March 29, 1938. M. KALISCHER 2,112,601

AIR CONDITIONING APPARATUS

Filed May 31, 1935 3 Sheets-Sheet 1

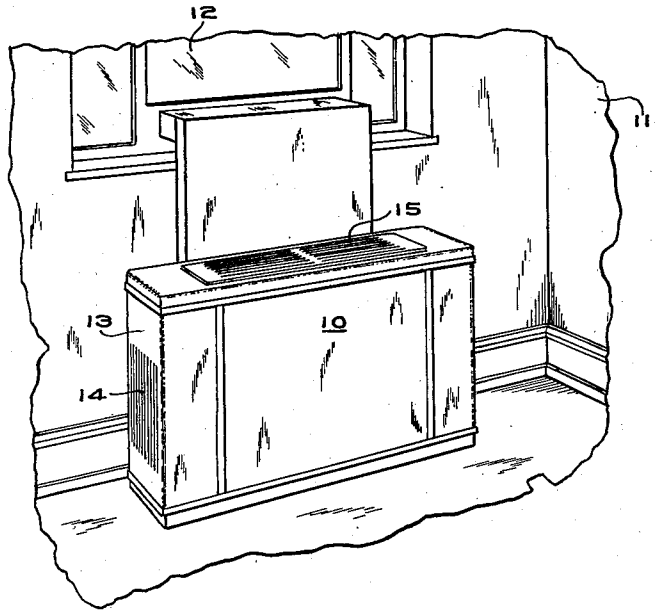


FIG. 1.

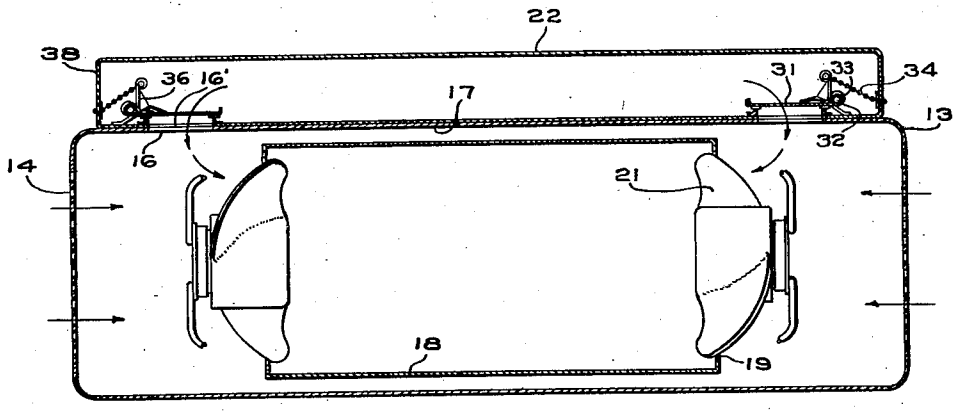


FIG. 2.

