 81 and 82 provide a fluid tight connection for the cup assembly.

At the outlet side of suction ports 77 is a one-way valve 83 which may be of any well known valve structure. An economical structure is to mount a thin strip 84 (see Fig. 5) of Swedish spring steel over the ports 77. The ends of the strip 84 are loosely held by retainer clips 85 on plate 91 so that the strip will bow outwardly under suction pressure and open the valve. Pressure chamber 79 connected with cylinder 42 by discharge port 78 has a one-way valve 86 similarly constructed at its outlet side. Connected to discharge outlets 80 of the device are manifolded discharge conduit lines 87 (Figs. 1 and 2) leading through pipe 88 to the top of the condenser coils 89. The condenser coils are disposed in a recessed portion of the outside casing. The recess is formed by cylindrical wall 90, its top edge being attached to top cover portion 19 and its lower edge to a lower side wall portion 91 of the casing.

The lower end of condenser coils 89 leads to a liquid cooler coil 92 abutting the inside wall of cylinder 16 under the flattened cooling coils 69. The liquid cooler coil 92 is connected to a conduit 93 which extends into the upper part of the liquid receiver vessel 32 through an opening in the wall of the vessel.

A control mechanism and circuit for operation of the device is diagrammatically shown by the wiring diagram of Fig. 9. Line wire 94 leads to a thermostat 95 and from the latter to a second thermostat 96, thence to motor 37 and back to the source.

The first thermostat 95 is designed for placement on the bottom of tank 14 as shown at 95 in Fig. 1. It is in contact with the underside of the annular plate 17. Thus the thermostat responds to the temperature of liquid in tank 14. When the temperature rises above a predetermined point the thermostat closes the circuit and starts the motor.

The second thermostat 96 is designed for a safety device and is governed by the heat of the motor. In the event the motor is overheated the circuit will be opened and the motor shut down. As in Fig. 1 a fluid tight box 97 is provided on the outside of motor housing 33 to enclose thermal posts at 98 for the wiring connections to the motor.

An outlet for the tank 14 is provided as by a faucet 99 in the lower side wall cylinder 91 of the casing 10 with a connecting conduit 100 from the tank. Below the faucet a sliding tray 101 is for concealing a glass within the cooler and to provide a drip pan. Walls 16 and 34 may be depressed at this location to receive the tray.

The operation of the cooler is as follows. Vessel 32 is partially filled with any volatile liquid refrigerant such as dichlorodifluoromethane (Freon 12). When the motor starts the cylinder and piston pumps in operation, the liquid refrigerant is drawn through the outlet opening in the bottom of the vessel 32 up through capillary

tube 67 into the expansion chamber 68 where the liquid evaporates and passes into the flattened cooling coils 69. The coils are chilled by the effect of the expanding gas and absorption of heat by vaporization of the low-boiling liquid refrigerant. Since coils 69 are in direct contact with one side of tank 14, the heat in the contents of tank 14 is transferred to the coils through the wall of the tank.

The evaporated gas is drawn from the bottom of the cooling coils through the suction line in tube 70 and into motor housing 33 through opening 71. The gas in the housing surrounds the motor parts and being relatively cool assists in preventing its overheating during operation of the motor. The gas is drawn from the housing into inlet chambers 76 of cups 74 where it passes through the inlet valves into cylinders 42 at each suction stroke of the pistons.

On each discharge stroke of the pistons compressed gas is forced out through discharge valves 78 and through discharge conduits 80 to the top of the condenser coils 89 mounted on the outside of the device. The gas is herein cooled by the heat loss through the condenser coils and is liquified in the coils.

To assure liquefaction of the gas, fluid from the condenser coils passes into the liquid cooler coil 92 disposed beneath the cooling coils 69 to receive any condensation drip from the cooling coils and from the inner surface of cylinder 16. The liquid is then returned to vessel 32 completing the refrigeration cycle.

The structure is easily adapted to function as a fountain or bubbler as shown by Fig. 2. A top cover 102 is substituted for cover 19 of casing 10. Cover 102 is shaped to support a basin 103 with an outlet 104 and drain pipe 105 extending to the lower portion of casing 10. A supply conduit 106 extends into casing 10 and is connected to an opening 107 of a plate 108 for the covering of tank 14. The edge of plate 108 is fastened on the upper edge of cylinder 18.

A bubbler head 109 with a spigot and handle is mounted on the rim of cover 102 at the edge of basin 103 with a conduit 110 connected thereto from the bottom of tank 14 through the wall of cylinder 18. A vent valve 111 is also mounted on the rim of cover 102 and connected with drain 105 by a vent tube 112.

Tank 14 in this form of the apparatus is also provided with a drain plug 113 at the bottom thereof in plate 17.

It will be noted that the device as shown by Fig. 1 is a portable unit requiring only its connection to a source of electrical current. The form of Fig. 2 needs as well connection to a supply of water under pressure. In either event, however, the unit itself requires a minimum of space and may be conveniently placed on a table top or other flat surface as desired.

What is claimed is:

1. In a portable liquid cooling apparatus a liquid cooling tank, being in vertical section of inverted U shape and receiving substantially

within the vertical depending sides thereof an hermetically sealed unit having a liquid coolant chamber and a chamber housing a motor and compressor operated by said motor, cooling coils connected to said coolant chamber and compressor and positioned in contact with said vertical tank sides, condenser coils connected to said compressor surrounding said tank in spaced relation therefrom and means controlled by the temperature of the tank to actuate said motor.

2. A portable liquid cooling device having a cylindrical outer casing wall with an opening at the top thereof formed to receive an inverted demijohn, a bell shaped liquid cooling tank of inverted U-shape in vertical cross-section in communication with said top opening and having its outer depending side walls inwardly spaced from said cylindrical casing wall, condenser coils on the outside of said casing wall, cooling coils positioned on the inner cylindrical side walls of said tank, an hermetically sealed unit having a chamber housing a motor and compressor operated by said motor, and a liquid coolant receiver chamber, said unit being mounted within the depending sides of the cylindrical tank wall, conduits connecting said compressor, cooling and condenser coils, and receiver chamber, means controlled by the temperature of the tank to actuate said motor, and an outlet conduit for said tank at the side of the casing wall.

3. A portable liquid cooling device having a cylindrical outer casing side wall and a top wall fitted with a drinking fountain basin, a bell shaped liquid cooling tank of inverted U-shape in vertical cross-section encased within said side wall and spaced therefrom, condenser coils surrounding said tank on the outside of said casing wall, cooling coils positioned on the inner vertical depending side wall of said tank, an hermetically sealed motor and compressor unit with a chamber housing said motor and compressor and having a coolant receiver chamber, said unit being mounted within the inner cylindrical tank wall, conduits connecting said compressor, cooling and condenser coils and chamber, means controlled by the temperature of the tank to actuate said motor, a bubbler head outlet for said tank at the top of said casing and a tank inlet for connection to a source of liquid under pressure.

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