United States Patent

Tutt

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[54] **AIR DISTRIBUTING APPARATUS**

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[52] **U.S. Cl.** .....**98/41**, 165/59, 137/608, 137/625.45, 181/64 A

[51] **Int. Cl.** **F24f 11/04**

[58] **Field of Search**....137/610, 608, 625.44, 625.45; 251/119; 181/36 D, 45, 64 A, 64 B; 98/41 R, 37; 236/49, 13; 165/22, 59

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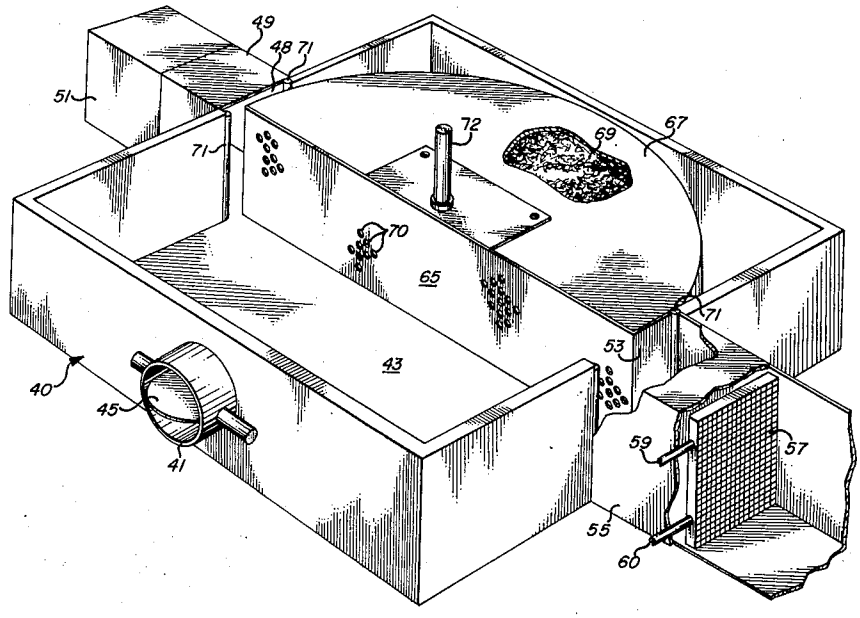
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[57] **ABSTRACT**

Apparatus is disclosed for use in connection with an air distribution system, wherein air under pressure is supplied to an inlet to the apparatus and is distributed to either of two outlets. The first outlet is connected to a duct for delivery to a room, while the second outlet supplies air to the system return plenum. The air enters an air receiving chamber of the apparatus and is directed toward a wall positioned substantially transversely to the direction of air entering the chamber. The wall is rotatably mounted within the chamber and is positioned to rotate from a first position to a second position where the wall shrouds either the first inlet or the second inlet. Positioning of the wall between the first and second positions results in the proportioning of the air to the first and second outlets; the areas of the outlets are thus reduced in proportion to the reduction in the volume of air to be delivered through the inlet. The wall may comprise a perforated sheet having holes therein to admit audible pressure variations through the holes to a sound deadening chamber positioned immediately behind the wall. The volume thus delivered by the apparatus remains constant for any rotatable position of the wall.