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AIR CONDITIONING APPARATUS

Filed May 31, 1935 3 Sheets-Sheet 2

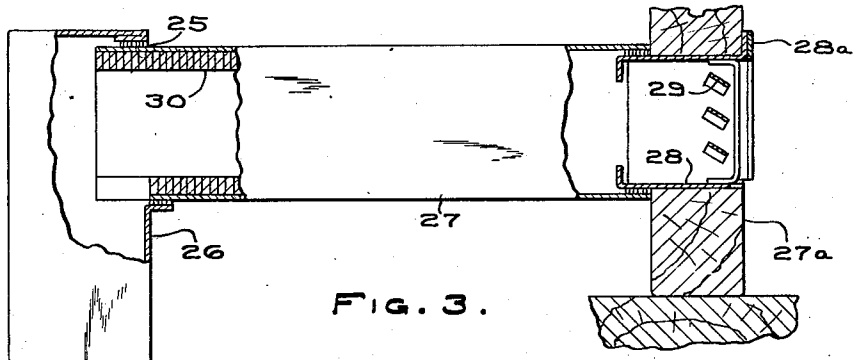
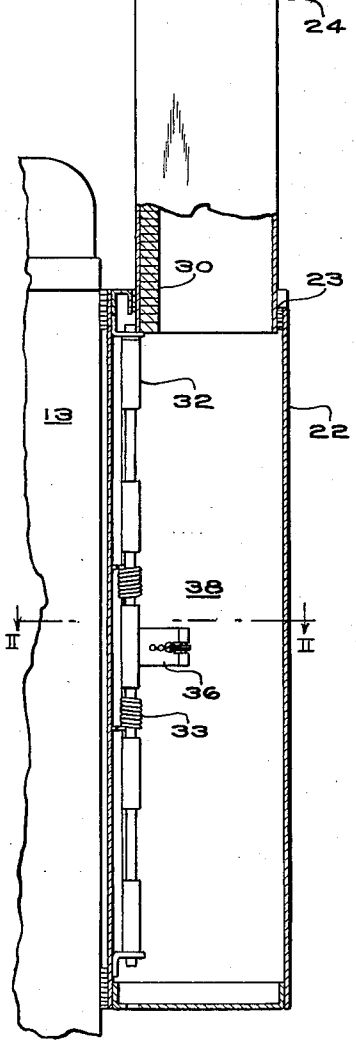


FIG. 3.



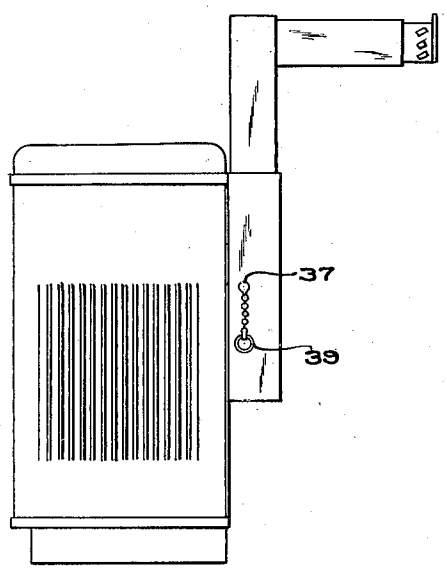


FIG. 4.

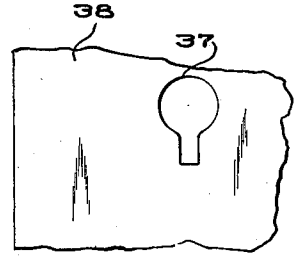


FIG. 4a.

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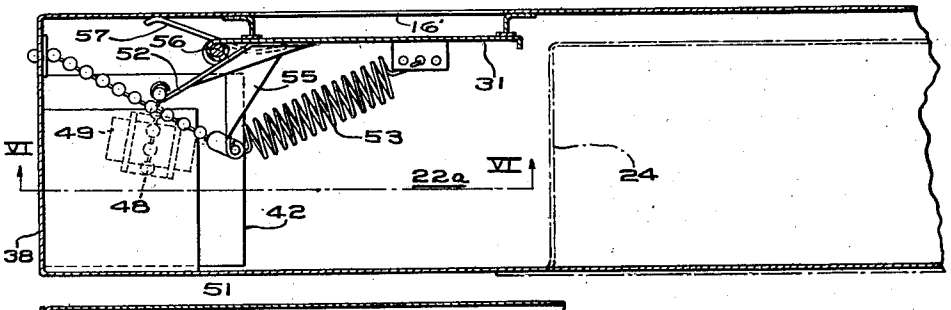


FIG. 5.

