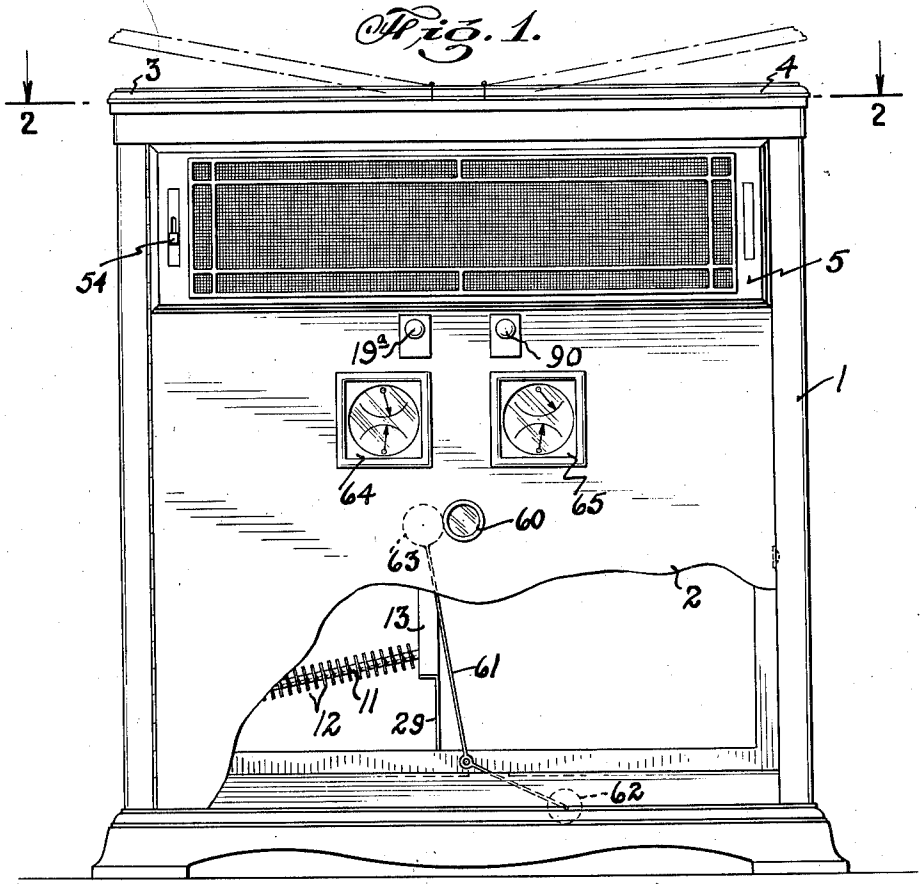
Oct. 27, 1936. J. C. GOOSMANN 2,058,973

AIR COOLING AND CONDITIONING APPARATUS

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Fig. 1.



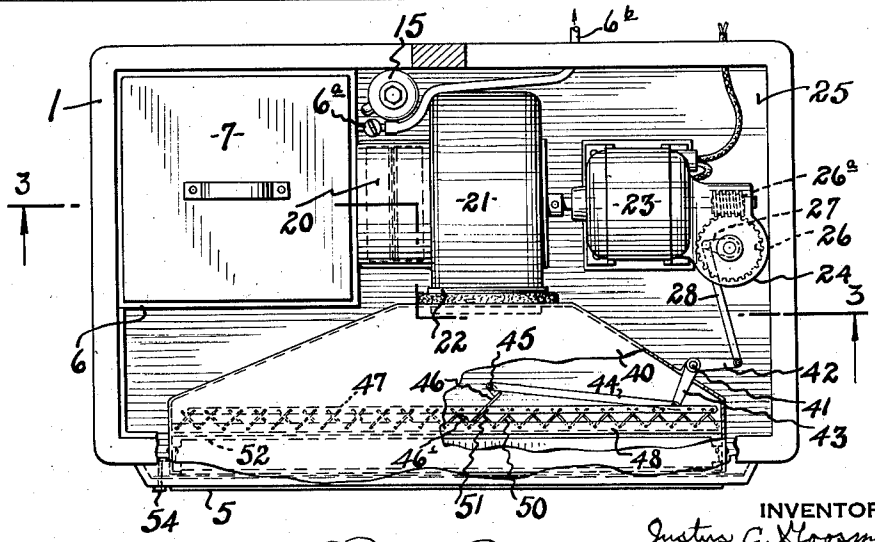


Fig. 2.

