Jan. 8, 1935. J. B. YOCH 1,986,873

AIR COOLING METHOD AND MEANS

Filed April 22, 1932

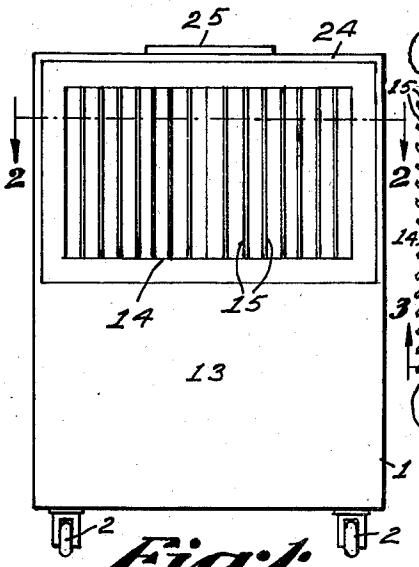


Fig. 1.

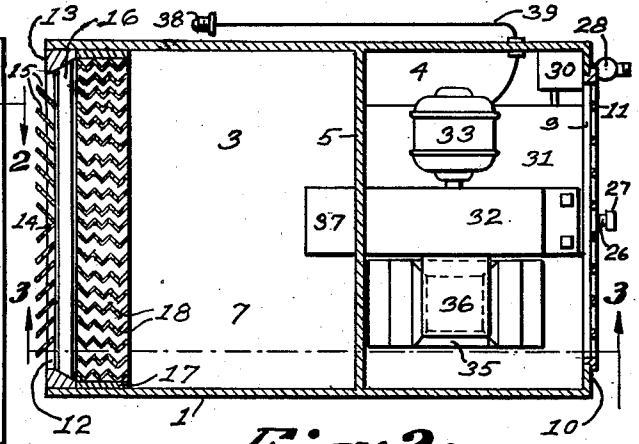


Fig. 2.

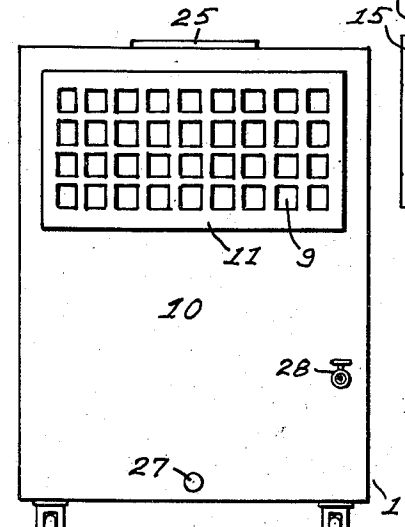


Fig. 4.

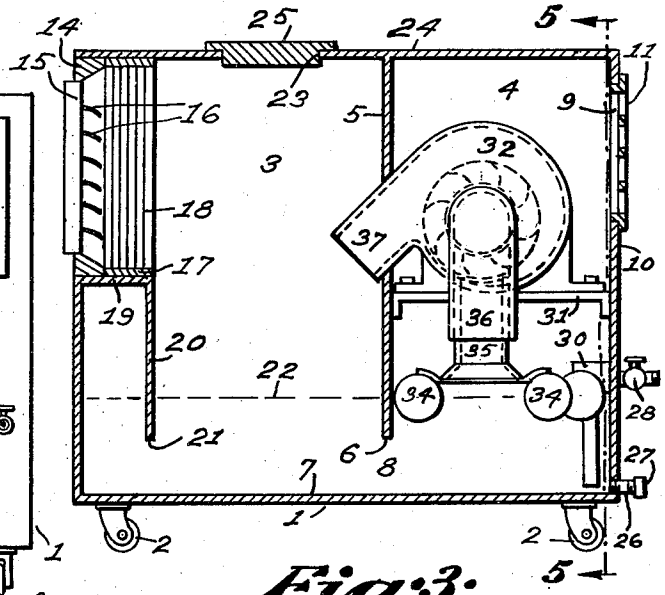


Fig. 3.

