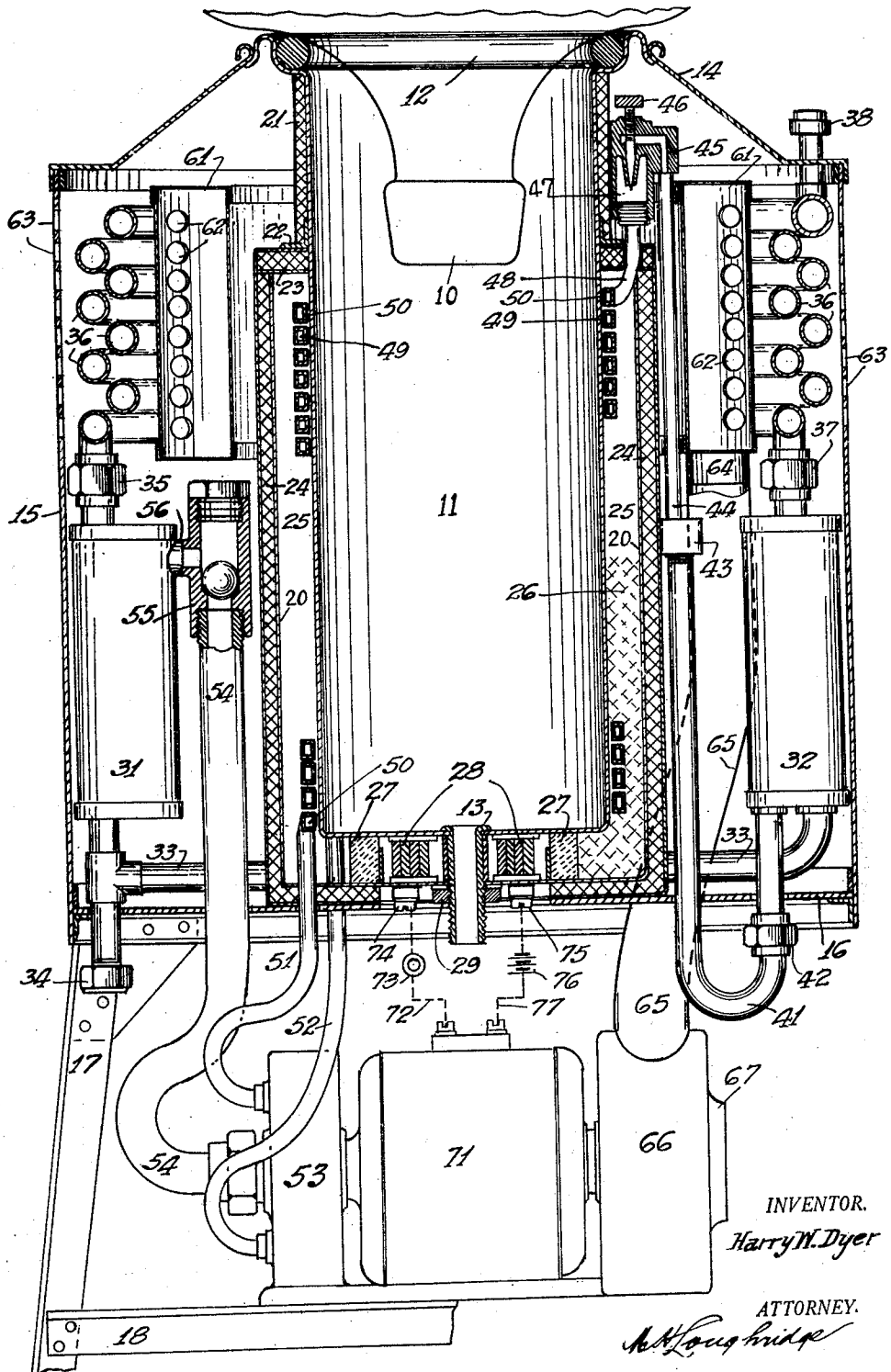


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LIQUID COOLING APPARATUS.
APPLICATION FILED JAN. 20, 1921.

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UNITED STATES PATENT OFFICE.

HARRY WING DYER, OF EAST ORANGE, NEW JERSEY.

LIQUID-COOLING APPARATUS.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARRY WING DYER, a citizen of the United States, and a resident of East Orange, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Liquid-Cooling Apparatus, of which the following is a specification.

This invention relates to a refrigerating apparatus and particularly to an apparatus of this kind designed for cooling liquids such as drinking water and has for an object to provide an apparatus that is light and portable, which is automatic in operation, is regulated by a thermostat, which is supplied with water from the ordinary demijohns and includes certain novel features in the application of the refrigerating coils, their insulation, radiator system and air circulating system operated by an electric motor. Other features of novelty will be understood from the following specification and accompanying drawing which shows in section a water cooling apparatus arranged according to my invention with the operating motor pump and fan shown in outline. This invention includes the features of, and is an improvement on the invention disclosed in my application Serial No. 125,157, filed October 12, 1916.

