Jan. 18, 1938. C. C. HUNICKE 2,105,692

AIR CONDITIONING APPARATUS

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Fig. 1.

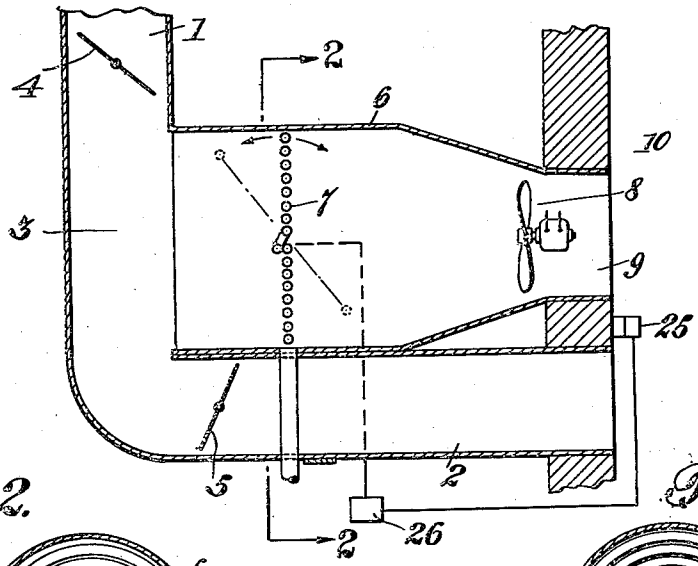


Fig. 2.

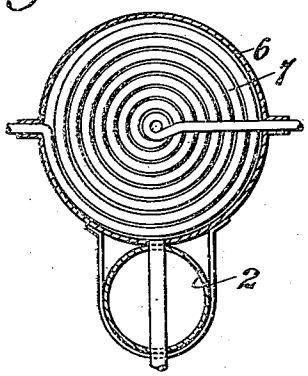


Fig. 4.

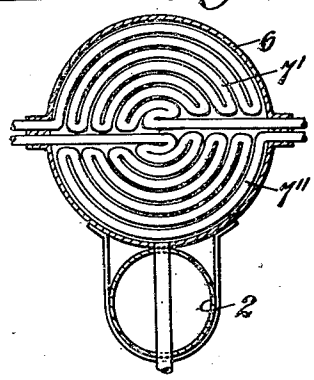
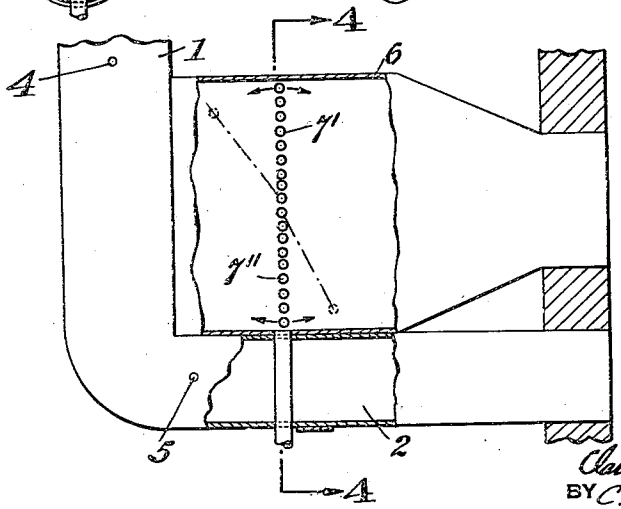


Fig. 3.



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AIR CONDITIONING APPARATUS

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Fig:5.

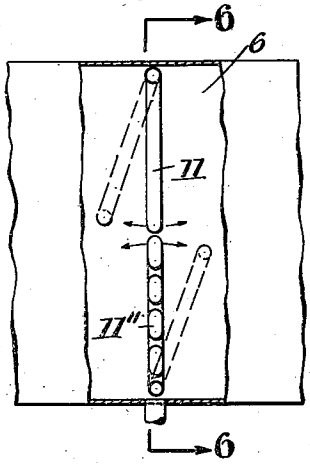


Fig:6.

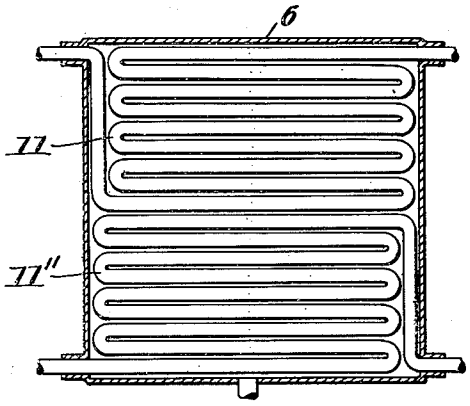


Fig:7.

