Sept. 24, 1940. H. GOODMAN ET AL 2,215,753

AIR COOLING UNIT AND ATOMIZER THEREFOR

Filed July 10, 1939

FIG. 1.

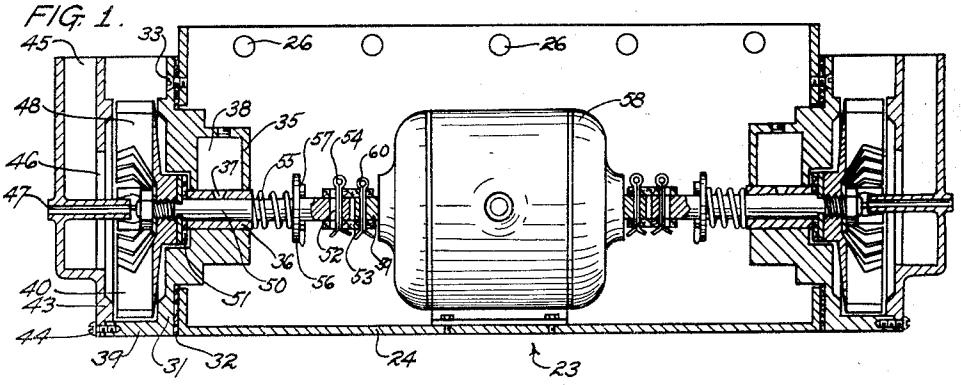


FIG. 2.

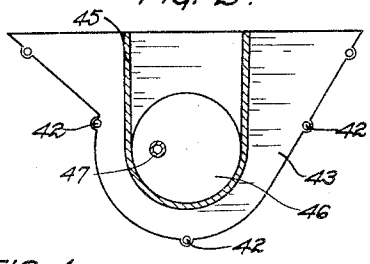


FIG. 3.

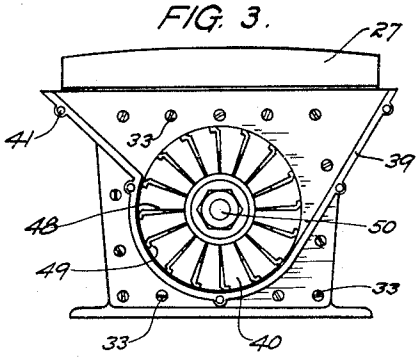


FIG. 4.

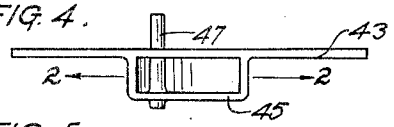


FIG. 5.

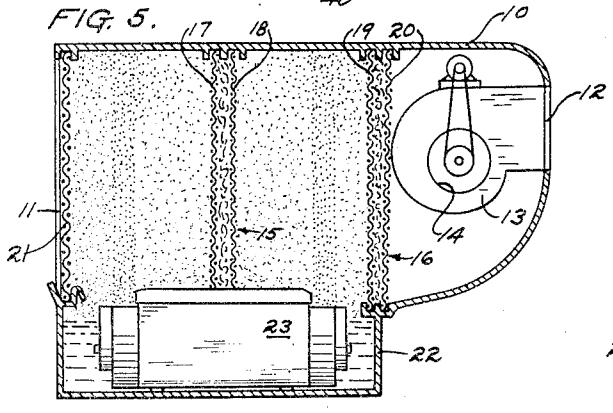


FIG. 6.

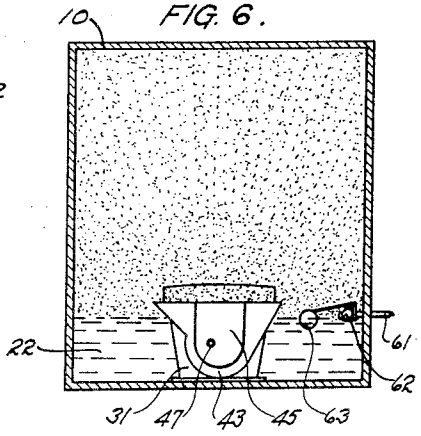
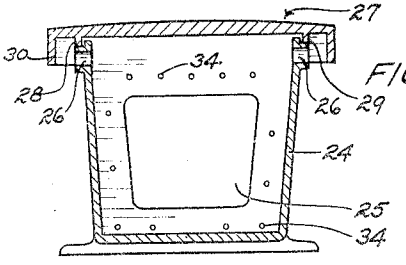


FIG. 7



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AIR COOLING UNIT AND ATOMIZER THEREFOR

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3 Claims. (Cl. 261—92)

This invention relates to evaporation air cooling units, and more particularly to a novel means for atomizing water for such units to increase evaporation.

