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AIR CONDITIONING SYSTEM

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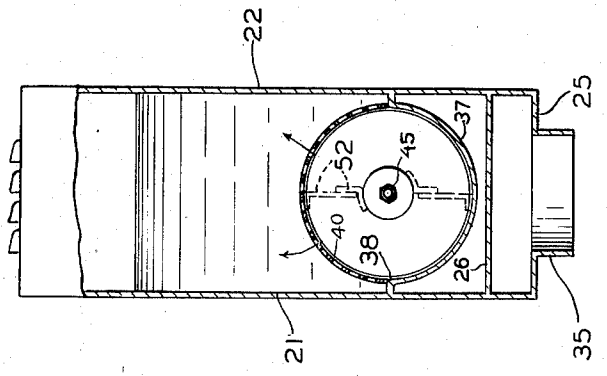


Fig. 2

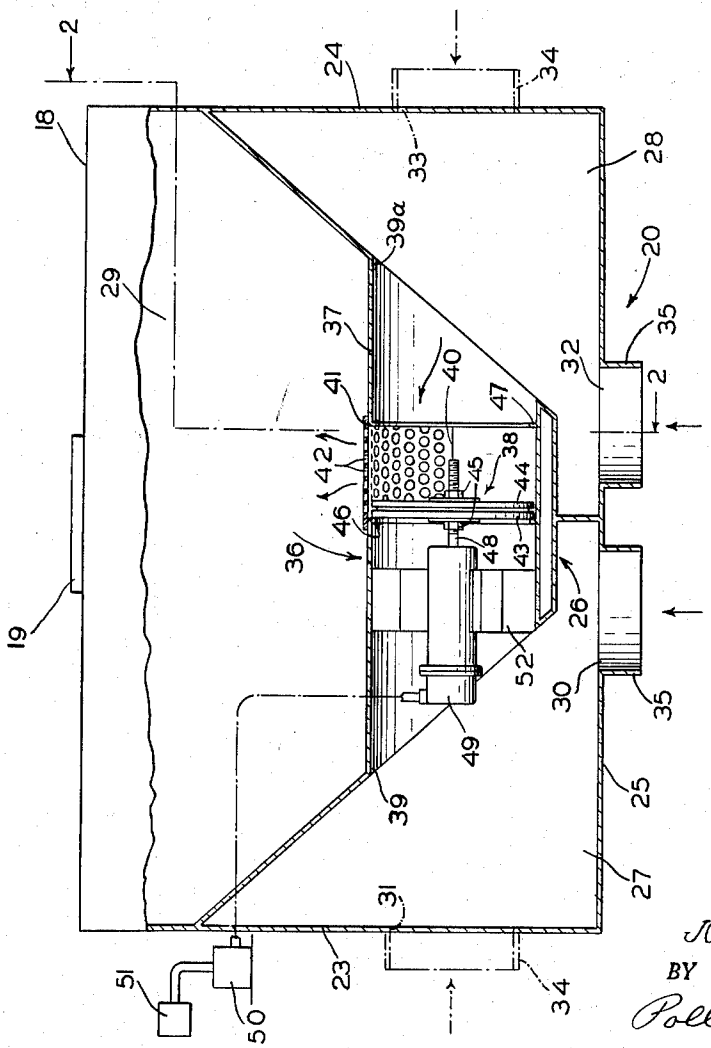


Fig. 1

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AIR CONDITIONING SYSTEM

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4 Claims. (Cl. 98—38)

This invention relates to air conditioning apparatus and especially to an improved air distributing unit for proportioning and mixing warm and cold conditioned air and for distributing such air into a room or zone. More particularly, it relates to a thermostatically controlled damper organization for such a unit.

Where warm air and cold air are separately supplied to individually regulated zone distributing units for mixing and subsequent distribution of the mixed air into a zone to be conditioned, dampers are usually provided to proportion warm air and cold air in proper amounts for producing desired room temperatures. In many prior devices, whenever existing air flow conditions were changed in response to variation in room temperature, objectionable audible noises were produced, especially in high pressure systems. It has been found that by maintaining substantially constant volumetric rates or by preventing more than a predetermined volume of conditioned air discharging into a zone, such objectionable noises are avoided, even though the proportional amounts of warm air and cold air discharged are changed. Furthermore, many prior damper arrangements for controlling the respective amounts of warm air and cold air discharged have required a plurality of interconnecting links for actuation and coordination.

One of the principal objects of this invention is to provide improved air control distributing units which proportion, mix and discharge warm and cold air supplied thereto in a noiseless manner, and which may be ambient temperature operated.

Another object of the invention is to provide damper arrangements which eliminate conventional dual damper coordinating linkage and damper sticking that occurs when such linkage binds.

Still another object of this invention is to provide air control distributing units having substantially uniform air flow conditions to the mixing chamber for both warm air and cold air, regardless of the angle at which the air supply ducts are connected to the unit. A special feature of this invention lies in the convenient and easy manner in which the distributing unit may be modified for altering its volumetric rate of discharge.

