

Oct. 11, 1955

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2,720,150

AIR CONDITIONING MIXING UNIT

Filed Nov. 6, 1952

4 Sheets-Sheet 2

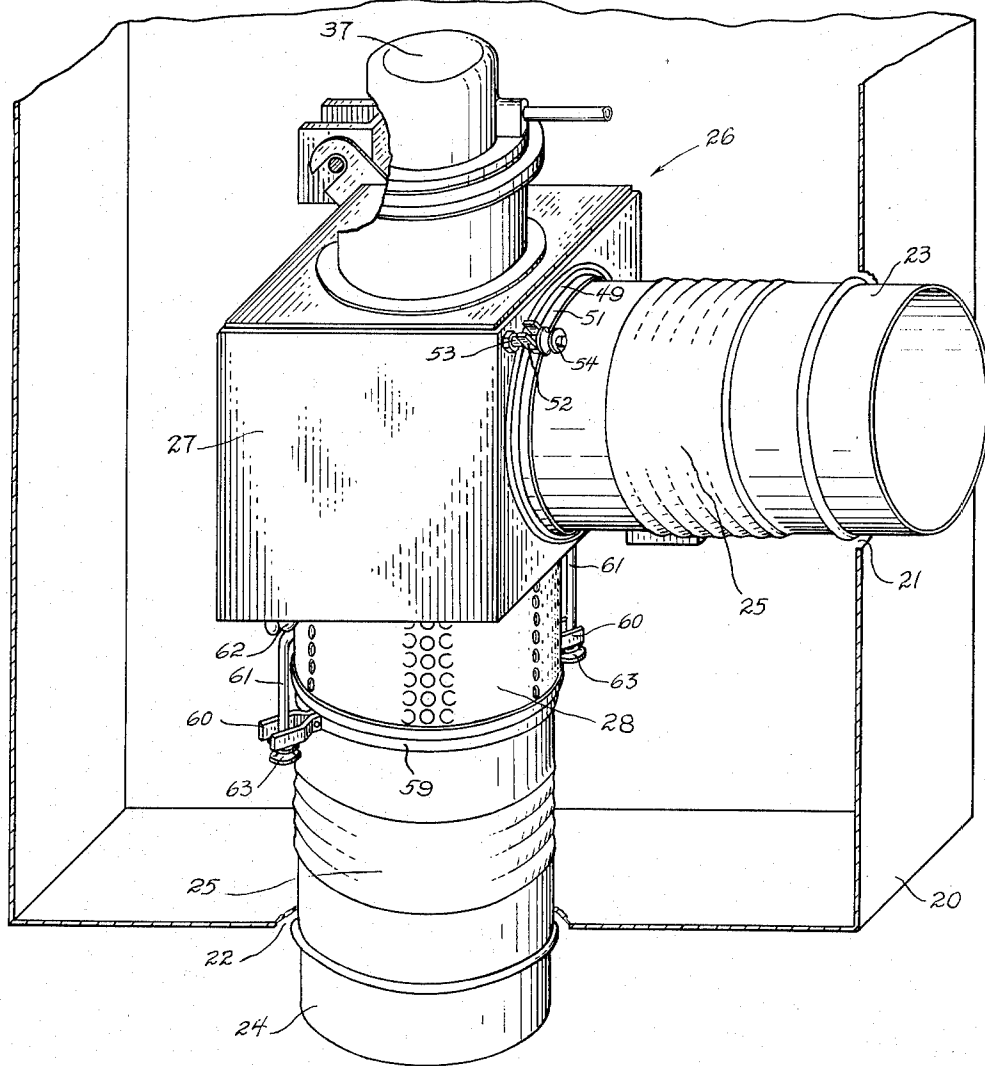


Fig. 2

