

May 17, 1955

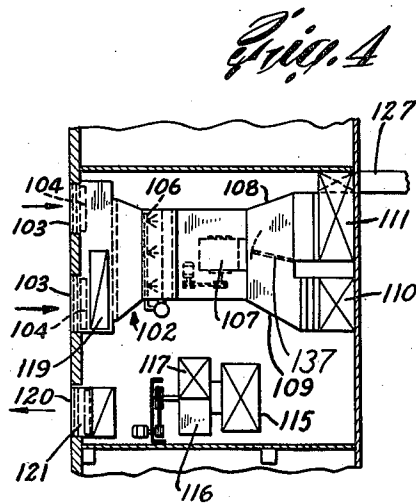
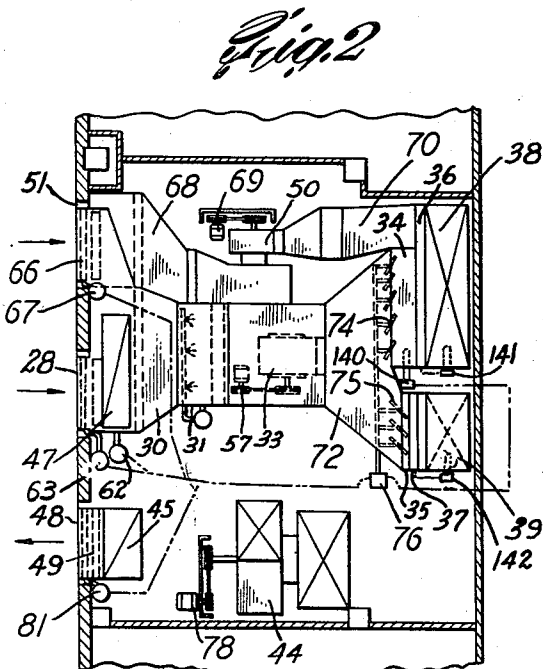
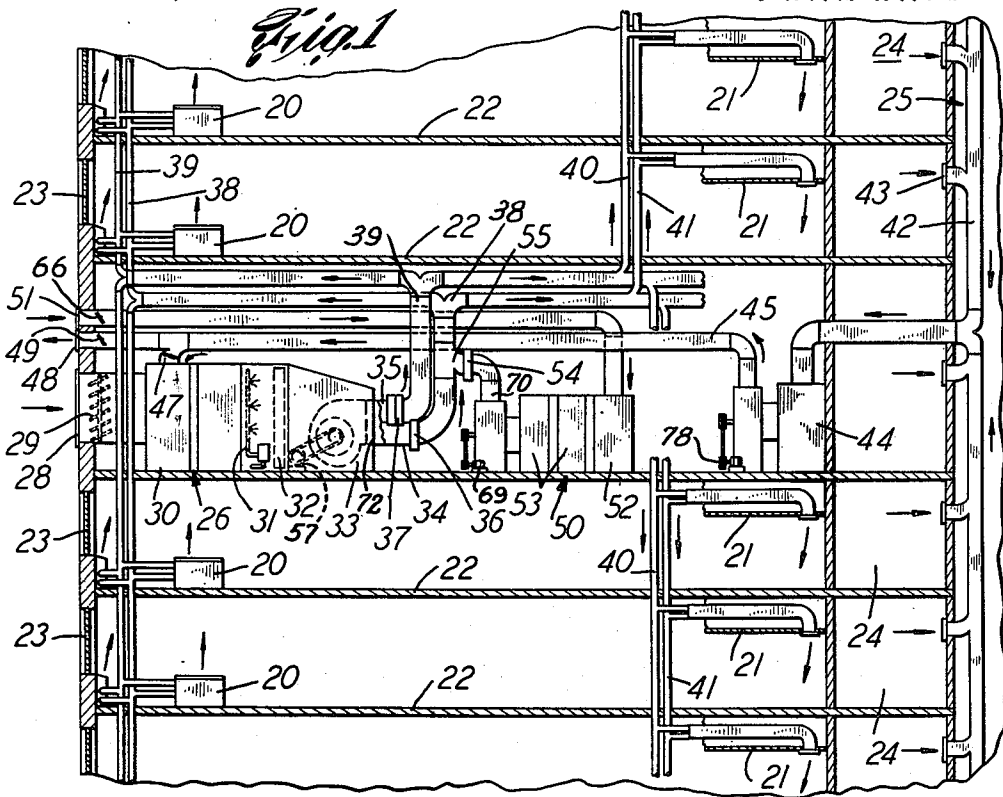
H. W. MARSHALL

