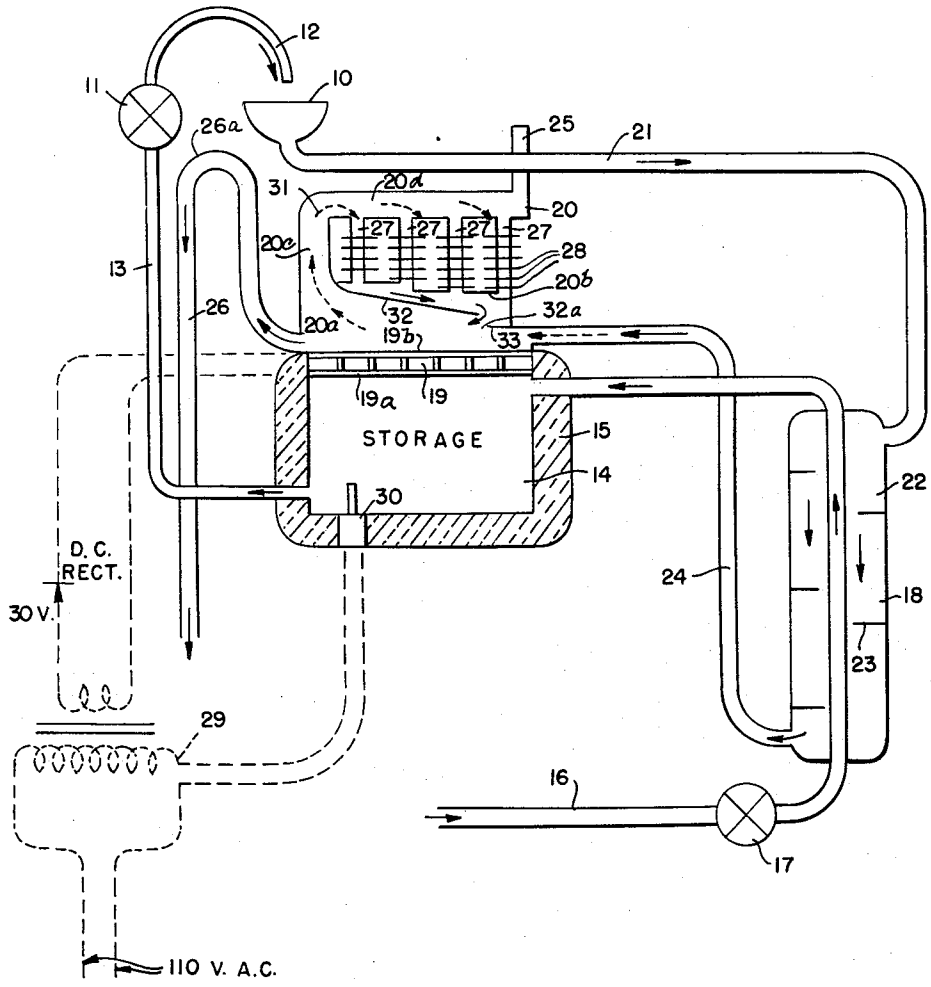
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FLUID COOLING APPARATUS

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FLUID COOLING APPARATUS

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This invention relates to a water cooler.

In the conventional electric powered water cooler a refrigeration system is used employing the conventional refrigerant compressor-evaporator-condenser circuit. Although such water coolers are satisfactory for providing a supply of cool water they have the disadvantage of being somewhat expensive, noisy and bulky because of the amount of equipment required. Furthermore they are subject to repair and require servicing because of the many moving parts such as pumps, the compressor and the like.

The water cooler of this invention is electrically powered but it uses no moving parts in that it depends upon thermoelectric couples for refrigeration. These couples are Peltier couples arranged in a group or bank to provide cold junctions on one side and hot junctions on the other. Typical Peltier couple panels or banks are shown and described in the copending application of M. K. Baer Jr. and C. R. Lopp, Serial No. 735,804, filed May 16, 1958, and assigned to the same assignee as in this application.

One of the features of this invention is to provide an improved apparatus for cooling and heating separate bodies of fluid comprising a thermoelectric structure having spaced hot junctions and cold junctions, means for thermally contacting one body of fluid with the hot junctions for heating said fluid and means for thermally contacting the other body of fluid with the cold junctions for cooling said fluid.

Another feature is to provide an improved apparatus for cooling and heating a liquid comprising a thermoelectric structure having spaced hot junctions and cold junctions, means for thermally contacting one body of liquid with the hot junctions for heating said liquid including a chamber for said liquid, means for thermally contacting the other body of liquid with the cold junctions for cooling said liquid including a chamber for said liquid, means for withdrawing cool liquid from its chamber, means for withdrawing heated liquid from its chamber, and supplemental means for cooling the liquid in the heated chamber when said liquid has reached a predetermined temperature.

