March 31, 1942. H. W. TAYLOR 2,278,225

FLUID COOLER

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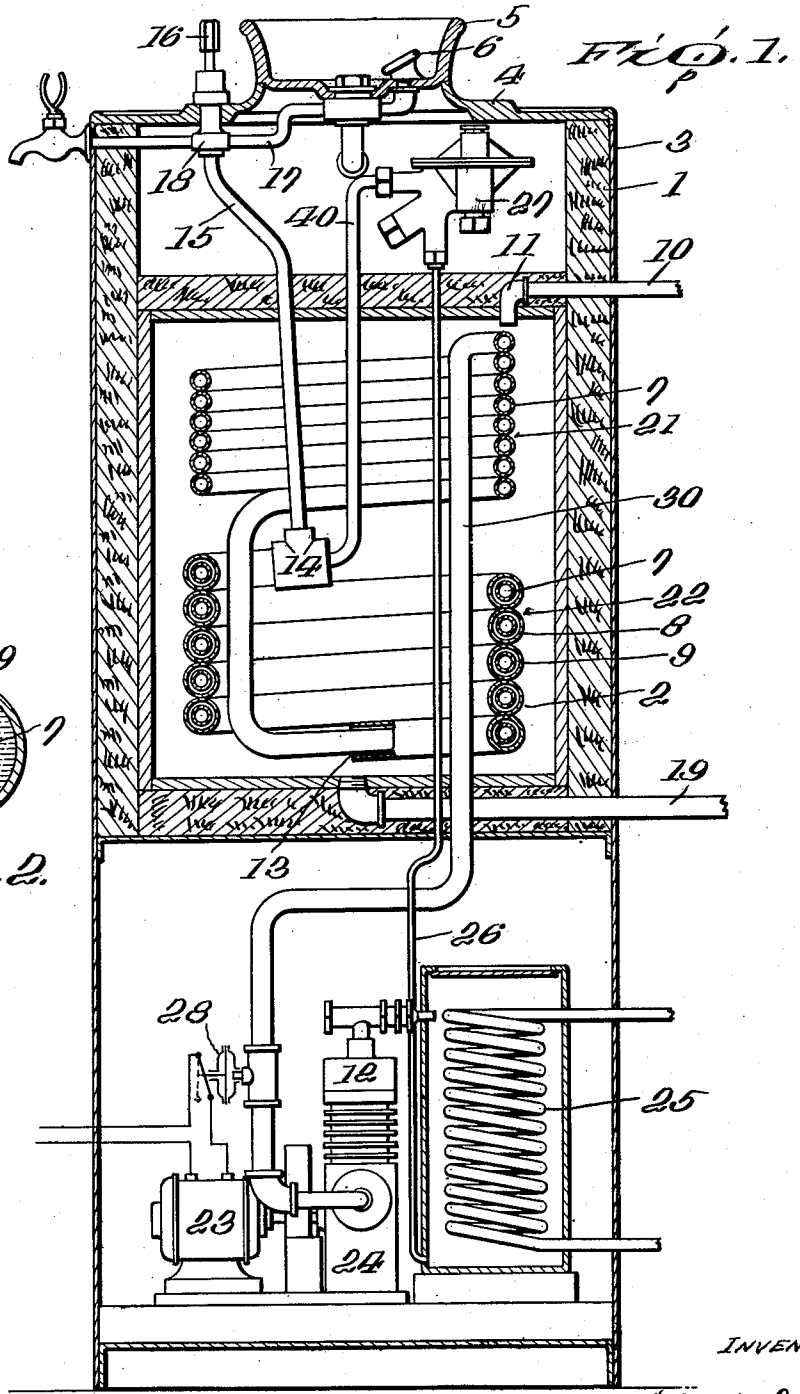


FIG. 1.

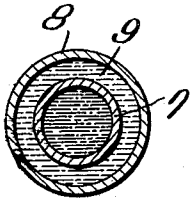


FIG. 2.

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FLUID COOLER

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4 Claims. (Cl. 62—141)

This invention relates to fluid coolers, and particularly to fluid coolers wherein the fluid, after being cooled by mechanical refrigerating apparatus, is delivered under pressure through suitable outlets or fixtures, such as taps, faucets, or drinking fountain nozzles or bubblers.

Due to the fact that dispensing apparatus and drinking fountains are used in such public places as office buildings, shops, restaurants, parks and the like, the demand is such that it is almost impossible to maintain the outgoing water at an average temperature without constant and objectionable starting and stopping of the compressor and associated cooling mechanism.