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Fig.3

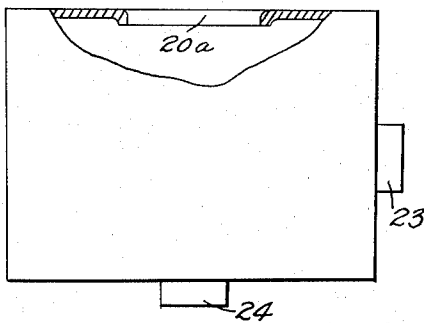
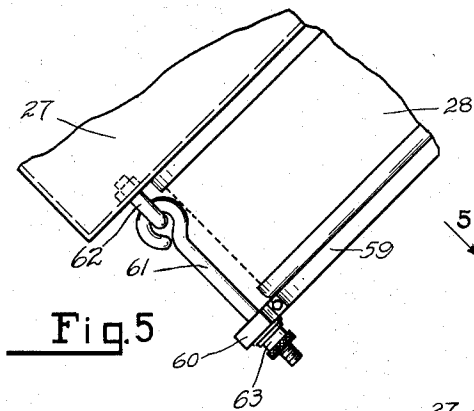
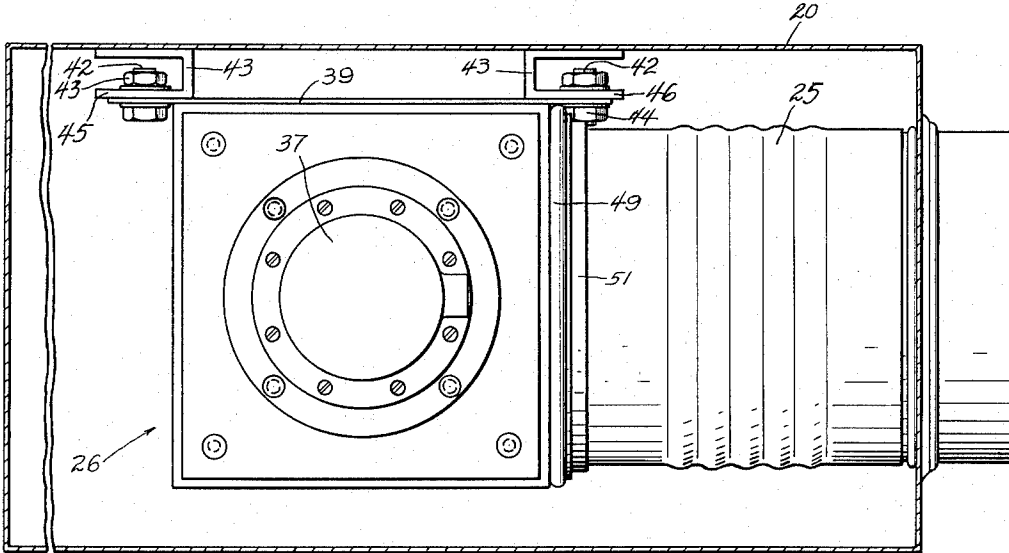
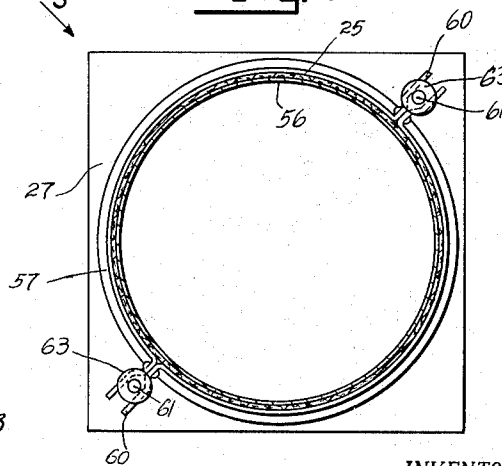


