

March 15, 1960

O. H. BRANDI
METHOD AND APPARATUS FOR THE DISTRIBUTION
OF CONDITIONED AIR

2,928,330

Filed May 20, 1957

2 Sheets-Sheet 1

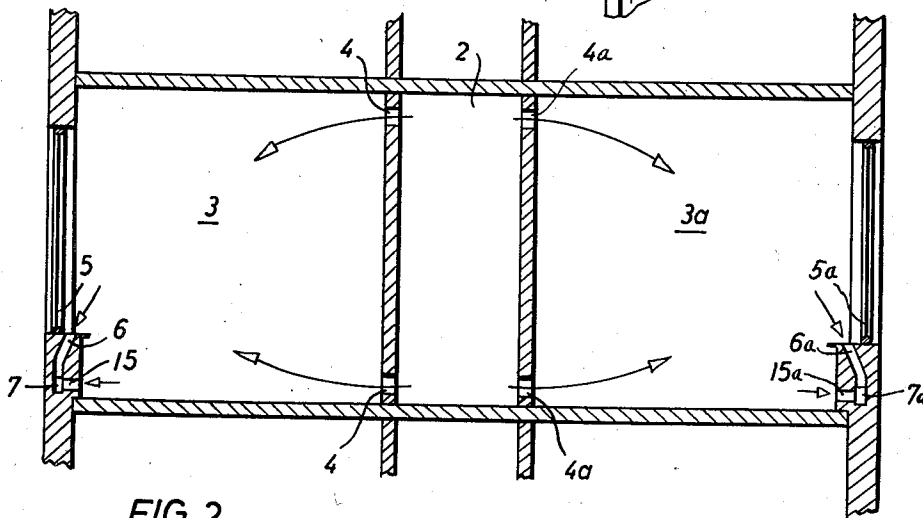
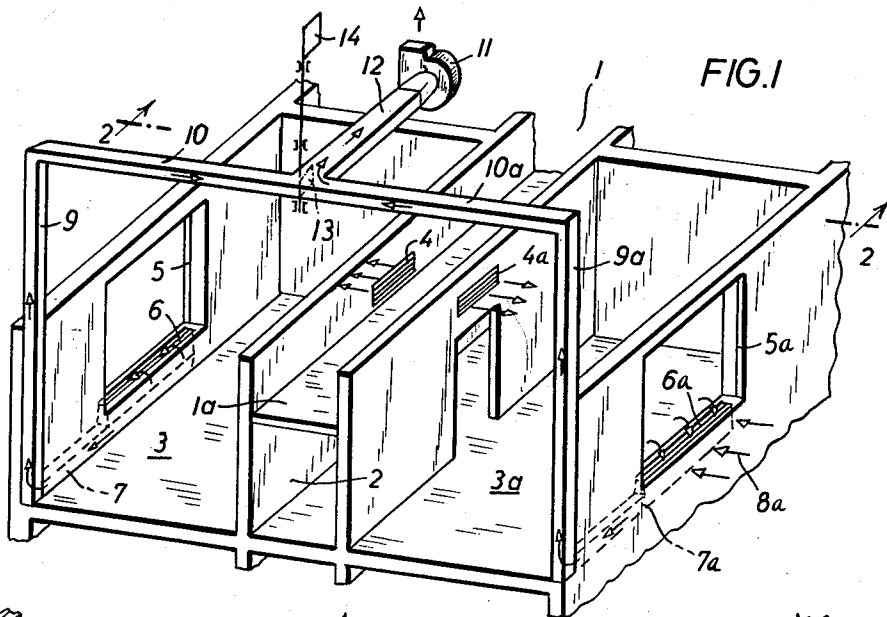


FIG. 2

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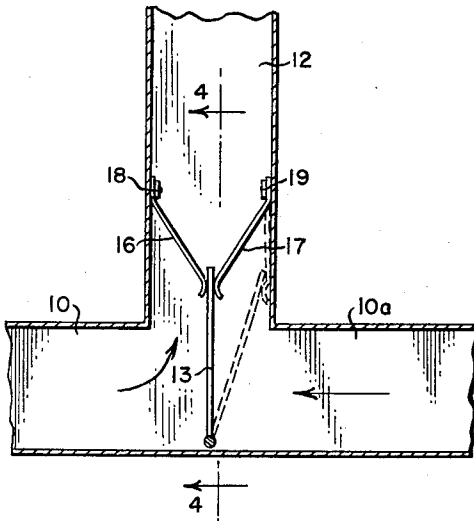


