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J. McELGIN

2,284,161

AIR CONDITIONING APPARATUS

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FIG. 1

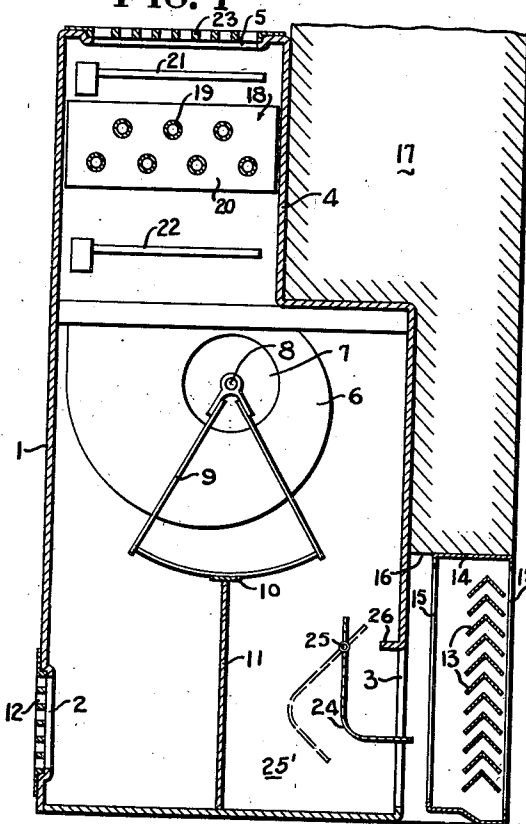


FIG. 2

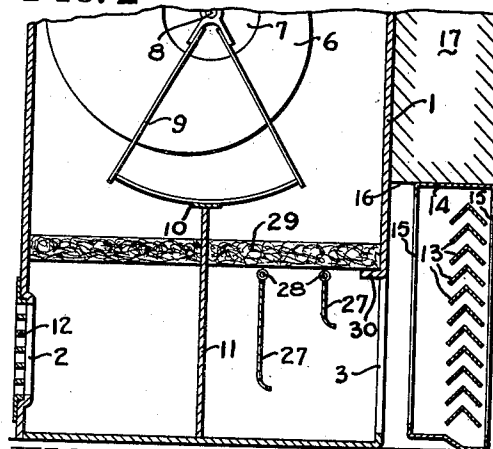


FIG. 3

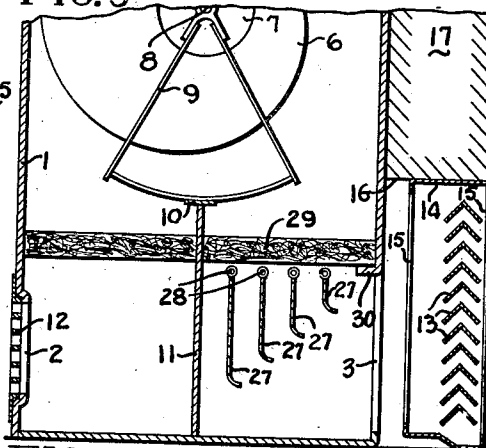


FIG. 4

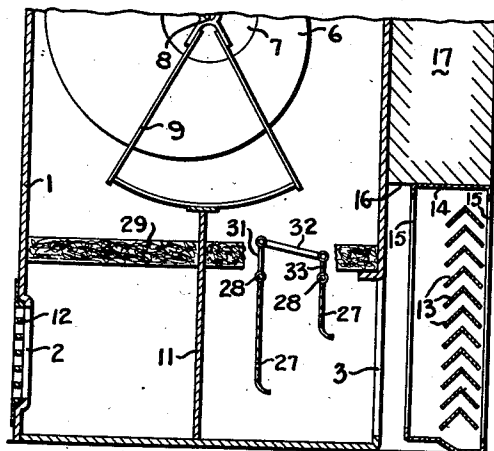
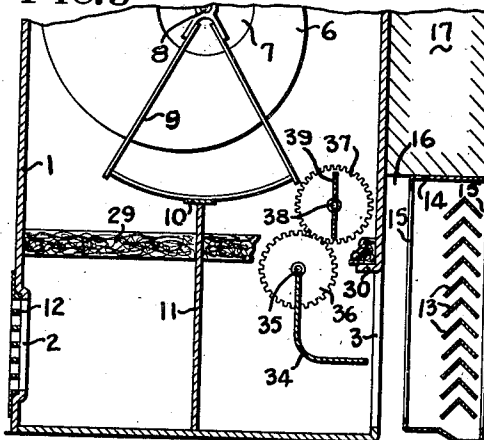


FIG. 5



INVENTOR
JOHN McELGIN

By *Toulmin & Toulmin*
ATTORNEYS

UNITED STATES PATENT OFFICE

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AIR CONDITIONING APPARATUS

John McElgin, Philadelphia, Pa., assignor to John J. Nesbitt, Inc., Philadelphia, Pa., a corporation of Pennsylvania

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8 Claims. (Cl. 98—38)

The present invention relates to the art of air conditioning and more particularly to a control system for regulating the amount of outdoor air admitted to the air conditioning unit.