2,708,568

AIR CONDITIONING SYSTEM

Filed Jan. 2, 1951

3 Sheets-Sheet 1



INVENTOR.
HARRISON W. MARSHALL
BY
Pollard & Johnston
ATTORNEYS

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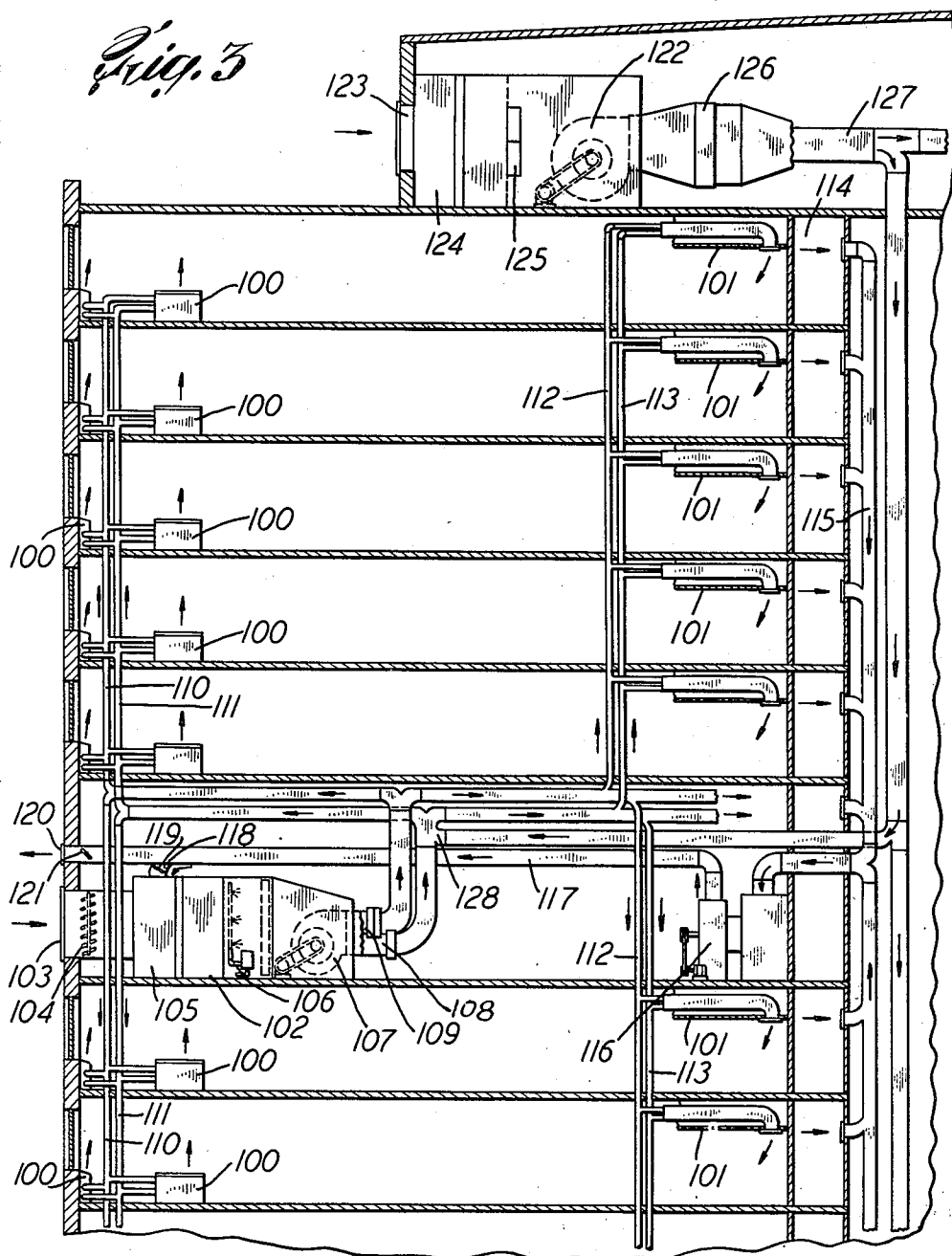
H. W. MARSHALL