8 Claims, 3 Drawing Figures



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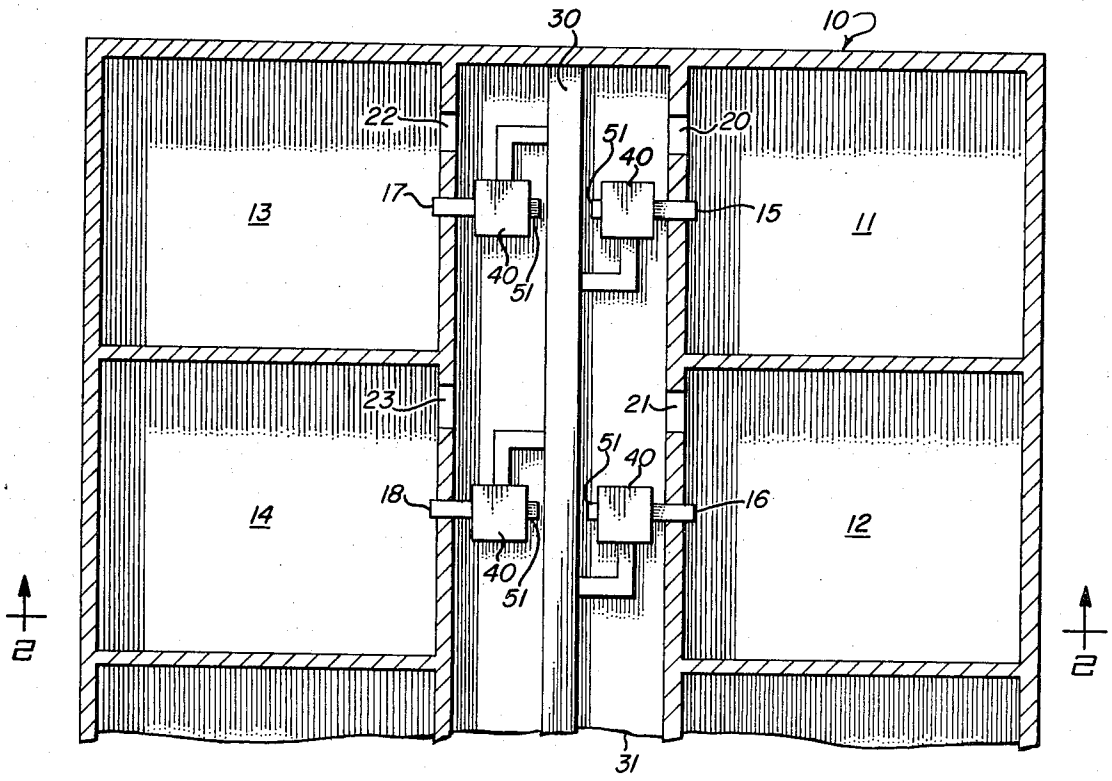


