July 1, 1941. H. K. JOHNSON ET AL 2,247,388

FLUID COOLING DEVICE

Filed Dec. 12, 1938

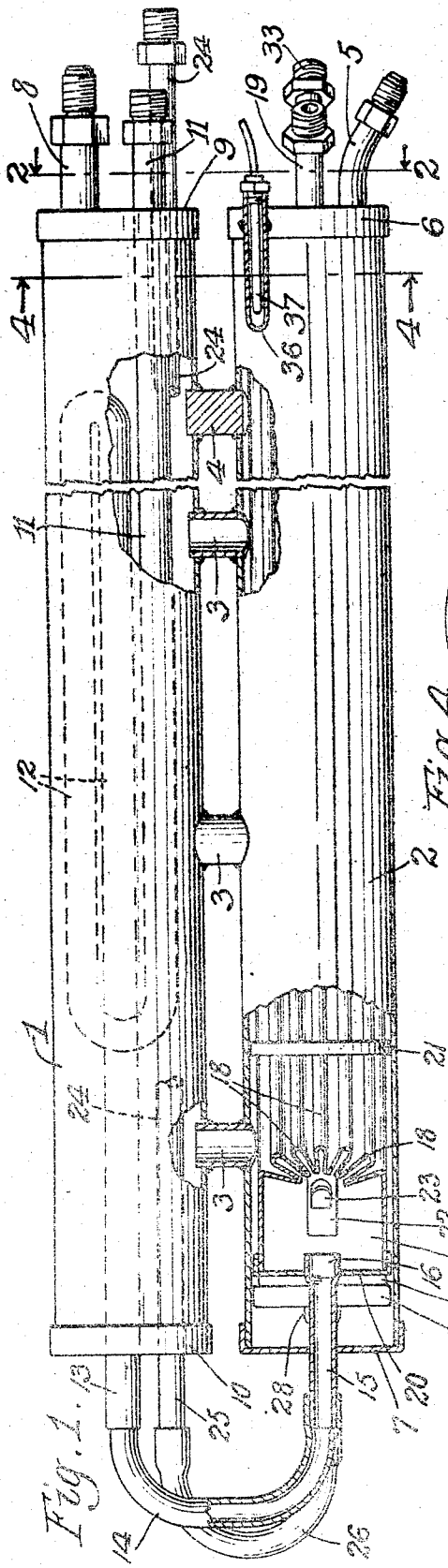


Fig. 1.

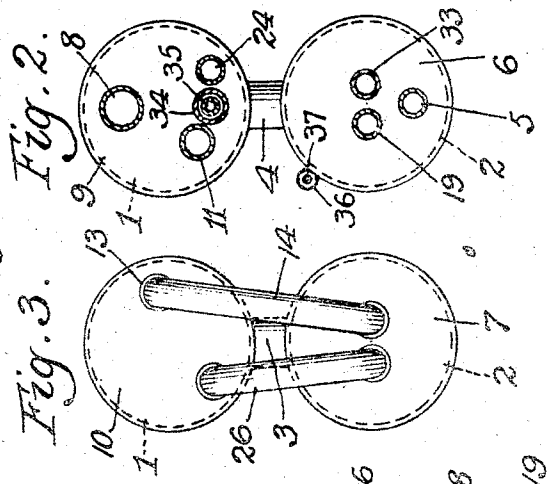


Fig. 2.

Fig. 3.

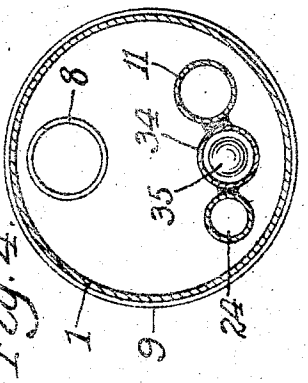
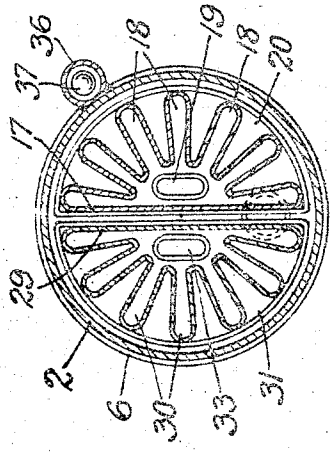


Fig. 4.



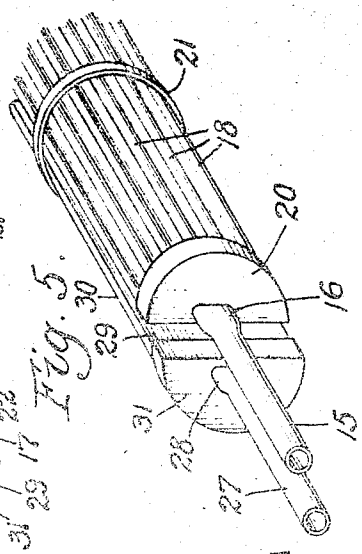


Fig. 5.

