United States Patent

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[54] **AIR CONTROL SYSTEM**

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[52] **U.S. Cl.** **98/33**, 98/10

[51] **Int. Cl.** **F24f 13/00**

[58] **Field of Search** ..... 98/33 A, 33 R, 10

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[57] **ABSTRACT**

A system of controlling the movement of forced air and the mix of this air through the utilization of synchronized panels which selectively vary the amount of outside air and recirculating air introduce into a mixing chamber for forced discharge into the storage house. An exhaust opening with a controlling panel therefor can be incorporated in the system and synchronized with the intake air closure panel and the circulating air closure panel.

6 Claims, 4 Drawing Figures

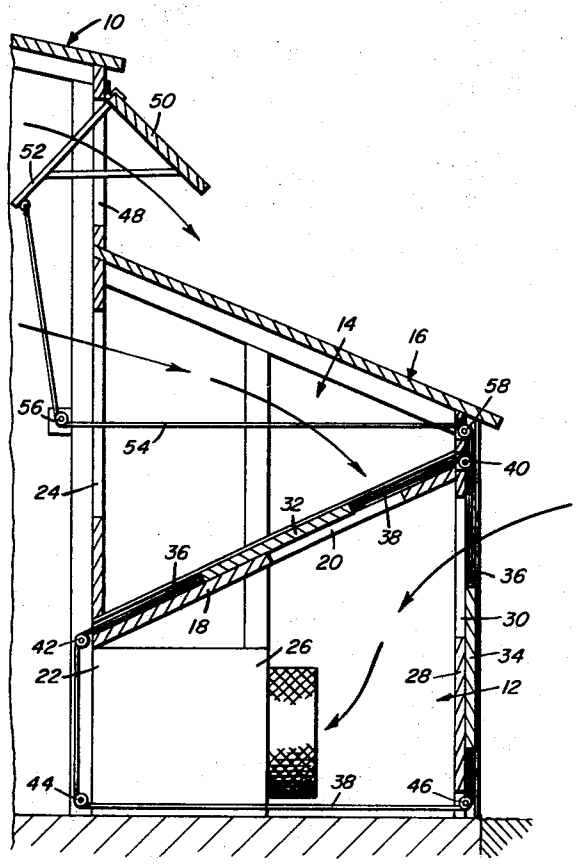


Fig. 1

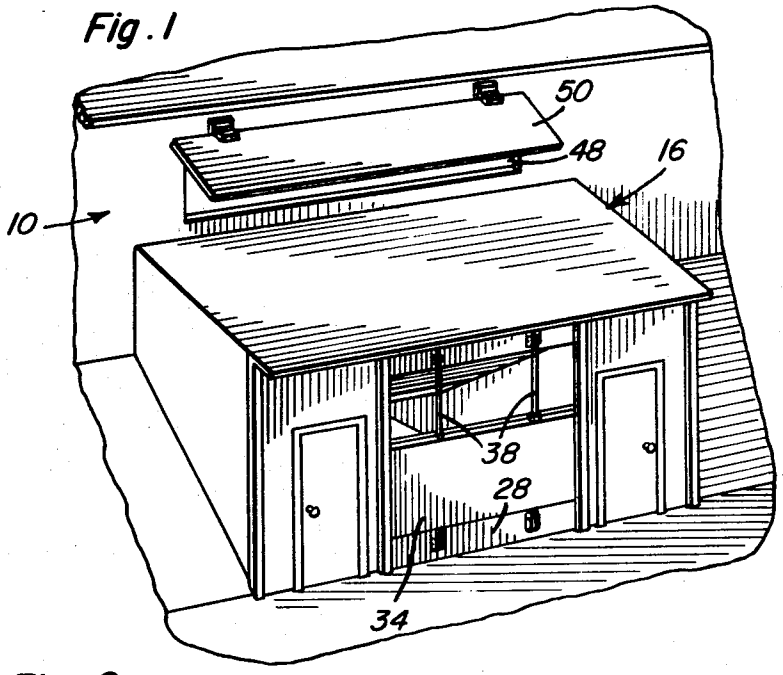
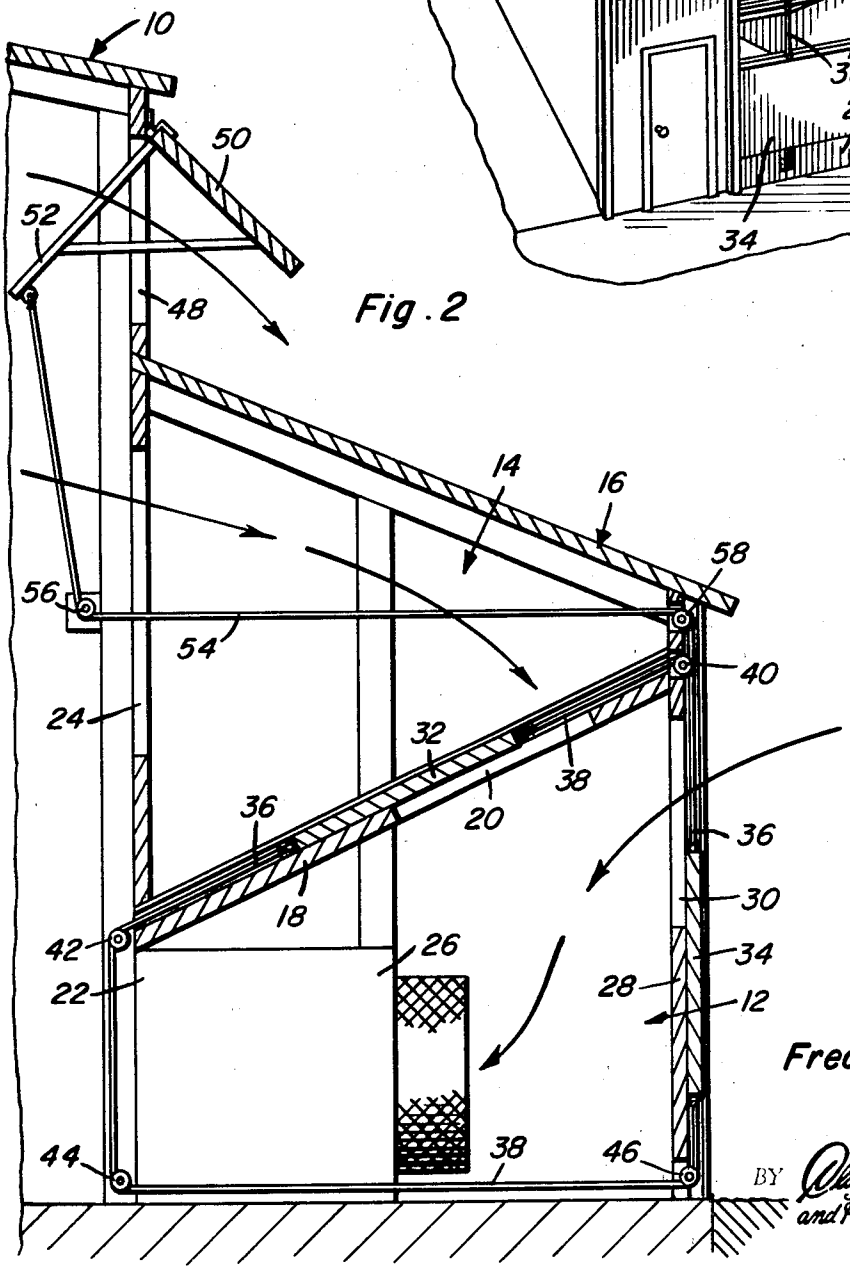
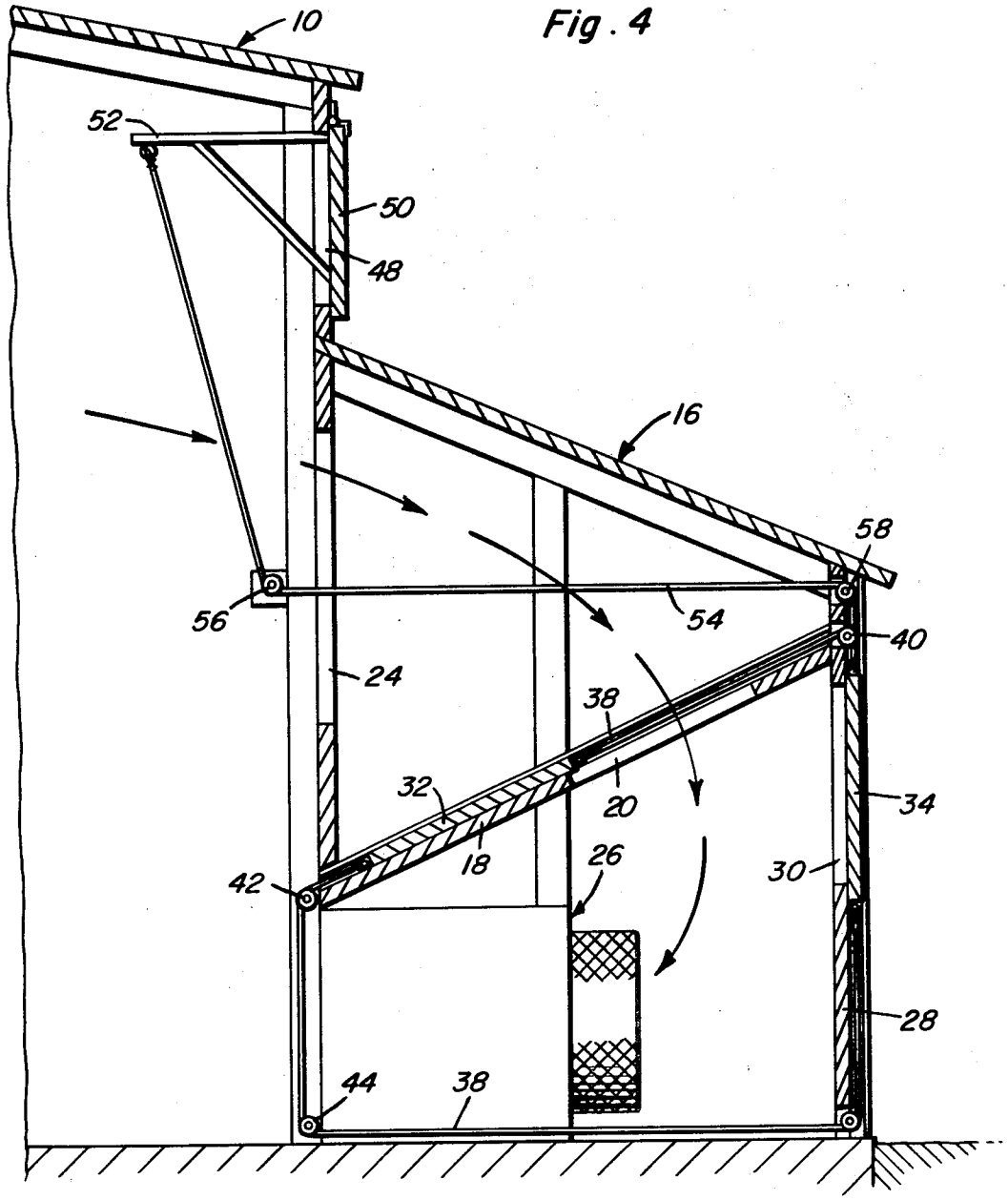


