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LIQUID COOLER

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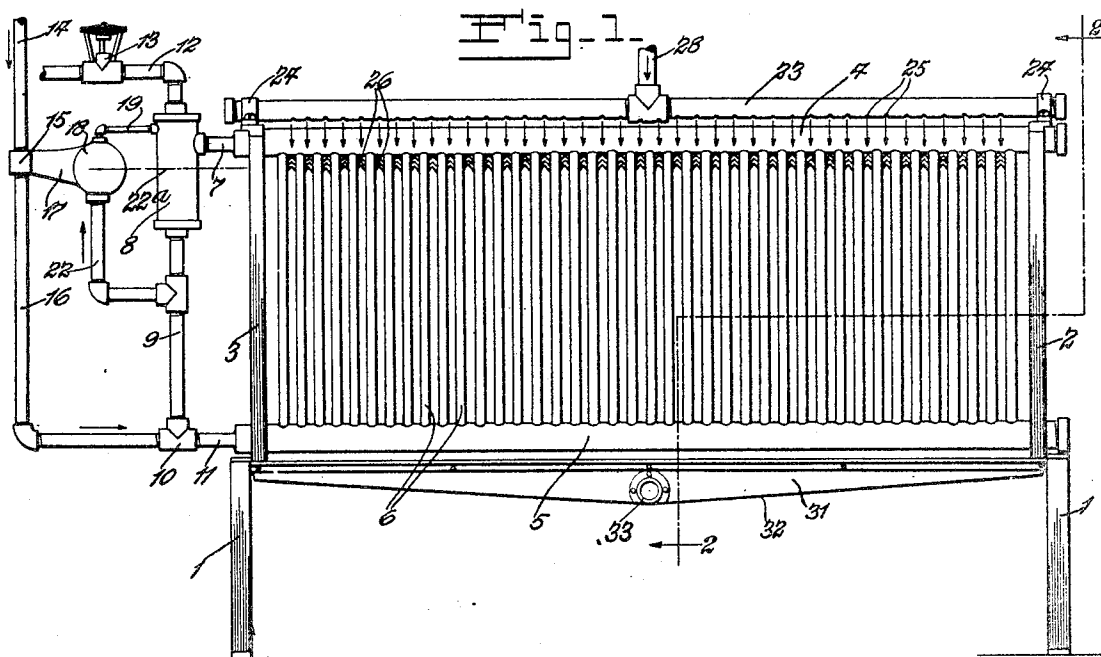


Fig. 2.

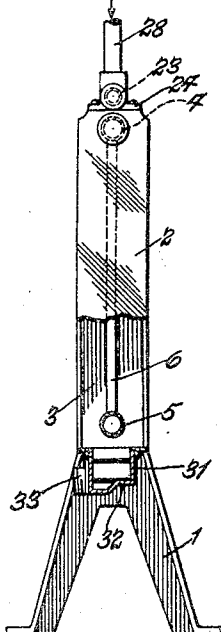


Fig. 3.

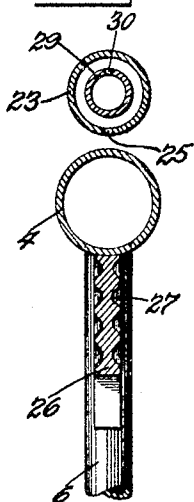


Fig. 4.

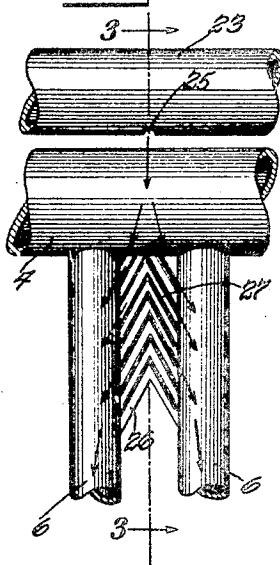
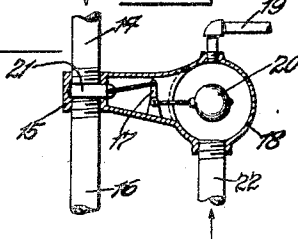


Fig. 5.



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# UNITED STATES PATENT OFFICE

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## LIQUID COOLER

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This invention relates to liquid coolers; and an object is to provide a device for cooling liquids comprising a series of parallel vertical pipes opening at their upper and lower ends into horizontal header pipes containing the refrigerant, in combination with means for spreading a flow of liquid over said pipes so that the liquid will flow by gravity to a withdrawal device.

Another object of the invention is to provide a cooler of the type and character mentioned embodying means for maintaining in the lower header pipe and vertical pipes a refrigerant liquid at approximately a constant level, and means for maintaining a constant pressure and temperature in the cooler.