This invention consists in providing a tank or reservoir for the liquid to be cooled, which is comparatively long and narrow, thereby exposing a large area of the fluid to the walls of the tank. Surrounding this tank on the outside are located refrigerating coils preferably made from square section tubing and placed closely together. In order to obtain a more uniform and better distribution of the refrigerating fluid in these coils, I prefer to use two or more independent spirals placed around the tank, each spiral leading to an independent cylinder of a pump which maintains the circulation of the refrigerating fluid in these coils. An outer container is placed around these coils and the space between the container and the tank may be filled with a plastic insulating material so that all the heat absorbed by the refrigerating coils shall be taken from the walls of the tank. Surrounding this container and the remainder of the tank, an asbestos covering or a covering of some corresponding non-conductor of heat is provided.

The tank and refrigerating coils are

placed inside a cabinet, usually of circular formation, and surrounding the upper section of this cabinet is a radiator made from copper piping or other suitable material and may be provided with fins to increase the radiating surface. Inside this radiator coil is provided a circular air duct with a series of perforations opposite the radiator coil, whereby when the air is drawn from this air duct a fresh supply of air is drawn from the atmosphere outside the cabinet through perforations in the wall and around the radiator coil, thereby cooling this coil. Each end of the radiator coil is connected with a receiving tank. These receiving tanks are connected together and partially filled with a volatile liquid. This liquid is fed to each of the square or rectangular refrigerating coils surrounding the tank by a nozzle which causes the liquid to vaporize when drawn into the refrigerating coils by the operating pump. After passing through these coils, this liquid is discharged back into the receivers through a ball valve and the vapor from it is cooled by the radiator and condensed into a liquid form.

On the outside bottom of the refrigerator tank a thermostat is provided which controls an electric motor according to the temperature of the liquid in the tank and brings into operation the refrigerating pump and fan until the temperature of the liquid is reduced, when the thermostat operates to stop the motor.

Referring to the drawing, 10 represents the usual type of glass demijohn filled with water and inverted over the cylinder or tank 11 upon which it is supported through the rubber gasket 12 according to the construction used in the familiar type of water-cooler. The tank 11 is preferably made from one piece of metal such as copper and flared at the top as shown to seat the gasket 12, also to receive the sheet metal cover as indicated at 14. An outlet 13 is provided in the bottom of tank 11 to which the usual faucet may be screwed. A cylindrical casing or cabinet 15 is provided as an outer protection to the mechanism. This is suitably supported by the sheet metal base 16 to which three legs corresponding to 17 are rigidly secured and braced by a horizontal member 18. The upper end of tank 11 is surrounded by an asbestos covering or a cover of similar material which is a non-

conductor of heat, indicated at 21, and held in position by a suitable sheet metal binder. An angular flange 22 is secured to tank 11 and rests upon the ring 23 which consists of two plates with an asbestos packing between. The lower section of tank 11 is surrounded by an outer container 20 enclosing the space or chamber 25. The container 20 is surrounded on the outside by a covering of asbestos indicated at 24, and held in position by a suitable sheet metal container. The bottom of tank 11 rests upon the soft rubber ring 27 which forms a seal between the bottom of the tank and the container 20. Pressure on this rubber ring may be regulated by means of nut 29 screwing onto outlet tube 13. Enclosed within the space formed by the interior of ring 27 is a thermostat 28 placed directly in contact with the bottom of the tank 11 so that it responds to the temperature of the liquid in the tank. Thermostats for purposes of this kind are made in a variety of ways and the device shown in the drawing is typical of any thermostatic device that may be used for this purpose, responding to a variation of temperature and arranged to control a circuit.

31 and 32 are receiving cylinders or small tanks connected together by an equalizing pipe 33 and provided with an outlet having a cap 34 whereby these receivers may be drained. The receiver 31 connects by union 35 to the coil of the radiator 36 and the opposite end of this radiator coil connects by union 37 to receiver 32. A vertical connection with the cap 38 is provided in the top pipe of the radiator and may be used either as a safety valve or as a means for filling the liquid to receivers 31 and 32.