FIG. 1

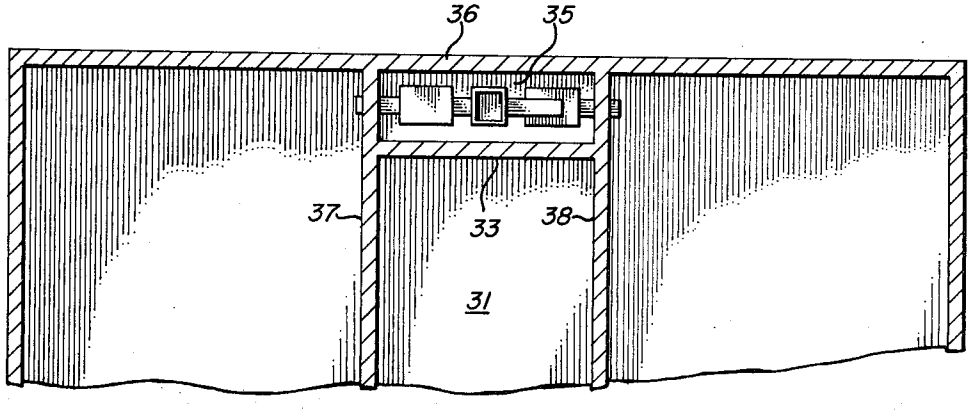


FIG. 2

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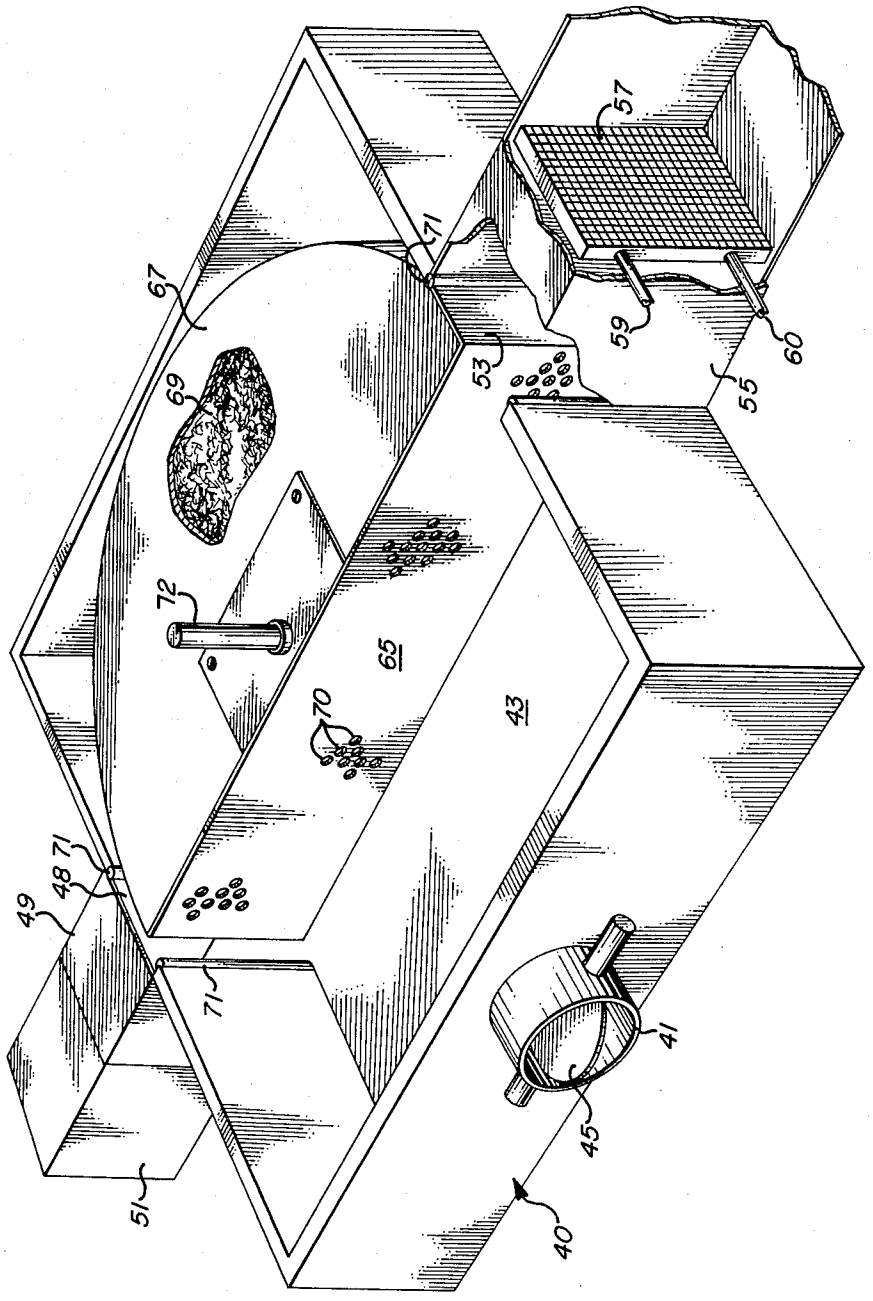
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FIG. 3



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AIR DISTRIBUTING APPARATUS

The present invention pertains to air distribution apparatus, and more particularly, to apparatus for use in combination with an air distributing system wherein apparatus presents a constant flow resistance to the system and, accordingly, yields a constant volume rate of flow.

The utilization of central air distribution systems provide continuing air to a plurality of rooms, deviating from the older concept of a central supply system in that individual room controls are permitted. Thus, the demand for conditioned air dictated by the requirements of a particular room will usually result in the variation of the volume rate of flow requirements for that room. These varying requirements reflected into the total system results in air distribution system complications which can be overcome if the system can operate the constant pressure/rate of flow.