Fig. 2



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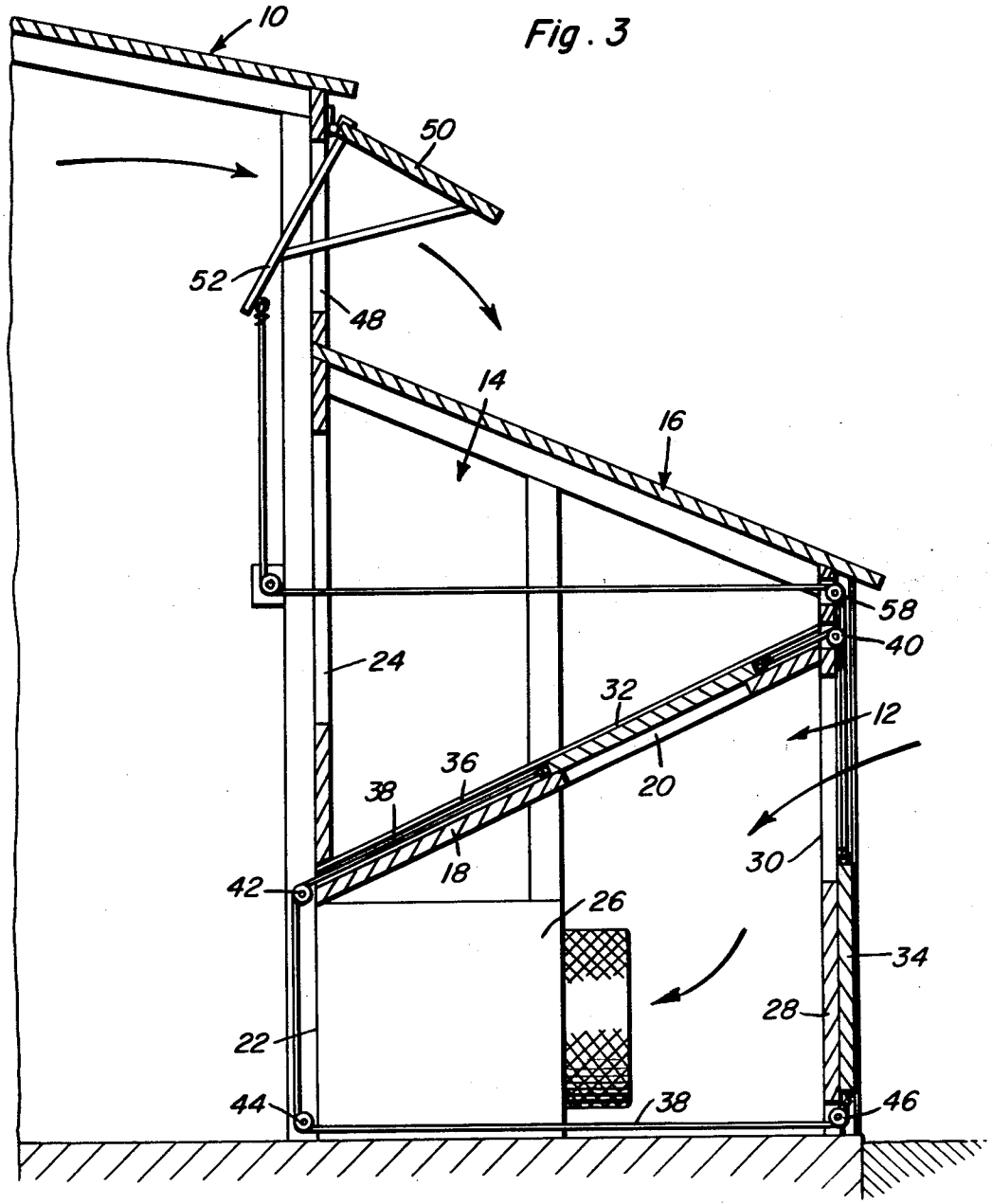
Fig. 4



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Fig. 3



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AIR CONTROL SYSTEM

The present invention generally relates to an air circulation system for a produce storage house or barn, and more particularly is directed to a system wherein a series of panels are interconnected and syncronized in operation so as to achieve any desired air mix from 100 percent outside air to 100 percent recirculating inside air for forced movement through the produce.