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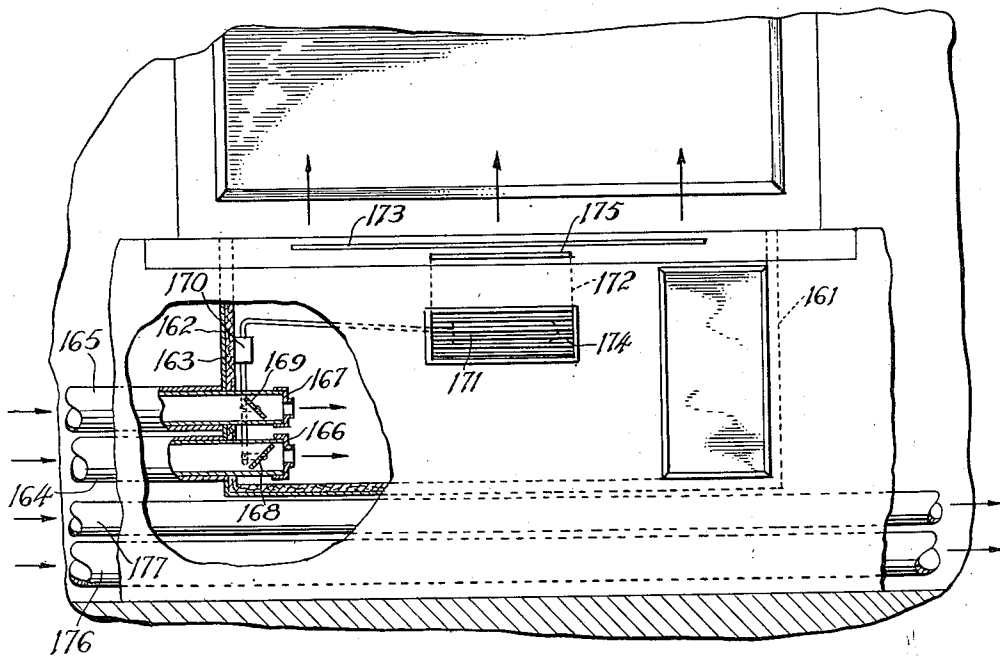
INVENTOR.
HARRISON W. MARSHALL
BY

Pollard and Johnston
ATTORNEYS

H. W. MARSHALL
AIR CONDITIONING SYSTEM

3 Sheets-Sheet 3

Fig. 5.



INVENTOR.
HARRISON W. MARSHALL
BY
Pollard and Johnston
ATTORNEYS

1

2,708,568

AIR CONDITIONING SYSTEM

Harrison W. Marshall, Pleasantville, N. Y., assignor to Buensod-Stacey, Incorporated, New York, N. Y., a corporation of Delaware

Application January 2, 1951, Serial No. 203,997

2 Claims. (Cl. 257—3)

This invention relates to an air conditioning system and especially to a system adapted for use in buildings having a plurality of zones which are to be conditioned. In prior practice, complicated and expensive duct work has been required for leading conditioned air and elements or agents to the various parts of the buildings to be conditioned. It has been found that this is especially objectionable because of the plurality of pipes and ducts required along the ceiling and in the risers between floors. In systems wherein steam, refrigerant, or other liquid must be led to the various zones, the joints and valves thereof are potential points of difficulty because of leakage. In systems providing conditioned air to the various zones, it is desirable and required in some instances to furnish a minimum amount of outside air.

One of the objects of the present invention is to provide an improved method and apparatus for conditioning air and for furnishing a minimum amount of outside air to the various zones and systems, a minimum of piping being used.

One of the features of the invention is the employment of high-pressure and high velocity air to zone controlled distributing units in the various zones. One or more central conditioning devices can be employed and placed in suitable positions in the building, said conditioning devices furnishing conditioned air, preferably at high-pressure and velocity. Cold and warm air ducts lead to the various control distributing units from the conditioning devices.

One of the particular features of this invention is an improved manner of furnishing a minimum amount of outside air to the system.