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Fig. 3.

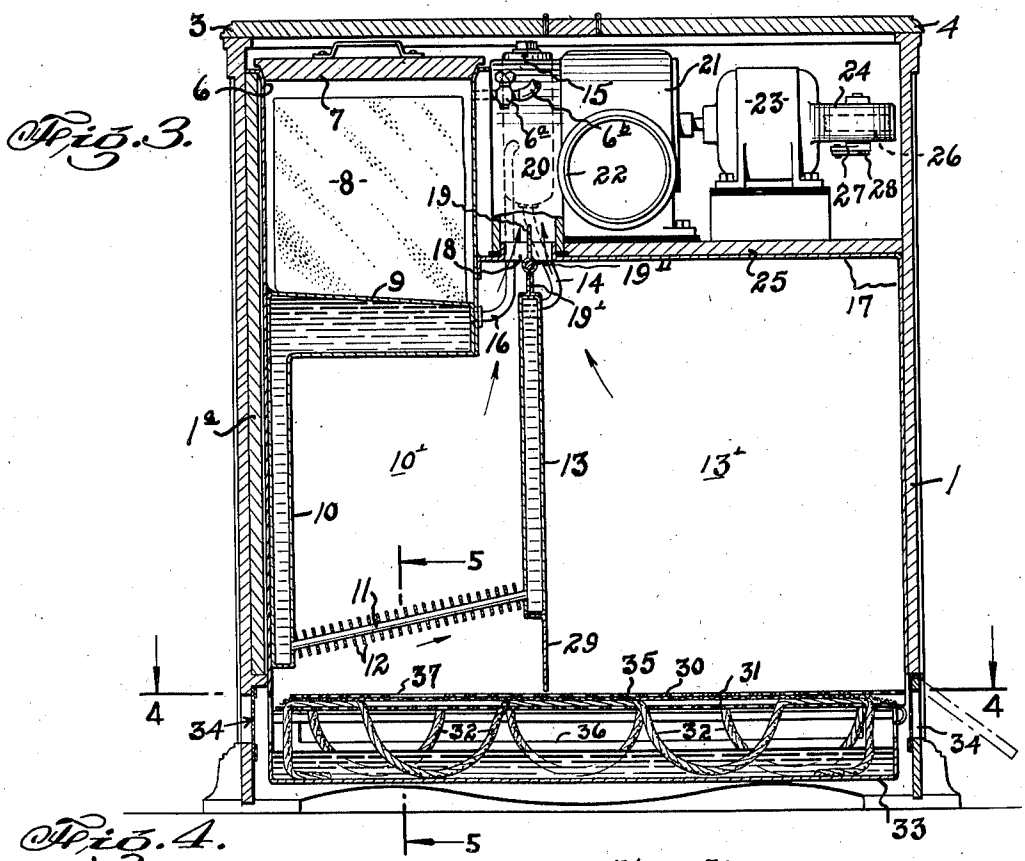


Fig. 4.

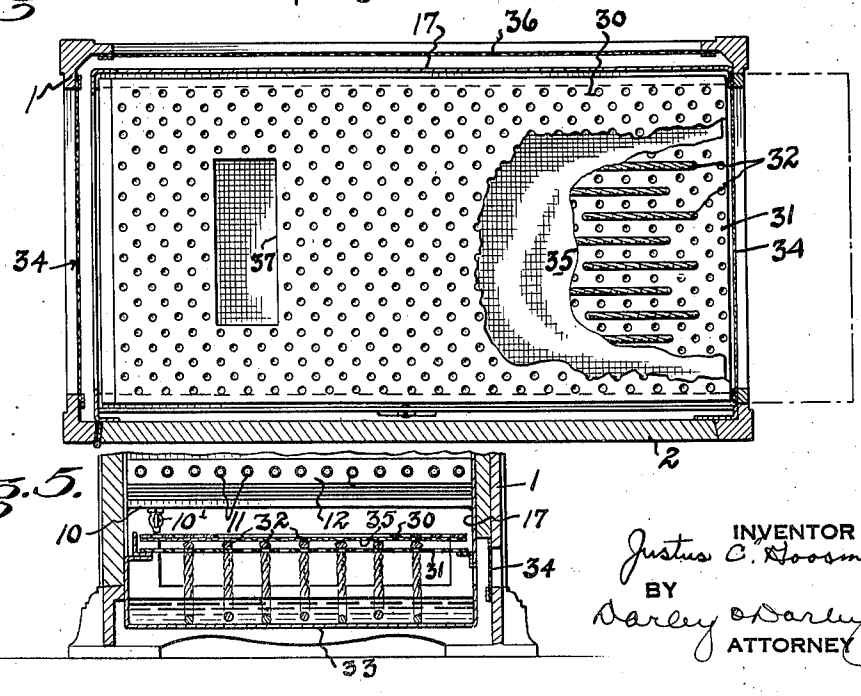


Fig. 5.