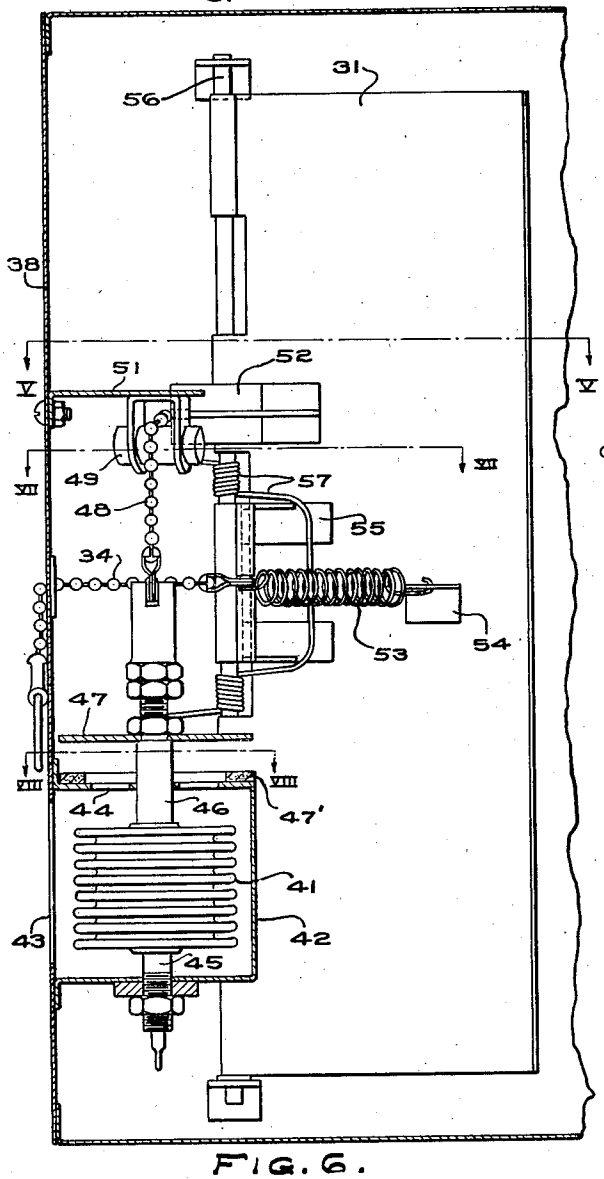


FIG. 6.

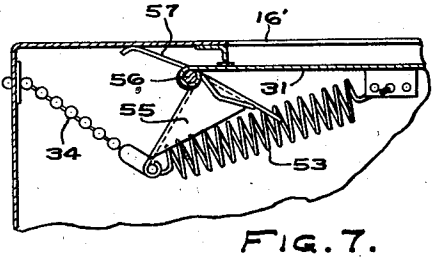


FIG. 7.

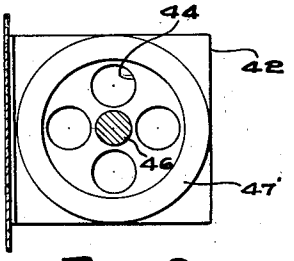


FIG. 8.

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Patented Mar. 29, 1938 2,112,601

UNITED STATES PATENT OFFICE

2,112,601

AIR CONDITIONING APPARATUS

Milton Kalischer, Springfield, Mass., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application May 31, 1935, Serial No. 24,287

3 Claims. (Cl. 98—38)

My invention relates to air conditioning apparatus, more particularly to a unit air conditioner having an outdoor or fresh air connection, and it has for an object to provide improved apparatus.

An object of the invention is to provide an outdoor air connection adaptable to window sills of varying heights and depths.

A further object is to prevent admission of cold outdoor air into the room through the return or room air inlet, which may otherwise be produced by the wind blowing a strong air current into the outdoor air connection and backwardly through the return air inlet into the room.

In accordance with a preferred embodiment of my invention, I provide a box-like duct portion on the back of the air conditioner cabinet. Said duct portion is formed with an opening in the top adapted to receive the lower end of a vertically extending duct portion. The latter is so constructed that a portion may be cut off at the lower end in order to provide the desired length thereof, and it has an opening in its rear wall adjacent the top for receiving the forward end of a horizontally extending duct portion. The latter is also constructed so that a portion at the front end may be cut off to provide the desired length, and its rear end is connected with a window or other opening so as to take in air from outdoors.