FIG. 3

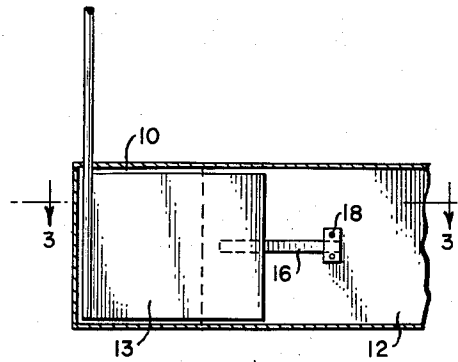


FIG. 4

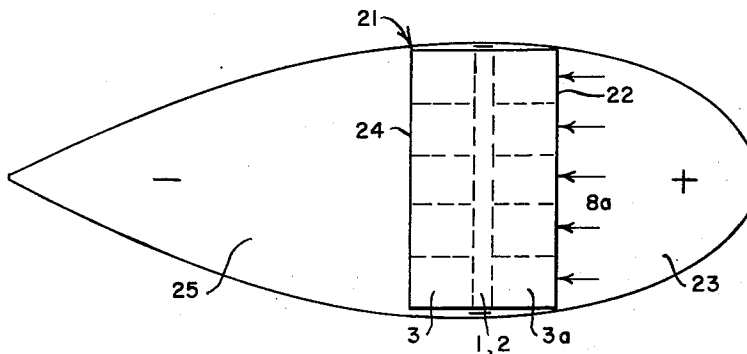
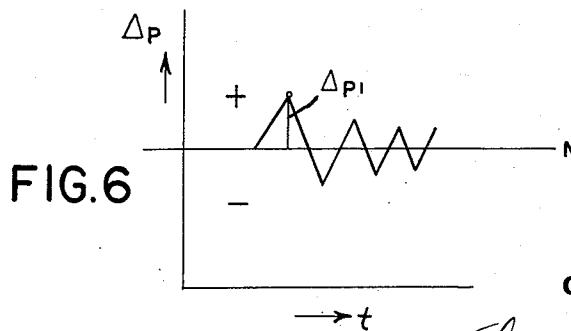


FIG. 5



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METHOD AND APPARATUS FOR THE DISTRIBUTION OF CONDITIONED AIR

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4 Claims. (Cl. 98-1.5)

This invention relates to a process and means for heating, cooling and distribution of preconditioned air into several rooms through ventilators in their walls.

The equal distribution of hot air to all rooms of a building, especially to rooms with windows facing different pressure areas, caused by outside atmospheric pressure conditions, where the admitted hot air is partly or wholly dissipated by leakage along the window sills, is often difficult to obtain. This is due to the fact that under the variable influence of the wind, the pressure distribution within the several rooms and along the outside of a building varies. The wind affects the pressure conditions in rooms facing in different directions relative to the wind in different ways, and consequently the circulation of the hot air to the several rooms is affected differently, especially in rooms where the window leakage is significant.

Pressure conditions are also affected in rooms in buildings which, for certain architectural reasons, have a certain amount of suction on one side. Buildings constructed around an inner court or ventilating shaft are thus, e.g., under the influence of a suction similar to the draft of a chimney, which may be considerable in the case of taller buildings.

According to this invention, this drawback may be eliminated by creating a pressure balance or equalization in all the rooms, in which, as a result of influences originating outside the building, different pressures would otherwise prevail to disturb the equal distribution of the hot air or any other preconditioned air to all the rooms. This pressure balance is created by means of a control device which regulates the amount of air discharged from each room through the exhaust system connected thereto, in accordance with the outside atmospheric condition affecting the pressures in the several rooms or directly in accordance with such room pressures.

If individual exhaust fans for each room are used, the control device may be applied to control each fan by controlling the capacity of each fan to provide the proper balance or equalization of pressures, such as by reducing the capacity of the fans in the rooms having reduced pressures in accordance with the amount of pressure reduction.

Similarly, it is possible to join together the exhaust ducts of the several rooms and provide a control valve means at the point of junction to vary the openings from the several ducts to the main exhaust duct connected to the common exhaust fan, for varying the amount of air drawn from each room in accordance with their variations in pressure which would otherwise occur without varying the overall capacity of the common exhaust fan.

The control device is advantageously provided at the place of junction of the suction ducts from the rooms facing different pressure areas. It may consist of an oscillatable regulating flap which is adjusted by a wind deflected vane mounted on the flap shaft above the building. The adjustment may alternatively be affected

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by means of pressure responsive controls in the individual rooms.