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Fig. 6.

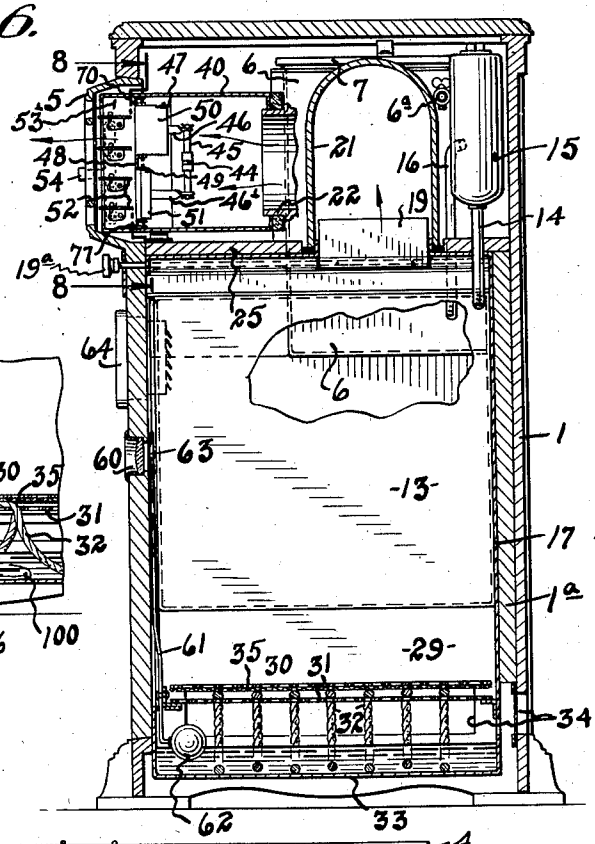


Fig. 9.

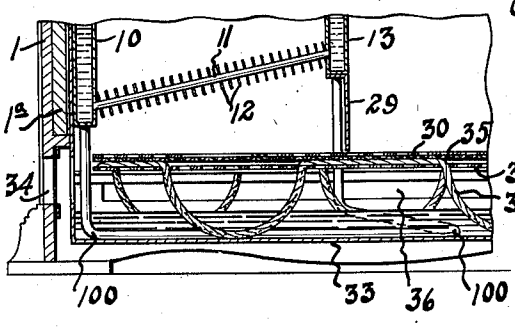
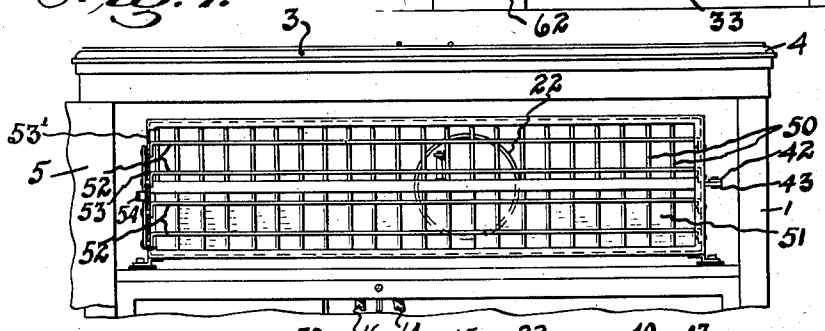


Fig. 7.



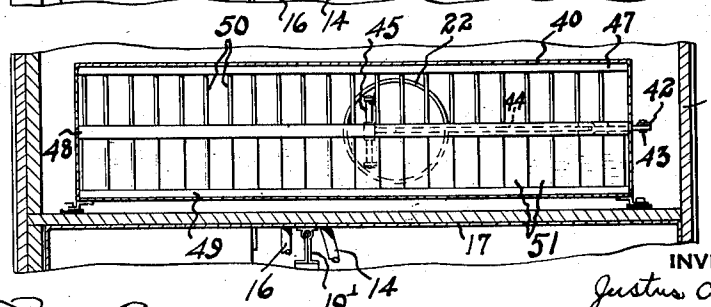


Fig. 8.