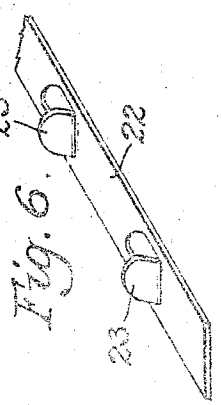


Fig. 6.

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FLUID COOLING DEVICE

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8 Claims. (Cl. 62—141)

This invention relates to a water cooling device and particularly to one effective to cool water rapidly. It has for one object therefor to provide means in which the temperature control is effective promptly in response to the flow of liquid through the apparatus. Another object is to provide a means of cooling liquid within a restricted space. Another object is to provide in a cooler for flowing liquid a coil through which the liquid to be cooled passes and in which the coil is located within a jacket or housing in which the refrigerant itself expands. Another object is to provide a water cooler so proportioned and shaped that it may be used in a soda fountain and may, if desired, be positioned adjacent the syrup rail so as to cool the syrup jars.

Other objects will appear from time to time throughout the specification and the claims.

The invention is illustrated more or less diagrammatically in the accompanying drawing, wherein:

Figure 1 is a side elevation with parts in section and parts broken away;

Figure 2 is an end view with certain of the pipes shown in section taken at line 2—2 of Figure 1;

Figure 3 is an end elevation looking from the left of Figure 1;

Figure 4 is a transverse vertical cross section taken at line 4—4 of Figure 1;

Figure 5 is an elevation of the finned tubing removed from the housing;

Figure 6 is an elevation showing the splasher or spreader strip.

Like parts are designated by like characters throughout the specification and the drawing.

1 is a pre-cooler tube. It is hollow and is associated with a second tube 2. One or more connections 3 join the two tubes. One or more solid supporting members 4 may be attached to the two tubes as spacing and supporting means.

Refrigerant is intended to pass through the two tubes 1 and 2. 5 is a refrigerant inlet connection through which refrigerant is conducted to the interior of the tube 2. The conduit 5 may be seated in the end closure 6 of the member 2. 2 is provided at its opposite end with an end closure 7. It is to be noticed that refrigerant entering the tube 2 through the conduit 5 must pass at least some distance from its point of entrance before it reaches one of the connecting tubes 3, through which it may leave the tube 2 in passing to the tube 1. 8 is a suction pipe or connection secured to the end closure 9 of the tube 1. Through this suction connection refrigerant is withdrawn from the tube and circulated through the rest of the cooling system. The opposite end of the tube 1 is closed by a closure 10.

The particular adaptation of the invention shown herewith is arranged for cooling sweet water and soda water in connection with a soda fountain or any other place where it is desired to cool both materials. The sweet water enters through a pipe 11 and this pipe is arranged to provide a loop 12 within the housing 1. It passes out of the housing at 13 and through a curved pipe 14 to a connection 15, which is flattened as at 16. From that point it is discharged into the finned tube. This tube has a relatively flat side 17 and a curved side made up of a plurality of fins 18. A discharge member 19 is associated with the tube 17, 18 and carries the sweet water out of it. Suitable closures are provided for the finned tube 17, 18, of which one is shown in Figures 1 and 5 and is numbered 20. One or more positioning bands 21 may be used to hold and position the finned tubes. Within the finned tube 17, 18 may be positioned a splasher or spreader strip 22 having a plurality of outwardly inclined members 23. These may be formed in any manner. As here shown, they are punched bodily out of the strip 22. They serve to deflect the water and to prevent its passing undisturbed through the finned tube.

A similar arrangement may be provided for the soda water. It enters through a tube 24, which may or may not have a loop formed in it. It passes outward from the housing 1 as at 25 and is connected by a curved portion 26 to an inlet connection 27, which is flattened as at 28, and through which it is discharged into a finned tube having a flat side 29 and fins 30. Heads or ends 31 may be provided for the tube, which may contain a spreader strip such as that shown in Figure 6 and has one or more spacing and holding bands 21 positioned about it. It has an outlet connection 33 corresponding to the sweet-water outlet connection 19.