The accompanying drawings show two embodiments of the invention for purposes of illustration.

Fig. 1 is a schematic diagram of the system according to the present invention for two rooms lying in opposed pressure areas,

Fig. 2 is a vertical cross-sectional view along the vertical plane through the line 2-2 of Fig. 1, for a modified system of air supply,

Figs. 3 and 4 are sectional plan and side views respectively of a suitable arrangement for biasing a control valve used in the instant invention, and

Figs. 5 and 6 are diagrammatic illustrations of the basic principles involved in the instant invention.

In the part of the building represented in the drawings, the air is admitted from an air conditioning apparatus or from a central installation through an air supply channel 1, which may be disposed, for example, along the ceiling of the corridor between the rooms through ventilator inlet shutters 4 and 4a into rooms 3 and 3a, the windows 5 and 5a of which face in opposite directions. These shutters for the admission of the air may be provided with heat exchangers for heating or cooling the air. The admitted hot air, e.g. flows through the room over to window 5 or 5a. The part of the air in the room which cools off near window 5 or 5a falls down along the window glass and into outlet 6 or 6a which is connected in each case to a draining channel 7 or 7a through which the cold air is exhausted.

At any given wind direction, e.g. if the wind is directed against the outer wall of room 3a as indicated by the arrows 8a, there will result in general a higher pressure in room 3a and a lower pressure in room 3. In order to establish a balance between the rooms with super and subatmospheric pressure, the air exhaust ducts 7 are brought together via ducts 9 and 9a, and the additional connecting channels 10 and 10a. The latter are connected to a common air exhaust source, e.g. fan 11, via a common channel 12. At the juncture of connecting channels 10 and 10a there is provided a control device means 13 which is regulated by the wind conditions outside. This control device may consist of a flap which is adjusted electrically or pneumatically by means of a wind vane 14. In the embodiment illustrated in the drawing, the wind vane is more or less turned by the wind in the direction of room 3 against some resilient means biasing the flap 13 into normal position providing equal openings from each of the ducts 10 and 10a. Flap or valve 13 thus opens at the point of junction the aperture from channel 10a to the mutual channel 12 beyond its normal position, whereas the aperture for the air flow from channel 10 to channel 12 is more or less throttled. The mutual air exhaust fan is therefore drawing a larger amount of air from the zone of higher pressure, i.e. from room 3a than from room 3, in which there is a certain lower pressure prevailing, and in this way identical air pressure conditions can be maintained in both rooms 3 and 3a. Upon lessening of the wind pressure upon one side of vane 14, flap 13 will return more or less into its normal position as a result of the adjustment of the wind indicator vane.

The resilient means for biasing the flap 13 may, as indicated in Figs. 3 and 4, comprise leaf springs 16 and 17 which are fixed at 18 and 19. In their normal position, these springs extend to the center and hold flap 13 between them. If the flap is turned by wind vane 14 in one direction or the other direction, spring 16 or spring 17 is pressed in the same direction. Flap 13, in Fig. 3, is illustrated by broken lines in a position where it is turned towards channel 10a.

The fundamental principles underlying the instant invention will be better understood by reference to Figs. 5 and 6 of the drawings. In the diagrammatic sketch of Fig. 5 the building is designated by the numeral 21. The wind 8a acts upon wall 22 thereof. Before building wall 22 builds up a pressure zone 23 with a pressure Δp_1 increased over normal height N (Fig. 6 of the drawings), it forms beginning at the front wall and particularly at the back wall 24 a zone 25 of under-pressure whose magnitude depends on static pressure Δp_1 . These pressure conditions between zone 23 of over-pressure and zone 25 of under-pressure naturally extend also into the rooms 3 and 3a. It is not necessary that the rooms be provided with windows, which can be opened, since the pressure drop surrounding the whole building is transferred by respiration of masonry or other leaks into the interior so that in rooms 3a an over-pressure and in rooms 3 an underpressure with respect to normal conditions will obtain. Under normal conditions of the air supply in the building according to the invention, the admission of additional air over channel 1 through shutters 4 into rooms 3, 3a and the withdrawal or suction through outlets 6, 6a and channel 12 will be balanced in such a manner that room 3a has the same pressure and air conditions as room 3. This compensation is illustrated by line N in Fig. 6.