Another object of the invention is to provide a cooler of the type and character mentioned having means for causing all or approximately all of the liquid to flow downwardly along the vertical pipes by preventing the liquid from dripping from the upper header.

Other objects appear from the following description, reference being made to the accompanying drawings in which—

Fig. 1 is a side elevation of my improved cooler.

Fig. 2 is an end elevation, with the parts in section, approximately on the line 2—2 of Fig. 1.

Fig. 3 is a vertical sectional view of the upper portion of the cooler approximately on the line 3—3 of Fig. 4.

Fig. 4 is a side elevation of the upper portion of the cooler shown in Fig. 3.

Fig. 5 is a detail of a float control valve included in the invention.

The cooler is mounted on a supporting frame-work 1 of any appropriate construction and comprises, at one end, an upright end member 2 and at the opposite end an upright member 3. These end members constitute supports for the horizontal header pipes and also constitute end walls of an enclosure for the cooler proper.

The upper header comprises a horizontal pipe 4 supported near the upper end of the end members 2 and 3, and the lower header comprises a horizontal pipe 5 supported near

the lower end of the end members 2 and 3. These horizontal pipes 4 and 5 are connected by a longitudinal series of vertical pipes 6, the upper ends of which open into the pipe 4 and the lower ends of which open into the pipe 5. The pipes 6 are of less diameter than the pipes 4 and 5.

The pipe 4 has communication through a pipe section 7 with a liquid trap 8 from the lower end of which the pipe 9 opens into a fitting 10 having communication with the adjacent pipe 5 through a pipe section 11. From the upper end of the trap 8 a pipe 12 extends to an absorber or compressor (not shown) and is equipped with a back pressure valve device 13 of any known or appropriate construction which acts to hold a constant pressure and thereby maintain approximately a constant temperature in the cooler but does not prevent passage of the vaporized refrigerant therethrough to the receiver when the pressure in the cooler exceeds the predetermined amount of pressure. A return pipe 14 for the condensed refrigerant has communication through a valve housing 15 and a pipe 16 to the fitting 10 and thence through the pipe 11 to the pipe 5. The valve housing 15 is at the end of an arm 17 which extends from a float chamber 18. The upper portion of the float chamber 18 has communication with the upper portion of the trap 8 through a pipe 19. A float 20 in the float chamber 18 is operatively connected with a valve 21 controlling the opening into the pipe 16 from the valve housing 15. A pipe 22 opens from the lower end of the float chamber 18 into the pipe 9. Thus, it is apparent that when the amount of liquid refrigerant in the cooler exceeds a predetermined maximum and rises through the pipe 11, the fitting 10 and the pipe 22 to a predetermined height in the float valve chamber 18, the float 20 will be raised and the valve 21 will be closed so as to prevent any additional amount of refrigerant liquid from passing through the pipe 16 into the cooler. This does not interfere with the operation of the valve device 13 to permit passage of vaporized refrigerant from the cooler to an absorber or compressor. When the amount of

liquid refrigerant within the cooler becomes reduced approximately to the line 22<sup>a</sup> (Fig. 1) the float 20 will open the valve 21 and permit an additional amount of liquid refrigerant to enter the cooler.

The distributor device comprises a pipe 23 mounted in supports 24 on the end members 2 and 3 and having through its lower side numerous outlet openings 25. These openings 25 constitute a longitudinal series of openings immediately above the pipe 4 so that any liquid discharged through said openings 25 is discharged onto the upper portion of the pipe 24 and thereby spread and caused to flow downwardly along the opposite sides of said pipe 24. A portion of this liquid passes directly from the pipe 4 to the vertical pipes 6. The remaining portion of this liquid passes from the pipe 4 to the distributor strips 26 located between and contacting with the upper ends of the pipes 6 and also contacting with the lower side of the pipe 4 and having on their opposite sides downwardly diverging grooves 27. That portion of the liquid flowing from the pipe 4 onto the distributor strips 26 is conducted by the grooves 27 to the respective pipes 6 so that all of the liquid is caused to flow downwardly along said pipe 6 and is thereby subjected to the cooling action of the refrigerant.

A supply pipe 28 opens into a pipe 29 supported longitudinally within the pipe 23 and spaced therefrom. The pipe 29 is concentric with the pipe 23 and has therethrough a longitudinal series of holes 30 from which the liquid is discharged into the pipe 23.

From the pipe 5 the cooled liquid drops into a trough comprising side walls 31 and a bottom wall 32 which inclines downwardly from which each end of its intermediate portion where said trough opens into a withdrawal pipe 33.