Most evaporation air cooling units in general use today utilize water sprays to increase evaporation and consequently decrease the dry bulb temperature of the air. Most cities require recirculation of water in such units to conserve the water supply. Water recirculation in turn necessitates the use of a ram or pump together with an electric motor or some other power means independent of the power means for circulating the air. In addition eliminators or filters of some type are used to remove water droplets from the air passing into the room or other closure being cooled. Another type of evaporation air cooling unit uses no water sprays but substitutes comparatively thick filters of excelsior, hair, or similar material, and drips the water downward through the filter material. Evaporation takes place as the air contacts the wet surfaces of the filtering medium. In this type, too, a pump is required to recirculate the water through the filters.

It is the chief object of this invention to provide an air cooling unit in which the water is atomized equally as well as by the recirculating spray system, but in which no pump or ram is required for recirculation or for efficient atomization. It is a further important object of the invention to provide a complete water atomizing and recirculating unit which may be substituted for the water handling means in evaporation air cooling units now in use.

The details in the construction of a preferred form of our invention, together with other objects attending its production, will be better understood from the following description when read in connection with the accompanying drawing, which are chosen for illustrative purposes only, and in which

Figure 1 is a side sectional view of an atomizing unit which embodies a part of the invention;

Figure 2 is a side sectional view of one of the two end plates of the atomizing unit shown in Figure 1, and is taken along the line 2—2 of Figure 4;

Figure 3 is an end view of the atomizing unit illustrated in Figure 1 with the end plate of Figure 2 removed;

Figure 4 is a top plan view of the end plate illustrated in Figure 2;

Figure 5 is a side sectional view of a complete air cooling unit embodying the invention, showing the atomizing unit of Figure 1 and its operative relation to the complete air cooling unit;

Figure 6 is an end sectional view of the cooling unit illustrated in Figure 5 and further illustrates the operative relation of the atomizing unit to the complete cooling unit;

Figure 7 is an end sectional view of the motor housing or box alone, and shows particularly the manner in which the top fits on said housing.

Like characters of reference designate like parts in all the figures.

Referring more particularly to Figures 5 and 6, the invention includes a housing 10 of any desired shape, provided with an inlet 11 and an outlet 12 of any desired size and shape. At a selected point adjacent the outlet 12 we provide a centrifugal blower fan 13, the outlet of which communicates directly with the housing outlet 12. At selected points between the blower inlet 14 and the housing inlet 11 we provide air filters 15 and 16, through which air must pass to reach the blower fan inlet 14. These filters 15 and 16 are preferably formed of respective spaced screens 17, 18 and 19, 20, with any suitable material such as excelsior, animal hair, spun glass, or charcoal, between the respective screens. We have also discovered by test that the cooling unit operates very efficiently without any filtering material whatever between the screens. In addition to the filters 15 and 16 we provide a screen 21 spanning the inlet 11, which screen serves to prevent atomized water within the housing from passing out of the inlet.

The bottom of the housing 10 is made in the form of a water tank 22, the side walls of which are preferably common with the side and end walls respectively of the housing.

As a means of atomizing water within the housing 10 we provide an atomizing unit which is designated as a whole by the numeral 23, and which is of a size to set inside the water tank 22. This atomizing unit includes a box-like motor housing 24 having an opening 25 in each of its ends. Adjacent the upper edge of each side wall of the housing 24 we provide a plurality of spaced perforations 26 which serve as air holes. A top 27 is provided for this housing 24, said top having downwardly projecting interior parallel ribs 28 and 29 which are adapted to seat on complemental exterior shoulders which extend along the side walls of the housing 24 adjacent their top edges, as clearly shown in Figure 7. The top 27 is provided with a skirt 30 which is spaced from the ridges 28 and 29 a sufficient distance

to permit free air circulation under the skirt through the perforations 26 and into the interior of the housing. Since both ends of the complete atomizing unit 23 are identical, a complete description of one end alone should suffice to clearly explain this unit.