Fig.4



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Fig. 6

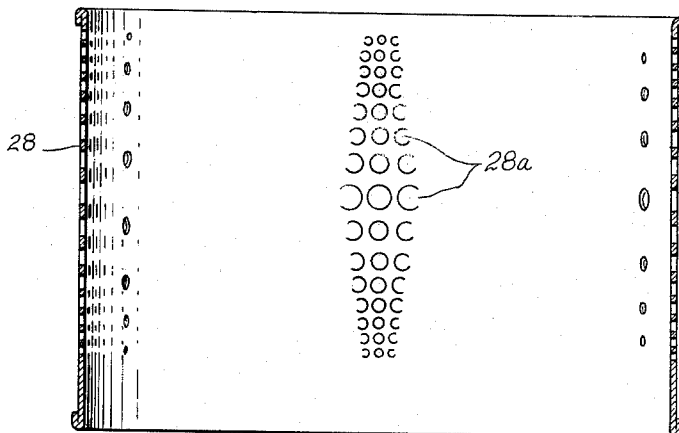
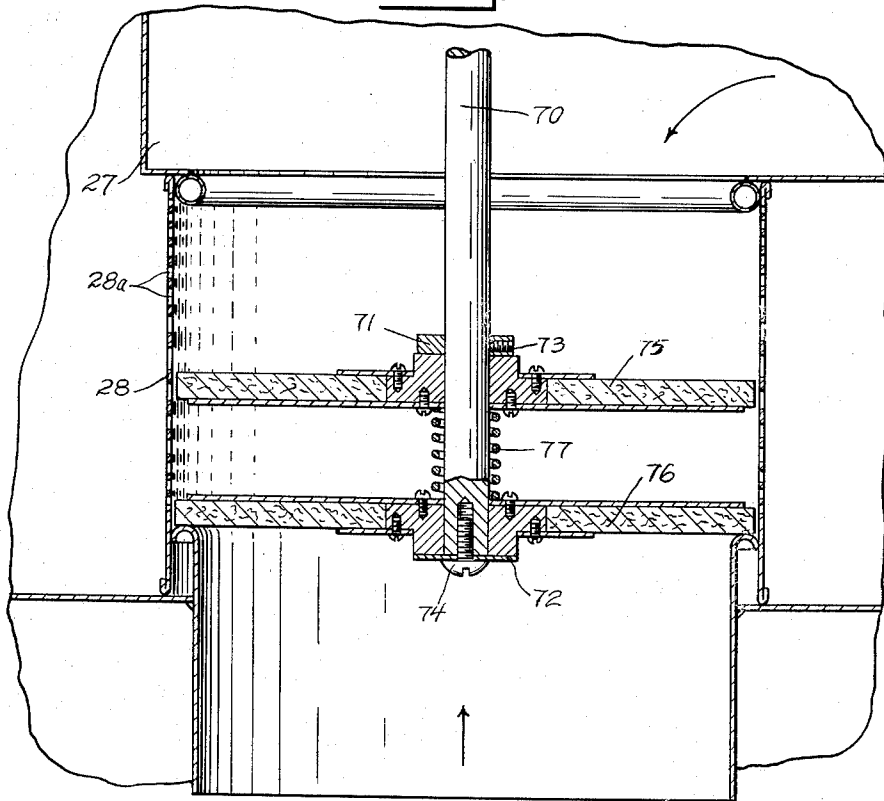


Fig. 7

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AIR CONDITIONING MIXING UNIT

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6 Claims. (Cl. 98—38)

This invention relates to air conditioning apparatus and especially to a novel arrangement for mixing conditioned air before it is distributed into a room or zone and particularly to a thermostatically controlled damper organization.

In air conditioning systems of the type having individual regulation in each room being serviced, upset of existing air flow conditions is accompanied by objectionable noises. Such noises are especially pronounced in high pressure air systems when a closed air duct is opened at a time when the other air duct is already open because of the great increase in total volume of air flowing into the room.

One of the objects of this invention is to provide air control damper arrangements which may be ambient temperature operated and will proportion cold and warm air properly and noiselessly.

