Aug. 12, 1947. J. J. BOOTH 2,425,417

DRY AIR COOLER

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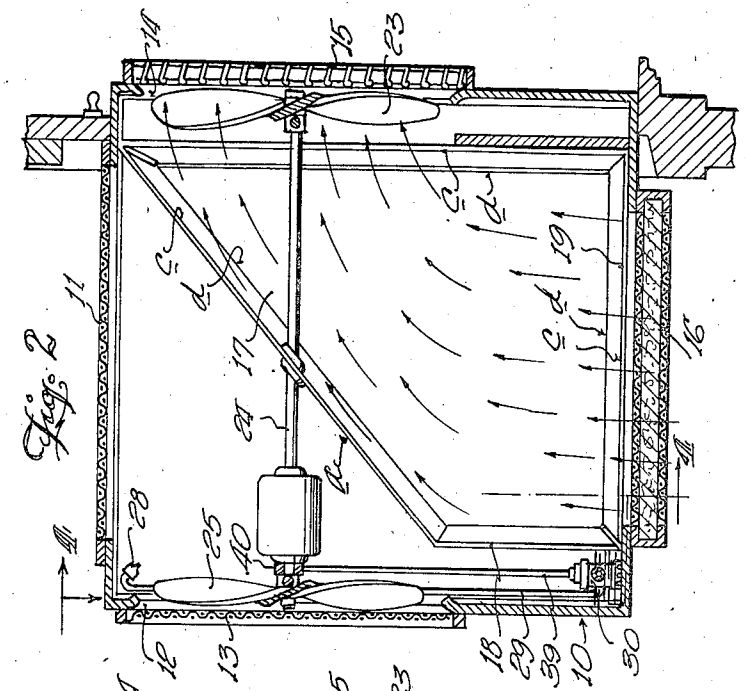