In the preferred form, outside air is fed into the cold air duct of the distributing system. The cold air duct can be furnished with air at high pressure and velocity from a fan unit and the warm air duct can be supplied with air at high pressure and velocity from the fan through a suitable conditioning means.

The air from the hot and cold air ducts, the air in the cold air duct including the minimum outside air fed thereto, must be proportioned, mixed, and in a preferred form, progressively reduced in pressure in each of the distributing units before being fed into the room. Thermostatic controls for the units may be located adjacent a zone control distributing unit in each room or zone. The mixed proportioned air may be reduced in pressure progressively in each of the zone control distributing units as it is supplied to the room space or zone through a nozzle or passage arrangement. The nozzle or passage will complete the reduction of pressure as the air is introduced into the room. The air from the zone control distributing means may be used to pick up air adjacent a wall or window by expiration and thus uniformly condition the entire zone or room.

The use of high pressure air in a system of the type described herein, permits the employment of smaller ducts, and the proportionment of air properly in all zones, so that all of the zones can be maintained at the desired

2

temperature simultaneously. The ducts leading to the zone control distributing units may have a maximum size in the range of 3 inches (3") to 6 inches (6") in diameter or an equivalent area.

When return air from the zones is to be used, as in the preferred form, it may be returned through a suitable damper arrangement to the central conditioning device. The return air duct feeding the conditioning device also may have dampers therein functioning so as to control exhausting of unneeded return air.

The zone control pressure reducing boxes or units do not require liquid or refrigerant lines led thereto or drains therefrom. Only the relatively small high pressure cold and warm air ducts need to be led to each of the zone control distributing units. Various control systems can be used for the purpose of controlling operation of the apparatus.

These and other objects, features, and advantages of the invention will become apparent from the following drawings and description which are merely exemplary.

Figure 1 is a fragmentary schematic elevation view of a building employing one form of the invention.

Figure 2 is a plan view of an apparatus arranged so that it will perform the functions illustrated in the schematic showing of Figure 1.

Figure 3 is a fragmentary sectional elevation of another form of the invention.

Figure 4 is a plan view of the arrangement of apparatus suitable for use in the schematic form illustrated in Figure 3.

Figure 5 is a fragmentary view of one type of distributor that can be used.

The zone control air distributing boxes are indicated at 20 in Figure 1, these boxes taking the form, for example, of that illustrated in copending application Serial No. 106,016, filed July 21, 1949.

As an example of one type of reducing air pressure distributing box which can be employed, reference may be made to Figure 5 illustrating a unit located under a window. The unit may have a cover 160 with a pressure reducing enclosure indicated generally at 161. There may be an outside cover 162 with sound absorbing material 163 therein. Cold air supply duct 164 can be connected with a cold air riser or conduit from the central conditioning means. The warm air duct 165 normally is not quite as large as the cold air duct being, for example, about 80% of the size thereof.

Dampers 168 and 169 in the cold air and warm air supply ducts can be interconnected so as to be operated by damper motor 170, said damper motor being controlled by thermostatic bulb 171 located in passageway 172 in casing 161. The thermostatic bulb will control damper motor 170 so as to control at the proportioning means the relative amount of cold and warm air entering the pressure reducing box to maintain the desired temperature in the zone. The pressure reducing slot 173 directs the mixed air into the room. Pipes 176 and 177 connect the main supply risers with the next unit. The ceiling units can have similar proportioning dampers and thermostats. In order to provide the minimum outside air, a hole can be cut into the periphery of the cold air damper or a segment of the periphery can be cut away.

Ceiling units operating in a similar manner are illustrated at 21. In the schematic drawing, the floors are indicated at 22, windows at 23, and corridors at 24. One of the duct shafts is illustrated at 25. Conditioning device or apparatus 26 can have a connection 28 with the outside air, said connection being controlled by dampers 29. Filter 30 is followed by a spray unit 31 and a water eliminator 32 leading to the cold and warm air fan 33. As will be explained hereafter, the fan has a cold air outlet duct 34 and warm air outlet duct 35, connected

therewith. Cooling coil 36 is located in the cold air duct and heating coils 37 are located in the warm air duct. The ducts are made of sufficient size to carry the required air under the high pressure and velocity to be employed. Merely by way of example, the cold air riser duct 38 may be approximately 5 inches in diameter if the air to be carried is at about 4 inches of water, static pressure at a velocity approximately 2500 to 3500 feet per minute.

