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G. T. VOORHEES.

COOLING APPARATUS.

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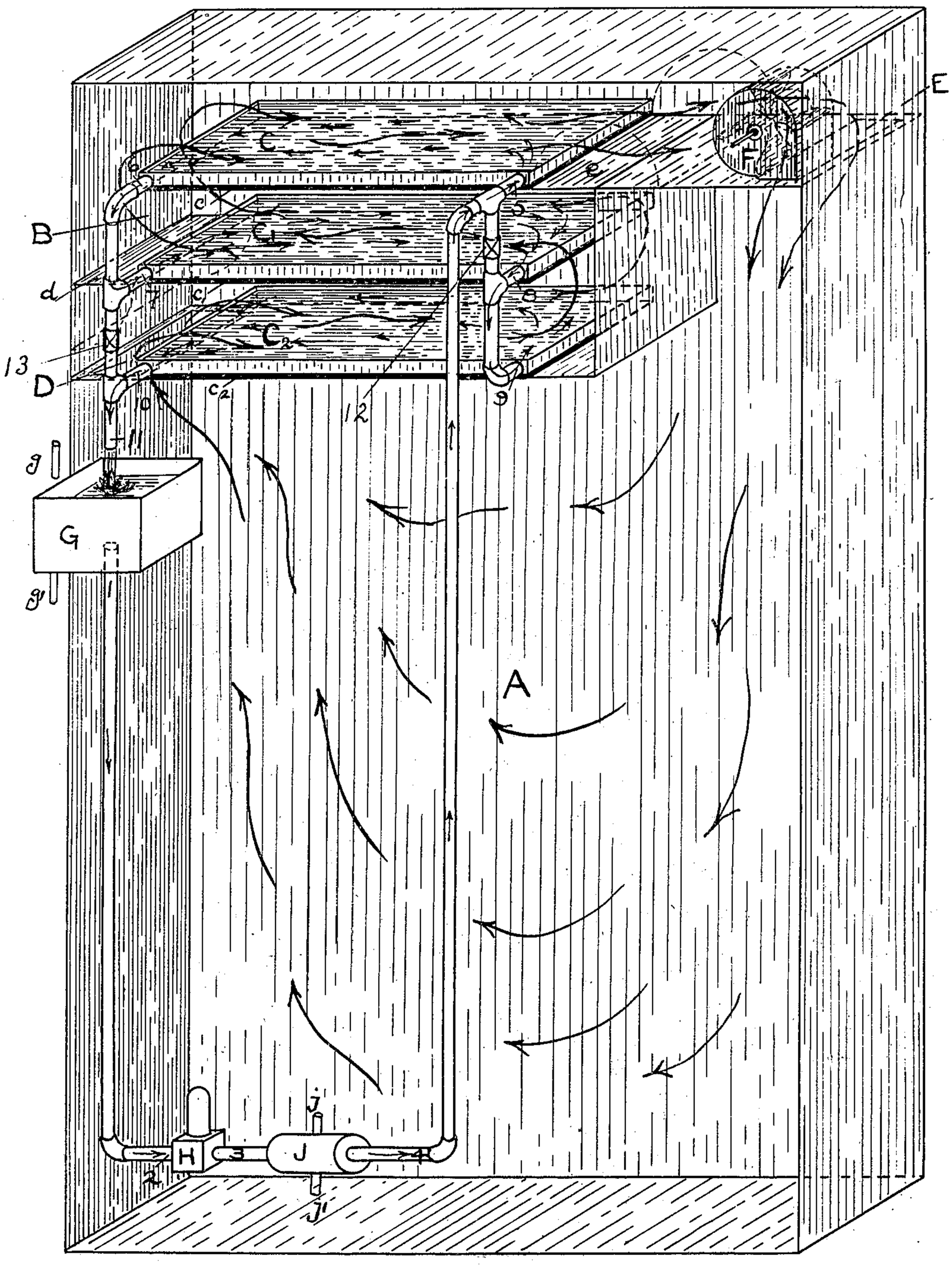

WITNESSES

John J. Moynihan

Genevieve Bolger

INVENTOR

Gardner Tufts Voorhees

by his attorney

Charles F. Richardson

UNITED STATES PATENT OFFICE.