It is a primary object of the instant invention to provide an automatic air mix system, either manually or power controlled, which utilizes solid closure panels, the movement of each one of which is directly related to the movement of the other panel or panels.

In conjunction with the above object, it is also a significant object of the instant invention to provide an air flow control system which eliminates the need for individually manipulated shutters or louvers, along with their numerous moving parts, thin uninsulated construction and the accompanying air leakage and temperature loss experienced therewith.

Other objects of the instant invention include the provision of a system which, while highly unique in construction and operation, is relatively simple from a structural standpoint, trouble free in operation, capable of providing a positive and exact control over air movement, and equally adapted for manual operation or power operation with motor controls and temperature and humidity sensors.

In achieving the above objects, the system of the instant invention is so constructed as to include a fan house normally constructed adjacent an exterior wall of the produce storage barn. The fan house is divided into two chambers having a communication opening or air flow port therebetween. A sliding closure panel is associated with this port. Both chambers are communicated with the interior of the barn, with one of the chambers communicating with the exterior, through a second air flow port which is selectively closable by a sliding closure panel. This latter chamber also has an enlarged fan unit which creates a pressure flow of the air therein into the barn. The two closure panels are interconnected for a syncronized movement whereby either one or the other of the ports are completely open or both ports partially closed, thereby regulating the air mix moved by the fan means. A third air flow port is provided in the barn wall spaced from the fan house. This port is closed by a swinging closure panel and constitutes an exhaust port. Movement of this exhaust port panel is also syncronized with the previous two panels.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIG. 1 is a perspective view of a portion of a storage barn having the system incorporating fan house of the instant invention constructed adjacent thereto;

FIG. 2 is an enlarged cross sectional view illustrating the relationship between the various components of the system wherein a partial air mix is circulated;

FIG. 3 is a cross sectional view similar to FIG. 2 wherein the system is adjusted so as to effect a circulation of outside air only; and

FIG. 4 is a similar cross sectional view wherein the system is so adjusted as to recirculate the interior air only.

Referring now more specifically to the drawings, reference numeral **10** is used to designate a storage building for agricultural produce and the like. It is the basic purpose of this invention to provide a system for moving and controlling the movement of air through the building **10** so as to, among other factors, maintain temperature and humidity control as well as air circulation.

In order to effect the desired air movement and control thereof, a pair of adjacent chambers, normally a lower chamber **12** and an upper chamber **14** are provided. These chambers **12** and **14** will preferably be housed within a separate housing or enclosure **16** constructed against an exterior wall of the building **10**.

The lower and upper chambers **12** and **14** are separated by a transverse wall **18** having an enlarged access port or opening **20** defined therethrough so as to communicate the chambers **12** and **14**. The chambers **12** and **14** include access ports or openings **22** and **24** respectively through the adjoining portion of the wall of the building **10** for a direct communication of the chambers with the interior of the building.

Mounted within the lower chamber **12** and discharging into the interior of the building **10** directly through the opening **22** is an enlarged fan unit **26**. While not specifically limited thereto, one preferred arrangement of the partition wall **18** is with the wall **18** inclining upwardly from the top of the lower chamber opening **22** to the outer wall **28** of the enclosure **16**, thus defining an enlarged air mixing area within the chamber **12** immediately outward of the fan unit **26**. The opening **20** in the partition wall **18** is located outward of the fan unit **26** whereby a proper mixing of air therefrom with fresh or ambient air can be effected as the air is drawn into the fan unit **26** for discharge into the building **10**.

The lower chamber **12** is also provided with an enlarged intake port or opening **30** through the outer wall **28** thereof for an intaking of fresh or ambient air.