Although the present distributing units are particularly suitable in high pressure air conditioning systems, they are not limited thereto and may be advantageously used in low pressure air conditioning systems. High pressure systems are preferable because relatively smaller sized ducts may be used to supply conditioned air to individual distributing units. For example, ducts having maximum diameters of about 2 inches to 6 inches, or its equivalent, can be used in high pressure systems with static pressures usually exceeding approximately 2 inches of water and with the potential velocity of air in the supply ducts between about 1500 and 3500 feet per minute, although these values may vary slightly from those given in what is known as a high pressure system.

These and other objects, features and advantages of the invention will become apparent from the following

description of the drawings which are merely exemplary.

In the drawings:

Figure 1 is a vertical longitudinal section through an air distributing unit embodying this invention; and

Figure 2 is a vertical transverse cross section taken along line 2—2 of Figure 1.

The air distributing unit, generally indicated at **20**, of this invention forms part of an air conditioning system in which warm air and cold air are conditioned by central conditioning apparatus (not illustrated) and are supplied through separate ducts to the zones to be conditioned. The ducts deliver such warm air and cold air to the distributing units wherein such air is selectively proportioned and mixed before it is discharged into the zone. In the event that high pressure air is used, as is preferable, air distributing unit **20** also reduces air pressure before distributing the air into the zone being conditioned.

Referring now to the drawings in detail, the air distributing unit comprises a casing formed by spaced parallel walls **21** and **22**, parallel transverse end walls **23** and **24**, and a transverse bottom wall **25**. A top wall **18** is also provided over the chamber defined by the side and bottom walls. This chamber is suitably divided in three compartments by a generally Y-shaped transverse partition **26** so as to form two lower air receiving compartments, generally indicated at **27** and **28**, and an upper air mixing and distributing compartment **29**. The air receiving compartments are substantially identical, and extend laterally on opposite sides of the stem of Y-shaped partition **26** to end walls **23** and **24** so that each air receiving compartment is accessible through any outer casing wall, except the top wall. Air receiving compartment **27**, hereinafter referred to as the warm air supply compartment, has a vertical inlet opening **30** in bottom wall **25** and a horizontal inlet opening **31** in end wall **23**; air receiving compartment **28**, hereinafter referred to as the cold air supply compartment, has a vertical inlet opening **32** in bottom wall **25** and a horizontal inlet opening **33** in end wall **24**. Although each air receiving compartment is shown with inlet openings in its end and bottom wall only, it is to be understood that inlet openings could also be provided in its side walls.

Thus, conditioned warm air can be supplied to the warm air supply compartment **27** by connecting a warm air supply duct to any of the inlet openings in the warm air supply compartment **27**, and conditioned cold air can be supplied to the cold air supply compartment **28** by connecting a cold air supply duct to any of the inlet openings in cold air supply compartment **28**. Suitable covers (not shown) may be provided for closing unused inlet openings. By this construction, the unit can be installed with substantially equal convenience and facility and with a minimum of curved ducts in zones with horizontally extending air supply ducts as indicated at **34**, **34** in broken lines or in zones with vertically extending air supply ducts as indicated at **35**, **35** in solid lines.

Conditioned air is admitted into mixing chamber **29** from warm air supply compartment **27** and cold air supply compartment **28** through a straight-line common air flow control damper arrangement, generally indicated at **36**, which includes a straight, open-ended duct **37** and a damper member **38** movable in such duct. The warm air and cold air are mixed in compartment **29**, and the mixture is discharged into the zone being conditioned through louver-like openings **19** in the top wall **18**. The straight, open-ended duct **37** extends between the two air receiving compartments **27** and **28** and registers with apertures **39** and **39*a*** in opposing legs of Y-shaped partition **26** so as to be in open communication at opposite ends with the warm and cold air supply compartments, respectively. The duct is formed with an axially extending opening **40**

between its ends, which connects the interior of the duct with mixing chamber 29. In the preferred embodiment shown, the duct 37 is open only along its upper half, and a semi-cylindrical, removable perforated cover 41 overlies opening 40 so that air passed from the duct 31 into mixing chamber 29 through apertures 42 in cover 41, is directed upwardly towards discharge openings 19. In this way the volume of air discharged through opening 40 can be selectively controlled by the size and number of apertures 42 in cover plate 41. Accordingly, the cover plate shown may be replaced by another cover plate having larger total discharge area in order to increase volumetric rate of discharge.

The damper member 38 comprises a pair of circular discs 43 and 44 fixedly mounted in tandem by nuts 45 on a single plunger 48. The damper is movable axially in duct 37 by a plunger 48 between axially-spaced annular seats 46 and 47, which are on the inner circumference of the duct at opposite ends of opening 40. Each of discs 43 and 44 has a diameter that is slightly less than the inner diameter of duct 37, and the stroke of plunger 48 is of such length that at one end thereof the disc 43, which controls air flow from warm air compartment 27 to mixing chamber 29, engages annular seat 46 in a fully closed position and the disc 44, which controls air flow from cold air compartment 28 to mixing chamber 29, is fully open to permit maximum cold air flow into mixing compartment 29. At the other end of the plunger stroke, disc 44 engages annular seat 47 to check air flow from cold air compartment 28 into mixing chamber 29, and disc 43 is fully open to permit maximum flow of warm air into the mixing compartment 29. At intermediate stroke positions, the discs 43 and 44 are partially open, and both warm and cold air will flow into mixing chamber 29 in proportion to the degree at which the discs 43 and 44 are respectively open.

