Nov. 16, 1937. R. T. SMITH 2,099,665

DEHUMIDIFIER

Filed March 1, 1937

Fig. 1.

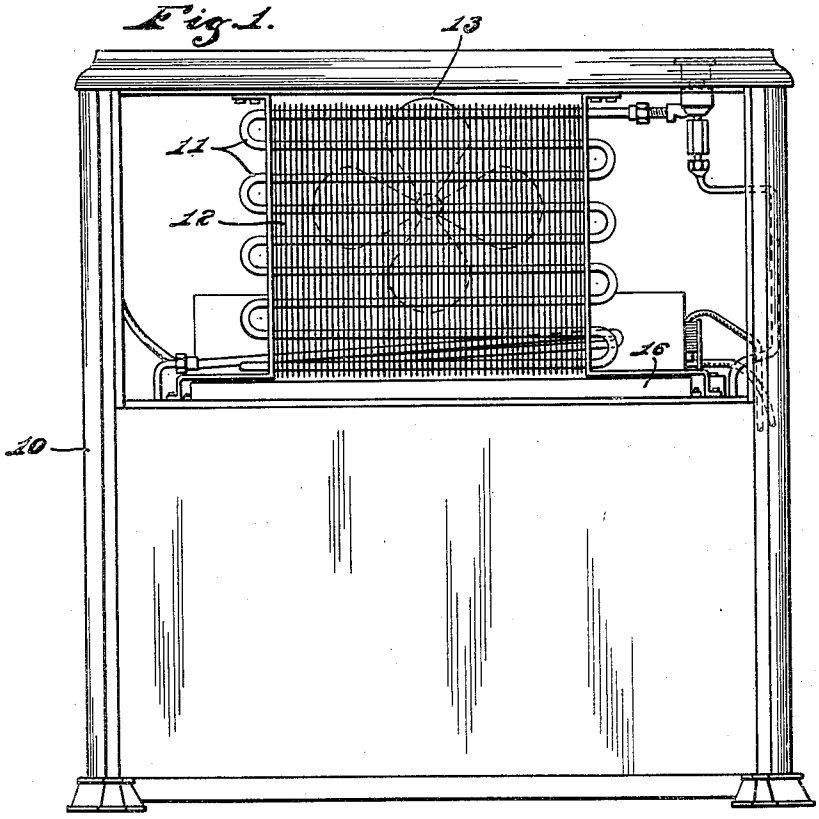


Fig. 2.

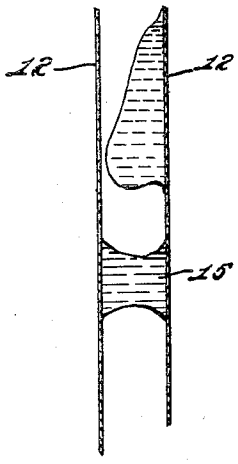
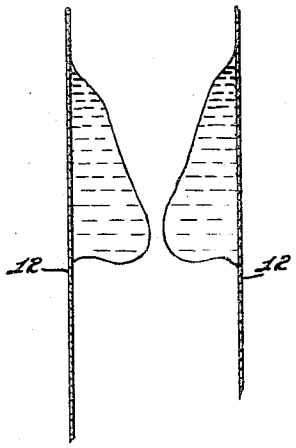


Fig. 3.



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DEHUMIDIFIER

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Application March 1, 1937, Serial No. 128,523

11 Claims. (Cl. 62—140)

The present application is a continuation in part of my copending application Serial No. 59,623, filed January 17, 1936, for Method of and apparatus for conditioning air; and relates to a dehydrator or dehumidifier, the function of which is to reduce the relative humidity of the atmosphere in an enclosed space.

