June 14, 1966 YOSHIAKI IWATA 3,255,688

DOUBLE-SASH DEVICE FOR AUTOMATIC AIR VENTILATION

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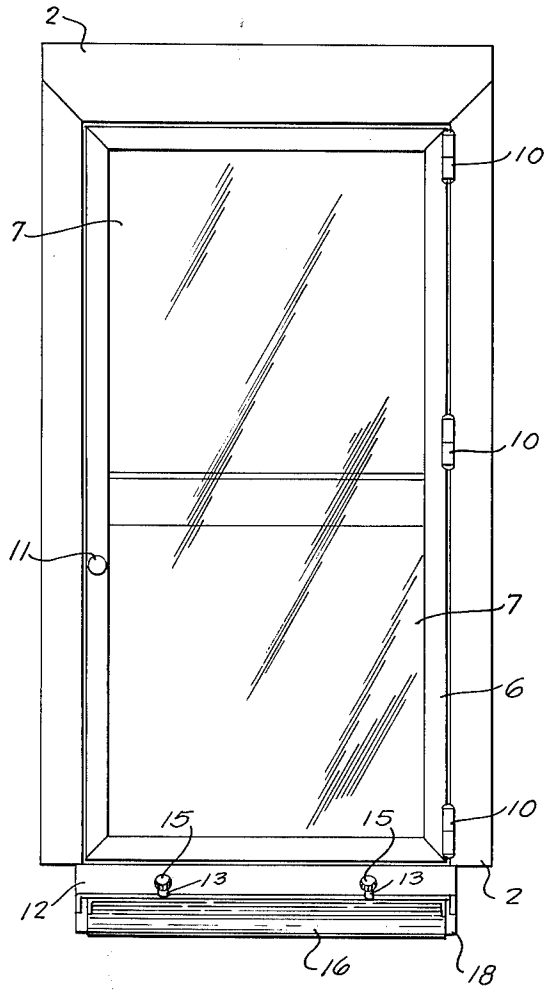


FIG. 1.

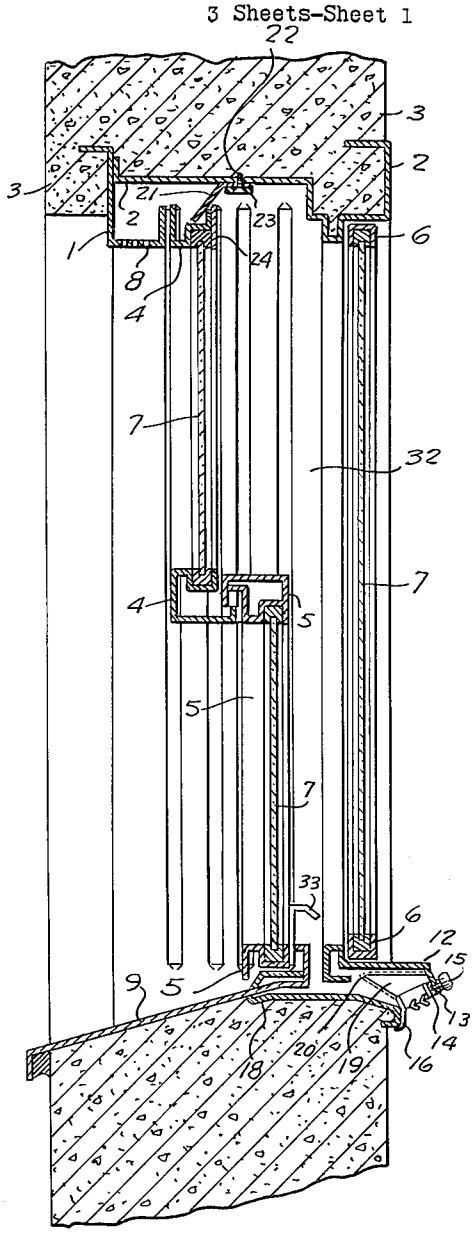


FIG. 2.

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FIG. 3.

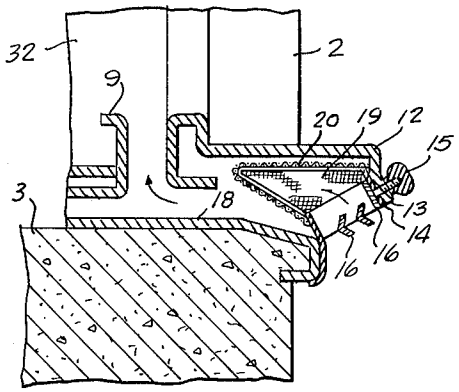


FIG. 4.