Panels **32** and **34** are respectively associated with the openings **20** and **30** for movement between a first position wherein the corresponding opening is completely open and a second position wherein the corresponding opening is completely closed. The panels **32** and **34** can also assume any intermediate position wherein a partial closing of the opening is effected. It is contemplated that the panels **32** and **34** be in the nature of sliding panels, each engaged with one face of the corresponding wall **18** or **28** and guided for sliding movement relative to the corresponding opening **20** or **30** in any appropriate manner, such as by the utilization of opposed guide tracks **36** for each of the panels. A significant feature of the instant invention is the fact that the movement of the panels **32** and **34** is to be syncronized with the opening **20** being completely open when the opening **30** is completely closed and vice versa. By the same token, any movement of one panel so as to partially expose or cover the corresponding opening will be immediately accompanied by a corresponding movement of the second panel and a directly opposed opening or closing of the opening associated with the second panel. In other words, should a major portion of the opening **20** be exposed, a major portion of the opening **30** will be closed.

One manner of providing for a simultaneous and syncronized movement of the panels **32** and **34** comprises the use of cables **38** engaged between the upper ends of the panels **32** and **34** and between the lower ends of these panels, the cables **38** in each instance extending over appropriately positioned pulleys whereby a straight pull on the panels will result from a selective tensioning of the cables so as to achieve the desired syncronized movement of the panels. It will be noted that the cable **38** engaged between the upper ends of the panels **32** and **34** extends over a single pulley **40** rotatably positioned at the point of intersection between the partition wall **18** and the front enclosure wall **28**, the cable **38**, as it extends from the upper end of each of the panels **32** and **34**, paralleling the corresponding wall. The cable **38** engaged between the lower ends of the panels **32** and **34** extends over a first pulley **42** at the inner or lower edge of the partition wall **18** in a manner whereby the cable **38** parallels the partition wall **18**. From this point, the cable **38** depends vertically and engages over a lower pulley **44** adjacent the base of the enclosure **16**. The cable then extends to the outer wall **28** and about a third pulley **46** aligned with the vertical panel **34** to which the cable is secured. The cables **38** are maintained under tension whereby a movement of one of the panels is immediately translated to a corresponding movement of the second panel. Further, the panels **32** and **34** are so orientated as to, as previously indicated, simultaneously open one opening while similarly closing the second opening.

It is contemplated that at least two cable and pulley arrangements be provided and that relatively long openings and associated panels will normally be utilized. The adjustment of the panels **32** and **34** can be effected manually whereby a manual movement of one of the panels or an appropriate pull on the related cables will effect the desired movement. On the other hand, a power operation can be utilized in which case the pulleys **40**, as an example, can be fixed to a common motor driven rotatable shaft with an activation of the motor, in either a forward or reverse direction, effecting a driving of the shaft and a corresponding travel of the cables **38** and movement of the closure panels **32** and **34**. This system is also particularly adapted for utilization of a more sophisticated arrangement whereby temperature and humidity sensors can be incorporated for effecting an automatic operation of the motor and movement of the panels in response to internal conditions within the produce building **10**.

Utilizing the system thus described, it will be appreciated now that the system can be adjusted so as to effect a powered induction of outside or ambient air solely with no recirculation of the internal air. By the same token, at the other extreme, the system can be adjusted so as to introduce no ambient air and merely recirculate the air within the building. Further, any desired degree of mixing of the interior and exterior air can be easily effected through an appropriate adjustment of the panels as described.