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UNITED STATES PATENT OFFICE

2,058,973

AIR COOLING AND CONDITIONING APPARATUS

Justus C. Goosmann, New York, N. Y.

Application August 10, 1934, Serial No. 739,213

9 Claims. (Cl. 62—129)

This invention relates to improvements in air cooling and conditioning apparatus of the portable as well as stationary type.

The broad object of this invention is to provide improved air cooling and conditioning apparatus in a form adapted for the purpose of producing comfortable conditions in offices, halls, stores, Pullman cars and the like as distinguished from larger equipment designed to condition the air in an entire building.

This invention comprises many objects which are successfully secured by means of the construction described in full detail in the following specification in connection with the attached drawings and pointed out in the appended claims.

This invention resides substantially in the combination, construction, arrangement and relative location of parts, all as will be set forth in the specification.

In the drawings,

Fig. 1 is a front elevational view of one form of the device of this invention with a portion of the front broken away to show the interior thereof;

Fig. 2 is a top view of the device on the plane 2—2 of Fig. 1 with some parts broken away;

Fig. 3 is a vertical cross sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a cross sectional view taken on the line 4—4 of Fig. 3 with some parts broken away;

Fig. 5 is a detail cross sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is a vertical central cross sectional view through the device;

Fig. 7 is an enlarged detail view of the air distributing vanes;

Fig. 8 is a cross sectional view taken on the line 8—8 of Fig. 6; and

Fig. 9 is an enlarged cross sectional view of a modified structure.

The invention relates to apparatus by means of which spaces of relatively small volumes such as rooms, offices, vehicles and the like may be rendered more comfortable for the occupants. The invention involves a relatively portable self contained unit which may be placed within the space to be conditioned and which in operation and under the control of the operator cools and humidifies the air of the space. Generally speaking, the apparatus comprises a refrigerant placed in heat exchange relation with a secondary circulatory refrigerant which in turn is associated with produced air currents from which heat may be abstracted. In addition humidifying apparatus is employed so that the cooled air may be given the proper moisture content.

In furtherance of the object of the invention the apparatus is constructed so that the air stream is controllably divided into two parts, one of which may be rendered colder than the other, after which the streams may be combined to provide a single cooling air stream of the proper temperature and moisture characteristics. The apparatus likewise includes distributing mechanism by means of which the combined air stream may be distributed or diffused in the space being treated so as to fully distribute its effects throughout that space.

Referring now in detail to the drawings, the device is shown comprising a cabinet or housing 1, which may be of any suitable size, shape and construction to meet the conditions of use. The casing is provided with a front door 2 preferably horizontally mounted thereon, and with a top in the form of separate horizontally mounted cover leaves 3 and 4. The door 2 is provided with an individually removable grill 5. Within the cabinet, as is clear from Fig. 3 there is provided a metallic container or casing 6 having a removable heat insulating closure member 7 access to which may be had by raising the top leaf 3. At 8 is indicated the refrigerant which may be in a number of known forms but is preferably solid carbon dioxide. The bottom wall of the casing 6 is provided by the top wall 9 of a closed metallic casing which has a depending leg portion 10 having considerable vertical and transverse extension but being relatively thin in depth in a horizontal plane, as is clear from Fig. 3. The lower end of this leg 10 is connected by a series of small metal tubes 11 near the bottom to the bottom of a similar metallic leg or casing 13 which has relatively large extension in a vertical and horizontal direction, but is relatively shallow in depth in a horizontal direction. The tubes 11 preferably incline upwardly from the lower end of leg 10 to the lower end of leg 13. The top of leg 13 is connected by a pipe 14 to the bottom of a metallic chamber 15 which is connected from a point above the bottom thereof by a pipe 16 to the top of the leg 10.