Heretofore it has been the custom to deliver water from the usual water supply system directly to a water pipe or coil associated in sleeved relation with a pipe through which water and a liquid or gaseous refrigerant is respectively circulated under pressure, the coils and pipes being housed in a cabinet or tank. In such direct flow constructions, where the outside pipe is exposed to the air or insulation in the tank, there is a definite loss as the temperature of the water being cooled in the outside coil is adversely affected by the exchange of heat through the outside wall of the tube. As this loss is not recoverable the efficiency of the system is correspondingly lowered.

One of the objects of the present invention is to eliminate the above mentioned loss and in fact turn it into a direct gain by submerging the coils in a stored and constantly renewed reserve supply of water. Other objects and advantages of the invention will be apparent as the description is read in connection with the accompanying drawing wherein:

Figure 1 is a sectional view of a cabinet embodying a drinking fountain fixture and a dispensing faucet, together with a cooling apparatus constructed according to the present invention; and

Figure 2 is a sectional view showing the sleeved arrangement of the double pipes or tubes composing the cooling coil.

Referring more particularly to the drawing, wherein similar reference numerals designate like parts throughout the several views, the numeral 1 designates generally a drinking fountain and water dispensing cabinet, of any desired construction or design, having a water cooling appliance 2 submerged in a suitably insulated drinking water tank 3, beneath a top 4 carrying an overflow bowl 5 for a fountain head or bubbler 6. A waste or drain fitting 20 in the bottom of the bowl 5 is connected to a wasteline, not shown, to pass off the overflow from the fountain.

The water cooling appliance 2 consists of a continuous coil of pipe 7, arranged in upper and lower connected tiers or groups 21 and 22 respectively, of superimposed convolutions, which act as the evaporator of the cooling system, all the convolutions being submerged in water in the tank 3. A length or coil of pipe 8, larger in diameter than the external diameter of the pipe 7, is sleeved over the lower group 22 of convolutions of the pipe 7 to provide a relatively narrow passage 9 through which a thin film or body of water or other liquid to be cooled may flow in constant contact with the inner coil 7. This length of double tubing constitutes a counter-flow cooling coil. The water to be cooled is conducted by a pipe 10 into and through a connection 11 where the water is discharged into the upper end of the tank 3, adjacent the side wall thereof. The water drops down in the tank, on the outside of the upper group of convolutions of pipe 7, and enters the open lower end 13 of the outer pipe 8 and passes upwardly through the passage 9 between these pipes and thence into a terminal fitting 14. From the fitting 14, the cooled water passes through a line 15 to discharge fitting 18 controlled by a hand valve 16 and thence to the fountain head or bubbler 6, after passing through connecting line 17. The water in the tank may be drained completely through a pipe 19, in the bottom of the tank, and this line is also adapted for use as an extra cold water outlet.

A suitable refrigerating or condensing unit 12 located in the base of the cabinet 1, beneath the tank 3, consists of a motor 23, compressor 24 and condenser 25. Liquid refrigerant from the condenser 25 flows upwardly through a line 26 to and through automatic expansion valve 27, above the tank 3, where it is converted to a liquid-vapor mixture, the temperature of which drops due to partial evaporation of the refrigerant. The mixture of liquid refrigerant and vapor, both having relatively low temperatures, enters into the upper end of an extension 40 leading downwardly from the expansion valve 27 to the fitting 14. This fitting also serves as a terminal for the end of the topmost convolution of the lower group 22 of the convolutions of pipe 7. The lowermost convolution of the topmost group of convolutions 21 of pipe 7 is extended downwardly to enter the lower open end 13 of pipe 8 and thence continues upwardly through the convolutions of the outer pipe 8, until it reaches fitting 14. The liquid

vapor mixture in pipe 7 cools the water in the surrounding passage 9 of the outer pipe 8, because of the evaporation of the refrigerant which is caused by the heat from the water in passage 9. Upon circling through the upper convolutions of the pipe 7, the gas leaves the pipe 7 and tank 3 by a downwardly extending suction or extension line 30. This suction line 30 carries the gas back to the compressor and condenser where it is compressed, condensed and converted to liquid so that the cycle may be repeated.