Fig. 2

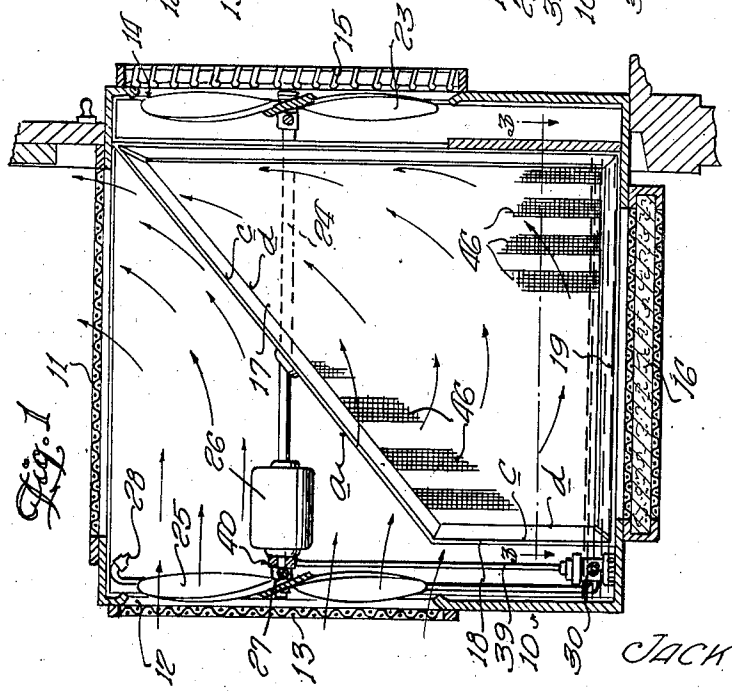


Fig. 1

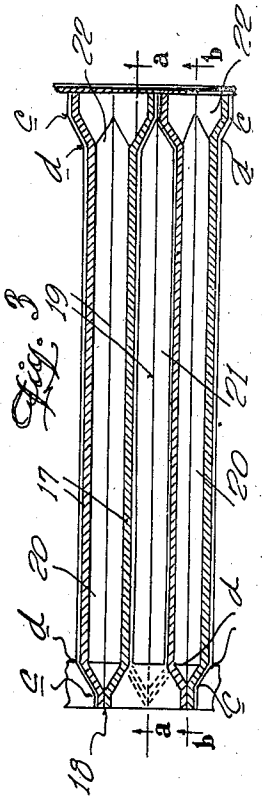


Fig. 3

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Fig. 4

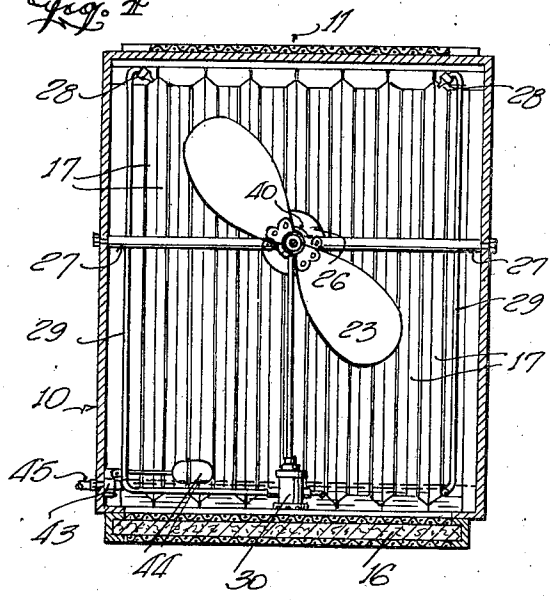


Fig. 5

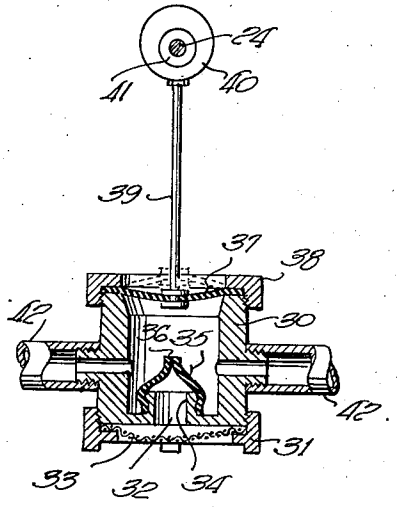


Fig. 6

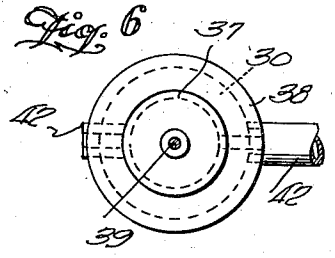
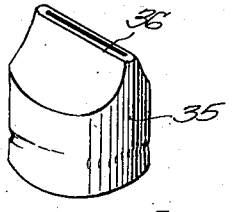


Fig. 7



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DRY AIR COOLER

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6 Claims. (Cl. 62—139)

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This invention relates to air cooling apparatus and more particularly to an air cooling apparatus in which air temperature is lowered by conduction.

The principal object of the invention is to provide apparatus for cooling air entering a room or enclosure without the necessity for filtering the same through water saturated mats, as usually done in evaporative cooling methods, but instead, by constraining the inflowing air to move between and across the surfaces of juxtapositioned plates, or through narrow chambers defined by the plates, alternate ones of which chambers being closed along their tops and frontal portions. Provision is made for cascading water continuously over the chambers during passage of air therethrough which dispels temperature from the plates, resulting in the lowering of the temperature of the air passing from said chambers into a room.

Another object of the invention is to provide a filter for the air entering the cooling chambers, said filter being composed preferably of a mat of fibrous material underlying the open bottoms of the dry chambers through which air is constrained to travel by fans or blowers. The water which is caused to precipitate onto the closed tops of the chambers from elevated spray nozzles is isolated from the filter, hence the latter remains dry, yet intercepts dust, insects and other foreign matter which would otherwise pass on into the room with the air.

Still another object of the invention is to provide a dry air cooler in which the exterior surfaces of the inflowing air chambers are covered wholly or in part by a water absorbent medium calculated to further increase the cooling effects on air passing through the chambers.

With the foregoing and other objects in view, the invention has particular reference to certain features of accomplishment which will become apparent as the description proceeds, taken in connection with the accompanying drawings wherein:

Figure 1 is a side elevational view of an air cooler in vertical section embodying the invention, taken between the plates defining the cooling chambers, as indicated at *a*—*a* in Figure 3 and which plates are exposed to moisture.