41 is a pipe connecting by a union 42 with the bottom of receiver 32 and terminating in a junction head 43 from which one or more pipes 44 are lead to the nozzle 45, having the pin valve 46 controlling the orifice to expansion chamber 47 from which the pipe 48 is lead to the refrigerating coil 50. A pipe corresponding to 44, leading to a duplicate of nozzle 45, but not shown on the drawing, leads to refrigerating coil 49, thus providing in duplicate a pair of refrigerating coils which are wound in a close spiral around the exterior of tank 11. Where desired, more than two nozzles with corresponding refrigerator coils may be applied and these coils may be wound one upon the other. The coils 49 and 50 it will be noted, are square or rectangular in section, with the object that they will bind closely around the tank 11 and closely against each other with a very small air gap. Also these coils are comparatively small in section, thereby presenting a large area in contact with the tank 11 and a comparatively small section of pipe through which the refrigerating fluid is forced. The outlet of refrigerating coil 50 is lead by

pipe 51 to one cylinder of the pump 53, and outlet of refrigerating coil 49 is lead by pipe 52 to another cylinder of pump 53.

Pump 53, operated by motor 71, is preferably of the centrifugal type without moving valves, and the end of each refrigerating coil is separately and independently exhausted by the pump and discharged into discharge pipe 54, which through ball valve 55 and connection 56 discharges the fluid from the refrigerating coils to receiver 31. Part of this discharge condenses and replenishes the liquid in receiving tanks 31 and 32. The remaining portion in vapor form, flows through the coil of radiator 36 where it is condensed by atmospheric air drawn in through a series of apertures 63 in the casing 15 around the radiator coil and through a series of apertures indicated at 62 in the circular air duct 61 which is placed inside and opposite the radiator coil. This air duct has one or more outlets similar to 64 connecting by pipe 65 with the fan 66 operated by motor 71 and having a discharge orifice 67.

The motor 71 is mounted below the refrigerating apparatus on the brace 18 as shown and is controlled by wire 72, switch 73 and wire to terminal 74 of thermostat 28 to terminal 75, wire to source of energy 76 and, wire 77 to motor, so that the operation of the motor is automatically controlled as the temperature in tank 11 varies. When the temperature increases the thermostat establishes a circuit between terminals 74 and 75 thereby applying the source of energy to the motor which continues in operation until the temperature of the liquid is sufficiently reduced to cause the thermostat to open the circuit when the motor ceases and remains idle until the temperature in tank 11 rises and again establishes a circuit between terminals 74 and 75.

A suitable temperature for drinking water is approximately 45 degrees F. and in the United States the temperature of this water may rise to 75 or 80 degrees F. This means that heat equivalent to approximately 35 degrees F. must in the most extreme cases be extracted from the drinking water. This represents a comparatively small expenditure of energy and as the system is automatic in its operation and can be regulated to become effective on 10 degrees variation in temperature, it is possible to use a very light motor for this purpose so that the apparatus is portable and consumes a very small amount of current. Water may be applied to the tank 11 by inverting a demijohn of water in the usual manner and a volatile liquid such as ethyl chloride or sulphur dioxide is applied to receiving tanks 31 and 32 until they are about three-quarters filled. When the motor starts operation, this volatile fluid is drawn through the pin valve of nozzle 45 into the expansion chamber 47

where it vaporizes and is drawn through the refrigerating coils in the form of a vapor. It is common practice in most refrigerating outfits to fill the chamber 25 with brine and for certain applications of the present invention brine may be desirable. However, I prefer to use a plastic insulating material indicated at 26 such as fire clay or asbestos compound. This overcomes certain mechanical difficulties that would arise in the use of a brine tank and is highly desirable in a portable apparatus. The volatilized fluid in the refrigerating coils extracts heat from the adjacent medium. This heat cannot be obtained from the insulating material 26 which is further insulated by the asbestos covering 24 and therefore the heat must be extracted through the walls of tank 11 from the liquid in the tank. By using square or rectangular refrigerating coils with a comparatively small section, a large area is exposed to the refrigerating fluid or vapor and this condition is distributed by using two or more spiral coils around the tank 11, each coil acting independently as a means of extracting heat from the tank. The large area of contact obtained by the square tubing, the small sectional area of the tube and the multiple spiral area provide for a direct application of the refrigerating effect from these coils without the use of a brine tank common in other types of cooling apparatus.

The air used for cooling the radiator tubes is drawn directly from the atmosphere to the air duct in comparatively large volume without pressure and the large area of the radiator insures condensation of the vapor discharged by the pump.

In the construction shown, the tank 11 can readily be removed by releasing nut 29. The top cover 14 may be removed by sliding upward and the radiator and receiver tanks 31 and 32 may be removed as one unit with outer casing 15, by disconnecting union 42 and pipe 54, thus facilitating assembling and inspection of the apparatus.

Having thus described my invention, I claim:

1. In a liquid cooling apparatus the combination of a stand having means for detachably supporting an inverted vessel containing liquid to be chilled, a chamber communicating with said vessel and a refrigerating apparatus supported on said stand comprising coils surrounding said chamber, and mechanical means for maintaining said coils at a low temperature.