In order to prevent cold outdoor air from entering the room through the return air inlet, in the winter, I may provide a damper in the outdoor air connection, and a thermostat connected thereto for operating the same. The thermostat that forms a connection is located in a small passage between the outdoor air stream flowing through the connection and the room, so that room air is normally drawn over the thermostat. However, when the wind blows air into said connection, the direction of flow is reversed so that cold air flows over said thermostat. The latter operates to close said damper in response to the lower temperature imposed thereon.

In its broader aspect, this feature of the invention contemplates an automatic control operative to close the outdoor air damper whenever the wind effects an undesired current of outdoor air.

The above and other objects are affected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a perspective view showing a unit air conditioner having my novel outdoor air duct applied thereto;

Fig. 2 is a plan view in section taken on the line II—II of Fig. 3;

Fig. 3 is an end elevation of the duct, parts being shown in section;

Fig. 4 is an end view of the unit air conditioner having the duct applied thereto;

Fig. 4*a* is a fragmentary view of a detail;

Fig. 5 is a horizontal section, taken on the line V—V of Fig. 6, of a second embodiment;

Fig. 6 is a vertical sectional view taken on the line VI—VI of Fig. 5, looking toward the air conditioner;

Fig. 7 is a horizontal section taken on the line VII—VII of Fig. 6; and

Fig. 8 is a horizontal section taken on the line VIII—VIII of Fig. 6.

Referring to Figs. 1 to 4*a* in detail, I show a unit air conditioner **10** resting on the floor of a room **11** adjacent a window **12**. It includes an outer casing or cabinet **13** having return or room air inlet openings **14** in the end walls, a discharge opening **15** in the top wall and outdoor air openings **16** in the rear wall **17**. It also includes an inner casing **18** in which there may be disposed the usual air treating elements, such as heating and humidifying elements for winter use and a cooling element for summer use. The inner casing **18** has inlet openings **19** in the end walls thereof, and fans **21** are disposed in said openings to draw in air from the room through the inlets **14** and outdoor air through the openings **16**.

To convey fresh air from outdoors to the outlet openings **16**, I provide the outdoor air duct constituting the present invention. It includes a box-like duct member **22** attached to the rear wall **17** of the cabinet and having openings **16'** registering with the openings **16** in said rear wall. The duct member **22** may be made of any suitable material, for example, sheet metal. It is formed with an opening **23** in the top wall thereof, as shown in Fig. 3, for connection with a vertically extending duct member **24**.

The duct member **24** has an opening **25** in its rear wall **26**, adjacent the top thereof, for connection with a horizontally-extending duct member **27**, and below said opening **25** it is of a uniform cross-section adapted to fit in the opening **23**. It is made of any suitable material that may be readily cut, for example, furniture steel or other suitable material. In manufacture, the duct member **24** is made of a length adapting the duct to a window sill of the maximum height expected to be encountered. To adjust the duct to a lower window sill, a portion of the duct member **24** is cut off from the lower end, and the lower end of the

shortened duct member is then inserted in the opening 23.

The horizontal duct member 27 is adapted to be connected at its rear end to a window sash 27a. An opening is cut in the window sash to receive a fitting 28, which has a flange 28a bearing against the outer surface of the sash. The fitting 28 projects beyond the inner surface of the sash and telescopes within the rear end of the horizontal duct member 27. Louvers 29 are preferably provided in the fitting 28 for excluding large foreign particles and minimizing entrance of rain. The forward part of the duct member is made of severable material and of uniform cross-section, similarly to the vertical duct member 24, so that a portion thereof may be cut off to provide the desired horizontal extent of the duct. The duct members 24 and 27 are preferably lined with sound and heat insulating material, such as "Celotex", shown at 30. An important function of this material is to prevent the external surface of the duct, particularly the horizontal portion, being cooled by the outdoor air and condensing moisture from the air in the room in case the latter has been humidified.

A damper or door 31 is provided for each opening 16', being hinged at 32 and biased to closed position by a spring 33. It is adapted to be opened by a bead chain 34 connected to the transverse arm of an angle member 36 fixed to the damper. The bead chain 34 extends through a key-hole slot 37, shown in Fig. 4a, in the adjacent end wall 38 of the duct member 22. The door 31 may be retained in any desired position by retaining the bead chain in the narrow part of the slot 37, which part is narrower than the beads in the chain and is thus adapted to receive the part between adjacent beads and to hold the chain. The latter preferably has a ring 39 at its outer end for operating the same.