A further object of this invention is to provide simplified damper arrangements which require fewer parts and which are readily removable for adjustment and maintenance.

The present invention is primarily intended for use in a high pressure air conditioning system since it is particularly useful in such systems. However, it is possible to use the present system in a low pressure air conditioning system. When high pressure air is used, pressure reducing distributing units are required in each zone to be conditioned for reducing the pressure of the air supplied from a central air conditioning apparatus before it is admitted or distributed into the zone. The sizes of the ducts supplying the air from such a central air conditioning apparatus to distributing units are much smaller in high pressure air conditioning systems than in low pressure air conditioning systems. For example, the sizes of high pressure air supply ducts can have a maximum size of about 2 inches to 6 inches in diameter or its equivalent. Furthermore, in high pressure systems the pressure is usually more than approximately 2 inches of water static pressure and the potential velocity of air in the supply ducts may be between about 1500 and 3500 feet per minute, although a system may operate with values which vary somewhat from these given and still be considered a high pressure system.

In one aspect of this invention, a pair of ducts can supply hot and cold conditioned air from central air conditioning apparatus to individual air distributing units in each zone to be conditioned. Each unit includes a chamber wherein the hot and cold air supplied from such central source are mixed and wherein the pressure of the air supplied is reduced before it is distributed into the zone. The proportionate amounts of warm and cold air are controlled by a damper arrangement in each air distributing unit. Preferably, the damper arrangement is thermostatically regulated, but it may be responsive to other variables. The discharge ends of the warm and cold air supply ducts are connected with the air control damper arrangement by clamping members which hold the ducts in tight connection with the damper arrange-

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ment. The latter includes a duct portion having apertured walls for admitting fluid within the duct portion to the distributing chamber and a damper member movable in said portion from a position closing one of the supply ducts and opening the other to a position closing the open duct and opening the closed duct. Detachable supporting elements normally hold the air control damper arrangement in operative position between the discharge ends of the supply ducts, but may be readily detached to remove said arrangement for purposes of adjustment and also to render the discharge ends of the warm and cold air ducts accessible for cleaning.

Another feature of this invention is the provision of single plunger or operating rod having dual dampers thereon for controlling flow of warm and cold air from their respective supply ducts. In one embodiment of the invention, an open damper can be partially closed before a closed damper is open so as to prevent increase in the total volume of air admitted by the dampers from the supply ducts over that volume admitted by the open damper in its fully open position. The plunger may be operated by a suitable damper motor which may be a conventional air motor or an electric motor. The damper motor can be controlled by an ambient temperature or other condition responsive mechanism.

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

In the drawings:

Fig. 1 is a longitudinal vertical section of a zone control air distributing unit, one of the air dampers being shown in fully open position with the other damper shown in closed position;

Fig. 2 is a perspective view of the unit shown in Fig. 1, partially broken away to show parts of the supporting structure;

Fig. 3 is a plan view taken along line 3—3 of Fig. 1;

Fig. 4 is a horizontal section of the cold air duct taken along the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary elevation as viewed in the direction of arrow 5 in Fig. 4;

Fig. 6 shows a modified form of damper arrangement;

Fig. 7 is a vertical section through the duct of the air control damper arrangement of Fig. 6; and

Fig. 8 is a schematic drawing of the distributing unit.

Referring to Figs. 1-5, an air distributing chamber 20 has openings 21 and 22 in side walls thereof for receiving warm and cold air supply ducts 23 and 24, respectively, which are connected to a central air conditioning unit (not shown). An outlet opening 20a is formed in the top wall of the chamber for discharging mixed air into the zone or room being conditioned. Such can be connected in a system such as illustrated in copending applications S. N. 158,840 (now Patent Number 2,620,983) or 240,428, filed April 28, 1950, and August 4, 1951, respectively. The ducts 23 and 24 may be soldered to the walls as indicated at 23a and 24a or may be held otherwise in sealed relation with the chamber 20. The discharge end of each duct includes a corrugated sleeve portion 25 which fits snugly on the soldered portion of the duct and gives the duct some degree of flexibility and resilience within the air distributing chamber. While the ducts are shown to be substantially the same size, the cold air duct is normally larger than the warm air duct. The discharge ends of the warm and cold air ducts 23 and 24 are connected to an air control damper assembly generally indicated at 26 which controls the relative amounts of cold and warm air admitted from the supply ducts to the air distributing chamber.