A further feature is to provide an improved water cooler comprising a thermoelectric structure having spaced hot junctions and cold junctions, a cold water storage chamber in thermal contact with the cold junctions, a separate heated water storage chamber in thermal contact with the hot junctions, an intake conduit for conveying water into said cold water chamber, an outlet conduit for conveying water from said cold water chamber to a place of access, a conduit for conveying excess cold water from said place to said heated chamber, a heat exchanger connected to said intake conduit and said excess water conduit for heat transfer between the water in said conduits, and supplemental means for cooling the water in said heated water storage chamber comprising a vertically arranged water circuit, one portion of which includes an air cooled radiator.

Other features and advantages will be apparent from the following description of one embodiment of the invention as illustrated in the accompanying figure. This figure is a semi-diagrammatic view showing a water cooler embodying the invention.

The water cooler shown in the accompanying drawing includes an ordinary drinking fountain arrangement embodied in the water receiving cup **10**, valve **11** and water stream indicated at **12**. The water is supplied to the valve by a conduit **13** which leads from the bottom of a cold water storage chamber **14** insulated as indicated at **15**.

Water is fed into the chamber **14** by means of an intake conduit **16** leading through a valve **17** through a heat exchanger **18** into the top of the chamber **14**. In the top of the chamber **14** is a bank **19** of Peltier couples having their cold junctions **19*a*** in thermal contact with the water in the chamber **14** and their hot junctions **19*b*** on the opposite side of the panel at the bottom of an upper heated water chamber **20**.

Water to the heated chamber **20** is fed through a conduit **21** leading from the cup **10** into the top of the heat exchanger **18**. As can be seen in the drawing, the conduit **16** which supplies water to the cold chamber **14** leads through the heat exchanger **18** while the overflow conduit **21** leads to a chamber **22** in the heat exchanger surrounding inlet conduit **16**. This chamber is provided with spaced baffles **23** for breaking up streamlined flow of the water in order to insure more efficient heat transfer between the incoming water and the overflow from the cup **10**. From the bottom of the heat exchanger **18** a conduit **24** leads to the bottom of the heated water chamber **20**. The top of this chamber is provided at one side with a vent pipe **25** extending upwardly.

The bottom of the heated chamber **20** on the side opposite to the inlet conduit **24** is provided with an outlet conduit **26** having an upwardly extending loop **26*a*** therein at a level higher than the top of the chamber **20** but beneath the open vent pipe **25** which is used to vent undissolved gases. The outlet conduit **26** leads to a sewer or other place of disposal.

The interior of the heated water chamber **20** is arranged to provide a closed flow path for the water. Thus the chamber **20** is divided into a bottom chamber **20*a*** having an upper baffle **32** sloping upwardly from the connection of the inlet conduit **24**, an upwardly extending end passage **20*c*** and a top manifold **20*d***. The bottom of the baffle **32** is spaced above the inner end of an inlet baffle **33** to provide an opening **32*a***. Extending between the chamber **20*a*** and manifold **20*d*** are a plurality of vertical pipes **27** each provided with a plurality of heat radiating fins **28**. The pipes **27** and the fins **28** are exposed to the atmosphere for cooling the pipes and their contents.

The direct current power supply to the Peltier couple bank **19** is indicated in broken line at **29**. This power supply is conventional and includes a rectifier powered by ordinary 110 volt 60 cycle alternating current to provide 30 volts of direct power to the couple bank. The power supply is controlled by a thermostat **30**, the temperature control portion of which is located in the bottom of the cold water storage chamber **14** adjacent to the exit into the cold water supply conduit **13**.

In operation the cold water flows through the conduit **16** and open valve **17** through the heat exchanger **18** into the cold water storage chamber **14**. In the heat exchanger **18** the incoming water is precooled by the overflow cold water from the cup **10** which flows through the conduit **21** and the outer chamber **22** of the heat exchanger **18**.

The cold water which is maintained cold by the junctions **19*a*** of the couple bank **19** is maintained at substantially constant temperature by the thermostat **30**. When cold water is required at the drinking fountain the user opens the valve **11** in the customary manner. As was previously stated the overflow from the receiving cup **10** flows through the conduit **21**, the heat ex-

changer 18 and through the conduit 24 from the heat exchanger into the bottom of the chamber 20. Of course, there will be no water flow through the system including this overflow portion until the operating valve 11 is turned on. During the time that the valve 11 is turned on the incoming overflow water from the conduit 24 will force water from the chamber 20 through the conduit 26 and into the sewer. This water flow through the chamber 20 serves to cool the hot junctions 19*b* of the thermocouple panel 19.