In the operation of the air conditioner, assuming the doors 31 to be open, the suction of the fans 21 causes flow of air from the room 11 inwardly through the inlets 14, and also flow of fresh air from outdoors through the outdoor air ducts and the openings 16', 16 to the interior of the cabinet 13, where it mixes with the return or room air before entering the inner casing through the openings 19. In the latter it is conditioned and discharged through the outlet 15 in the top. By moving the position of one or both of the doors 31, the admission of outdoor air may be varied as desired, the damper being retained in position by latching the bead chain 34 in the recessed or slotted portion of the opening 37.

In the above embodiment, the duct is used to convey fresh outdoor air to be supplied to the room. It may also be used, however, to convey outdoor air to the conditioner for cooling the condenser, and/or for exhausting air from the condenser or from the room.

In the use of the above structure in winter, it has been found that a strong wind blowing into the outdoor air connection causes a current of fresh air through the duct of such force as to counteract the suction effect of the fans and to cause flow of the cold outdoor air outwardly through the return air inlet openings 14 into the room. To avoid such a draft of cold air, the control mechanism shown in Figs. 5 to 8 may be used to close the doors 31.

In this embodiment, a thermostat is provided for each door 31. The thermostat comprises a bellows 41 disposed adjacent the end wall 38 and enclosed in a casing 42. The bellows contains a volatile fluid providing a pressure increasing with the temperature to which the bellows is subjected, which pressure causes the bellows to expand with increase in temperature and vice versa. The end wall 38 has an opening 43 communicating with the casing 42, and the latter has a number of small openings 44 in the top thereof. The bottom of the bellows is fixed through a stem 45 to the bottom of the casing 42, while the top of the bellows has a movable stem 46 extending through the top of the casing. The stem 46 has a closure disc 47 mounted thereon above the casing for closing the openings 44 upon downward movement, being adapted to seat against a felt ring 47'. A chain 48 is connected to the upper end of the stem 46 and extends over a pulley 49, carried by a bracket 51, to the outer end of an arm 52 fixed to the door 31.

A bead chain 34 is provided for opening the door 31 by hand, as in the first embodiment, but in this case, the pull on the door is transmitted through a spring 53, in order that the door may be closed by the thermostat against the action of the chain 34. One end of the spring 53 is connected to a bracket 54 fixed on the door 31, while the other end of the spring 53 and the end of the chain 34 are connected to the outer end of one arm of an angle member 55. The latter is hinged on the same hinge pin 56 on which the door 31 is hinged. The other arm of the angle member 55 is adapted to bear against the door in closing direction, being biased in such direction by a coil spring 57. It is to be understood that the embodiment of Figs. 5 to 8 is in other respects, the same as that of Figs. 1 to 4.

Assuming first that the bellows 41 is extended, the door 31 may be adjusted to any position by means of the chain 34, which may be latched in the recess of the opening 37, as in the first embodiment. The spring 53 pulls the hinged angle member 55 and the door 31 together, so that they move as a single member and are biased to door closed position by the spring 57 acting through the angle member 55. A pull on the chain 34 acts directly on the angle piece 55, against the action of the spring 57, and the door 31 is brought along under the influence of the spring 53.

As may be noted from the outline of the vertical duct member 24 in Fig. 5, the thermostat is located beyond the outdoor air stream normally flowing through the duct member 22, which enters at the top and leaves through the openings 16'. The casing 42 in which the thermostat is located, however, is subjected to the suction effect of the fans 21, and a flow of air from the room 11 is effected through the opening 43, the casing 42, the openings 44, the interior of the duct member 22a, the openings 16' and 16 and the cabinet 13 to the fan 21. Accordingly, under normal conditions, the bellows 41 is responsive to the temperature of the air in the room and expands sufficiently to permit the door 31 to be opened by the chain 34 as described above.