A pocket 34 may be positioned within the housing or tube 1 and, as shown in Figures 2 and 4, it is between the sweet water and soda water entering connections 11 and 24, respectively. A thermostat bulb 35 is positioned within this pocket. Because of its location close to the water inlets, it is promptly affected by the change in the temperature of the entering water. A pocket or socket member 36 may be secured on the outside of the tube 1 or 2, and a thermostat bulb 37 may be positioned within it. This thermostat

bulb is preferably connected to a switch which operates in response to variations of the thermostat to control a tell-tale light. This light will be located where the operator can see it; and in ordinary use, the operation of the light will be controlled by a relay. The differential of this relay will be such that should the water warm up beyond a predetermined temperature, due, for example, to failure of the mechanism or to improper adjustment of the cooler, the tell-tale light will be turned on and the operator will be warned that some adjustment is necessary.

Although there is shown an operative form of the device, it will be understood that many changes in the form, shape and arrangement of parts might be made without departing from the spirit of this invention, and it is wished that this showing be taken as in a sense diagrammatic. In particular, the device might be larger or smaller than that shown, and it might be associated with other mechanism. In one form it may be associated with a soda fountain; and when so used, it is adapted to cool the syrup rail and its contents; and also because of its location at that point the water—both sweet and soda—which it cools is cooled without waste of space which occurs where the cooling coils are located in the storage space. Generally, in the past, in installations of this general type the cooling mechanism, including the expansion coil, is placed in a counter or show case and the space occupied by the coil assembly is not available for storage of material. In the applicants' device, because of its construction, that space is saved. This construction also saves space because, instead of cooling a body of brine, for example, then circulating it past the incoming water to cool the latter, the coil through which the entering water passes is located in a jacket or container in which the refrigerant expands and thus abstracts heat from the water flowing through the coil. This has an advantage both in efficiency and in a saving of space.

The use and operation of this invention are as follows:

The apparatus, as shown, is installed in any desired system. It may be used merely to cool drinking water. In that case, there would be no soda-water system. Or it may, as shown, be used to cool both sweet water and soda water. In that case, it would ordinarily be associated with a soda fountain; and, if so, it might or might not be arranged to cool some part or parts of the soda fountain assembly. However it is used, some fluid to be cooled enters a pipe through one of the main containers and passes into the other. It is cooled in passing. The refrigerant is conducted into the jacket of the last chamber through which the fluid to be cooled passes. It is expanded in that chamber, and in the form shown herewith is expanded around the finned pipe so that the fluid which is flowing through the system is dispersed in the fins, and a wide area of the fins is available for rapid cooling by its wide-spread contact with the expanding refrigerant in the jacket and about the finned tube. The refrigerant is further expanded in the second chamber to which it passes, which is the first chamber through which the entering water passes to be cooled.

A thermostatic control is provided which operates in response to the effect of the temperature variations upon the member **35**. Because this member is provided, as shown particularly in Figure 4, close to the pipes through which both types of water enter and, therefore, when the relatively uncooled water enters, the moment that it starts to flow past the thermostat **35**, the latter is affected by the temperature; and if the water is warm, an almost instant change in the operation of the refrigerating mechanism occurs. Because of this, the system is completely and instantly responsive to temperature changes in the entering water; and a rapid cooling is thus assured.

The refrigerant which enters through the passage **5** is controlled by a thermostatic expansion valve, and this valve is controlled by the thermostatic bulb **35**. Because of the location of the bulb, as above mentioned, experience has shown that the thermostatic valve will open when only a single glass of water has been drawn. The location of the thermostatic bulb permits this extremely rapid transfer of heat from the water to the bulb, and hence the rapid actuation of the thermostatic expansion valve. This arrangement will give the operator water just as cold in the first glass as later. After the first three or four ounces have been drawn off in one typical installation the water temperature wil be down to 38 or 40 degrees Fahrenheit, regardless of the temperature of the incoming water. The rapid action is also aided by the fact that it is possible to get a very wide area of contact between the refrigerant and the finned tubes which carry the water. Not only is a wide area provided by the shape of the finned tubes, but the sprayer or distributor **22**, **23** compels the water to pass through the corrugations and prevents it from flowing straight out through the constricted discharge opening, and compels the water to flow over a large amount of cooled wall surface.

Also, the construction shown avoids frost formation on the suction line of the refrigerant. This is due to the fact that the gas entering through the connection **5** must pass at least to the first tube **3** before it can enter the tube **1**, and it must travel again from there some distance before it reaches the suction outlet **8**. Since the warm incoming water is passing through that part of the cooler tube **1**, the vapor in the tube tends to be very dry and is dry as it leaves the cooler. The effect is thus that the water is pre-cooled in the tube **1** and is finally cooled in the tube **2** as it passes through the finned tubes. This pre-cooling of the water also vaporizes the refrigerant gas and assists in avoiding the frosting of the suction line above mentioned.