Warm air riser duct 39 may be appropriately dimensioned and warm air riser 40 and cold air riser 41 may be connected to the various ceiling units. Return air duct 42 receives air from the corridors through the various openings 43 and returns the same to the return air fan 44. The return air fan outlet duct 45 is connected to the cold air conditioning apparatus 26 through damper 47 and to the outside through relief duct 48 controlled by damper 49. The flow of air from the fan 33 to ducts 34 and 35 is controlled by a suitable damper arrangement as will be described hereafter in conjunction with Figure 2.

A minimum outside air fan and conditioning apparatus is illustrated at 50, said fan drawing air through the minimum outside duct 51, and passing it through filters 52 and heaters 53. An auxiliary cooling coil 54 may be located in the connection of the minimum outside air duct with the cold air duct at 55.

A specific arrangement of the apparatus of Figure 1 is illustrated in Figure 2 wherein the parts are given the same reference numerals as in Figure 1. The primary cold and warm air fan 33 is driven by a suitable motor 57 and the maximum outside air damper 29 and inlet 28 are connected through the filters 30 and spray 31 with the inlet of fan 33. Relief air damper 47 to the central conditioning apparatus can have a suitable damper motor 62 connected therewith. Damper 29 can be controlled by damper motor 63. The minimum outside air fan 50 draws air through opening 51 having a damper 66 therein controlled by a damper motor 67.

Duct work 68 (Figure 2) may have the heating coils and filters therein. Minimum outside air fan 50 is driven by motor 69, said fan delivering air to duct 70 which is connected to the main cold air duct 38. The outlet of fan 33 is connected through duct 72 with the main cold air duct 38 and main warm air duct 39 through cold air damper 74 (Figure 2) and warm air damper 75 respectively. The dampers 74 and 75 may be interconnected and operated by damper motor 76 so as to proportion the air from the cold and warm air fan fed to the cold air duct and the warm air duct. The return air fan 44 is operated by motor 78 to feed the air to the relief duct 45 and relief outlet 48 through damper 49 controlled by damper motor 81.

The minimum outside air arrangement also may be located on top of the roof or remote from the remainder of the conditioning apparatus as illustrated in Figure 3.

Zone control distribution boxes 100 (Fig. 3) are located in the various zones together with ceiling units 101 where desired. Cold and warm air conditioning unit 102 draws air from the maximum outside air intake 103 through dampers 104, said air being passed through filter 105 and the spray unit 106. The outlet from cold and warm air fan 107 is distributed through the cold air duct 108 and the warm air duct 109 through warm air risers 110 and cold air risers 111. The ceiling units can be fed from warm room air riser 112 and cold air riser 113. Return air is taken from corridors 114 to the return air duct 115 and from there to return air fan 116. The outlet 117 from the return air fan directs return air through duct 118 to the cold and warm air conditioning apparatus 102 through damper 119 or to the relief opening 120 controlled by relief damper 121. The minimum outside air fan 122 (Figure 3) draws air from the minimum outside air duct 123 through filters 124 and heater units 125. The outlet from the minimum outside air fan leads to cooling coil 126 which is connected to the minimum

outside air duct 127. Minimum outside air duct 127 is connected at 128 to the main cold air supply duct fed by the central conditioning apparatus 102.

Figure 4 illustrates a specific manner in which the apparatus of Figure 3 can be arranged. The cold and warm air fan 107 receives air from the maximum outside air dampers 104, dampers in said openings 103, 103 being controlled by suitable damper motors. Return air duct 115 is connected with the return air fan 116. The relief air outlet 120 also is connected to the return air fan. The cold and warm air fan 107 is connected to cold air duct 108 and warm air duct 109. A thermostatically controlled proportioning damper 137 may be employed to proportion the air supply fed to the cold and warm air ducts 111 and 110 respectively. Minimum outside air duct 127 is connected to the cold air duct as illustrated.

The proportioning dampers 74, 75 (Figure 2) or the proportioning damper 137 (Figure 4) can be suitably controlled by an automatic damper regulator so as to direct air from the main or central conditioner into the main warm and cold air supply ducts.

The control of the various dampers for the outside air to the central conditioner, relief air, return air, and operation of the main heating and cooling coils, for example, can be similar to that illustrated in the aforesaid co-pending application, Serial No. 106,016, filed July 21, 1949.