The primary object of the invention is to provide a unit of such character that, when a stream of air is directed therethrough, moisture from the air will be condensed upon the elements of the unit and will be rapidly precipitated from the elements of the unit into a receptacle from which the moisture may be readily drawn. Further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the form illustrated in the accompanying drawing, attention being called to the fact, however, that the drawing is illustrative only, and that change may be made in the specific construction illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a view of a cabinet containing the dehumidifier of the present application, associated with certain other elements of an air conditioning mechanism;

Fig. 2 is a highly magnified view of two adjacent condensing fins showing the manner in which moisture gathers on, and is carried away from, the fins; and

Fig. 3 is a view similar to Fig. 2, but showing the manner in which droplets of water gather and hang upon fins of previously known units.

Referring more particularly to the drawing, it will be seen that I have illustrated a cabinet 10 in the upper portion of which is mounted a unit comprising a refrigerating coil 11 with which is associated a series of substantially parallel fins 12 mounted in vertical planes. A fan 13, driven by any suitable motor (not shown) is so mounted as to draw air through the unit and between the fins 12.

Within the lower part of the cabinet 10 is mounted a refrigerating unit of any desired type which operates to force a refrigerant through the coil 11, thereby cooling the fins 12; the refrigerating unit being so operated as to hold the temperature of the fins slightly below the dew point; viz., at a temperature between 40° and 50° F.

It will be obvious that, as air is drawn through the unit between the fins 12, when it strikes the fins which are held at a temperature somewhat below the dew point, a part of the moisture carried by the air will be condensed upon the surfaces of the fins. This condensation results in the formation of droplets of water which tend to adhere to the vertical surfaces of the fins.

As broadly described thus far, the organization does not differ materially from the prior art as illustrated, for instance, in the patent to Strang et al No. 1,933,771. In structures of the type of the Strang patent, however, the spacing of the fins is such that the droplets of water form thereon in the manner illustrated in Fig. 3; and, after a relatively short period of operation, the fins are so profusely covered with such droplets as to be not only insulated, so far as cooling effect upon the passing air is concerned, but further as to permit no further condensation of moisture from the air and, in fact, in many instances, the air passing through the spaces between the moisture-covered fins actually absorbs moisture therefrom.

According to the present invention, I space the fins 12 in such a manner that, as a droplet of water grows upon one fin, it soon contacts the next adjacent fin, in the manner illustrated in Fig. 2; whereupon, the surface tension of the droplet being broken, the mass of water assumes the form indicated at 15 and promptly flows down the surfaces of the adjacent fins and drops off at the bottom into the collecting pan 16.

I prefer to arrange my fins, which are formed of sheet metal, 0.012 inch in thickness, so spaced as to provide ten fins in each inch; but it will be seen that slight variations from that optimum are permissible. The limits of such variation may be stated by saying that the adjacent fins are separated a distance less than the maximum horizontal dimension of a water droplet adhering to the vertical surface of a fin, but greater than a distance such as to hold water, by capillary effect, against gravitational flow. At present, I believe that the minimum spacing is approximately 0.0505 inch and the maximum spacing is approximately 0.113 inch; with the optimum being 0.088 inch. If fins having a thickness of 0.012 inch are used, the minimum spacing provides 16 fins to the inch, and the maximum spacing provides 8 fins to the inch. Obviously, as the number of fins per inch is increased, the degree of dehumidification will be increased, whereby the relative humidity of the air discharged from the device will be decreased. Similarly, the relative humidity of the air discharged from the device may be varied by varying the temperature of the fins.

I claim as my invention:

1. In a device for conditioning air, a cooling unit comprising a conduit for refrigerant and a series of fins disposed in substantially parallel vertical planes and in intimate contact with said conduit, means for directing over said cooling unit a stream of air to be conditioned, and means for circulating a fluid refrigerating medium through said conduit at a rate to effect condensation of moisture from such air stream upon said fins without causing freezing thereof, said fins being substantially equally spaced apart a distance less than the maximum horizontal dimension of a water drop condensed on one of said fins from such air stream and of such mass that the surface tension thereof tending to cause said drop to adhere to said one fin is merely sufficient to overcome the force of gravity tending to slide said drop from said fin, but greater than a distance such as to hold water by capillary attraction against gravitational movement.