If deemed desirable, the system of the instant invention can also incorporate an exhaust opening **48** provided through the exterior wall of the building **10** beyond the enclosure **16** so as to enable a direct exhausting of the air within the building **10** to outside or ambient atmosphere. This opening **48** is provided with a closure panel **50**, preferably hingedly mounted for operational convenience. The panel **50** is provided with an inwardly extending control arm **52** toward the upper hinged end thereof. An elongated cable **54** is secured to the end of the arm and extends generally vertically therefrom about a first lower pulley **56** and then laterally to a second pulley **58** located vertically above the pulley **40** and slightly laterally thereof. The cable **54** then extends downwardly and is secured to the upper edge of the vertically moving panel **34**. This cable **54** is appropriately tensioned and of a length whereby movement of the panel **34** is directed translated into movement of the panel **50**. It is contemplated that the opening and closing movement of the panel **50** directly correspond to the opening and closing movement of the panel **34** whereby when the panel **34** completely closes its corresponding opening **30** so as to enable a recirculation of the interior air through the now completely open opening **20**, the panel **50** also completely closes the exhaust opening **48** so as to not interfer with the desired recirculation. By the same token, when the panel **34** is in its completely open position, the panel **32** being in its completely closed position so as to provide for a movement of 100 percent outside or ambient air, the panel **50** is in its extreme open position whereby a maximum exhausting of the introduced air is being effected. In this manner, a constant movement of outside air is achieved through the building **10**, thus avoiding internal pressure build-up within the building **10** and assuring a smooth continuous changing of the air. Incidentally, as with the cables **38**, two or more cables and associated sets of pulleys can be provided as required. Further, while cables and pulleys have been referred to, it should be appreciate that roller chains and gear wheels, or other appropriate direct connection means can be utilized.

FIG. **3** and **4** are of significance in illustrating the extreme positions of the system. In FIG. **3**, the recirculating air port or opening **20** is completely closed by its associated panel **32** with the openings **30** and **48** being opened to their maximum. In this manner, 100 percent outside or ambient air is moved through the produce storing building **10**, being forcibly blown in by the fan unit **26** and exhausting through the exhaust opening **48**.

FIG. **4**, on the other hand, illustrates the other extreme wherein the air recirculating opening **20** is completely open and both the intake opening **30** and the exhaust opening **48** are completely closed. In this arrangement, the fan unit **26** effects a powered recirculation of the internal air within the housing **10**.

FIG. **2** illustrates one of the many intermediate positions of the system. This particular arrangement illustrating an orientation of the panels whereby a larger percent of outside air is being combined and mixed with a smaller percent of inside air and introduced under pressure by the fan unit **26** through the opening **22** between the lower chamber **12** and the interior of the building **10**.

From the foregoing it will be appreciated that a simple although highly unique and effective means has been devised for controlling the movement of air into and within a produce storing building. This in turn contributes substantially to the necessary temperature and humidity controls required in that any desired mix of outside and inside air can be achieved rapidly, and if so desired automatically.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A ventilation system for produce and the like, said system comprising a produce storage building, first and second chambers separably communicating with the interior of the building through first and second openings, a third opening communicating said first and second chambers with each other, a closure panel associated with said third opening for a variable opening and closing thereof, a fourth opening and associated closure panel communicating the first chamber with the ambient air, air moving means in said first chamber positioned adjacent and discharging through said first opening into the building, said third and fourth openings being located in a manner whereby said air moving means can effect a forced drawing of air therethrough for discharge into the building, closure operating means engaging said closure panels for a synchronized movement thereof to effect a selective and variable opening and closing of the third and fourth openings in a predetermined relation to each other to achieve a desired relationship between the amount of air moved therethrough by the air moving means, said closure panels sliding relative to the associated openings, and means mounting said panels for sliding movement relative to said openings.

2. The system of claim 1 wherein said panels move between two extreme positions, a first position wherein the third opening is completely open and the fourth opening is completely closed, and a second position wherein the third opening is completely closed and the fourth opening is completely open.

3. The system of claim 2 wherein said closure operating means comprises first elongated flexible means engaged between the upper ends of the panels and second elongated flexible means engaged between the lower ends of said panels, said flexible means moving over guide means between the panels and being tensioned whereby a movement of one panel is directly translated into a movement of the second panel.

4. The system of claim 3 including a fifth opening and associated closure panel communicating the building interior directly with the ambient air.

5. The system of claim 4 wherein said panel associated with the fifth opening is selectively movable between a first position closing the fifth opening and a second position completely opening the fifth opening, said closure operating means engaging the panel associated with the fifth opening and syncronizing the operation thereof with the two previously mentioned panels.

6. The system of claim 5 wherein said first and second chambers are formed within a housing located exteriorly of and immediately adjacent said building.

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