The assembly 26 includes hollow box-like member 27 supported on a wall of the air distributing chamber 20 in a manner described hereinafter, a duct 28 having

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opposite open ends in communication with the warm and cold air supply ducts, respectively, and a damper member 29 movable in the duct 28. Duct 28 has side wall apertures 28a for admitting fluid from within the duct to the air distributing chamber 20. The damper member 29 is made up of a damper 30 for controlling air flow from warm air duct 23 into air distributing chamber 20 through the duct 28, and a damper 31 for controlling air flow from cold air duct 24 into air distributing chamber 20 through duct 28. Both dampers are adjustably mounted on a single plunger or operating rod 32 by nuts 34. A member 35 may be used to space the dampers relative to each other. Plunger 32 is operated by a thermostatically controlled motor 37 which is supported by member 27. Such may be either a conventional air motor or an electric motor. In the form shown, the thermostatically controlled motor 37 may have a pressure relay 38 connected to a suitably disposed thermostat 38a to control the position of plunger 32 and damper member 29.

The box-like member 27 is detachably mounted on a side wall of the chamber or distributing box 20 by a brace 39 fixed by rivets 40 to one side of member 27 and having slots 41 at opposite ends thereof which open to opposite longitudinal edges of the brace. The brace is swingable onto a pair of spaced studs 42 extending horizontally from brackets 43 fixed on the side wall of the chamber and fitting into slots 41. The studs are threaded at both ends to receive nuts 44 on both sides of the bracket flange 45 to hold the brace in a fixed position in the chamber.

The discharge end of the warm air duct registers with an opening 46 in one side of member 27. A cylindrical sleeve 47 telescopically fits into said discharge end and has a substantially outward extending S-shaped flange 48 at the free end thereof. A sealing ring 49 is carried by the outer end of the said flange and is adapted to fit around a raised lip 50 bordering opening 46. A clamp 51 encircles sleeve 47 and has diametrically opposed Y-shaped lugs 52, only one of which can be seen in Fig. 2, which receive studs 53 extending from and fixed to member 27. Nuts 54 on studs 53 can be adjusted to bear against the arms of the lugs for urging the sealing ring 49 into contact with the member 27 and around lip 46 so as to provide an air tight connection between the warm air duct and the member 27. Likewise, nuts 54 may be easily adjusted to release the lugs 52 and clamp 51 so as to disconnect the warm air duct from member 27.

The discharge end of the cold air duct registers with one end of duct 28 which in turn has its other end in registration with a second opening 55 in another side of member 27. A cylindrical sleeve 56 telescopically fits into the cold air duct and has a substantially outward extending S-shaped flange 57 at the free end thereof. The outer portion of the flange 57 receives one end of duct 28. The other end of duct 28 fits around a raised lip 58 bordering opening 55. A clamp 59 encircles sleeve 56 and has a pair of diametrically opposed Y-shaped lugs 60 which receive the threaded end of eye bolts 61. Hook bolts 62 secured to member 27 engage the heads of eye bolts 61. Adjustable nuts 63 on the threaded ends of eye bolts 61 can be turned to bear against the arms of lugs 60, thus urging the sleeve 56 into tight engagement with duct 28 and duct 28 into tight connection with member 27 around lip 58. Here again, nuts 63 may be turned to release the eye bolts from clamp 59 to disconnect cold air duct from the damper arrangement.