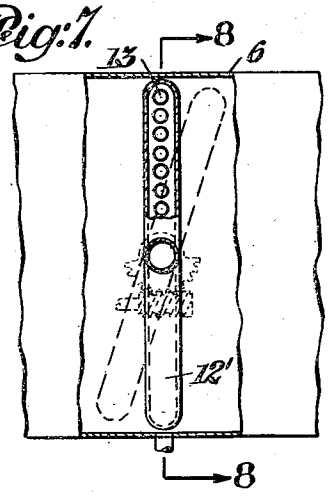


Fig:8.

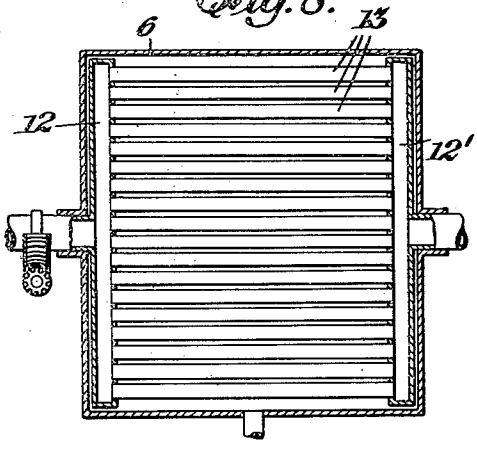
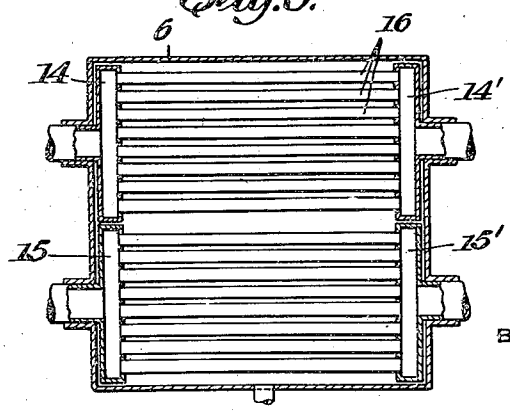


Fig:9.



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AIR CONDITIONING APPARATUS

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Fig:10.

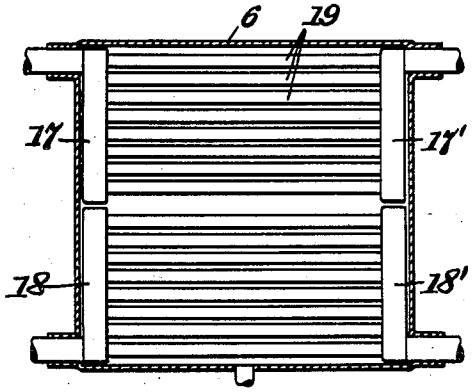


Fig:11.

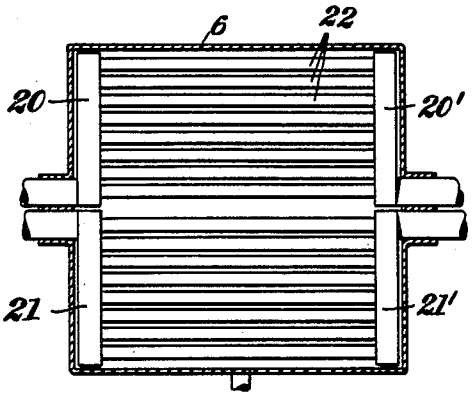


Fig:12.

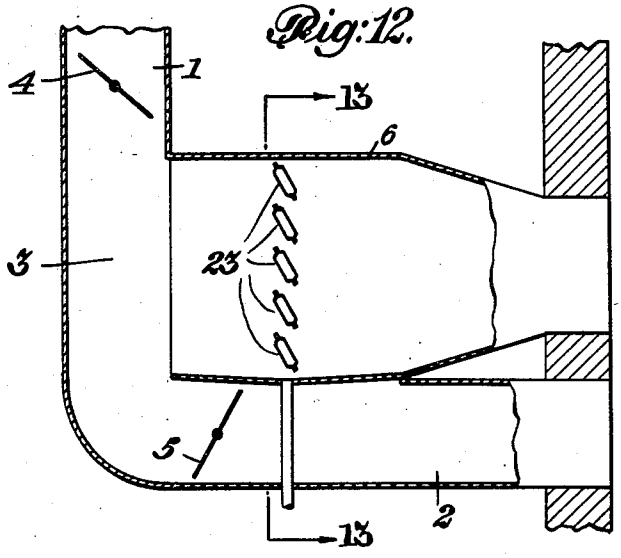
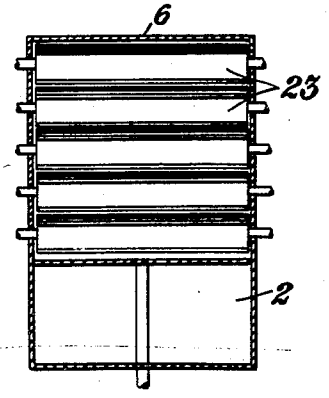