When the valve 11 is not turned on so that there is no water flow through the various conduits and the heat exchanger the water within the chamber 20 will be automatically cooled by the radiator comprising the vertical pipes 27 and the fins 28. This is brought about by a thermosyphon effect indicated by the dotted lines 31. The water flows to the left as seen in the drawing along the hot junctions 19*b*, then flows up the bottom of the inclined baffle 32 and upwardly in end passage 20*c* and into the upper manifold 20*d*, down the top surface of the inclined baffle 32 and back into the chamber 20*a* by way of the end opening 32*a*. Here the water flows down through the vertical pipes 27 because the water in these pipes is cooled by the surrounding air. Thus there is a continuous circulation of water brought about by the changes in temperature of the water in the different portions of the system. The chamber is kept filled at all times by reason of the elevated loop 26*a* which extends above the top of the chamber but beneath the open outlet of the vent pipe 25.

As can be seen the water cooler of this invention uses no pumps, compressor or other moving mechanical parts. Furthermore, the waste water from the water cooler overflow is used to cool the hot junctions or heat dissipator side of the couple bank. The temperature in the cold water chamber 14 is kept substantially constant by the thermostat 30 while the temperature in the hot water chamber 20 is automatically cooled by the radiator operating on thermosyphon principles in the manner previously described.

Although the specific embodiment of the invention is directed to a water cooler of the drinking fountain type it is obvious that the apparatus is usable for cooling and heating separate bodies of fluid. Thus the cooling portion described is used in the specific embodiment to cool water for drinking purposes. It could, of course, be used for cooling any other fluid. Similarly the heated water is shown as being directed into the sewer or any other waste disposal system. However, it is obvious that this heated water or other heated fluid put through the system could be used wherever such heated fluid is desired.

In one specific embodiment the water was maintained in the storage chamber 14 at a temperature of about 47° F. At the valve 11 the water was 50° F. The incoming water into the conduit 16 was at 90° F. and the outlet water through the conduit 26 was also at 90° F. The overflow water from the cup 10 was about 54° F.

Having described my invention as related to the embodiment shown in the accompanying drawing, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. Apparatus for cooling and heating separate bodies of fluid, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; means for thermally contacting one body of fluid with the cold junctions for cooling said fluid; means for thermally contacting a portion of said body of cooled fluid with the hot junctions for heating said fluid; and supplemental means for cooling at all times the fluid receiving heat from said hot junctions.

2. Apparatus for cooling and heating separate bodies of fluid, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; means for thermally contacting one body of fluid with the hot junctions for heating said fluid; means for thermally contacting the other body of fluid with the cold junctions for cooling said fluid; and supplemental means for cooling said heated fluid, said supplemental means comprising a vertically arranged fluid circuit for said body of heated fluid, one portion of which includes cooling means.

3. Apparatus for cooling and heating separate bodies of liquid, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; means for maintaining liquid in thermal contact with the hot junctions for heating said liquid including a first chamber for said one body of liquid; means for thermally contacting the other body of liquid with the cold junctions for cooling said liquid including a second chamber for said second body of liquid; means for withdrawing cool liquid from said second chamber; means for withdrawing heated liquid from said first chamber; and supplemental means for cooling the liquid in the heated chamber, said supplemental means being operated by the heat delivered to the liquid at said hot junctions.

4. The apparatus of claim 3 wherein said supplemental means comprises a vertically arranged liquid circuit for said body of heated liquid, one portion of which includes an air cooled radiator.

5. A water cooler, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; a cold water storage chamber in thermal contact with the cold junctions; a separate heated water storage chamber in thermal contact with the hot junctions; an intake conduit for conveying water into said cold water chamber; an outlet conduit for conveying water from said cold water chamber to a place of access; a conduit for conveying excess cold water from said place to said heated chamber; and means for cooling the water in said heated chamber, said cooling means comprising a vertically arranged water circuit, one portion of which includes an air cooled radiator.

6. A water cooler, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; a cold water storage chamber in thermal contact with the cold junctions; a separate heated water storage chamber in thermal contact with the hot junctions; an intake conduit for conveying water into said cold water chamber; an outlet conduit for conveying water from said cold water chamber to a place of access; a conduit for conveying excess cold water from said place to said heated chamber; a heat exchanger connected to said intake conduit and said excess water conduit for heat transfer between the water in said conduits; and supplemental means for cooling the water in said heated water storage chamber comprising a vertically arranged water circuit one portion of which includes an air cooled radiator.

7. Apparatus for cooling and heating separate bodies of fluid, comprising: a thermoelectric structure having spaced hot junctions and cold junctions; means for thermally contacting one body of fluid with the hot junctions for cooling said junctions; means for thermally contacting the other body of fluid with the cold junctions for cooling said fluid; fluid circuits for the fluid contacting the hot junctions including a closed circuit wherein a portion of the fluid therein is in thermal contact with the hot junctions to cause fluid flow through the closed circuit; and means for cooling the fluid in a portion of the closed circuit.

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