In operation, the liquid to be cooled is admitted to the pipe 29 from the pipe 28. From the pipe 29, the liquid to be cooled passes from the openings 30 into the pipe 23 and thence through the openings 25 onto the upper side of the pipe 4 approximately throughout the length of said pipe 4. The liquid flows downwardly across the opposite sides of the pipe 4, a portion of the liquid passing directly from the pipe 4 to the vertical pipes 6. The remainder of the liquid passes from the pipe 4 to the distributor strips 26 and is conducted along the grooves 27 to the respective pipes 6. Thus, the entire amount of liquid is caused to flow downwardly along the pipes 6 and across the lower pipe 5 and thence into the receiving trough at the lower end of the cooler. The liquid is withdrawn from the trough through the pipe 33. An approximately constant temperature is maintained in the cooler by the ar-

range shown generally in Fig. 1 and described above.

From the foregoing, it is now apparent that my invention obtains all its intended objects in a highly efficient and satisfactory manner. The construction and arrangement may be varied widely within equivalent limits without departure from the nature and principle thereof. I do not restrict myself in any unessential respects, but what I claim and desire to secure by Letters Patent is:

1. A cooler of the character described comprising a longitudinal series of vertical pipes, horizontal pipes opening into the upper and lower ends of the vertical pipes respectively, a pipe system for maintaining a liquid refrigerant filling said horizontal pipe that opens into the lower ends of said vertical pipes and filling said vertical pipes to a constant level below said horizontal pipe that opens into the upper ends of said vertical pipes, means for discharging the liquid to be cooled upon the upper side of said upper horizontal pipe, a device for regulating the supply of liquid to said discharging means, and means for preventing the liquid from dripping from said upper horizontal pipe and for causing the liquid to flow down said vertical pipes.

2. A cooler of the character described comprising a longitudinal series of vertical pipes, horizontal pipes opening into the upper and lower ends of the vertical pipes respectively, a pipe system for maintaining a liquid refrigerant filling said horizontal pipe that opens into the lower ends of said vertical pipes and filling said vertical pipes to a constant level below said horizontal pipe that opens into the upper ends of said vertical pipes, means for discharging the liquid to be cooled upon the upper side of said upper horizontal pipe, a device for regulating the supply of liquid to said discharging means, means for preventing the liquid from dripping from said upper horizontal pipe and for causing the liquid to flow down said vertical pipes, and a receptacle for receiving the liquid dripping from said lower horizontal pipe.

3. A cooler of the character described comprising a series of vertical pipes, a horizontal pipe opening into the upper ends of said vertical pipes, means for discharging liquid along the upper side of said horizontal pipe, and means for preventing the liquid from dripping from said horizontal pipe and causing the liquid to flow downwardly along said vertical pipes.

4. A cooler of the character described comprising a series of vertical pipes, a horizontal pipe opening into the upper ends of said vertical pipes, means for discharging liquid along the upper side of said horizontal pipe, a device for regulating the supply of liquid to said discharging means, means for preventing the liquid from dripping from said

horizontal pipe and causing the liquid to flow downwardly along said vertical pipes, a horizontal pipe opening into the lower ends of said vertical pipes, and means for receiving liquid dripping from said last named horizontal pipe.

5. A cooler of the character described comprising two parallel spaced horizontal pipes supported one above the other, a series of vertical pipes having their upper ends opening into the upper one of said horizontal pipes and their lower ends opening into the lower one of said horizontal pipes, a pipe supported above said upper horizontal pipe and having holes for discharging liquid onto said upper horizontal pipe, and means in said last named pipe for distributing the liquid in said last named pipe for discharge through said holes.

6. A cooler of the character described comprising two horizontal pipes spaced one above the other, a series of vertical pipes having their upper and lower ends opening into said horizontal pipes respectively, means for maintaining a liquid refrigerant completely filling the lower one of said horizontal pipes and filling said vertical pipes to approximately a constant level, a discharge pipe supported above the upper horizontal pipe and having holes for discharging liquid onto said upper horizontal pipe, and a distributor pipe in said discharge pipe having holes for discharging liquid into said discharge pipe for discharge therefrom as aforesaid.

7. A cooler of the character described comprising a series of vertical pipes, a horizontal pipe opening into the upper ends of said vertical pipes, a discharge pipe supported above said horizontal pipe and having holes for discharging liquid onto the upper side of said horizontal pipe, and a distributor device in said discharge pipe for distributing the liquid in said discharge pipe for discharge through said holes.

8. A cooler of the character described comprising a series of vertical pipes, a horizontal pipe opening into the upper ends of said vertical pipes, a discharge pipe supported above said horizontal pipe and having holes for discharging liquid onto the upper side of said horizontal pipe, a distributor device in said discharge pipe for distributing the liquid in said discharge pipe for discharge through said holes, means for maintaining a refrigerant in said vertical pipes, and means for preventing the liquid from dripping from said horizontal pipe and for causing the liquid to flow downwardly along said vertical pipes.

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