Fig:13.



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Patented Jan. 18, 1938

2,105,692

UNITED STATES PATENT OFFICE

2,105,692

AIR CONDITIONING APPARATUS

Clarence C. Hunicke, Palisade, N. J., assignor to Auditorium Conditioning Corporation, a corporation of New Jersey

Application May 17, 1935, Serial No. 21,971

4 Claims. (Cl. 62—129)

This invention relates to an apparatus for conditioning air.

In the conditioning of air the basic principle is the chilling of the air to a certain temperature to obtain a saturated air at the predetermined temperature in order to remove moisture therefrom and then to raise the temperature of the air without adding moisture to the desired temperature. The humidification of air is relatively simple only requiring the addition of moisture to air which is easily accomplished. Effective dehumidification depends upon the contacting area between the air to be dehumidified and the cooling medium. Also upon the velocity of the air in contact with the cooling medium, the temperature of the cooling medium and depending upon the apparatus various other factors such as the rate of heat transfer, where the cooling medium is enclosed, of the container walls. If the control of the humidity is accomplished by changing the temperature of the coolant a time element intervenes and expensive automatic controls must be utilized. If cold water from a deep well is the coolant the temperature is more or less constant and cannot be automatically changed.

One of the objects of this invention is to provide means for the dehumidification of air wherein the area of contact between the air stream to be dehumidified and the coolant is varied in accordance with the requirements of the enclosure to which the conditioned air is supplied.

Another object of the invention is to dehumidify air and to control the dehumidification by varying the effective area of contact between the coolant and the stream of air being dehumidified.

A still further object of the invention is to vary the position of the coolant in accordance with the requirements of the enclosure being conditioned and with respect to the air stream whereby more or less of the air stream will contact directly with the coolant.

Referring to the drawings:

Figure 1 is a diagrammatic longitudinal sectional view of a device embodying the principles of my invention.

Figure 2 is a sectional view along the line 2, 2, of Figure 1, looking in the direction of the arrows.

Figure 3 is a modified form of device.

Figure 4 is a sectional view of Figure 3 along the line 4, 4, looking in the direction of the arrows.

Figure 5 is a detail view of a modified form of device.

Figure 6 is a view of Figure 5 along the line 6, 6, looking in the direction of the arrows.

Figure 7 is a detail view of another modified form of device.

Figure 8 is a view of Figure 7 along the line 8, 8, looking in the direction of the arrows.

Figure 9 is a modified form of cooling surface.

Figure 10 is a modified form of cooling surface.

Figure 11 is a further modified form of cooling surface.

Figure 12 is still another modified form of dehumidifying device.

Figure 13 is a view of Figure 12 along the line 13, 13, looking in the direction of the arrows.

In carrying out my invention, I propose to admit fresh air through conduit 1 and return air through conduit 2 to chamber 3. Dampers 4 and 5 control the proportions of the mixture and may be manually, automatically or conjointly controlled. A conditioning chamber 6 has one or more cooling coils 7 situated therein. The usual blower or fan 8 draws the air through the conditioner 6 and into the distribution conduit 9 which leads to the enclosure 10. The coil or coils 7 are carried on trunnions, the coolant being fed through the axis on one side and out the other. The coils are adapted to be rocked from the vertical to the horizontal position dependent upon the conditions in the enclosure 10. The usual humidistat or wet bulb control 25 operating through a pneumatic motor 26 can be utilized to vary the setting of the coil 7. Heating coils may be inserted between coil 7 and fan 8 which can be controlled by a thermostat from the enclosure. The heating coils and thermostat are not shown as this is common and well known in the air conditioning art.