2. In a liquid cooling apparatus the combination of a cabinet having means for supporting on its upper wall an inverted vessel containing the liquid to be cooled, a chamber or tank within the cabinet positioned to receive the liquid from said vessel, said chamber extending to substantially the bottom of the cabinet, a refrigerating appara-

tus mounted in said cabinet and comprising coils, and means for circulating the refrigerating medium therein, said coils and said tank being arranged to promote the conduction of heat from the liquid in said tank to said coils.

3. In a liquid cooling apparatus, the combination of a cabinet having means for supporting on its upper wall an inverted vessel containing the liquid to be cooled, a chamber or tank within the cabinet positioned to receive the liquid from said vessel, said chamber extending to substantially the bottom of the cabinet, a refrigerating apparatus mounted in said cabinet and comprising coils, means for circulating the refrigerating medium therein, said coils and said tank being arranged to promote the conduction of heat from the liquid in said tank to said coils, and means for circulating air through said cabinet to absorb the heat transferred to the refrigerating fluid.

4. In a liquid cooling apparatus the combination of a cabinet, a reservoir for the liquid to be cooled supported on said cabinet, a tank in said cabinet communicating with said reservoir and means for cooling the liquid in said tank comprising a refrigerating coil surrounding said tank, a motor-driven pump connected to one end of said coil to produce sub-atmospheric pressure therein and thereby volatilize the refrigerating fluid in said coil, a radiator into which said pump discharges and means for circulating air through said radiator to cool the refrigerating fluid discharged by said pump.

5. In a liquid cooling apparatus the combination of a stand, a cabinet supported on said stand, a reservoir for the liquid to be cooled, a container in said cabinet communicating with said reservoir, said container having an outlet at its lower end, and means for cooling the liquid in said container comprising refrigerating coils in proximity thereto, a pump at one end of said coils, a reducing valve at the other end, a container for the refrigerating fluid intermediate the two ends of the coil to receive the fluid discharged from the pump, said container having radiating surface, and means for circulating air through said cabinet across said radiating surface to absorb the heat from the fluid contained therein.

6. In a liquid cooling apparatus the combination of a stand, a cabinet supported on said stand, a reservoir for the liquid to be cooled, a container in said cabinet communicating with said reservoir, said container having an outlet at its lower end, means for cooling the liquid in said container comprising refrigerating coils in proximity thereto, a pump at one end of said coils, a reducing valve at the other end, a container for the refrigerating fluid intermediate the two ends of the coil to receive the fluid discharged

from the pump, said container having radiating surface, means for circulating air through said cabinet across said radiating surface to absorb the heat from the fluid contained therein, and a motor supported by said stand and operatively connected to said pump and said air circulating means to operate the same.

7. In a mechanically operated cooling apparatus, a vertical tank containing the substance to be cooled, a refrigerating coil in a double spiral surrounding said tank, one end of said refrigerator coil connected to a receiver tank containing a volatile liquid, the other end connected to a pump, the discharge from said pump connecting to receiver tank containing said volatile liquid, a radiator surrounding said vertical tank connected to said receiver tank, an air duct placed adjacent to said radiator and an air pump for creating a circulation of air through said radiator.

8. In a mechanically operated cooling apparatus, a vertical tank containing the substance to be cooled, a refrigerating coil surrounding said tank, an air duct surrounding said vertical tank, a radiator surrounding said air duct, a receiver tank connected to said radiator, one end of said refrigerator coil connected to said receiver tank, the other end of said refrigerator coil connected to a pump, the discharge from said pump connecting to said receiver tank, an air fan for causing the circulation of air through said air duct and a motor for operating said pump and said air fan.

9. In a mechanically operated cooling apparatus, the combination of a cabinet having a vertical tank containing the substance

to be cooled, a refrigerating coil surrounding said tank, an air duct surrounding said vertical tank, a radiator surrounding said air duct, perforations in the wall of said air duct and corresponding perforations in the wall of said cabinet, a receiver tank connected to said radiator with one end of said refrigerating coil connected with said receiver tank, the opposite end of said refrigerating coil connected with a pump, the discharge from said pump connected with a receiver tank, a fan for exhausting the air from said air duct whereby the circulation of air is created between said perforations through said radiator and a motor for operating said pump and said air fan.

10. In a mechanically operated cooling apparatus, the combination of a vertical tank containing the substance to be cooled, a refrigerating coil surrounding said tank, an outer container for said coil, an air duct surrounding said container, a radiator surrounding said air duct, receiver tanks connected to the outlets of said radiator, a refrigerating fluid in said receiver tank, said refrigerating coil connecting at one end through a nozzle with said receiver tank and at the opposite end to a pump, the discharge from said pump connected with said receiver tank, an air fan connected with said air duct, a thermostat controlled by the temperature of the liquid in said vertical tank, a motor operating said pump and said air fan, said motor controlled by said thermostat.

Signed at New York city in the county of New York, and State of New York, this 19th day of January, A. D. 1921.

HARRY WING DYER.