In operation, the ducts 23 and 24 can supply warm and cold air, respectively, to opposite ends of duct 28. Apertures 29a admit air into the distributing chamber 20 from the duct 28. The position of the dampers 30 and 31 controls the proportionate amounts of cold and warm air admitted from these supply ducts to the distributing chamber 20. When one wishes to clean the warm and cold air supply ducts or replace the duct 28 with another duct having different sized apertures, the damper assembly is readily removed by disconnecting the discharge

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ends of each supply duct from the damper arrangement 26 as described above and by subsequently rotating brace 39 out of engagement with studs 42. Such adjustment, cleaning, or replacement may then be made. Thereafter, the parts can be easily reassembled in a manner which is believed apparent from the foregoing description.

Referring now to Figs. 6 and 7, a modified damper arrangement is shown which comprises a plunger 70 having a pair of spaced abutments 71 and 72 thereon. Abutment 71 is adjustably movable along plunger 70 and is held in a fixed position by set screw 73. Abutment 72 is fixed in position by cap screw 74. Between the abutments a pair of dampers 75 and 76 are slidably mounted on the plunger. The dampers are normally urged apart and into contact with their respective adjacent abutment by a spring 77. When the plunger is moved in one direction, for example, when the plunger is moved downwardly to open damper 75 and close damper 76, the construction described permits of closing damper 76 before damper 75 reaches its fully open position and of subsequent over-travel of the plunger 70 until damper 75 is fully opened. During the over-travel movement of the plunger, spring 77 yields under the force of the abutment 71 acting against the spring through damper 75 and is in a state of compression when damper 75 is fully open. When the plunger is then moved upwardly to open closed damper 76, abutment 71, which moves with the plunger, tends to move away from damper 75. However, as the spring 77 is released, it simultaneously moves damper 75 upward with the abutment 71 and away from damper 76 so that warm air duct is partially closed before abutment 72 opens damper 76. Likewise, damper 75 closes before damper 76 becomes fully opened, and damper 76 is partially closed before damper 75 is opened. Such movement of an open damper from fully open position toward closed position before a closed damper is opened limits the total volume of air admitted by the dampers in such a manner that the combined volume of air admitted from the two supply ducts never exceeds that volume admitted by the open damper when in its fully open position.

The sizes of the apertures 28a in the wall of duct 28 may increase, as shown in Fig. 7, toward the central portion of the wall so that these apertures together with the dampers may effectively meter the conditioned air admitted from the cold and warm air ducts into the air distributing chamber.

It will be understood that the foregoing detailed description and the accompanying drawings are illustrative and that the improvements herein disclosed may be embodied in various forms of construction within the scope of the appended claims.

What is claimed is:

1. In an air distributing apparatus, the combination comprising an air distributing chamber having air outlet connection means to a zone, an air mixing and proportioning device, a warm air supply duct and a cold air supply duct leading into said chamber and having connecting means to said device, said device including a duct communicating at opposite ends with said connecting means to the warm air and cold air supply ducts, respectively, and having a plurality of apertures in the side wall thereof to pass air from the respective ducts into the chamber, a power-operated rod, a pair of spaced abutments on said rod, a pair of damper elements extending across said duct communicating at opposite ends with the warm air and cold air supply ducts slidably carried on the rod between said abutments and movable in said duct to vary proportionally the number of apertures open to the respective supply ducts, a spring normally urging said dampers apart and into contact with their respective adjacent abutments, said spring being yieldable to vary the spacing between the two dampers so that an open damper can be moved by

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its abutment to its fully opened position after the other damper has been closed and so that, as the rod is moved in a direction to open the closed damper, the open damper will be moved toward closed position before the closed damper is contacted and opened by its abutment so as to limit the total amount of air which can be admitted by said dampers at one time.