One of the problems in the unit ventilator field is the influence of outside wind pressure on the unit capacity and performance. The relatively low fan tip speed employed for quiet operation of unit-ventilating equipments makes the equipment quite sensitive to changes in outside wind conditions. It is quite easy for the wind to reach a velocity or pressure under which the quantity of air entering the outdoor air intake exceeds the fan capacity. Where all of the air is introduced from outdoors during the ventilating cycle, this effect is of importance only in that it increases the predetermined ventilation rate.

However, if the unit is designed to introduce a minimum percentage of outdoor air for ventilation, there may occur not only an increase in ventilation rate, but a condition that is commonly described as "blow through." Under this condition, excess outdoor air, unable to pass through the fans, may enter the room through the recirculating grille. It can be readily appreciated that such leakage is uncomfortable for the occupants of the room.

In order to prevent this "blow through" condition, the prior art has devised several schemes, none of which have been altogether satisfactory. Perhaps the best known method in this respect is that in which a back draft damper is employed in the recirculating opening of the unit ventilator. The damper is operated to prevent entry of air into the casing through the recirculating grille by automatically closing when the fan suction reaches a minimum level. In order more accurately to gauge my invention described hereinafter, it is desired to point out some of the difficulties brought about by wind in unit ventilators and particularly as these difficulties are applied to those systems in which back draft dampers are employed.

In the first place, to have any degree of effectiveness, back draft dampers must be constructed so sensitive to variations in fan suction pressure that they will completely close, well before the full fan capacity from outdoors is reached. The result is that, even on moderately windy days when no "blow through" would occur, these dampers will close and remain closed for the greater portion of the day. Thus, no room air would be circulated under these conditions. Moreover, after the dampers have closed, full

wind pressure is exerted on the interior of the cabinet or unit as well as on the inside of the back draft dampers. It is impossible to construct such self-closing dampers absolutely tight at the point of contact and, therefore, some leakage will take place. The degree of leakage is not important, since even a small leakage is just as troublesome for the adjacent occupants as a larger quantity, particularly in cold weather. The air delivery of the unit with back draft dampers is at the mercy of outside winds. The introduction of an excessive amount of outdoor air into the room is very liable to cause drafts, even where a means is provided to limit the lowest discharge temperature. An airstream control cannot react quickly enough to sense a sudden gust of wind and hence the discharge temperature will be depressed.

Finally, in order to achieve gravity heating effect during shut-down periods of the fan, the back draft dampers must be connected to the outdoor damper in such a manner that the back draft dampers will open when the outdoor damper is closed. This introduces a complex spring linkage which may readily destroy the sensitivity of the dampers and the protection they offer against "blow through."

The primary object of the present invention is to eliminate the difficulties referred to in the immediately preceding paragraphs and, in particular, to provide an arrangement by which the wind is prevented from entering the outdoor air inlet and thus excluded entirely from the casing. The general object is to provide an improved unit ventilator which prevents an excess of outdoor air pressure from affecting the unit.

Other objects are to eliminate the condition known in the ventilator art as "blow through" when the gusts of wind are severe; to provide a unit in which the size of the outdoor air inlet is varied in accordance with the pressure of the outdoor air; to provide a device of this character which is controlled directly by the pressure of the wind and which responds instantaneously to pressure changes and finally to provide, as a combination, a unit ventilator of the variable outdoor air inlet type and a simple, inexpensive adjustment member for varying the size of the inlet which operates much faster for high wind pressures than for low pressures.

These objects are attained in brief by providing one or more baffles mounted in the outdoor inlet and arranged to swing in response to changes in wind pressure to close the inlet. These baffles have such a shape and are so

mounted that, as the gusts of wind become more severe, the baffles will operate to change the size of the inlet at a faster rate.

The invention will be more clearly understood when reference is made to the following description in connection with the accompanying drawing, in which—

Figure 1 is a sectional view taken across the improved unit ventilator which is provided with one exemplary form of baffle.

Figure 2 shows a fragmentary cross sectional view of a unit employing a modified baffle arrangement, while

Figures 3, 4 and 5 show still other modifications.