When the main fan motor is activated, the system can be arranged to energize the outside air dampers for the main or central conditioner. The damper motor for the main outside air is interconnected with the damper motor for the return air to the main conditioner and the relief air outlet. A thermostatic relay (140, Figure 2) can be located in the main cold air supply duct to control operation of the main outside, return, and relief air dampers. Suitable thermostats (142, 141, Figure 2) also can be present in the warm and cold air ducts to control the operation of the heating and cooling coils (37, 36) therein so as to maintain predetermined temperatures. A suitable static pressure control relay can be made responsive to the pressure in the cold and/or warm air supply ducts, or to the main fan outlet for the purpose of maintaining the desired pressure. This can be accomplished by controlling the inlet damper means for the main fan. Suitable humidity controls also can be installed for operating the sprays in the main conditioning means.

In the form shown in Figure 2, thermostat 140 can control damper motors 76, 62, 63, 81 and 67. Thermostat 141 can control cooling coils 36 and thermostat 142 can control heating coils 37. Similarly located and arranged thermostats (not shown) can be employed in conjunction with Figure 4.

There may be one or more central or main air conditioning units as needed in the building. The thermostatic controls may be of the fluid type or of the electrical variety. The air pressure distributing means in the zones may have dampers therein arranged so that the one controlling the air supply which the minimum outside air fan outlet supplies, cannot be completely closed off. This also could be accomplished by a by-pass.

The proportioning dampers at the main fan outlet (such as 74, 75, Figure 2) may be operated by separate damper motor or by one motor as shown. The dampers may be controlled by a static pressure regulator responsive to the cold air supply duct. If there are separate damper motors, there may be a static pressure regulator in both warm and cold air supply ducts for controlling its respective damper.

It should be apparent that the details of construction and operation can be varied without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In a multi-zone air conditioning system, the combi-

5

nation including central air conditioning means, fan means moving air through said central air conditioning means, high pressure cold air supply means receiving air from said central air conditioning means, cooling means in said cold air supply means, warm air supply means receiving air from said central air conditioning means, heating means in said warm air supply means, pressure reducing distributor enclosure means in each of several zones remotely located relative to said cold air and warm air supply means, temperature control means for controlling means in each air supply means maintaining predetermined temperatures therein, cold air and warm air supply connections between said supply means and said pressure reducing distributor means, proportioning dampers in each of said supply connections at its respective distributor enclosure means, motor means connected with said dampers proportioning air supplied to the distributor enclosure, temperature responsive means adjacent said distributor means connected to its motor means proportioning the warm and cold air admitted to the distributor and thus fed to the zone, return air connections from at least some of said zones to said central air conditioning means returning air thereto outside air connections to said central air conditioning means, a separate fresh air supply fan connected with said cold air supply means through cooling means and after said central conditioning means and first mentioned cooling means in said cold air supply means furnishing a predetermined minimum quantity of outside air thereto, and means admitting a predetermined quantity of air from the cold air supply means, including fresh air from said separate fan, to each distributor enclosure means.

2. In a multi-zone air conditioning system, the combination including central air conditioning means, central fan means moving air through said central air con-

6

ditioning means, pressure reducing air distributors in the various zones remotely located relative to said central fan means, high pressure cold air supply means, cooling means in said cold air supply means, high pressure warm air supply means, heating means in said warm air supply means, connections between said warm air and cold air supply means and said remotely located distributors, proportioning dampers in said connections at each distributor, outside air connections to said central conditioning means, return air connections between said central conditioning means and the zones, relief air means, damper means controlling said outside air, return air and relief air flow relative to said central conditioning means, temperature responsive means maintaining predetermined temperatures in said cold and warm air supply means, damper means controlling flow of air from said central conditioning means to said cold and warm air supply means, a separate minimum outside air supply fan means connected to said cold air supply means after said central conditioning means and said cooling means in said cold air supply means, cooling means in the minimum outside air supply to said cold air supply means, temperature responsive means adjacent said air distributors proportioning the cold and warm air fed by said supply connections into their distributors and thus to the particular zone involved, and means admitting a predetermined minimum supply of cold air into each of said distributors including air from said separate outside air supply fan means.

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