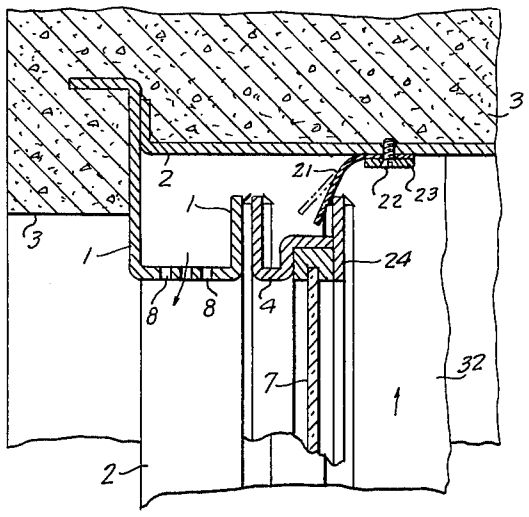
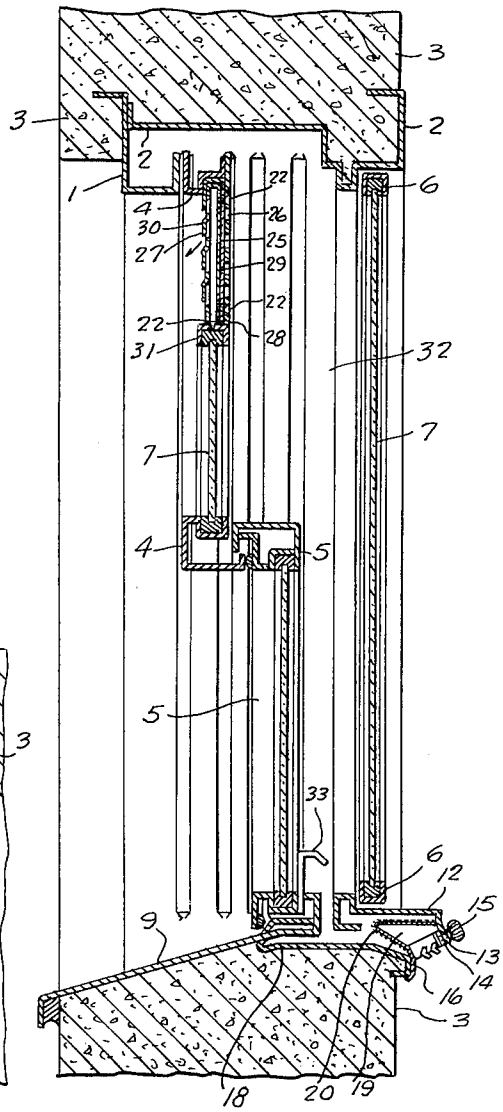


FIG. 5.



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FIG. 7.