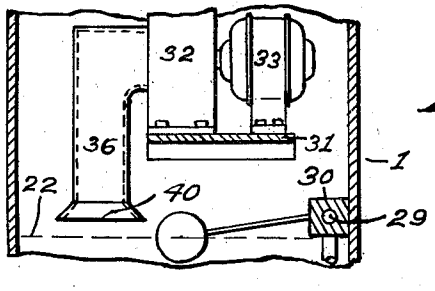


Fig. 5.

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Patented Jan. 8, 1935 1,986,873

UNITED STATES PATENT OFFICE

1,986,873

AIR COOLING METHOD AND MEANS

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Application April 22, 1932, Serial No. 606,888

9 Claims. (Cl. 261—119)

This invention relates to the art of refrigeration by the evaporation of moisture, and more particularly to the art of providing cool, washed and purified air for the interior of homes, offices, factories, auditoriums and the like. In a system of air refrigeration of this character, as the incoming air enters the cooling unit and passes through the finely atomized water spray, it begins the process of evaporating the fine mist until the air becomes partially saturated. In this process, the transfer of heat from the air to the water takes place. At the same time the water, which is constantly recirculated, is being aerated and cooled, and remains at constant wet-bulb temperature. The cooled air then passes through the eliminator plates, where free moisture is removed and returned to the water source. This system requires a blower for moving the air, and hitherto, has also required a water pump for delivering the water at high pressure to spraying nozzles. The water pump, spray nozzles, and other parts of the water system are expensive in first cost, absorb considerable power, and require occasional inspection and repairs. Furthermore, such a system is not adapted for use in connection with the usual wiring system of homes, in which the load on an outlet should not exceed one-fourth of a horse-power, for the reason that the blower alone of a small cooling system requires at least one-fourth of a horse-power to drive it.

Accordingly, the principal purpose of the present invention is to provide an improved cooling system of this character which can be operated without the use of a water pump and spray nozzles.

Another purpose is to provide a cooling apparatus which is adapted for use in small rooms and which can be operated from an ordinary electric light socket.

Another purpose is to provide a portable cooling apparatus which can be shifted readily from one location or room to another.

Another purpose is to provide a cooling apparatus which can be much more cheaply built and operated than those hitherto in use, and which will occupy much less space.

Other objects, advantages and desirable features of the invention will appear in the course of the following description of illustrative embodiments of the spirit of the invention.

In the accompanying drawing forming part of this specification, in which like numbers of reference denote like parts wherever they occur,

Figure 1 is an elevation of the delivery or output end of a portable cooling device made in accordance with this invention;

Figure 2 is a horizontal section, taken on the line 2—2 in Figure 1;

Figure 3 is a vertical section, taken on the line 3—3 in Figure 2;

Figure 4 is an elevation of the input end of the machine; and

Figure 5 is a fragmentary vertical view of a modification, taken through the housing on the line 5—5 in Figure 3.

The apparatus comprises a housing 1, supported on rollers or castors 2, so that it can be moved about at will to any point where its cooling action is desired. The housing is divided into an anterior compartment or chamber 3 and a posterior compartment or chamber 4 by means of a vertical transverse partition or wall 5, whose lower end 6 is spaced from the floor 7 of the housing 1 to provide an opening 8 between the chambers 3 and 4. An air intake opening 9 in the upper end of the posterior end wall 10 of the housing is provided with a screen or open-work plate 11; and an air outlet opening 12 in the upper end of the anterior end wall 13 is provided with an air-diffusing register 14, preferably one having movable or adjustable louvers 15. The register 14 is provided with curved horizontal deflector-slats 16 behind the louvers 15. A frame 17, holding eliminator plates 18, is removably supported on a horizontal shelf or partition 19 behind the deflector slats 16. A vertical partition 20 depends from the posterior or inner edge of the shelf 19, the lower edge 21 of said partition 20 being spaced from the floor 7, preferably at the same height as the lower edge 6 of the partition 5. The lower portion of the housing 1 is adapted for holding a body of water, the maximum level of the water being indicated by the water line 22. An opening 23 is provided in the top wall 24 of the tank 1, and is closed by a removable cover or lid 25. The tank 1 may be drained through a nipple 26, normally closed by a removable cap 27. Water may be supplied to the tank through a manually operated valve 28 at the posterior end of the tank. A pipe 29 extends through the wall 10 to a float valve 30, that shuts off the flow of water automatically when the level of the water reaches the water line 22. A platform 31 is secured to the wall 10 and partition 5 and has mounted thereon a centrifugal air blower 32 and an electric motor 33 for driving the blower 32. A pair of floats 34 are secured to and support an air intake pipe 35, whose upper end telescopes into the depending

air intake conduit 36 of the blower 32. The outlet conduit 37 of the blower extends obliquely downward and forward through the partition 5 so as to direct the air stream forcibly against the surface of the water in the bottom of the housing 1.