Various devices have been suggested in the prior art to enable the air distribution system to operate at a constant volume rate of flow by insuring a constant flow rate at each individual room outlet; however, these devices have been complicated and also frequently do not provide for infinite variation between maximum and minimum rates of flow. Further, damping of audible pressure variations is sometimes difficult with these prior art systems.

It is therefore an object of the present invention to provide air distributing apparatus that will insure constant volume rate of flow regardless of the individual room requirements.

It is another object of the present invention to provide air distributing apparatus that permits infinite variation between maximum and minimum room air requirements without altering the overall volume rate of flow through the apparatus.

It is still another object of the present invention to provide air distributing apparatus that, while effectively proportioning air supplied by an air distribution system to the system return or to a room, will receive and absorb audible pressure variations by the imposition of a sound deadening wall directly in the audible path of the sound waves.

These and other objects of the present invention will become apparent to those skilled in the art as the description thereof proceeds.

Briefly, in accordance with the embodiment chosen for illustration, the apparatus of the present invention incorporates an air receiving chamber having an inlet connected thereto for receiving air under pressure directly from the air distribution of the supply duct. The air entering the receiving chamber exits from the chamber by flowing either 90° right or left, depending on the available area of a first or second outlet. The opening available at the respective outlets depends on the positioning of a rotatable wall mounted substantially transversely to the flow of incoming air. In this manner, the audible pressure previously emanating from the system into the chamber strikes the wall and passes through opening provided in the wall and is absorbed. The wall is rotatable between a first and second position and may be positioned intermediate to provide any desired proportioning between the first and second outlets. The wall may be pivoted through a shaft connected to a suitable servo system operated through a thermostat provided in the connected room. The first outlet is connected to the room inlet whereas the second inlet is connected to the return plenum of the air distribution system.

The present invention may more readily be described by reference to the accompanying drawings, in which:

FIG. 1 is a schematic plan view of a typical air distribution system incorporating the apparatus of the present invention.

FIG. 2 is an elevational cross-sectional view, taken along line 2—2 of FIG. 1.

FIG. 3 is a perspective view, partially disassembled, of the air distributing apparatus constructed in accordance with the teachings of the present invention.

Referring now to FIGS. 1 and 2, a brief review of a typical air distribution system will be helpful in understanding the apparatus of the present invention. A building, shown generally at 10, includes a plurality of rooms 11, 12, 13, and 14, each of which includes an air conditioning inlet 15, 16, 17, and 18 respectively. Similarly, air return vents or registers 20, 21, 22, and 23 are provided for each room. Thus, conditioned air will enter the room through the respective inlet and will be returned to the air distribution system via the corresponding return register. The air distribution system includes a main supply duct 30 that is connected to a suitable source of air under pressure (not shown) and delivers the air longitudinally along a hallway 31. The hallway characteristically includes a false ceiling 33, thus defining an air chamber or plenum 35 bounded by the ceiling 36, false ceiling 33, and walls 37 and 38. The air supplied through the duct 30 is connected through ducts to distributing apparatus 40. The apparatus 40 is constructed in accordance with the teachings of the present invention and may be described now by reference to FIG. 3.

The apparatus 40 includes an inlet duct 41 for connection to the main supply duct. In the embodiment chosen for illustration, the apparatus is shown in basically rectangular shape and includes a receiving chamber 43 which receives air directly through the inlet 41. It may be noted that a calibrating damper is positioned in the inlet 41 for purposes to be described more fully hereinafter. A first outlet 48 is provided and communicates through an adjustable damper 49 with an exit duct 51. The exit duct (as can more clearly be seen by reference to FIG. 1) communicates with the plenum 35 above the false ceiling. The plenum 35 forms the return air path for the air distribution system.