The opening 25 in the end of the housing 24 is adapted to be closed by one surface of a water wheel housing 31, a gasket 32 being placed between the two adjacent surfaces to make the housing water tight. The water wheel housing 31 is held in position on the end of the housing 24 by means of countersunk screws 33 which screw into threaded perforations 34 in the end wall of the motor housing. The water wheel housing 31 is preferably cast and includes a bearing box 35, into which a brass bearing 36 is pressed. The bearing 36 is provided with a slot 37 for receiving oil. The bearing box 35 includes an oil reservoir 38. The water wheel housing 31 includes an outwardly extending skirt 39 which forms the edge wall of the wheel housing. In Figure 3 it will be seen that the upper end of this housing is wider than the lower end, in fact the housing is substantially of triangular shape with the water wheel 40 being mounted near the apex of the triangle. The skirt 39 is, of course, formed arcuately to conform to the shape of the water wheel. This skirt 39 is provided with screw holes 41 which are identically spaced with screw holes 42 of an end plate 43 which forms the other side of the water wheel housing. In other words the end plate 43 and the water wheel housing plate 31 are spaced apart by the skirt 39 and form an open topped trough in which the water wheel 40 rotates. Screws 44 hold the end plate 43 in position on the skirt 39. The end plate includes an integral open topped air duct 45 which communicates at its lower end with a substantially circular opening 46 in the end plate proper. This opening 46 is concentrically positioned with relation to the water wheel 40. The outer wall of the air duct 45 carries an integral water conduit 47. This water conduit may be located at any desired point with relation to the water wheel 40, but we prefer to locate it in the position shown in Figure 2. The outer end of this conduit communicates with the atmosphere while the interior end of this conduit is positioned at a point closely adjacent the inner ends of the vanes 48 of the water wheel 40, so that when the atomizing unit is placed in the water tank 22, water is conducted by gravity through the conduit and fed to the water wheel 40. We prefer to locate this water conduit 47 so that its inner end projects through the air opening 46, so that air passing through the conduit 45 to the center of the water wheel will aid in pulling water through the conduit to the wheel. The atomizer will work efficiently, however, if water is fed into the water wheel housing from any point, even at its bottom.

The water wheel 40, as clearly shown in Figure 3, includes a plurality of radially extending axially disposed vanes 48, the outer ends of which are provided with forwardly projecting portions 49. Since the clearance between the forwardly projecting portions 49 of the vanes on this water wheel and the arcuate portion of the skirt 39 is very small, water which enters the trough at any point will be picked up by these forwardly projecting portions and thrown out the open upper end of the trough. The wheel 40 is non-rotatably mounted in a suitable manner on a shaft 50 which is journaled in the bearing 36. An oil and water impervious plastic or fiber washer 51 serves to seal between the interior of the water wheel trough and the end of the bearing 36. That end of the shaft opposite the water wheel 40 is provided with an elongated longitudinally extending slot 52 for permitting a slight longitudinal movement of the shaft within a cylindrical flexible coupling 53. One end of the coupling is slipped over the slotted end of the shaft 50 and a cotter pin 54 is passed through the slot 52. This prevents relative rotation between the shaft and the coupling but affords longitudinal movement for the shaft. A spring 55 has one of its ends bearing against the bearing 36 and its opposite end against a washer 56, which washer is held in position by a cotter pin 57. The spring 55 thus normally serves to keep the water impervious washer 51 pressed tightly against the adjacent end of the bearing 36 to prevent leakage of water from the water wheel housing into the interior of the motor housing 24.

A motor 58 is positioned within the motor housing 24 with the motor shaft in alinement with the shaft 50. The opposite end of the flexible coupling 53 is slipped over the end of the motor shaft 59 and a non-rotatable connection is made by means of a cotter pin 60 passing through the coupling 53 and the motor shaft, a space being left between the end of the motor shaft and the adjacent end of the shaft 50 to permit longitudinal movement of the latter shaft. The opposite end of the atomizing unit 23 is constructed of corresponding parts throughout, and it is not believed necessary to give a complete description of this opposite end.