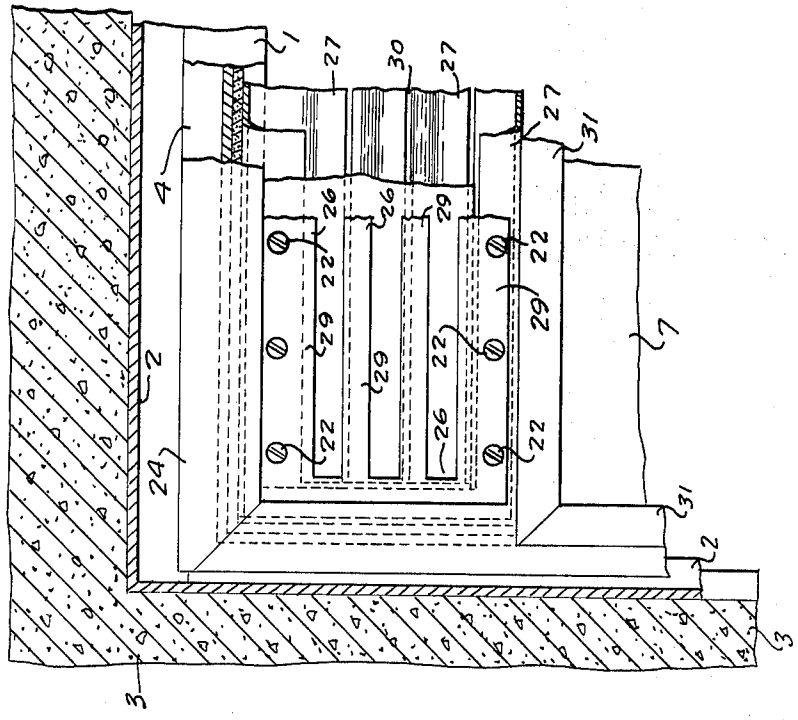
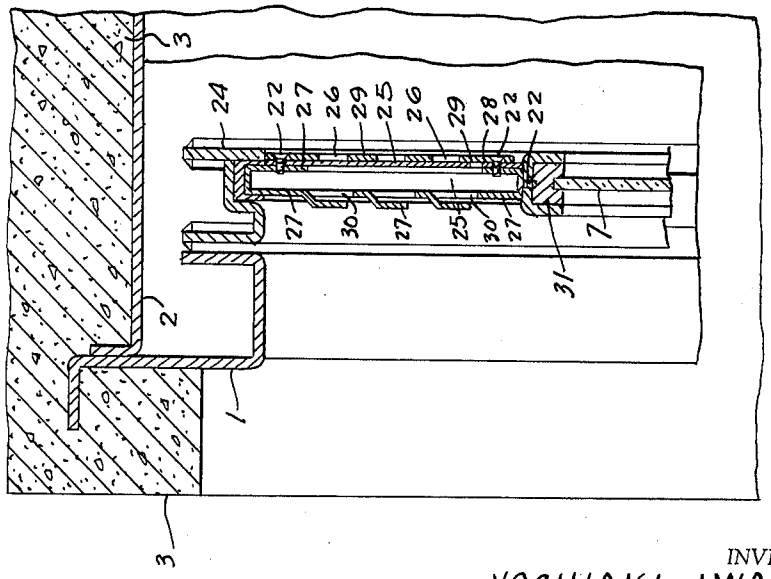


FIG. 6.



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3,255,688

DOUBLE-SASH DEVICE FOR AUTOMATIC AIR VENTILATION

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5 Claims. (Cl. 98—95)

This invention relates to a double window sash device and has particular reference to a device employing such double-sash structure for effecting an automatic ventilation for air-conditioning in the interior of a building.

Generally, in the planning and designing of an air-conditioning system, the biggest problem confronting the designer has always been how he could best eliminate heat losses resulting from the permeation or escape of heat through glass windows. A concomitant problem has been the difficulty in location and positioning air supply and ventilation ducts to suit the particular circumstances of a given building. The permeation and dissipation of heat through glass panes in a building or house has necessitated a trend of an air-conditioning design to pay more attention to the arrangement of ducts so that heat losses may be thereby minimized. The usual practice for this has been to distribute the supply of conditioned air more to places adjacent windows, where thermal load is greatest, than the places remote from the windows, thereby compensating for the heat loss therethrough.

The primary object of the present invention is to provide a novel, simple device of this character which is formed essentially of a double-sash window panel and which will eliminate the above noted difficulties.

Another object of the present invention is to provide a device of this character which is comprised of a double sash structure having inside and outside sashes designed to create an intermediate air current therebetween communicating with the outside atmosphere whereby the air-conditioned room is protected against the interference of varying outdoor temperature.

A further object of the present invention is to provide a device of this character which is capable of venting the room air automatically to the atmosphere without the aid of any separate ventilation apparatus or exhaust ducts.

Still further object of the present invention is to provide novel, simple and economical means for enhancing the effect of air-conditioning at once and for minimizing the initial cost of air-conditioning equipment installation.

These objects and other merits of this present invention will be more apparent from the following description of the invention taken in connection with the accompanying drawings, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is an inner face view of the interior sash device embodying the present invention;

FIG. 2 is a vertical sectional view of the assembly of the double-sash inner and outer device of the present invention illustrating a means for drawing air from within the room provided at the bottom and a room air discharging means provided at the top of the device;

FIG. 3 is an enlarged detail view of the room air drawing means provided in the double-sash device of the present invention;

FIG. 4 is an enlarged detail view of the room air discharging means of the outside sash.

FIG. 5 is a vertical sectional view of a modification of the double-sash device according to the present invention;

FIG. 6 is an enlarged detail view of the air discharging means employed in the modified device of FIG. 5, and

FIG. 7 is an inner face view of the air discharging means of FIGS. 5 and 6, illustrating the same in more detail.