Referring more particularly to Figure 1, numeral 1 designates the casing of an air conditioning unit, the lower portions of which terminate at one side in an indoor or recirculated air inlet 2 and at the other side in an outdoor or fresh air inlet designated generally by the character 3. The casing is of restricted dimension at its upper end, as indicated at 4, and terminates in a mixed air outlet 5.

The lower end or larger portion of the casing contains one or more blowers 6 preferably of the well-known centrifugal type having an eye 7. In line with the eye 7, there is a shaft 8 which carries a damper 9 of arcuate configuration and adapted to oscillate, pendulum fashion. The lower end of the damper rests on a plate 10 which forms the upper terminus of a partition or wall 11, positioned approximately midway between the two sides of the casing 1.

The recirculated air inlet 2 is preferably provided with a grille 12 and the outdoor air or fresh air inlet 3 is preferably provided with an angular form of louvre 13. The latter is conveniently mounted in a casing 14 having openings 15 at each side. The casing 14 is shown as being positioned within a casement opening 16 of a wall 17 which constitutes part of the building which is being air conditioned. The inlet opening 3 of the casing 1 is positioned in line with the openings 15, and preferably in line with the inlet opening 2, from which it is separated by the partition 11.

The upper or restricted portion of the casing 1 contains a heat exchanger 18 which may consist of pipes 19 provided with fins 20, the pipes being adapted to carry either a heating fluid such as steam or a cooling fluid such as brine or other refrigerant. On each side of the heat exchanger 18, there is positioned a thermostat 21, 22 which may be of the pneumatic, electric or bi-metallic strip type. However, for practical reasons, I prefer to employ a "leakstat" form of thermostat such as is described in my application Serial No. 144,216, filed May 22, 1937. A thermostat of this type depends on the relative expansion of two metals when subjected to heat, these metals being so arranged that the change in expansion causes the pressure in a fluid system to change in a corresponding degree. This change in pressure operates a pneumatic motor or engine (not shown). The latter is mechanically connected to the damper 9 and serves to actuate the damper. It is apparent that, if desired, the thermostats 21, 22 can be so arranged as to operate electric motors for actuation purposes. These thermostats have been indicated purely by diagram, since their construction is well known in the art. As shown on the drawing, the outlet or discharge opening 5 is provided with a grille 23.

In the normal operation of the unit ventilator which has been described up to this point, the thermostat 22 which is positioned so as to respond to the mixed air being discharged by the blowers 6 will respond to any change in temperature of the mixed air and thus detect any change in the proportion between the outdoor and recirculated air passing through the inlets 3 and 2 respectively. In case the outdoor air is at lower temperature than the indoor air, a greater amount of outdoor air than the predetermined amount for which the thermostat 22 is set will cause the latter to swing the damper 9 to the right and thus reduce the amount of outdoor air admitted to the blowers. The thermostat 22 will likewise sense a preponderance of the recirculated or room air admitted through the inlet 2 and will thereupon cause the damper 9 to swing to the left to cut down the amount of recirculated air. The thermostat 21 is provided for the purpose of controlling the temperature of the mixed air after it has passed through the heat exchanger 18 and this it does by regulating in any suitable and well-known manner the amount of the cooling or heating medium passing through the pipes 19.

The system, as described above, operates quite satisfactorily under normal conditions, but it is apparent that if a sudden gust of wind, particularly of cold air were to strike the inlet 3, the thermostats 21, 22 could not operate with sufficient speed to turn on more steam through the radiator and to move the damper 9 to the right. In case of periodic gusts, it is apparent that the thermostats and associated control mechanism may fluctuate rather wildly, which would prevent the unit from delivering air of a proper and even temperature to the room through the outlet 5.

In accordance with the present invention, I provide an improved structure which takes care of these gusts of wind and thus removes their effect from the thermostats 21, 22. Figure 1 shows one form which this improvement may take and is exemplified as a baffle 24 pivoted at 25 in the outdoor air inlet passageway 25', the pivot being preferably positioned in line with a flange 26 which extends inwardly from the casing 1 at the inlet opening 3. The baffle preferably has an angular configuration and the portion which extends downwardly from the pivot 25 is considerably greater than the portion which extends upwardly from the pivot. The latter portion is preferably of the same length as the distance between the pivot and the flange 26. The lower or angular portion of the baffle has a curved rather than a sharp corner.