Figure 2 is a view similar to Figure 1 but in which the vertical section is taken through one of the cooling chambers as indicated at *b*—*b* in Figure 3.

Figure 3 is a fragmentary view of the heat exchanging chamber assembly, taken on line 3—3 on Figure 1.

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Figure 4 is a front elevational view in vertical section, taken on line 4—4 on Figure 2.

Figure 5 is a detail view of the water pump in vertical section.

Figure 6 is a plan view thereof, and

Figure 7 is a detail perspective view of the resilient valve of the pump.

Continuing with a more detailed description of the drawing, reference numeral 10 denotes a cabinet having an open top with an overlying foraminous covering 11 and an air inlet opening 12 having a foraminous covering 13. At the front or cool air exhaust end of the cabinet is an opening 14, over which is disposed adjustable louvers 15. At the bottom of the cabinet, there is placed a mat or filter 16 of some suitable material having the characteristic of removing from the air passing therethrough, much of the floating foreign matter entrained therein. It will be understood that this filter mat is not wetted by the moisture in the cabinet, nor is it moistened at all insofar as the present invention is concerned, for reasons to be hereinafter explained.

It will become apparent presently how the machine operates to cause pre-chilled air to enter a room at extremely low humidity but at this point it is disclosed that to accomplish the expressed result, the arrangement must be such that the air to be cooled will enter and be exhausted from the cabinet without exposure to the water, used to extract the heat from the air.

With the foregoing in view, a heat exchanger is installed in the cabinet 10, consisting of a multiplicity of parallel plates 17, disposed vertically in the cabinet, and whose upper edges *a* terminate on a common, inclined plane. Each plate 17 has parallel bends *c* and *d* adjacent the perimeter thereof to insure uniform relative spacing of the plates in assembly. The bent edges of one plate along its inclined top and downwardly along the forward edge 18 meet and are secured to the oppositely bent top and front edges of the next adjacent plate while the lower edge 19 and rear edge 20 of said adjacent plate are met and joined by the next succeeding plate. By carrying out this construction throughout the width of the plate assembly 17, a cross-section therethrough, taken vertically or horizontally, will reveal a continuous zig-zag line, represented by the plates and their meeting edges throughout the assembly. This is borne out in Figure 3 which reveals that a plurality of parallel chambers 20 is formed, flanked by an equal number of chambers 21.

The chambers 20 are open only along their bottoms and at the rear thereof while the contrary is true of chambers 21 whose forward ends and tops are open. It remains therefore, that air caused to move upwardly into the chambers 20 will find outlet only at their open ends 22 and will, under no circumstances, be exposed to water cascaded into chambers 21, to collect and form in the closed bottoms of these chambers a common reservoir to be recirculated by a pump which will be presently described.

To constrain air to pass through chambers 20, which may also be referred to as ducts, a blower or a fan 23 is disposed at the exhaust opening 14 and is mounted on a shaft 24, which extends horizontally through the cabinet to support a similar blower or fan 25 which latter creates a suction to force air to enter the cabinet through opening 12 and be exhausted through the top opening of the cabinet covered by screen 11, after being caused to be brought into intimate contact with the inner surfaces of chambers 21. A motor 26, supported by cross-braces 27, operates the shaft 24.

In Figures 5, 6 and 7 is illustrated in detail a pump for elevating water from the reservoir or series of communicating basings defined by chambers 21, to the spray heads 28 through risers 29. This pump consists of a chamber 30 having an elevated base 31 for admission of liquid through an opening 32 in the bottom of the chamber, covered by a filter 33. Embracing the opening 32 interiorly of the chamber 30 is a boss 34, circumferentially beaded to retain a rubber valve, consisting of a cylindrical body 35 and a normally collapsed mouth 36, which is expanded by suction created by pulsations of a rubber diaphragm 37. The diaphragm is held in position over the upper end of chamber 30 by a threaded ring 38.

To actuate the diaphragm 37, a connecting rod 39 has one end secured to the diaphragm at its center and extending upwardly, the opposite end of this rod carries an eccentric ring 40, embracing a disc 41 mounted on the motor shaft 24. Thus, it will be seen that as the motor shaft rotates, the rod 39 will reciprocate to pulsate the diaphragm, thereby to draw water through the valve head 35 whose inherent resiliency causes the same to close periodically as the diaphragm is moved upwardly, thereby preventing egress of water from chamber 30 except through pipes 42 simultaneously to force water upwardly into nozzles 28, which latter, incidentally may be of a construction identical to that of the valve head 35.