Reference numerals 1 and 2 (FIG. 2) designate an outer window frame and an inner window frame, respectively, that are fixed at their upper ends into a concrete base 3. The outer window frame 1 receives an upper sash 4 and a lower sash 5 slidable therein, while the inner window frame 2 is adapted to fit air-tightly with a single full length inner sash 6, each of said sashes carrying a glass pane 7. The outer window frame 1 is provided therein at the top with a plurality of aperture 8 adapted to allow the passage of air therethrough.

In closed position, the outer lower sash 5 has an upper end thereof engaged air-tightly with the lower end of the outer upper sash 4 and its lower end seated hermetically against an outer frame member 9. The inner sash member 6, as illustrated in FIG. 1, is hinged at 10 so that it may be opened and closed by horizontal movement, for which there is provided a knob 11. As illustrated in FIG. 2, there is provided a sash sill 12 against which is seated the inner sash 6 and which has formed adjacent thereto recess for the escape of room air through the sash assembly.

The sash sill 12 is provided at the lower marginal portion with oblong grooves 13, as illustrated in FIG. 1, which are adapted to engage with a threaded neck 14 (FIG. 2). The neck part 14 is in threaded engagement at one end with a rotatable knob member 15 and is fixedly connected at the other end thereof with a perforated panel member 16 or the perforated panel member 16 extends horizontally substantially as far as the sash sill 12 and fits snugly with an inner bottom frame member 18 embedded in the lower concrete base 3, as illustrated in FIG. 2.

Within the recess formed by the walls of the sash sill 12 and bottom plate supporting member 18, there is inserted detachably an air filter 19 supported on a wire mesh or the like 20 as illustrated in FIGS. 2 and 5. It will be appreciated that the air filter 19 is easily taken out, when necessary, by removing the perforated panel member 16 by loosening the screw knob 15.

A suitable resilient flat sheet member or flapper 21 such as of rubber or plastics is provided at the upper section of the outer double-sash structure. This flapper in a first form of the invention as illustrated in FIG. 2 is elongated horizontally as far as the width of the upper sash member 4 and is substantially equal in length to the perforated panel member 16 at the bottom of the window. The flapper or resilient strip 21, in the instance of the embodiment of FIG. 2, is secured at one end by a bolt 22 across a suitable metal washer 23 to the wall of the upper inner window frame 2, and has the other end riding over a fence member or extention 24 of the outer upper sash 4. The resilient strip 21 is adapted to remain closed over the edge portion of the fence member 24 of the outer upper sash 4 so long as the internal room pressure is equal to outdoor atmospheric pressure, but is lifted upwardly out of engagement with said fence member 24 by the action of the air current produced upon increasing room pressure, as illustrated in the dotted line portion in FIG. 4.

A modification of the flapper 21 is shown in FIG. 5 which comprises a horizontally elongated sheet 25 of rubber or similar resilient material having an upper end portion thereof secured by bolts 22 together with a perforated metal member 26 to the upper portion of an air escape frame member 27. The lower end portion of the resilient sheet 25 is so disposed as to freely contact a washer 28 inserted between said metal member 26 and frame member 27, said washer being substantially equal in thickness to the resilient flapper 25 so that the latter may engage flatly with the former.

The perforated metal member **26** is provided centrally with a plurality of apertures **29** (FIG. 5) resembling those of a harmonica for allowing the current of room air to flow therethrough to the atmosphere as the flapper **25** is forced open.

The air escape frame member **27** (FIG. 5) is provided with apertures **30** which may be of the character illustrated in cross section in FIG. 5 and which may be located in positions substantially corresponding to the apertures **29** of the metal member **26**. The configuration of the outer frame member **27**, as illustrated in FIG. 5, is intended to prevent the direct entrance of turbulent atmosphere into the room.

As illustrated in the form of FIG. 5, the frame member **27** is secured at its bottom by bolts **22** to the upper end of a window sash **31** which is slidably engaged at the associated lower sash portion **4** with the sash **5**.