It is apparent that, in case a gust of wind comes through the louvres 13 and the inlet opening 3, the pressure developed thereby will cause the baffle to swing to the left, as indicated by the dotted lines in Figure 1, and the area of the baffle as projected against the inlet opening becomes greater. It will be further noted that, due to this increase in projected area, depending on the position assumed by the baffle, the latter will move at a much faster rate when the gusts of wind become more severe. Thus, the baffle will assume its proper position determined by the instantaneous forces exerted by the wind in a very short period of time and hence immediately preventing an excess of outdoor air to find its way into the blowers 6. The excess of air brought about by increased wind pressure is, in one sense, excluded practically entirely from the casing and hence the thermostats 21, 22 are not called upon

to exercise any control function insofar as the short blasts of air are concerned. However, it will be understood that the latter will make the necessary adjustments in the heat exchanger 18 and the damper 9 when the changes in outdoor air temperature or the changes in the volume of the outdoor air at the same temperature are of a steady character and thus can be sensed by the two thermostats.

The optimum shape of the baffle to take care of abrupt changes in wind pressure can readily be determined by experiment and its position carefully adjusted in the absence of wind conditions in any suitable manner, for example, by applying weights at any part of the baffle. In general, this position will be that shown in the drawing in which the long leg of the baffle is substantially vertical. In case the shape of the baffle or its initial position is such that the baffle does not take care of all of the increase in pressure brought about by the gusts of wind, the excess pressure as represented by the small portion of wind which gets into the casing can be readily accommodated by the thermostats 21, 22. This proportion is usually so small that, even if it is not sensed quickly enough by the thermostats, its effect is sufficiently diluted by mixture with the recirculated air in the blower 6 as to cause little or no discomfort to the occupants of the room.

In order more nearly to close off the outdoor inlet to the casing in response to wind pressures, it may be desirable to provide a plurality of baffles. Thus in Figure 2, I have shown a pair of baffles 27 which are pivoted at 28 at positions just below a filter 29 of any suitable and well-known type. While these baffles may assume a pronounced angular shape, as in the case of Figure 1, I have shown them in the form of a flat plate with a short curved portion at the bottom. The inlet opening in this case is determined by the space between the partition 11 and the flange 30 which may provide a support at one end for the filter.

It will be noted in this case that the baffles 27 have no projection or extension above the pivots 28. As gusts of wind pass through the louvres 13, the baffles 27 are swung to the left and it is apparent that they can assume positions depending on increase in wind pressure such as to practically entirely cut off the space between the partition 11 and the flange 30, except for the small space between the righthand baffle and the flange. As in the case of Figure 1, their projected area increases as they are swung to the left, but in Figure 2, this area is measured with respect to the lower surface of the filter 29 rather than the space between the flange 30 and the lower edge of the casing.

It is evident that the greater the number of baffles which are employed to break the wind, the less will be the space between the righthand baffle and the flange 30 which is always left exposed to the wind. Thus, in Figure 3, I have shown four baffles 27, hanging in vertical planes and pivoted at 28 with only a very small space between the righthand baffle and the inner edge of the flange 30.

Figure 4 shows a modification, in which the baffles 27 are mechanically interconnected by levers 31, 32, 33. The pivots 28 may carry shafts which extend across the entire width of the filter 29 and the levers 31, 32 are connected to these shafts at a position beyond the edge of the filter. The fact that the levers 31, 32 and 33 are positioned away from the filter 29 and, therefore, not

in the same plane as the baffles 27 is indicated by the lack of cross-hatching, whereas the baffles are cross-hatched. The filter 29 has been broken away in Figure 4 so as to show the relative positions of the levers 31, 32 and 33. The lever-operated baffle shown in Figure 4 may have advantages under certain conditions, particularly in case the wind pressure is not the same over the entire height of the outdoor air inlet. Thus, when any part of either of the baffles 27 is subjected to wind pressure, all of the baffles operate as a unit to close off the space between the partition 11 and the flange 30, except for a small space between the righthand baffle and the flange.

It is also apparent that the lever system shown in Figure 4 provides a very positive movement of all of the baffles in response to changes in outdoor air velocity pressure. As in the case of Figure 3, additional baffles may be employed in Figure 4, with a corresponding increase in the lever system.

Instead of providing levers between the various baffles, I may employ gears for causing the baffles to operate in synchronism. Thus, in Figure 5, the baffle 34, which may take the general form shown in Figure 1, is adapted to swing with a shaft 35. This shaft extends to a position beyond the filter 29 and carries a gear 36 which meshes with a gear 37 which is mounted on a shaft 38. The latter carries a plate baffle 39 which, as in the case of the baffle 34, extends the entire length of the filter. Thus, as a gust of wind enters the inlet 3 through the louvres 13, the baffle 34 is swung to the left and the gear 36 is rotated clockwise, depending on the amount that the baffle has shifted. The rotative effort of the gear 36 causes the gear 37 to rotate in the counter-clockwise direction which, in turn, rotates the shaft 38 and moves the baffle plate 39 to the left.