To insure a uniform level of water in the common reservoir created by the chambers 21, a conventional valve 43 (Fig. 4) is actuated by a float 44 to evacuate excess quantities of water through drain pipe 45.

From the foregoing it is apparent that with chambers 21 open to the water escaping from the spray heads 28, the interior wall surfaces thereof are covered continuously with a thin sheet or film of water. Simultaneously, air is forcibly brought against these wetted surfaces by the fan 25 for evaporation and consequent cooling of the water which dispels heat from the plates 17 which constitute the walls of the chambers. As a result, the isolated air chambers 20 become quite cold and the temperature of the air constrained to flow therethrough by the fan 23 is lowered to a comfortable degree without the attendant humidity common to the well known evaporative type coolers.

To increase the effectiveness of the water sprays, the surfaces of the plates 17 which are exposed to water, are coated wholly or in part by a sheet or strips 46 (Fig. 1) of a water absorbent material such as heavy, closely woven fabric. This fabric retains the water in intimate contact with the chamber walls for longer periods with obvious results.

While the machine is shown as a window cooler for best results, it is obvious that no restriction to use is intended. Moreover, certain changes and modifications may be made from time to time in the construction of the machine as described without departing from the spirit or intent of the invention, as described in the following claims therefor.

What is claimed is:

1. An air cooling apparatus including a cabinet having front, top and bottom openings and a controlled rear opening, a heat exchanger in said cabinet comprising an assembly of parallel chambers, every other chamber in said assembly being open, along its top and front to define an intermediate chamber open at its bottom and rear, said chambers forming respectively water and air chambers, the water chambers being numerically one less than the air chambers; means for cascading water into said water chambers to continuously moisten the walls thereof, means including the walls of said water chambers for constraining air to pass through the front opening of said cabinet across the walls of said chambers and outwardly through the top of said cabinet, means including the walls of said air chambers for causing air to pass through the bottom of said cabinet, through said air chambers and outwardly through the rear of said cabinet, and means for directing the water collected in the water chambers to the cascading means.

2. An air cooler including a cabinet having air inlets at its front and bottom and air outlets at its top and rear, means prohibiting intermingling of air entering through said separate inlets, said means comprising parallel chambers in said cabinet, alternate ones being closed to the lower portion of said cabinet, the remaining chambers being closed to the upper portion of said cabinet, means for continuously wetting the inner wall surfaces of said first chambers, means including the walls of the first chambers for circulating air thereacross, means including the walls of the second chambers for constraining air to pass through said second chambers, losing temperature in passage, and means for depriving the latter air of entrained foreign matter.

3. An air cooler including a heat exchanger comprising a plurality of vertically disposed and closely spaced, parallel chambers, certain of said chambers being closed along their bottom and rear portions to define a set of similar chambers, the rest of said chambers being closed along the tops and front portions to define a second set of similar chambers, means for continuously wetting the interior wall surfaces of said first mentioned chambers, means including the walls of the first set of chambers for passing a stream of air across the surfaces thereof to cool the interiors of said second chambers and means including the walls of the second set of chambers for constraining a separate stream of air to pass therethrough.

4. An air cooler including a heat exchanger comprising vertically disposed non-communicating chambers arranged in parallelism, the bot-

toms and rear ends of alternate chambers being closed and defining one set of similar chambers, the remaining chambers being closed at their tops and front ends and defining a second set of similar chambers, means for continuously wetting the interior wall surfaces of the first set of chambers, means including the walls of the first set of chambers for causing a continuous current of primary air to pass over the surfaces thereof, and means including the walls of the second set of chambers for causing a stream of secondary air to pass therethrough.

5. A cooler as set forth in claim 4, in which the heat exchanger is positioned in a cabinet having air inlets in its front and bottom, and

having air outlets in its top and rear, the heat exchanger separating the air inlets and outlets.

6. A cooler as set forth in claim 4, having separate outlets for the primary and secondary air.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,209,999	Patch	Aug. 6, 1940
2,107,280	Ballard	Feb. 8, 1938