A second outlet 53 is provided and communicates with a duct 55 which provides air directly to the room. It may be noted that a heat exchanger 57 is positioned in the duct 55 and includes conduits 59 and 60 for connection to a hot or cold water source to heat or cool the air passing through the heat exchanger 57.

A wall 65 is mounted in the receiving chamber 43 and is positioned substantially transversely of the air entering the inlet 41. The wall is backed by an airtight, sound deadening chamber 67 that may conveniently be packed with fibrous sound dampening material 69. The wall 65, in order to permit the audible pressure variations entering the receiving chamber 43 to pass into the sound deadening chamber 67, includes a plurality of perforations or holes 70. The wall 65 is rotatably mounted in the chamber 43 and is rotated about shaft 72 to either expose or close the openings 48 and 53. It

may be noted that when the wall **65** has been rotated so as to expose the entire exit area of the opening **48**, the opening **53** is entirely closed, and vice-versa. The intermediate positions beyond the openings **48** and **53** are exposed such that the total exposed area of both openings is equal to the area of one of the openings. In this manner, a constant opening area is presented to air entering the receiving chamber, regardless of the amount of air passing into the room through the duct **55**.

It may be noted that the flow resistance in the duct **55** is affected by the existence of a heat exchanger **57** therein; to compensate for this increased flow resistance, the valve **49**, which may be any of numerous conventional air distribution variable designs, may be partially closed so as to present an equivalent resistance to the flow of air through the duct **51**. Conversely, the area of the opening **48** may be reduced and, instead of being equal to the area of the opening **53**, may actually be constructed of a smaller area. This differential in area would then compensate for the higher resistance to flow existing in the duct **55** by reason of the heat exchanger **57**. The smaller opening **48** (while smaller in area) would nevertheless present the same "effective" area as the area of the exit opening **53**. Therefore, by varying the actual areas of the openings **48** and **53**, the effective areas of the openings may be maintained equal to compensate for differing flow resistances exiting in the outlet ducts connected to the respective openings.

In operation, air at a predetermined pressure will be supplied through the main supply duct **30** to the inlet **41**. The air will enter the receiving chamber **43** and impinge upon the wall **65**, thereafter to be divided into two streams flowing through the openings **48** and **53** respectively. Assuming that the room being supplied by the apparatus **40** requires additional heating, and further assuming that the heat exchanger **57** is supplied with hot water (the heat exchanger could alternatively be electric), the common thermostat would detect the demand for warm air and would position the shaft **72** through a suitable and commercially readily available servo. The wall **65** would thus be positioned to increase the flow of air from the receiving chamber **43** through the outlet **53** and to decrease the flow of air through the outlet **48**. As the warm air enters, the requirement for conditioned warm air diminishes; the wall **65** will gradually close the opening **53** and correspondingly enlarge the opening **48** (the apparatus may include a stop to prevent the wall from completely closing the outlet **53** and to thereby maintain a predetermined minimum air flow into the room).

In the event the system is in a cooling cycle (that is, cool air is being delivered by the system to the apparatus **40** for delivery to the room), then the operation will differ somewhat from that described above. For example, the amount of cool air delivered through the apparatus will depend on the temperature requirements of the room. If the room temperature drops below a desired value, the operation of the servo mechanism would be the reverse of that described and the wall **65** would be positioned to decrease the flow of air from the receiving chamber **43** through the outlet **53**. At some predetermined position of the wall **65** (a position where the volume of air passing through the outlet **53** is at a predetermined minimum), the heat exchanger may be activated to warm the otherwise cool air flowing to the room. This reheating cycle is utilized when the overall system is being used to generally cool the rooms and wherein individual rooms require less cooling or where heating rather than cooling is required.

Regardless of the positioning of the wall **65**, the total resistance to the flow of air through the apparatus will remain constant and the air will either be directed to the respective room or will be returned to the system through the return plenum.