It is apparent that if the gust of wind is sufficiently severe, the baffles 34 and 39 may be caused to take positions such as practically entirely to close the space between the partition 11 and the flange 30. Thus, the wind or rather the majority of the excess pressure due to a sudden gust of wind is prevented from deleteriously affecting the ventilating system.

From the foregoing it is evident that I have invented an improved unit ventilator which contains an adequate provision for taking care of sudden gusts of wind or other abrupt increases in pressure of the outdoor air. By providing the baffle or baffles in the region of the outdoor air inlet, it is apparent that the excessive air pressure is not introduced into the casing at all. Furthermore, there is no opportunity for the wind to pass through the outdoor air inlet and get by the damper in such quantity as to cause a "blow through" effect. It is, therefore, possible to position the unit ventilator on either the leeward or the windward side of a building and still obtain conditioned air at an even temperature through the outlet 5, regardless of any abrupt changes in air velocity pressure conditions on the outside of the building.

It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A ventilating unit comprising a casing having a recirculated air inlet, an outdoor air inlet

and a mixed air outlet, a passageway leading from said outdoor air inlet into said unit, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for materially reducing the size of the outdoor air inlet passageway in accordance with instantaneous increases in the velocity pressure of the outdoor air, said means comprising a baffle of L-shaped cross section pivoted along one edge of one of the legs in order to swing in response to wind pressure and adapted to assume such a position that the size of the outdoor air inlet passageway is materially reduced in accordance with increases of said velocity pressure.

2. A ventilating unit comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a passageway leading from said outdoor air inlet into said unit, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for reducing the size of the outdoor air inlet passageway in accordance with instantaneous increases in the velocity pressure of the outdoor air, said means comprising a baffle adapted to swing in response to wind pressure, said baffle being L-shaped in cross section and pivoted along one edge of one of the legs so that upon being swung out of position directly by the wind, the area of the baffle projected in the direction of the wind materially increases.

3. A unit ventilator comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering the casing through said outdoor air inlet, said means comprising a baffle of angular cross section and pivoted at its upper edge in line with the upper edge of the outdoor air inlet whereby the projected area presented by the baffle to the wind increases rapidly as the baffle is swung away from its normal vertical position.

4. A unit ventilator comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a passageway leading from said outdoor air inlet into said unit, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering the casing through said outdoor air inlet passageway, said means comprising a plurality of baffles of similar configuration and each pivoted at one end in line with the upper edge of the outdoor air inlet whereby the baffles hang in a substantially parallel relationship and when struck by wind each baffle tends to close a proportionate amount of the area of the outdoor inlet passageway.

5. A unit ventilator comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering the casing through said out-

door air inlet, said means comprising a plurality of baffles of similar configuration and each having a pair of legs angularly positioned with respect to one another, one of said legs being longer than the other leg, said baffle being pivoted to the casing at the end of the longer leg whereby the projected areas presented by the baffles to the wind attempting to enter the casing through the outdoor air inlet increase rapidly as the baffles are swung away from their normal parallel position away from the outdoor air inlet.

6. A unit ventilator comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering the casing through said outdoor air inlet, said means comprising a baffle having a pair of legs angularly disposed with respect to one another and pivoted at the end of one of the legs in line with the upper edge of the outdoor air inlet, the leg containing the pivot being longer than the other leg whereby the projected area presented by the baffle to the wind attempting to enter through the outdoor air inlet increases rapidly as the baffle is swung away from its normal position.

7. A unit ventilator comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering the casing through said outdoor air inlet, said means comprising a baffle pivoted intermediate its ends and nearer the upper end in line with the upper edge of the outdoor air inlet opening whereby the baffle hangs vertically downward across the opening, said baffle being L-shaped in cross section with the apex of the baffle directed away from the outdoor air inlet opening, the distance between the pivot and the nearer end of the baffle being commensurate with the distance between the pivot and the casing whereby when the baffle is swung out of position by an impinging wind, the pivoted end of the baffle tends to close the space between the pivot and the casing.

8. A ventilating unit comprising a casing having a recirculated air inlet, an outdoor air inlet and a mixed air outlet, a damper for controlling the proportion of outdoor air with respect to recirculated air, and means for preventing a gust of wind from entering said casing through the outdoor air inlet, said means comprising a pair of baffles operatively connected together by gearing, one of said baffles having an angular configuration and pivoted at one end and the other of said baffles having a flat configuration and so positioned with respect to the angular baffle that the two baffles together restrain the entry of wind into the casing over the entire area of the outdoor air inlet.

JOHN McELGIN.