The apparatus can be wheeled about on the floor or from one room to another, wherever a cooling stream of air is desired. However, the apparatus is preferably placed near an open window or door, with its intake opening 9 facing the door or window, so that the warm, undersaturated exterior air will be taken in by the apparatus. Water may be supplied to the tank either by means of a hose or buckets through the opening 23 or through a hose or pipe connection to the valve 28. A body of water six inches deep in a tank having a floor thirty-six inches long and thirty inches wide will last twenty-four hours before it needs replenishing, so that the apparatus need not be continually connected to a source of water supply, but, after being filled to the water line, may be transported to any point remote from the source of water supply, if so desired. Of course, a system of piping might be laid in a building so as to provide convenient connections to the apparatus in a plurality of rooms or at different points in a building, in which case the water supply to the tank may be continuous.

The tank or housing 1 having been given its supply of water, the electric plug 38 of the motor circuit 39 is connected to an electric light socket, and the blower 32 begins to operate, drawing in air from chamber 4 into the lower flared end of pipe 35 and thence into conduit 36, through the blower chamber and thence forcibly impinging it against the surface of the water in chamber 3. The height of the lower end of pipe 35 above the level of the water is such that the air suction of the pipe 35 on the water will be sufficient to detach and draw up particles of water from the surface, but without drawing up the full body of water into the pipe 35. The spray thus drawn up accompanies the air stream and is ejected with the latter from the blower outlet 37, thoroughly agitating the water and so rippling the surface thereof in both chambers 3 and 4, which facilitates the production of spray underneath the suction end of pipe 35, as well as in the chamber 3 under the impact of the discharge from the blower. Furthermore, the weight of the water particles in the air stream greatly exceeds that of the air alone, so that the impact of the mist-laden discharge from the outlet 37 on the surface of the water is more effective in producing a spray in the chamber 3 than if the discharge consisted of air alone. It will, therefore, be appreciated that the discharge from the blower outlet 37 facilitates the production of spray under the suction end 35 of the blower by virtue of its rippling the surface of the water thereat, and that the charging of the air stream with spray at the suction end 35 in turn increases the momentum and impact of the stream at the discharge outlet 37, thereby facilitating the rippling of the water as well as the production of additional spray in the chamber 3. Another important feature that contributes to the thorough atomization of the water particles resides in the action of the blower itself: the particles of water in the air passing through the blower are broken up into still finer particles by the impact of the moving blades or vanes of the blower against them, while at the same time the particles of air and water are thrown outwardly by centrifugal force against the walls of the blower housing so as to disintegrate the water particles still further. The mist-laden air is cooled in chamber 3 by the evaporation of the mist to increase the saturation or humidity of the air, and this mist-cooled air of increased humidity rises in the chamber and blows through the eliminator 18 and through the air diffuser 14 into the atmosphere outside of the housing 1, all free moisture in the stream having been removed by the eliminator plates 18, on which it descends to the partition 19, from which it drains off down into the bottom of the tank 1. The free moisture, having been cooled by the process of evaporation, lowers the temperature of the water into which it drains at the bottom of the tank. Thus the water remains constantly cool, exactly at the wet-bulb thermometer reading, or dew point, the entering air being cooled by this constant supply of water. The slats or vanes 16 deflect the rising stream into a horizontal direction toward the diffuser 14. The velocity of the air passing through the apparatus is such that the air is not exposed long enough to the evaporating mist to become completely saturated, so that the cooled air stream delivered from the apparatus is still capable of absorbing more moisture and so producing a still greater sensation of coolness in the auditorium or room to which it is being supplied.