The warm inlet water, entering at the top of the tank drops down on the outside of and is cooled by refrigerant gas in the uppermost convolutions of the pipe 7. The pre-cooled water reaches the bottom of tank 3 and enters the open end 13 of passage 9, between the inner and outer coils 7 and 8, at a point adjacent to the center of the tank and at the bottom thereof, the coldest section of the tank. Passing through the passage 9, the pre-cooled water is completely cooled by coming in contact with the evaporating gas from expansion valve 27.

The temperature in the system is automatically and uniformly maintained by means of a capillary tube and thermostatic bulb (not shown) connected to a temperature responsive switch 28, in turn connected to the motor 23. It will thus be understood that when the temperature of the water in the tank falls below a predetermined degree, say 45°, the thermostatic bulb serves to open the motor switch 28 and shut off the compressor 24, and when the temperature of the water rises above a predetermined degree, say 50°, the thermostatic bulb acts to close the switch 24, which in turn causes the motor to actuate the compressor. It is therefore, possible to consume or draw off considerable water without raising the temperature of the water to the point where the motor switch will be closed. It will be understood that water under pressure is being constantly and automatically fed to the storage tank 13, under the usual city water system pressure, through the inlet pipe 10.

Due to the fact that the convolutions of pipes 7 and 8 are constantly submerged in a relatively large body of stored water in tank 3, as distinguished from those types of coolers or drinking fountains wherein the outside tube is exposed to air or insulation with consequent loss of water cooling properties, the temperature of the water immediately surrounding the coils or convolutions will be correspondingly lowered and the former loss will become a direct gain. Furthermore, the thin film of outlet water in the narrow space or passage 9 being in direct contact with the coldest gas, and storage water passing into the open end 13 of the pipe 8, also the coldest water in the tank 3, must pass the coldest gas in the system before reaching the bubbler and at the same time the previously mentioned effective heat exchange relation between the pipes 7 and 8 and the water immediately surrounding these pipes reduces the temperature of the storage water at this point and thereby increases the efficiency of the system to the maximum.

While I have shown and described an arrangement wherein the refrigerant is circulated through the inner pipe 7, and the water passes through the outer pipe 8, it should be understood that a reversal of this arrangement falls within the scope of my invention.

Having thus described my invention, what I claim is:

1. An apparatus for cooling drinking water comprising a container having a dispensing outlet adjacent its top, said container having a fluid storage tank therein, means for admitting a constant supply of water under pressure to said tank, a cooling unit submerged in the body of water in said tank, said cooling unit comprising two pipes sleeved one within the other and spaced apart to provide a water passage and a passage for a refrigerant, said water passage communicating at one end with said dispensing outlet and at its other end with the interior of said tank, and means for circulating said refrigerant through said last named passage for precooling the water in the storage tank before it enters said first passage.

2. An apparatus for cooling fluid comprising a container having a dispensing outlet adjacent its top, said container having a fluid tank therein, means for admitting a constant supply of fluid under pressure to said tank, a circular cooling coil having its convolutions submerged within the fluid in said tank, a fluid coil sleeved over some of the outermost convolutions of said cooling coil to provide a fluid circulating passage, said fluid passage communicating at one end with said dispensing outlet and at its other end with the interior of said tank, and means for circulating said refrigerant through said fluid coil for precooling the fluid in the storage tank before it enters the fluid passage.

3. An apparatus for cooling fluid comprising a container having a dispensing outlet adjacent its top, said container having a fluid tank therein, means for admitting a constant supply of fluid under pressure to said tank, a circular cooling coil having a series of superposed convolutions submerged within the fluid in said tank, a liquid coil sleeved over and encasing some of the convolutions at one end of said tank to provide a fluid circulating passage, said fluid passage communicating at one end with said dispensing outlet and at its other end with the interior of said tank adjacent one end thereof, and means for circulating said refrigerant through said fluid coil for precooling the fluid in the storage tank before it enters the fluid passage.

4. An apparatus for cooling drinking water comprising a container having a dispensing outlet adjacent its top, said container having a fluid tank therein, means for admitting a constant supply of water under pressure to said tank, a circular cooling coil having a series of superposed convolutions submerged within the water in said tank, a liquid coil sleeved over and encasing the lowermost convolutions of said cooling coil to provide a water circulating passage, said water passage communicating at one end with said dispensing outlet and at its lower end with the interior of said tank adjacent the bottom and substantially in the middle thereof, and means for circulating said refrigerant through said liquid coil for precooling the water in the storage tank before it enters the water passage.

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