2. In an air conditioning apparatus for a zone, the combination comprising an air distributing chamber having air outlet connection means to said zone, confronting warm air and cold air inlet ports in said chamber to admit warm air and cold air, respectively, into said chamber, a warm air supply duct connected with said warm air inlet port and a cold air supply duct connected with said cold air inlet port, air flow control means including a tubular connection extending between said inlet ports and having lateral aperture means to be traversed by air flowing from the inlet ports into said chamber, damper means extending across said tubular connection and movable in said tubular connection to vary proportionally the aperture means open to the respective ports, and ambient temperature responsive thermostat control means connected with said damper means.

3. In an air conditioning apparatus for a zone, the combination comprising an air distributing chamber having air outlet connection means to said zone, an air mixing and proportioning device in said chamber removably secured to a side wall of said chamber, warm air and cold air supply ducts leading into said chamber and being detachably connected to said device, said device including an open-ended duct communicating at opposite ends with the warm and cold air supply ducts, respectively, and having a plurality of apertures in the side wall thereof to pass air from the respective ducts into the chamber, and a damper extending transversely across said open-ended duct and slidable along the length of said open-ended duct to vary proportionally the number of apertures open to the respective supply ducts.

4. In an air conditioning apparatus for a zone, the combination comprising an air distributing chamber having air outlet connection means to said zone, confronting warm and cold air inlet ports to admit warm and cold air, respectively, into said chamber, a warm air supply duct extending into said chamber and connected with said warm air inlet port and a cold air supply duct extending into said chamber and connected with said cold air inlet port, air flow control means including an open-ended duct extending between and registering at opposite ends with the warm and cold air inlet ports, respectively, said open-ended duct having a plurality of apertures in the side wall thereof for passing air from the respective supply ducts into said chamber, the size of the apertures progressively increasing from the ends to the center of the duct, and damper means transversely located in said open-ended duct and movable in said open-ended duct to vary proportionally the number of apertures open to the respective ports.

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5. In an air conditioning apparatus for a zone, the combination comprising an air distributing chamber having air outlet connection means to said zone, an air mixing and proportioning device in said chamber, warm air and cold air supply ducts leading into said chamber and having fluid connections with said device, said device including an open-ended duct communicating at opposite ends with the warm and cold air supply ducts, respectively, and having a plurality of apertures in the side wall thereof to pass air from the respective ducts into the chamber, a power-operated rod supported in said mixing and proportioning device and having spaced abutments thereon, a pair of dampers slidably carried on the rod and between said abutments for movement between one position in which one of the dampers closes the warm air supply duct and the other damper opens the cold air supply duct and another position in which said one damper opens the warm air supply duct and said other damper closes the cold air supply duct, and yieldable means between said dampers normally holding said dampers in spaced relation against said abutments on said plunger, said yieldable means being positioned to be compressed between the dampers as the rod moves in one direction to open fully one of said dampers after the other damper has been closed, so that the open damper will be partially closed by such spring when the rod is moved in the opposite direction before the closed damper is opened.

6. In an air conditioning apparatus for a zone, the combination comprising an air distributing chamber having air outlet connection means to said zone, a warm air supply duct and a cold air supply duct leading to said chamber, connecting means on the ends of said ducts to provide spaced opposed and aligned warm air and cold air inlet ports respectively, air flow control means including a tubular connection extending between said ports and having a plurality of side wall apertures to be traversed by air flowing from said inlet ports into said chamber, and damper means extending across said tubular connection movable rectilinearly in said tubular connection to vary proportionally the number of apertures open to the respective ports.

References Cited in the file of this patent

UNITED STATES PATENTS

76,717	Crane	Apr. 14, 1868
194,782	Mihan	Sept. 4, 1877
1,782,758	Gavin	Nov. 25, 1930
2,539,148	Malir, Jr.	Jan. 23, 1951
2,620,983	Lyman	Dec. 9, 1952

FOREIGN PATENTS

297,955	Italy	June 24, 1932
632,014	Great Britain	Nov. 15, 1949
649,447	Great Britain	Jan. 24, 1951