





# UNITED STATES PATENT OFFICE.

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## LIQUID-COOLER.

976,803.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, FRANK P. HOPKINS, a citizen of the United States, and resident of Lakewood, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Liquid-Coolers, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide a cooler for water or other fluid, by means of which its temperature can be reduced rapidly from approximately the boiling point, to nearly 50° Fahrenheit, and is applicable to all systems requiring the use or condensing liquid in large quantities. These objects are obtained by means of currents of air at ordinary temperatures, which preferably is charged with aqueous vapor, is driven at a high velocity and is caused to affect a column of falling liquid both on the interior surfaces of the column and upon its exterior surfaces simultaneously, so as to absorb and conduct away the heat rapidly. The liquid from which the heat is to be extracted falls in a thin annular sheet at a low rate of speed and the air current is passed first therethrough, and afterward is forced to flow exteriorly thereto so as to exert the greatest possible absorbent effect, and to immediately conduct away the heat to the exterior air. To obtain these improved results the air is kept in constant motion and constantly renewed, and its rate of speed of travel being in excess of the rate of speed of travel of the fluid, the heat of the liquid is readily imparted to the air and quickly conveyed away. To accomplish these objects the apparatus employed is hereinafter described, shown in the accompanying drawings, and specifically pointed out in the claims.

In the accompanying drawings Figure 1 is a plan view of a preferred form of device, Fig. 2 is a vertical longitudinal section of the device, Fig. 3 is an enlarged plan view of a pair of the circulating pipes, and Fig. 4 is a vertical section, illustrating the concentric circulating pipes, and a valve for adjusting the flow of liquid through the annular fluid passage.

In these views 1 is a pan or open liquid receptacle, mounted upon the cooling chamber 2, which serves as an air passage, and com-

municates with the fan or blower 3, at one end and with the open air at the upwardly tending outlet 4. In the upper and lower walls, 5 and 6 of this chamber or passage, are secured the liquid carrying pipes 7, 7, through which the liquid deposited in the pan falls by gravity, and is caught in the drip pan 8 below.

Concentrically placed within the pipes 7, 7, are the circulating air pipes 13, 13, which take the air at their upper ends which are raised above the liquid pan, and discharge it into a lower chamber or passage, 9, which leads to the blower 3. This chamber is open at the lower end and the vertical walls W extend into the drip liquid in the drip pan 8 below, and the liquid forms a seal for the chamber.

The fluid such as hot water, is admitted through a header, 10, and branch pipes 11, and thereby distributed in the pan, so as to flow as evenly as possible down the annular openings between the concentric pipes, and to become as thin a stream as possible. Thence it falls through the sealed chamber or passage 9, into the drip pan 8 below, and the excess is taken care of by means of an overflow pipe 12, whence it may be returned to the system employing the cooled water.

The air is drawn first into the upper ends of the inner pipes 13, 13, with great velocity, and conveys away the heat from the thin annular column of liquid exterior to it. The air then enters the sealed chamber below and mingles with the liquid, so as to become impregnated with moisture. It is then drawn into the blower, and is discharged laterally through the chamber 2 and impinges upon the exterior surfaces of the larger pipe 7, 7. These pipes are staggered in arrangement so as to cause a perfect and wide circulation of the moistened air, so as to envelop each pipe completely in the rapid current, and convey the heat away from the exterior surface of the annular water columns. The air in this manner obtains a double effect upon the liquid between the outer and inner pipes, and the heat is exhausted therefrom with very great rapidity.

To prevent the waste of aqueous vapor or vaporized liquid at the outlet, the outlet is provided with a vertical wall 14, against which the liquid is discharged from the air and flows back into the drip pan.

In case more air is required than it is pos-



sible for the small pipes 13, 13 to carry, the pipe P leading from the sealed chamber may be provided with an exterior inlet I, in which is placed a damper J to regulate the size of the exterior opening. Through this inlet additional and cool air can be conveyed to the blower to be forced laterally against the outer pipes.

In Fig. 4 is shown a valve, V by means of which the size of the annular liquid opening between the pipes can be regulated at pleasure.

All the valves in the system can be connected together by means of bars K, and can be simultaneously raised and lowered to regulate the size of the annular openings.

In Fig. 2 the lower ends of the inner tubes 13, 13, are shown spread outwardly and the tubes connected together, so that the tubes themselves can be raised or lowered at pleasure, for regulating the flow of liquid between the outer and the inner tubes.

Having described the invention what I claim as new and desire to secure by Letters Patent is:

1. In a cooler, the combination with a liquid pan open to the air above, a blower, a cooling chamber underneath the liquid pan, communicating with the blower at one end and with the outer air at the other end, a sealed chamber communicating with said blower and located underneath said cooling chamber, outer and inner pipes, concentrically arranged in pairs and secured in the upper and lower walls of said cooling chamber, the inner pipes projecting above the outer pipes, between which outer and inner pipes the liquid is adapted to circulate, the inner pipes adapted to convey air, and a vertical wall for the outlet opening against which the discharged air impinges.

2. In a cooler, a liquid receiving pan, a cooling chamber for air thereunder, concentric pipes adapted to receive liquid between them and passing through said cooling chamber, the inner pipes adapted to receive air, a sealed chamber below the cooling chamber adapted to receive the discharged liquid from said pipes, and a blower adapted to draw the air into said sealed chamber through said inner pipes and to discharge it laterally against the outer pipes in said cooling chamber.

3. In a hot liquid cooler, a system of outer and inner vertical pipes concentrically arranged and adapted to permit hot liquid to fall by gravity between them, a blower for causing a current of air to flow through said inner pipes at a high rate of velocity, means for supplying a current of liquid between said concentric pipes, said blower being adapted also to force said current of air against the surfaces of the outer pipes.

4. In a hot liquid cooler, a system of outer and inner vertical pipes, concentrically arranged and adapted to permit hot liquid to fall by gravity between them, a blower for causing a current of air to flow through said inner pipes at a high rate of velocity, means for supplying a current of liquid to flow between said concentric pipes, said blower being adapted also to force said current of air against the surfaces of the outer pipes, and means for regulating the flow of liquid through the spaces between said concentric pipes.

In testimony whereof, I hereunto set my hand this 24<sup>th</sup> day of November 1909.

FRANK P. HOPKINS.

In presence of—

WM. M. MONROE,  
GEO. S. COLE.