The leg 10, pipes 11; leg 13, pipe 14; tank 15 and pipe 16 provide a closed circulatory system which contains the secondary refrigerant which may be any one of a number of well known liquids usually employed for such purpose, as for example alcohol. It will be noted that the parts are so related that the solid refrigerant rests directly upon the wall 9 which forms the top of a

portion of this circulatory system and adjacent the point of delivery of the secondary refrigerant into the leg 10, after it has absorbed heat from the air stream. It might be noted that in accordance with well known principles in the art and when desirable, heat insulating pads of various thicknesses may be interposed between the refrigerant 8 and the wall 9 to retard the rate of heat transfer from the secondary refrigerant to the solid refrigerant.

As is clear from the figures, the tubes 11 are provided with fins 12 to provide larger surfaces of contact between the circulatory system and the air stream. The lower portion of the cabinet 1 is provided with a metallic lining casing 17 which extends to the casing 6 and is provided with an air opening 18 therethrough in which is mounted an adjustable damper 19 pivotally supported upon the bracket 19' by means of a shaft 19'' which extends through to the front of the casing as shown in Fig. 6, and is provided with an operating knob 19a. When the damper is in the position shown in Fig. 3 air may pass through the opening 18 from both sides of the leg 13 or from the two chambers formed thereby in conjunction with the baffle wall 29.

The member 18 is mounted in the intake casing 20 of a blower 21 of any suitable form. At 22 is the discharge port of this blower. The blower is operated by means of a small electric motor which is supported upon the horizontal wall 25. This wall, together with the walls 1a, serves to further insulate the inner metallic walls of the apparatus from direct exposure to the atmosphere. The motor 23 is provided with an extending casing 24 which houses the worm 26a (Fig. 2) and the meshing worm wheel 26 which is mounted upon the same shaft with the crank 27. Mounted in the bottom of the cabinet, so as to extend under the two chambers of the device, is a water pan or receptacle 33 positioned so that air entering the casing through the screened openings 34 and 36 will pass over the top thereof.

Located above the pan is a separably mounted filter plate, slidingly supported upon brackets, consisting of two perforated plates 30 and 31 which have interposed between them a fine mesh fabric filtering material 35. Supported by the plates 30 and 31 and passing through the filtering material 35 are the wicks 32 which depend into the water contained in pan 33. Owing to the capillary action of the wicks 32 the water in pan 33 is drawn into the filtering material 35 whereby the latter is constantly maintained in a wet condition.

The warm air entering the casing through screened openings 34 and 36 passes over the top of the water pan 33 through the wet filtering material 35 into the respective cooling chambers 10' and 13' to be cooled and de-humidified.

The water in pan 33 may be cooled by an extension 100, (Fig. 9), of cooling surfaces attached to the cold leg 10 on one side and the warm leg 13 on the other.

It receives further cooling by the suction of blower 21 which draws the water vapor above the water level in pan 33 along with the entering air into the cooling chambers 10' and 13' where it condenses upon the various cooling surfaces.

At 40 is a casing which is connected to the discharge port 22 of the blower, and is shaped so as to be substantially rectangular at its discharge mouth which is mounted in back of the grill 5. As is clear from Fig. 6, there is pivotally supported within this casing on the fixed horizontal bars 48, 70 and 71, two sets of vanes 50 and 51. The vanes of each set are pivotally connected together by the bars 47 and 49 respectively so that they may be given conjoint pivotal movement. The upper vanes 50 are provided with a lever 46 and the lower vanes 51 are provided with a lever 46', which levers are pivotally connected to a vertical bar 45 which in turn is pivotally connected by the link 44 (see Fig. 2) to the bell crank lever 42, 43, in turn pivotally supported on the casing 40 at 41. Arm 42 of the bell crank lever is pivotally connected through link 28 to the crank 27.

Pivotally mounted upon horizontal axes are the transverse vanes 52 which extend from side to side across the grilled opening of the cabinet. These vanes 52 are pivotally mounted on the stops 53' of the casing 40 and are all pivotally connected together by means of a link 53 which has an operating extension 54 which projects through the front of the cabinet. As will be apparent, by moving the operating extension up and down the horizontal deflectors 52 may be positioned to direct the issuing air stream either downwardly, horizontally or upwardly. The circulatory system is provided with a drain cock 10' (see Fig. 5) by means of which the secondary refrigerant may be removed therefrom.