When the wind blows into the horizontal duct member 27 with such force as to effect a greater flow of outdoor air through the duct than is drawn in by the fans 21, the outdoor air stream overcomes the suction effect of the fans and begins to flow outwardly through the room air inlet openings 14 into the room. At the same time, the outdoor air stream also overcomes the suction effect on the space in the casing 42 and

flows through the openings **44** and **43**, and over the bellows **41**, into the room. If the outdoor air is cold, as in the winter, the bellows **41** responds to the cold temperature by contracting and exerting a pull on the chain **48**, thereby closing the door **31** and cutting off the supply of outdoor air if it is very cold, or partially closing the door to reduce the admission of outdoor air in accordance with the temperature thereof if it is only moderately cold. The bellows **41** has sufficient force to overcome the tension of the spring **53**. In this case, the chain **48** pulls the door **31** closed against the tension of the spring **53**, so that it is closed regardless of the position at which it may have been manually adjusted. As the bellows **41** contracts, it pulls the closure disc **47** toward the openings **44** to restrict the admission of cold outdoor air into the room through the casing **42**. If the openings **44** are completely closed, the cold air in the casing **42** will slowly mingle with the adjacent room air, so that the bellows will begin to expand again after a short period of time, so that the door may be reopened if the wind has abated, or if it has not, outdoor air will again flow through the openings **44** onto the bellows **41** to maintain the same contracted.

It will thus be seen that the admission of cold outdoor air through the outdoor air duct and the room inlet openings, during a strong wind blowing into the duct, and the objectionable draft produced in the room **11** thereby, is avoided.

The thermostatic damper control is of still greater advantage on a cold day if the fans are not running. At such time, even a slight breeze into the fresh air duct could readily flow outwardly through the inlet openings **14** into the room, as there is no fan suction to effect inward flow of room air. Also, if the outdoor air is cold enough, it may freeze the water in the humidifier pipes and spray nozzles in the inner casing **18**, there being no warmer room air circulated by the fans. The thermostatic damper control prevents such contingencies by closing the dampers in response to the lower outdoor air temperature in the same manner as above described.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What I claim is:

1. Apparatus for air conditioning an enclosure comprising a housing for air treating elements, said housing having a first inlet communicating with said enclosure and a second inlet communicating with outdoors for admitting fresh air to the housing, an outlet communicating with said enclosure and with both said first inlet and said second inlet, a damper for controlling flow through said second inlet, means for positioning said damper, and means for automatically moving said damper in closing direction substantially independently of the action of the first-mentioned positioning means in response to a predetermined maximum force and a low temperature of the current of air entering the second inlet, whereby admission of fresh air into the enclosure by reverse flow through said first inlet is avoided.

2. A fresh air duct for conveying a stream of fresh air from outdoors to an air conditioning cabinet disposed in an enclosure to be air conditioned, said duct having a damper for controlling flow of air through the duct, means providing a space adapted to communicate with the interior of the duct and with said enclosure so that air from the enclosure may flow through said space to the interior of the duct when the force of said air stream is substantially normal and so that fresh air may flow through said space when the force of said air stream becomes excessive by reason of wind blowing into the duct, a thermostat disposed in said space for controlling said damper, means for manually positioning said damper when the temperature in said space is above a predetermined value, and said thermostat acting to close said damper substantially independently of the action of said positioning means in response to decrease in temperature in said space below said predetermined value.

3. A fresh air duct for conveying a stream of fresh air from outdoors to an air conditioning cabinet disposed in an enclosure to be air conditioned, said duct having a damper for controlling flow of air through the duct, means providing a space adapted to communicate with the interior of the duct and with said enclosure so that air from the enclosure may flow through said space to the interior of the duct when the force of said air stream is substantially normal and so that fresh air may flow through said space when the force of said air stream becomes excessive by reason of wind blowing into the duct, a thermostat disposed in said space for controlling said damper, means for positioning said damper substantially independently of the action of said thermostat when the temperature in said space is above a predetermined value, and said thermostat acting to close said damper substantially independently of the action of said positioning means in response to decrease in temperature in said space below said predetermined value.

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