We claim:

1. In combination in a cooling system, means defining a primary cooling chamber and a secondary cooling chamber, and passage-forming means joining the two, a refrigerant inlet to said secondary chamber, a refrigerant outlet from said primary chamber, a fluid passage member extending through said primary chamber and adapted to carry fluid to be cooled, a fluid passage member positioned within said secondary chamber and in communication with said first mentioned fluid passage member, there being positioned within said second fluid passage a fluid spreader, said spreader being positioned along one side of said second fluid passage and shaped to direct fluid across said passage and away from the wall along which said spreader is positioned.

2. In combination in a cooling system, means defining a primary cooling chamber and a secondary cooling chamber, and passage-forming means joining the two, a refrigerant inlet to said

secondary chamber, a refrigerant outlet from said primary chamber, a fluid passage member extending through said primary chamber and adapted to carry fluid to be cooled, a fluid passage member positioned within said secondary chamber and in communication with said first mentioned fluid passage member, said second fluid passage member formed with a plurality of hollow ribs in communication with its interior and having a generally unribbed side, there being positioned within said second fluid passage a fluid spreader.

3. In combination in a cooling system, means defining a primary cooling chamber and a secondary cooling chamber, and passage-forming means joining the two, a refrigerant inlet to said secondary chamber, a refrigerant outlet from said primary chamber, a fluid passage member extending through said primary chamber and adapted to carry fluid to be cooled, a fluid passage member positioned within said secondary chamber and in communication with said first mentioned fluid passage member, said second fluid passage member having a plurality of hollow ribs, there being positioned within said second fluid passage a fluid spreader, spreading means on said spreader positioned within the path of incoming fluid and adapted to direct said fluid into said hollow ribs.

4. In combination in a cooling system, means defining a primary cooling chamber and a secondary cooling chamber, and passage forming means joining the two, a refrigerant inlet to said secondary chamber, a refrigerant outlet from said primary chamber, a fluid passage member extending through said primary chamber and adapted to carry fluid to be cooled, a fluid passage member positioned within said secondary chamber and in communication with said first mentioned fluid passage member, said second fluid passage member having a plurality of hollow ribs, there being positioned within said second fluid passage a fluid spreader, and a thermostat positioned within said primary chamber and adjacent said fluid passage where the latter enters the primary chamber.

5. In combination in a cooling assembly, means defining a primary cooler and a separate secondary cooler, a plurality of passage-forming members joining them, a refrigerant inlet passage connected to said secondary cooler, a refrigerant outlet connection connected to said primary cooler, a plurality of liquid conduits positioned within said primary cooler, and a plurality of liquid conduits in said secondary cooler, each of said last mentioned conduits being in communication with one of said first mentioned liquid conduits positioned in said primary cooler.

6. In combination in a cooling assembly, means defining a primary cooler and a secondary separate cooler, a plurality of passage-forming members joining them, a refrigerant inlet passage connected to said secondary cooler, a refrigerant outlet connection connected to said primary cooler, a plurality of liquid conduits positioned within said primary cooler, and a plurality of liquid conduits positioned in said secondary cooler, each of said last mentioned liquid conduits being in communication with one of said first mentioned liquid conduits positioned in said primary cooler, a thermostatic element positioned in the primary cooler adjacent the inlet end of said liquid conduits therein, and adapted to be connected to a thermostatic valve for controlling the flow of refrigerant to and from said coolers.

7. In combination in a cooling assembly, means defining a primary cooler and a secondary cooler, a plurality of passage-forming members joining them, a refrigerant inlet passage connected to said secondary cooler at a point separated from said passages, a refrigerant outlet connection connected to said primary cooler, at a point separated from said passage-forming members, a plurality of liquid conduits positioned within said primary cooler, and a plurality of liquid conduits positioned in said secondary cooler, each of said first mentioned conduits being in communication with one of said first mentioned conduits positioned in said primary cooler, the liquid passages in the secondary cooler provided with hollow fins, a liquid spreader positioned in each of said finned passages extending longitudinally of said passages and lying within the path of entering liquid.

8. In combination in a cooling assembly, means defining a primary and a secondary cooling container, a plurality of passage-forming members joining them, a refrigerant inlet passage connected to said secondary cooler at a point separated from said passages, a refrigerant outlet connection connected to said primary cooler at a point separated from said passage-forming members, a plurality of liquid conduits positioned within and extending beyond said primary container, a plurality of liquid passage members positioned in said secondary cooler, each in communication with one of said first mentioned passages positioned in said primary cooler, the liquid passages in the secondary cooler provided with hollow fins, a liquid spreader positioned in each of said finned passages and lying within the path of entering liquid, a thermostatic element positioned in the primary cooler adjacent said water inlets and adapted to be connected to a thermostatic valve for controlling the flow of refrigerant to and from said coolers.

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