GARDNER TUFTS VOORHEES, OF BOSTON, MASSACHUSETTS.

COOLING APPARATUS.

No. 891,020. Specification of Letters Patent. Patented June 16, 1908.

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To all whom it may concern:

Be it known that I, GARDNER TUFTS VOORHEES, citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Cooling Apparatus, of which the following is a specification.

The isometric drawing shows my invention, the front of the cooling chamber having been removed.

In existing apparatus for cooling air by contact with liquid surfaces or cooling liquids by contact with air, such as water towers and air coolers, I have found numerous objections arising from the fact that the liquid presented its surface to the air by either flowing like rain through the air or flowing in a vertical or nearly vertical direction over surfaces, such as pipes, wood, cloth, sheet metal etc.

One of the objections is that the downward flow of the liquid due to gravitation is too rapid. If a number of these surfaces are supposed to have equal quantities of liquid flowing over them, the question of regulation of the flow of the liquid is extremely difficult. As a result, some of the surfaces get too much liquid over them, and others do not get nearly enough. The liquid surface is so variable that the work of cooling is variable also. Again, the downward flow of the liquid is so rapid that there is hardly time to do the required cooling before the liquid has left the surface.

In the process of artificial refrigeration, it is becoming a well known fact that the most successful way to cool rooms, buildings, cold storage warehouses, theaters, packing houses, etc. is to have the air cooled in a chamber outside of the room or space to be so cooled, and to circulate the air so cooled in the space to be cooled. This air is circulated either by natural or artificial circulation. The earliest method of cooling this air was to pass it over coils of pipe that were cooled by cold brine or ammonia circulated in them. These pipes would accumulate much frost and thereby obstruct the passage of air. Then it was discovered that if brine was allowed to trickle over the outer surfaces of these pipes it would keep the pipes free from frost, and also keep the air drier than heretofore. This method is used extensively to-day, but owing to the great expense of the pipe coils, their valves, and connections, new methods are coming into use whereby the pipes are done away with and vertical surfaces of cloth, boards, coke, sheet iron etc. are used to form surfaces on which to conduct the brine which has been previously cooled, and which after passing over these surfaces is recooled and again passed over the surfaces.

In order to regulate the flow of the brine with any degree of nicety many regulating valves must be governed which require resetting upon change in quantity of brine circulated or from stoppage due to foreign matter. These methods require great attention and much apparatus to regulate properly the flow over these surfaces.

Now the object of my invention is to provide means to overcome the difficulties presented by these methods.

In the drawing illustrating my invention, A is a body of air which may be indefinite, as all out doors, or which may be confined in any kind of an inclosed space in any building or structure of any description.

B is the cooling chamber.

C, C_1, C_2, are shallow pans or supports containing water, brine or other liquid.

D and E are openings or flues connecting space A with cooling chamber B.

d and *e* are movable dampers in cooling chamber B.

c, c_1, c_2, are the bottom exposed surfaces of pans C, C_1, C_2. Each of these surfaces is shown by a heavy black line at the bottom of each pan, and may be made of insulating material to prevent or check the flow of heat through said surfaces.

F is a fan to aid the circulation of air and may be located in either the supply or discharge end of the cooling chamber. It is here shown in the discharge end of the cooling chamber.

G is a liquid tank.

H is a liquid pump.

J is an apparatus in which the liquid is cooled or heated; and j and j_1 are pipes conveying the heating or cooling medium to and from J.

If water is cooled the quantity in the system will diminish by evaporation. The loss will be made up by addition of water to system through pipe *g*. If air is cooled the brine in the system will be weakened by the addition of water condensed from the air. The brine can be partially drawn off from

time to time through pipe g_1; and may be strengthened and then returned to system through pipe g.