The float 34 maintains constant the distance between the lower end of the suction pipe 35 and the surface of the water, irrespective of the level of the water in the tank, lifting and lowering the pipe 35 in the conduit 36 as the level of the water changes. Float 34 is essential for this purpose in cases where the water supply is not continuously connected to the valve 28. However, where the water supply to the tank is continuous, the float 34 and the movable pipe 35 may be omitted and the lower end 40 of the suction conduit 36 may be flared and brought down to the proper distance from the plane of the water line 22, as shown in Figure 5, relying upon the float valve 30 to maintain constant automatically the distance of the water level from the end 40 of the suction conduit 36.

Of course, if desired, the size of the apparatus may be increased to provide a greater capacity and to utilize more power. It will, also, be appreciated that, in some of its aspects, the invention extends beyond the art of cooling and may be useful in other situations.

It is understood that the words "blower", "air", "water", etc. are intended to be broad and comprehensive and to include within their scope equivalents that will serve the purpose of the particular feature or aspect of the invention defined by each respective claim. For instance, a disc-blade fan or screw propeller that projects the air axially is, also, a blower, and will have a suction end as well as a discharge end.

Having thus fully described this invention, I hereby reserve the benefit of all changes in form, arrangement, order, or use of parts, as it is evident that many minor changes may be made therein without departing from the spirit of this invention or the scope of the following claims.

I claim:

1. The method of producing a spray, which comprises passing a stream of air in proximity to a body of water so as to entrain particles of the water, beating the water-laden stream to break

up the particles of water into still finer particles, and then impinging the water-laden stream against the body of water.

2. In an apparatus for charging air with moisture, means for holding a body of water so as to expose its surface, and means for blowing air, said blowing means having its intake end above, and presented in spaced relation to, the surface of the body of water, and having its discharge end directed toward the surface of the body of water.

3. In an apparatus for treating air, a pair of chambers each adapted for holding water at the bottom, and means for delivering air from one of said chambers into the other, the first-mentioned chamber having an air-inlet and the second of said chambers having an air-outlet, the intake end of the air delivery means being located in said first-mentioned chamber above, and presented in spaced relation to, the plane of the level of the water in said chamber, and the said air delivery means discharging down against the plane of the level of the water in said second-mentioned chamber.

4. In an apparatus for treating a stream of air, a pair of chambers each adapted for holding water at the bottom, and means for blowing air from one of said chambers into the other, the first-mentioned chamber having an air inlet and the second of said chambers having an air outlet, the intake end of the air blowing means being located in said first-mentioned chamber above, and presented in spaced relation to, the plane of the level of the water in said chamber, and means in said second-mentioned chamber for extracting free moisture from the air before it arrives at the said air cutlet in said second-mentioned chamber.

5. In an apparatus for treating air, a pair of chambers each adapted for holding water at the bottom and communicating with each other at their bottoms, and means for delivering air from one of said chambers into the other, the first-mentioned chamber having an air-inlet and the second of said chambers having an air-outlet, the intake end of the air delivery means being located in said first-mentioned chamber above, and presented in spaced relation to, the plane of the level of the water in said chamber, and the said air delivery means discharging down against the plane of the level of the water in said second-mentioned chamber, and means in said second-mentioned chamber for extracting free moisture from the air before it arrives at the air outlet of the second-mentioned chamber.

6. In an apparatus for treating air, a tank adapted for holding water at the bottom, and a centrifugal blower mounted in said tank above the level of the water and having a depending suction conduit whose lower end is presented in suitable space relation to the surface of the water, and a discharge pipe which is directed obliquely downward toward the surface of the water.

7. In an apparatus for treating air, a tank adapted for holding water at the bottom, and a centrifugal blower mounted in said tank above the level of the water and having a depending suction conduit whose lower end is so spaced from the level of the water as to suck in the maximum quantity of water and air.

8. Apparatus for producing a spray which comprises two chambers for holding water, means for delivering air from one of said chambers into the other, the first mentioned chamber having an air inlet and the second of said chambers having an air outlet, said outlet having horizontal deflector slats curved downwardly, the intake end of the air delivery means being located in said first mentioned chamber above, and the said air delivery means discharging down against the water in said second mentioned chamber.

9. In an apparatus for treating air, a tank for holding water and comprising two compartments, a centrifugal blower mounted in one of the said compartments above the level of the water and having a vertically depending suction conduit, and a discharge pipe directed obliquely downward toward the surface of the water in the said second compartment.

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