Additional liquid may be introduced into the circulatory system through the removable plug into tank 15. This tank is provided as an expansion chamber to provide the necessary volumetric space to accommodate the changes in volume of the secondary refrigerant under the varying temperatures which it may encounter in ordinary use. Thus, when the apparatus is not in use and is at room temperature the secondary refrigerant requires considerably more volume than it does when the apparatus is in operation. The casing 6 is provided with a discharge pipe 6b leading to the exterior of the casing, and provided with a pet cock 6a. The purpose of this tube is to conduct the carbon dioxide gas which is formed as the solid sublimes, to the exterior of the casing. It is of course apparent that when desired this gas may be discharged around the apparatus and within the cabinet, and particularly around the motor 23 to aid in keeping it cool.

Any surplus of carbon dioxide vapor may be discharged from the casing through a tube or hose connection into the outside atmosphere or any other convenient point of exit, such as windows, sewer connection, wall partitions and the like.

The front of the cabinet is provided with a window 60 in back of which a signaling vane 63 may move. This vane is mounted upon a bell crank lever 61 pivotally supported in the casing and provided at the opposite end with a float 62 positioned to float in the liquid in the pan 33. When the liquid level gets low the signal vane will appear in the window 60, indicating this fact. At 54 and 65 are instruments for indicating the temperature as well as the relative humidity of the two air streams that are passing upwardly on opposite sides of the partition formed by the leg 13 and the baffle 29. At 90 (Fig. 1) is the control knob for the switch which turns the motor 23 off and on in an obvious and well known way.

The modification of Fig. 9 differs only from the structure previously described in providing a metallic pipe connection 100 between the extreme lower ends of the legs 10 and 13. This pipe 100 is submerged in the water in the pan 33 for the purpose of lowering its temperature.

It might be well to note here that for the purpose of claiming the leg 10 will be called the cold leg and the leg 13 will be called the warm leg, since they are of relatively different temperatures, as will be obvious from the following description and the operation of the apparatus. In the operation of the apparatus when the motor is running the blower will draw air from outside of the cabinet through the grilled openings 34 and 36 by the bottom thereof over the top of the water in the pan 33 and around the wicks 32 and thence upwardly through the filtering material of the perforated plates 30 and 31 and the screen 15 into the two chambers of the cabinet.

Referring to Fig. 3, the left hand stream of air will pass around the tubes 11 and the fins 12 and upwardly along the legs 10 and 13. This portion of the stream will travel upwardly into the intake 20 and the blower and in maximum amount when the chamber 19 is in the position shown. Likewise, the other stream of air will pass upwardly through the right hand chamber and into the intake 20 on the opposite side of the chamber. The air in the left hand stream will have considerable heat and moisture abstracted therefrom while the air in the right hand stream will have considerably less heat abstracted therefrom. The two streams will then mix in the blower and be discharged by the blower through the discharge port 22 into the casing 40.

The air in passing around the wicks and over the water in the pan will pick up moisture in an amount depending upon its temperature and its rate of movement through the apparatus. Its rate of movement can obviously be controlled by controlling the speed of the blower and the size of the openings 34 and 36 which may be provided by doors, as indicated in dotted lines for example in Fig. 3. By positioning the damper 19 at various angles the relative amounts of air going through the two compartments of the cabinet can be varied so that the temperature and humidity of the resultant stream which issues from the blower can be readily controlled.

The secondary refrigerant will give up heat through the wall 9 to the primary refrigerant 8. It will increase in density and move downwardly through the leg 10 where it may pick up some heat and will continue in its movement through the tubes 11 into the warm leg 13. In passing through the tubes 11 it will pick up additional heat and will be decreasing in density. The liquid will then flow upwardly through the warm leg 13 getting warmer and warmer, and will pass through pipe 14 into the tank 15. From there it will return through pipe 16 with its maximum heat content into the cold leg at the top adjacent the wall 9. Here it will give up its heat and continue its movement through the closed circulatory system, all in accordance with well known principles. It will be apparent that when desired the damper 19 may be positioned to entirely stop the flow of air through either chamber and between these limits the resultant stream of air issuing from the blower can be readily controlled as well as the humidity thereof.

The air after it issues into chamber 14 will pass out through the vanes 50, 51 and 52, and through the grill 5 into the space to be treated. As previously stated, the vanes 52 may be manually positioned to deflect the air downwardly, horizontally or upwardly. The air is given a distribution from side to side by means of the vanes 50 and 51 which are slowly oscillating back and forth. As will be clear from Fig. 2, these vanes are connected to the operating link 44, so as to be always relatively displaced approximately 90 degrees. By means of the crank 27 these vanes will be caused to oscillate back and forth on their vertical axes so that the upper portion of the stream will be directed in one direction with respect to the direction of movement of the air in the lower portion of the stream. Thus the discharging air will be well diffused in horizontal planes.