With reference to both embodiments of FIGS. 2 and 5 with the foregoing construction of the double sash device of the present invention, it will be appreciated that when the pressure in an air-conditioned, normally air-tight room, increases over atmospheric, as a result of continuous supply of fresh air, the room air tends to seek its way out from the inside room through the perforated panel member **16** located at the bottom of the window. The air travels upwardly, as shown by arrows (FIGS. 3, 4), through the chamber formed between the outer and inner window sash members, and forces open the resilient flapper **21** (FIG. 2) or the resilient sheet **25** (FIG. 5), and flows into the outside atmosphere through the apertures **8** (FIG. 2) or the apertures **30** (FIG. 5).

Experiments conducted by the inventor showed that the difference between room and outside pressures required to create a steady intermediate air layer within the space between the double sash compartment designated at **32** (FIGS. 2 and 5) is only of the order of 1 to 2 mm. Hg. In other words, this value of pressure differential exists where fresh conditioned air is supplied continuously to the room, and is sufficient to allow the intermediate air current between the sashes to force open the flapper **21** or **25** to replace the room air and have an equivalent amout of fresh air supplied.

The term "intermediate air current" as used herein implies a continuously moving air layer which serves as a barrier to block the direct communication between outdoor and indoor air temperatures. This air current maintained in the double-sash chamber according to the present invention carries with it the heat of the outside atmosphere permeating through the glass panes as it travels up through the chamber.

It will be appreciated that the air exhausted from a thermally conditioned room tends to absorb the heat of the outdoor atmosphere through the glass panes **7** of the windows at it travels upwardly through the intermediate air zone **32** (FIG. 2), thus thermally isolating the exterior atmosphere from the interior atmosphere. By virtue of this fact, it is possible to maintain a steady temperature distribution in the room cooled or warmed, whichever the case may be, and to considerably reduce the heat load usually required for air-conditioning a given unit of area.

Thus, in accordance with the present invention, it is made possible to replace the room air automatically by the prevailing pressure difference between indoors and outdoors, without recourse to conventional ventilation apparatus usually required for this purpose.

It will be further appreciated that the air filter **19** inserted in the recess of the bottom sash sill **12** may be replaced, when necessary, simply by disengaging the air drawing perforated panel member **16** at the bottom of the window. The inner window sash **6** with the knob **11**, as illustrated in FIG. 1, may be swung open toward the interior of the room so that the glass panes may be cleaned and the outer window may be opened, when desired, for which purpose there is provided a handle **33** adapted to lift the outer window.

In addition to the principal advantage of the double-sash device in allowing automatic ventilation for an air-conditioned room without having to install conventional ventilation equipment, the present invention is further characterized by the nature of the flapper construction **21** or **25** which can maintain sealing against the flow of outdoor air or liquid which tends to infiltrate the interior of the building when storm conditions arise.

While the preferred embodiment of the present invention has been illustrated and described herein, it will be understood that various changes or modifications in the construction may be made as will be obvious to those skilled in the art within the scope of the appended claims without departing from the principles of the present invention.

What I claim is:

1. in an air conditioning system, a double sash device for effecting automatic air ventilation comprising a window frame having a plurality of apertures communicating with the outer atmosphere, an outer sash unit and an interior sash unit mounted in mutual spaced-apart face-to-face relation and defining an enclosed chamber with said window frame, said outer sash unit comprising two sashes slidably mounted in said window frame, a supporting means for seating said interior sash unit thereon, hinge means interconnecting said supporting means and said interior sash unit for enabling the latter to be moved out of abutting relation with the former at the bottom of said interior sash unit, means for drawing air from within the room into said chamber, and resilient sheet means having one end secured to the upper portion of said window frame and the other end disposed to overlie the upper marginal portion of said outer sash unit.

2. The double-sash device as defined by claim **1**, wherein said outer sash unit is divided into two sections, one being slidable relative to the other.

3. The double-sash device as defined by claim **1**, wherein said resilient means is made of plastic.

4. The double-sash device as defined by claim **1**, said interior sash unit being hingedly mounted on said frame.

5. In an air conditioning system, a double-sash device for effecting air ventilation comprising inner and outer window frame members, first inner and second outer sash units disposed in mutual spaced-apart face-to-face relation and mounted in said frame members defining an enclosed chamber therewith, a sash sill supporting said first inner sash member thereon, a bottom supporting plate member mounted below said frame members and forming a recess with said sash sill, an air filter detachforming a r ecess with said sash sill, an air filter detachably mounted within said recess provided between said bottom supporting plate member and said sash sill and a rubber flapper connected to said inner window frame member above said second outer sash units and positioned to permit air to exhaust from, but not enter said chamber above said second outer sash units.

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