As the humidity increases the position of the coil is changed from the horizontal toward the vertical. The change in the position of the coil causes it to intercept a greater area in cross section of the air stream thereby causing an increased area of contact and in consequence increasing the dehumidifying effect. As the change of the position of the coil is practically simultaneous with the change in the humidity in the enclosure, the humidity control is relatively quick and close particularly as the settings have a wide range. In addition, the air not contacting with the surfaces and passing through the conditioner functions to raise the temperature of the contacting air reducing the necessity in most cases of the use of the heater. The device may be modified as shown in Figures 3 and 4 wherein the coil or coils 7', 7'', are two separate coils and separately controlled. With this modification, the major portion of the fresh air may be separately

treated from the major portion of the return air by the different settings of the two coils 7', 7'', the fresh air and the return air having more or less stratification.

With the modifications shown in Figures 5 and 6, the coils 11, 11', instead of pivoting centrally of the conditioner, are pivoted at the top and bottom, thus permitting the mixed airs passing through the central portion untreated while the major portion of the fresh and return airs are individually treated depending upon the rocking of the coils.

Figures 7 and 8 are similar to Figures 1 and 2, except that the coils have headers 12, 12', connected by straight pipes 13 to form the cooling surfaces.

Figure 9 shows a modified form wherein two sets of headers 14, 14', 15, 15', and pipes 16 are utilized, each set of headers pivotally and centrally supported so that they may individually be rocked from the horizontal to the vertical.

Figure 10 is similar to Figures 5 and 6, showing the use of headers 17, 17', 18, 18', connecting pipes 19 in place of the coils 11, 11'.

Modification 11 is similar to Figures 3 and 4, except that it has headers 20, 20', 21, 21', connected to pipes 22.

Figures 12 and 13 show the application of my invention to surfaces 23 in place of the coil form of coolant container. In this modification the surfaces are each rotatable on their individual axis from the horizontal to the vertical position.

With my invention, the temperature of the coolant need not be varied so long as it is below the predetermined required temperature, that is, at or below 53° Fahrenheit. In addition, the by-pass of recirculated air may be used in place of the customary heater, if desired, and control of the temperature of the refrigerant is also not precluded. In most cases, I prefer to use the modifications wherein the cooling surface is in balance in order to reduce the power required for controlling the position of the cooling surface.

It should be noted that the area of the coolant and the area of the cross section of the air being conditioned are not changed but the effective areas of contact of the coolant and of the air being conditioned are varied and that the control can be accomplished from a single control instrument thereby decreasing the cost of installation. In addition, a quick response is had and closer control can be obtained. There is also a saving in power consumed since the internal friction of the air is reduced as the requirement for dehumidification is reduced and I propose to utilize the constant volume fan to take advantage of the decrease of internal friction of the air.

Thus, by my invention, air may be dehumidified and maintained at any desired relative humidity and temperature with a minimum of controls without changing the number of cooling surfaces in use with a constant coolant temperature or variable, as desired, and one wherein it is adaptable for use in connection with by-pass systems, differential control systems and variable temperature cooling systems.

What I claim is:

1. In a dehumidifier, a chamber through which air is passed, a pair of heat exchangers adapted together to extend across the full cross-sectional area of said chamber, and pipes for circulating a cooling medium through each heat exchanger, said pipes being journalled in the walls of said chamber and supporting each heat exchanger for rotary movement to vary the cooling effect of the heat exchanger on the air passing through the chamber.

2. In a dehumidifier, a chamber through which air is passed, a pair of heat exchangers adapted together to extend across the full cross-sectional area of said chamber, and pipes for circulating a cooling medium through each heat exchanger, said pipes for one heat exchanger being journalled in the walls of said chamber near the top thereof and said pipes for the other heat exchanger being journalled in the walls of said chamber near the bottom thereof and said pipes supporting said heat exchangers for rotary movement to vary the cooling effect of the heat exchanger on the air passing through the chamber.

3. In a dehumidifier, a chamber through which air is passed, a plurality of heat exchangers arranged in alinement across said chamber and being adapted together to span the cross-sectional area of said chamber, and means for circulating a cooling medium through said heat exchangers, said heat exchangers being supported for movement to vary the cooling effect of the heat exchanger on the air passing through said chamber.

4. In a dehumidifier, a chamber through which air is passed, a plurality of heat exchangers arranged in alinement across said chamber and being adapted together to span the cross-sectional area of said chamber, a pair of pipes for circulating cooling medium through each heat exchanger, said pipes being journalled in the walls of said chamber and supporting said heat exchangers for rotation to vary the cooling effect of the heat exchanger on the air passing through said chamber.

CLARENCE C. HUNICKE.