2. In a device for conditioning air, a cooling unit comprising a conduit for refrigerant and a series of fins disposed in substantially parallel vertical planes and in intimate contact with said conduit, means for directing over said cooling unit a stream of air to be conditioned, and means for circulating a fluid refrigerating medium through said conduit at a rate to effect condensation of moisture from such air stream upon said fins without causing freezing thereof, adjacent fins of the series being spaced apart at least approximately 0.0505 inch but not more than 0.113 inch.

3. In a device for conditioning air, a cooling unit comprising a conduit for refrigerant and a series of fins disposed in substantially parallel vertical planes and in intimate contact with said conduit, means for directing over said cooling unit a stream of air to be conditioned, and means for circulating a fluid refrigerating medium through said conduit at a rate to effect condensation of moisture from such air stream upon said fins without causing freezing thereof, adjacent fins of the series being spaced apart approximately 0.088 inch.

4. In an air conditioning device, a refrigerant compressor, a condenser, and an evaporator for refrigerant, and conduits connecting said units, whereby refrigerant is compressed and condensed and circulated to said evaporator in liquid form and there evaporated to extract heat from the circumambient atmosphere, a fan, operable to direct a stream of air over said evaporator, said evaporator comprising a plurality of runs of conduit connected to receive refrigerant from said condenser and to discharge refrigerant to the intake end of said compressor, and a series of fins disposed substantially in parallel vertical planes in intimate contact with said conduit runs, adjacent fins of said series being spaced apart at least approximately 0.0505 inch and not more than approximately 0.113 inch.

5. In an air conditioning device, a refrigerant compressor, a condenser, and an evaporator for refrigerant, and conduits connecting said units, whereby refrigerant is compressed and condensed and circulated to said evaporator in liquid form and there evaporated to extract heat from the circumambient atmosphere, a fan, operable to direct a stream of air over said evaporator, said evaporator comprising a plurality of runs of conduit connected to receive refrigerant from said condenser and to discharge refrigerant to the intake end of said compressor, and a series of fins disposed substantially in parallel vertical planes in intimate contact with said conduit runs, adjacent fins of said series being spaced apart approximately 0.088 inch.

6. In an air cooling system; the combination of a cooling unit, means for supplying fluid refrigerent thereto, means for withdrawing refrigerant therefrom, and a blower positioned to direct a current of air to be conditioned through said cooling unit; said cooling unit comprising a set of vertically extending, parallel spaced apart plates of heat conducting material, and a conduit for refrigerant, each plate having a set of perforations therein alined with the perforations in the other plates and said conduit passing through the perforations in said plates and extending from side to side of said cooling unit and being connected to said refrigerant supplying means and said withdrawing means; the spacing of the plates being so correlated with the rest of the system that the drops of water condensed on a plate surface from the air directed against the same by the blower will bridge the gap between such surface and the confronting plate surface and pass downwardly out of the set of plates at a rate sufficient to leave surfaces of the plates at all times in a condition to condense moisture from all of the air passing through the unit.

7. The structure defined in claim 6 in which the spacing of the plates falls between 0.0505 inch and 0.113 inch.

8. The structure defined in claim 6 in which the plates are spaced apart approximately 0.088 inch.

9. In an air cooling system; the combination of a cooling unit, means for supplying fluid refrigerant thereto, means for withdrawing refrigerant therefrom, and a blower positioned to direct a current of air to be conditioned through said cooling unit; said cooling unit comprising a set of vertically extending, parallel spaced apart plates of heat conducting material, and a conduit for refrigerant, each plate having a set of perforations therein alined with the perforations in the other plates and said conduit passing through the perforations in said plates and extending from side to side of said cooling unit and being connected to said refrigerant supplying means and said withdrawing means; said plates being arranged with their facing surfaces so close together that water droplets condensed on one plate from such air stream will bridge the gap between said one plate and the adjacent plate, but so far apart that capillary action will not hold said droplets against flow under the forces urging them along the surface of the plate.

10. The structure defined in claim 9 in which the spacing of the plates falls between 0.0505 inch and 0.113 inch.

11. The structure defined in claim 9 in which the plates are spaced apart approximately 0.088 inch.

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