The operation of the apparatus as a water cooler is as follows: Water is pumped from tank G, through pipe 1, 2, to pump H, then through pipe 3 to heater J, which may be of any desired description, as an ammonia or steam condenser, etc. Then through pipe 4, 5, to upper pan C. Here the water flows through pan C, as shown by the small arrows, and out through pipe 6, 7, to pan C_1 and through pan C_1 and pipe 8, 9 to pan C_2, and then through pan C_2 and pipe 10, 11 to tank G. The air from space A is sucked by fan F through the opening D into the cooling chamber B over the water surface presented by the pans, thereby evaporating some of the water and so cooling it, and then the air passes out again into space A. The large arrows show the flow of air. The air could enter flue E and flow down over the pans and out flue D if desired, which would be the natural way to circulate it if the fan F were dispensed with. Dampers *d* and *e* can be opened to the positions, shown in the dotted lines, and then the air will divide and go straight through the spaces between the pans without doubling. This may be desirable for large quantities of air when its humidity is great. Whenever the word water is used I mean any liquid that can be used as a medium to be cooled by evaporation by the air. The relative locations of tank, pump, heater and cooling chamber are not important and may be varied. The pans may take the place of the tank, and the heater may be located in one or more of the pans if so desired.

The operation of the apparatus to cool air is as follows:—Brine is pumped from tank G through pipe 1, 2 to pump H, then through pipe 3 to brine cooler J, then through pipe 4, 5 to upper pan C. Here the brine flows through pan C, as shown by the small arrows, and out through pipe 6, 7 to pan C_1, then through pan C_1 and pipe 8, 9 to pan C_2, and through pan C_2 and pipe 10, 11 to tank G. The exposed bottoms *c*, c_1, c_2, of pans C, C_1, C_2 may be of heat insulating material to prevent the formation of frost thereon, as is the case when the liquid is below 32° Fah.; should liquid be above 32° Fah. the bottom may be of heat conducting material. The air from space A is sucked by fan F through the opening D into cooling chamber B over the cold brine surfaces presented by the pans, where the air is cooled, and flows out again into space A. The large arrows show the flow of air. The air could enter flue E and flow down over the pans and out flue D if desired, which would be the natural way to circulate it, if the fan F were dispensed with. The air cooled by the pans may be used for various purposes, and not again passed through the cooling chamber, new or fresh air being continually supplied. The brine may be cooled by any desired means for example, a brine coil, ice, or any refrigerating machine. Dampers *d* and *e* can be opened to the positions shown in the dotted lines and then the air will divide and go straight through the spaces between the pans without doubling. This may be desirable for large quantities of air to prevent undue friction through the cooling chamber. Also the brine may be made to flow through only one pan before returning to the tank by opening valves 12 and 13. Whenever the word "brine" is used I mean any liquid that can be used as a medium to cool the air.

The relative locations of tank, pump, cooler, cooling chamber and space to be cooled are not important and may be altered. The pans may take the place of the tank, and the brine cooler may be located in one or more of the pans if so desired, or the space to be cooled may be above the cooling chamber.

It is understood that the liquid surface must be enough out of level for the liquid to flow over the supports. Whenever I use the word approximately level liquid surface I mean that the liquid surface shall only be so much out of level that the upper surfaces of the supports are not exposed to the air but are covered by the liquid.

What I claim is:—

In a cooling apparatus, a series of supports in tiers, whose upper surfaces are adapted to be entirely covered by a liquid; the exposed under surfaces of these supports being insulated from the liquid surfaces above them; suitable liquid outlets and inlets for said supports whereby the liquid can flow from the upper support to the bottom support; means whereby the liquid may be caused to flow from the lower support to the upper support; a heat transferring device to contact with this liquid; means to circulate air between the supports and liquid surfaces, so as to cool said air.

In testimony whereof I affix my signature in presence of two witnesses.

GARDNER TUFTS VOORHEES.

Witnesses:
GENEVIEVE BOLGER,
JOHN J. MOYNIHAN.