When the system is installed, it is usually necessary to balance the system by calibrating each individual distribution apparatus. This calibration is required as a result of such variables as the position of the apparatus in the overall system as well as the varying requirements of the specific room, or perhaps the geometry of a required architectural layout. To permit this balancing, the valve **45** is provided at the inlet **41**. Pressure variations that are generated in the air distribution system frequently attain audible frequencies and, as such, are transmitted as sound waves and emanate into the rooms through the room inlets. The utilization of sound deadening materials to absorb these audible pressure variations is well known; however, the apparatus of the present invention imposes the wall **65** directly in the path of the pressure variations. The wall is constructed of a perforated material incorporating openings or holes **70** which admit the low frequency sound waves to the deadening chamber **67**. The sound waves thus admitted to the chamber **67** are effectively eliminated and are not transmitted to the room. The chamber **67**, in the embodiment chosen for illustration, is shown as semi-circular, which presents a convenient shape and enables the ready sealing of the receiving chamber **43** through the utilization of flexible seals **71**. Since the rotating motion of the wall **65** and the chamber **67** is limited to the exposing of one of the openings **48** or **53**, it is not necessary that the chamber **67** be a complete semi-circle; however, it has been found that the sound deadening afforded by the particular embodiment greatly enhances the desirability of the apparatus.

I claim:

1. In an air distribution system, air distributing apparatus comprising: an air receiving chamber having an inlet, a first outlet, and a second outlet, each of said outlets having a predetermined effective area; means connecting said inlet to a source of conditioning air under pressure; a movable wall in said chamber positioned opposite said inlet and substantially transversely of air entering said chamber, said wall rotatably secured in said chamber and rotatable between a first position and a second position; said wall, when in said first position, closing said first outlet and opening said second outlet, and when in said second position closing said second outlet and opening said first outlet; said wall, when in positions intermediate said first and second positions, partially opening both said first and second outlets, the sum of the effective areas of the openings of said first and second outlets being equal to the effective area of one of said outlets, whereby the total volume of air per unit time being discharged through said apparatus remains constant; means connecting said first outlet to an air return for said air dis-

tribution system; and means connecting said second outlet to a duct for delivering air to a room.

2. In an air distribution system, air distributing apparatus comprising: an air receiving chamber having an inlet, a first outlet, and a second outlet, each of said outlets having a predetermined area; means connecting said inlet to a source of conditioning air under pressure; a movable wall in said chamber positioned opposite said inlet and substantially transversely of air entering said chamber, said wall rotatably secured in said chamber and rotatable between a first position and a second position; said wall, when in said first position, closing said first outlet and opening said second outlet, and when in said second position closing said second outlet and opening said first outlet; said wall, when in positions intermediate said first and second positions, partially opening both said first and second outlets, the sum of the areas of the openings of said first and second outlets being equal to the area of one of said outlets, whereby the total volume of air per unit time being discharged through said apparatus remains constant; means connecting said first outlet to an air return for said air distribution system; and means connecting said second outlet to a duct for delivering air to a room.

3. The combination set forth in claim 1, wherein said wall comprises a sound absorbing barrier to dampen audible pressure variations entering said chamber.

4. The combination set forth in claim 1, including an airtight sound dampening chamber positioned behind said wall and rotatably mounted to rotate with said wall, said wall comprising a perforated plate having openings therein to admit sound waves into said sound dampening chamber.

5. The combination set forth in claim 2, wherein said wall comprises a sound absorbing barrier to dampen audible pressure variations entering said chamber.

6. The combination set forth in claim 2, including an airtight sound dampening chamber positioned behind said wall and rotatably mounted to rotate with said wall, said wall comprising a perforated plate having openings therein to admit sound waves into said sound dampening chamber.

7. The combination set forth in claim 4, wherein said airtight sound dampening chamber is formed by two semi-circular plates separated along the straight edges thereof by said wall.

8. The combination set forth in claim 6, wherein said airtight sound dampening chamber is formed by two semicircular plates separated along the straight edges thereof by said wall.

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