From the above description it will be apparent that this invention resides in certain principles of construction and operation which may be embodied in other physical forms by those skilled in the art without departure from the scope thereof. It is not desired, therefore, to be strictly limited to the disclosure as given for purposes of illustration, but rather to the scope of the appended claims.

What is sought by United States Letters Patent is:

1. A device of the type described comprising a cabinet having air inlet openings and an air outlet opening, a metallic secondary refrigerant circulatory system within said cabinet having a part thereof for dividing the cabinet into two chambers, a primary refrigerant in heat exchange relation with said circulatory system, a blower within said cabinet positioned so that its intake port provides the outlet for said chambers, and means for connecting the discharge outlet of the blower with the discharge outlet of the cabinet.

2. A device of the type described comprising a cabinet having air inlet openings and an air outlet opening, a metallic secondary refrigerant circulatory system within said cabinet having a part thereof for dividing the cabinet into two chambers, a primary refrigerant in heat exchange relation with said circulatory system, a blower within said cabinet positioned so that its intake port provides the outlet for said chambers, means for connecting the discharge outlet of the blower with the discharge outlet of the cabinet, and means in the bottom of said cabinet adjacent the air inlet openings for generating water vapor.

3. A device of the type described comprising a cabinet having air inlet openings and an air outlet opening, a metallic secondary refrigerant circulatory system within said cabinet having a part thereof for dividing the cabinet into two chambers, a primary refrigerant in heat exchange relation with said circulatory system, a blower within said cabinet positioned so that its intake port provides the outlet for said chambers, means for connecting the discharge outlet of the blower with the discharge outlet of the cabinet, and a controllable chamber in the intake port of the blower for controllably varying the amount of air flowing through said chambers.

4. A device of the type described comprising a cabinet having air inlet openings and an air outlet opening, a metallic secondary refrigerant circulatory system within said cabinet having a part thereof for dividing the cabinet into two chambers, a primary refrigerant in heat exchange relation with said circulatory system, a blower within said cabinet positioned so that its intake port provides the outlet for said chambers, means for connecting the discharge outlet of the blower with the discharge outlet of the cabinet, means in the bottom of said cabinet adjacent the air inlet openings for generating water vapor, and a chamber in the intake port of the blower for controlling the relative amounts of air flowing through said chambers.

5. An apparatus as described comprising a cab-

inet having inlet openings at the bottom and an outlet opening above them, means for dividing the interior of the cabinet into two chambers, refrigerating apparatus in one of said chambers, a blower within said cabinet mounted so that its intake port provides a common outlet for said chambers, means for connecting the discharge port of the blower with the outlet opening of the cabinet, movable vanes mounted adjacent the outlet opening of the cabinet, and means for driving the blower and continuously oscillating the vanes.

6. In a device of the type described the combination comprising a cabinet having two compartments, a closed metallic circulatory system for a liquid refrigerant mounted in one of said compartments, means for cooling the liquid, a water container at the bottom of said cabinet, means for drawing air through said compartments and discharging it exteriorly of the cabinet, and means connected to said circulatory system for cooling the water in the water container.

7. In a device of the type described the combination comprising a cabinet having two compartments, a closed metallic circulatory system for a liquid refrigerant mounted in one of said compartments, means for cooling the liquid, a water container at the bottom of said cabinet, means for drawing air through said compartments and discharging it exterior of the cabinet, means connected to said circulatory system for cooling the water in the water container, and means for indicating the level of the water in the container.

8. In an air conditioning apparatus comprising a cabinet having an inlet and an outlet, the combination with means for moving air through the cabinet from the inlet to the outlet and means for cooling the air as it passes through the outlet, of a plurality of vertical vanes pivotally mounted in the outlet opening, and means for continuously oscillating said vanes while the apparatus is in operation to direct the discharged air from side to side.

9. In an air conditioning apparatus comprising a cabinet having an inlet and an outlet, the combination with means for moving air through the cabinet from the inlet to the outlet, means for cooling the air as it passes through the outlet and power means for operating the cooling means, of a plurality of vanes disposed in the outlet opening for oscillation on a vertical axis, and means connecting the vane with the power means to effect continuous oscillation thereof on their vertical axes.

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