A higher pressure in the rooms 3a caused by the zone 23 of over pressure disturbs the balance of admission of additional air through channel 1. More additional air will flow into rooms 3 than into rooms 3a since the pressure existing in rooms 3 is below normal height N. Since the additional air is heated and conditioned, a lesser amount of this fresh air is admitted into rooms 3a. For this reason, rooms 3a are heated to a lesser degree. There will be adjusted a final condition in rooms 3a which is characterized by the increased pressure Δp_1 (Fig. 6). Herein lies the invention. Since by the withdrawal of air from rooms 3a a greater part of the cross-section is relieved than by the withdrawal of air from rooms 3 (caused by flap 13 which, according to Fig. 1, would be pressed toward the left by wind vane 14), more air is withdrawn from rooms 3a but only until increased pressure Δp_1 diminishes to line N or normal height. In practice, this will be effected in such a manner that pressures oscillate more or less above or below the normal line N (Fig. 6). From rooms 3a there is released only the static overpressure resulting from pressure of wind 8a. If the pressure of wind 8a diminishes or ceases completely, the wind vane 14 and flap 13 will automatically return to a normal middle position. With the device according to the invention, the normal pressure conditions shall be maintained also if one wall of the building is subjected to the action of wind. There is no cause to create a pressure below atmospheric whereby due to the zone 23 of over-pressure an increasing amount of air may enter the rooms 3a. All that is done is to remove the peaks above normal line N resulting from wind pressure to the level of this normal line. The device according to the invention has been carried out in practice and works very satisfactorily.

When, according to the invention, rooms 3 and 3a show nearly equal pressure conditions in spite of the one-sided zone of wind pressure, there will be admitted equal amounts of heated air into the rooms and the same are heated and aerated in a uniform manner. A further essential feature of the invention is the fact that there is a true circulation of air, i.e. not only is additional air admitted into rooms 3 and 3a but the air is also continuously withdrawn from these rooms. By the arrangement proposed herein, the balancing of this circulation

will be maintained in spite of varying pressure conditions on the outside, the regulation being effected on the side of withdrawal of the air.

If there are a plurality of rooms, the air exhaust ducts of rooms facing in different directions are suitably joined in each case and the individual ducts again joined into manifold exhaust ducts at suitable points at which the control devices may be arranged. These regulating devices can be so adjusted, that approximately identical air conditions are obtained in the rooms facing in different directions, in spite of the differential pressure caused by the wind.

In the modified embodiment illustrated in Fig. 2, the entire space of the corridor 2 serves as the air supply duct, the air in the rooms is continuously drawn away along the windows. The false floor 1a which serves to form air supply duct 1 as shown in Fig. 1, is omitted. The entire area of the corridor is flooded with conditioned air under pressure and without restricting supply flow to any special ducts. Inlets 4 and 4a of known structure lead from corridor 2 to the rooms 3 and 3a. The air from the rooms is continuously drawn off on the side of the window through duct 6 or 6a. Vent openings 15 and 15a may additionally be provided.

The disposition illustrated in Fig. 2 is particularly suited for use in buildings in which several rooms are connected by a long corridor. There is no danger that the flow of air is impaired by the opening of doors, since the amount of air exhausted determines the amount of air supplied from the corridor. Moreover, adequate ventilation is ensured by the constant withdrawal of air through the exhaust ducts.

What is claimed is:

1. In a system of ventilating and supplying preconditioned air simultaneously to a plurality of rooms having windows exposed to different outside air pressures, means for supplying said preconditioned air to the said rooms from a common source and at substantially constant pressure, outlet means in each room for withdrawing the air from the said rooms, a common air exhaust means, a pair of duct means provided with discharge orifices connecting the respective outlet means in the said rooms to the said common air exhaust means at a common junction point, a common valve means for said outlet means disposed at the common junction point of said common air exhaust means and all of the room outlet connecting means, a valve control means for said valve means, said valve control means being responsive to changes in outside wind conditions, and said valve control means also being adapted to operate said valve means so as to vary the openings of the discharge orifices of the connecting duct means for said room outlet means in direct proportion to the pressure differential between the corresponding rooms produced by said different outside air pressures, whereby the supply of the preconditioned air to the several rooms will not be adversely affected by changes in outside wind conditions.

2. A system as set forth in claim 1 wherein said valve control means includes a wind operated vane.

3. A system as set forth in claim 1 wherein the air outlet means for the said rooms initiate at points adjacent the lower portion of the windows in the said rooms.

4. The system as set forth in claim 1 wherein the air outlet means for the rooms initiate at points above and adjacent the floors in the said rooms.

References Cited in the file of this patent

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