As illustrated in both Figures 5 and 6, the atomizing unit 23 is adapted to be placed in the water tank 22. The tank 22 is connected with a source of supply 61 and the flow of water into the tank from this source of supply is controlled preferably by a float valve 62 operated by a float 63. The water in the tank may thus be maintained at a substantially constant level, and since the edge walls of the tank are approximately the same height as the open end of the water wheel trough of the atomizer, there is no danger of the water overflowing into the interior of the water wheel trough or into the air duct 45. The motor is started and water flows by gravity through the water conduits 47, into each of the water wheel troughs and is picked up by the water wheels 40.

While it is true that centrifugal force would throw this water from the respective wheels, we have found by test that centrifugal force alone will neither properly atomize the water, nor evenly distribute the water droplets in the air. It is for these reasons that we have built these water wheels to act as small blower fans, and have provided comparatively large air ducts to feed air to the center of these wheels. By the combined use of air moving at high speed and centrifugal force, the water which is fed to the wheels is very finely atomized, and is thrown from the wheels out the open upper ends of the respective troughs and is evenly distributed in a fog across the entire cross sectional area of the housing 10, as shown in Figures 5 and 6. In other words, regardless of the direction of rotation of the wheels, there is substantially the same amount of atomized water distributed to one side of the housing 10 as is distributed to the other side, and the fine particles of water are thrown against the sides and top of the

housing with such force that they bounce back into the air and fill practically the entire air space inside this housing. The atoms are so fine that a fog is formed, which fog circulates in the housing much the same as smoke would do, making it impossible for air to pass from the inlet 11 to the fan intake 14 without passing through this fog.

With the blower fan 13 operating, air is drawn through the inlet opening, through the screen 21, through the atomized water, through the filter 15, through a second mass of atomized water, through the filter 16, into the blower fan and out into the room through the housing outlet 12. The filters 15 and 16, as previously stated, remove the water droplets from the air before it reaches the fan 13. Evaporation takes place within the housing 10 and greatly decreases the dry bulb temperature of the air before it reaches the fan.

While we have described and illustrated a specific embodiment of our invention, we are aware that numerous alterations and changes may be made therein without departing from the spirit of the invention, and we do not wish to be limited, except by the prior art and by the scope of the appended claims.

We claim:

1. A portable air humidifying unit adapted to be placed in a tank or pan of water and to obtain its water therefrom, comprising: a comparatively high walled motor housing; a transverse partition at one end of the housing dividing the housing into adjacent compartments, one for a motor and one for a centrifugal water wheel, both compartments being open at the top; a motor mounted in one of said compartments; a centrifugal water wheel rotatably mounted in the other of said compartments and adapted to be driven by said motor through said partition; sealing means to prevent the passage of water from the water wheel compartment into the motor compartment; and a water passage through an outside wall of the water wheel compartment for admitting water thereto from said tank during the rotation of the wheel.

2. A portable air humidifying unit adapted to be placed in a tank or pan of water and to obtain its water therefrom, comprising: a comparatively high walled open topped housing which includes a motor compartment, a centrifugal water wheel compartment having one of its walls common to one wall of said motor compartment, and an air duct having one of its walls common to one wall of said water wheel compartment; a motor mounted in said motor compartment; a centrifugal water wheel in said water wheel compartment; a driving connection between said motor and said water wheel; packing means for preventing the entry of water into said motor compartment from the water wheel compartment around said driving connection as it rotates; a water passage thru a wall of said water wheel compartment for admitting water to the compartment from the tank or pan in which the complete unit may be seated; and a perforation in the wall which is common to the water wheel and air duct compartments for admitting air into the water wheel compartment during rotation of the water wheel.

3. An air humidifying unit which includes: a narrow water wheel trough the bottom of which is arcuate in cross section, one edge wall of which lies in a plane tangential to said arcuate bottom, and the opposite edge wall of which lies in a plane which is secant to said arcuate bottom and in divergent relation to said first mentioned plane; and a centrifugal water wheel rotatably mounted in said trough, its radius being substantially the same as the radius of said arcuate bottom, and being so mounted that its periphery is evenly spaced only a very slight distance from said arcuate bottom during rotation of the wheel, and said wheel including a plurality of spaced vanes the outer ends of which are turned forward in the direction of rotation of the wheel so as to better pick up any water in the bottom of said trough.

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