Plunger 48 is operated by a thermostatically controlled motor 49, which may be either a conventional air motor or an electric motor. In the form shown, the thermostatically controlled motor may have a suitable relay 50 connected to a thermostat 51 to control the position of the plunger 48 and discs 43 and 44. Motor 49 may be centrally supported within duct 37 by radially extending angles 52. The thermostat 51 may be disposed in the zone being conditioned so that the position of plunger 48, and thus the proportional amounts of warm and cold air admitted into the mixing chamber may be controlled by ambient zone temperature.

By such a device as just described, warm air flow and cold air flow into the mixing chamber are controlled by a unitary damper arrangement, which eliminates pivoted linkage heretofore necessary to actuate dual dampers and to coordinate their relative movements, and which accordingly avoids the dangers of binding associated therewith. The device, by its warm air and cold air receiving compartments, compactly provides convenient warm and cold air reservoirs. Furthermore, substantially uniform conditions are provided on opposite sides of damper 38 in the duct between each air receiving compartment and opening 40 so that pressure drops in warm air flow and cold air flow across such duct are substantially equal, thereby providing a substantially constant, total volumetric rate of discharge of conditioned air, regardless of the position of damper 38. The device is easily serviced and adjusted by lifting apertured cover plate 41, which makes the interior of the air flow control damper arrangement readily accessible.

It will be understood that the foregoing detailed description and the accompanying drawings are illustrative and that the invention herein disclosed may be embodied in various forms of construction within the scope of the appended claims, as will become apparent to those skilled in the art.

What is claimed is:

1. In an air conditioning apparatus for a zone, an air distributing unit comprising a closed box-like casing having a generally Y-shaped partition extending transversely between opposite longitudinal side walls of the casing and longitudinally from one transverse side wall to the bottom wall and thence from the bottom wall to the other transverse side wall of the casing so as to form two lower opposing air receiving compartments and an upper air mixing compartment having an outlet opening, one of said lower compartments having inlet means for receiving cold air and the other of said lower compartments having inlet means for receiving warm air, a tubular member extending between the arms of said Y-shaped partition and communicating at opposite ends with the lower opposing air receiving compartments, said connection having aperture means between its ends opening into said air mixing compartment for passing air from each air receiving compartment into said air mixing compartment, damper means including a transversely disposed disc in said connection separating the side of the connection connected with said warm air receiving compartment from the side connected with the cold air receiving compartment, and means in said connection for moving said disc axially to vary proportionally the aperture means open to said warm and cold air receiving compartments.

2. In an air conditioning apparatus for a zone, an air distributing unit comprising a closed box-like casing having a generally Y-shaped partition extending transversely between opposite longitudinal side walls of the casing and longitudinally from one transverse side wall to the bottom wall and thence from the bottom wall to the other transverse side wall of the casing so as to form two lower opposing air receiving compartments and an upper air mixing compartment having an outlet opening, each of said lower compartments having air inlets in the bottom and side walls through which the respective compartment is accessible at different angles from locations outside the casing, one of said lower compartments receiving cold air and the other of said lower compartments receiving warm air, a tubular member extending between the arms of said Y-shaped partition and communicating at opposite ends with the lower opposing air receiving compartments, said connection having aperture means between its ends opening into said air mixing compartment for passing air from each air receiving compartment into said air mixing compartment, damper means including a transversely disposed disc in said connection separating the side of the connection connected with said warm air receiving compartment from the side connected with the cold air receiving compartment, and means in said connection for moving said disc axially to vary proportionally the aperture means open to said warm and cold air receiving compartments.

3. In an air conditioning apparatus for a zone, an air distributing unit comprising a closed box-like casing having a generally Y-shaped partition extending transversely between opposite longitudinal side walls of the casing and longitudinally from one transverse side wall to the bottom wall and thence from the bottom wall to the other transverse side wall of the casing so as to form two lower opposing air receiving compartments and an upper air mixing compartment having an outlet opening, one of said lower compartments having inlet means for receiving cold air and the other of said lower compartments having inlet means for receiving warm air, said air mixing compartment having an outlet opening formed in the top wall of the casing for discharging conditioned air into such zone, a tubular member extending between the arms of said Y-shaped partition and communicating at opposite ends with the lower opposing air receiving compartments, said connection having aperture means between its ends underlying said outlet opening and opening into said air mixing compartment for passing air from each air receiving compartment upwardly into said air mixing compartment towards said outlet opening, damper

means including a transversely disposed disc in said connection separating the side of the connection connected with said warm air receiving compartment from the side connected with the cold air receiving compartment, and means in said connection for moving said disc axially to vary proportionally the aperture means open to said warm and cold air receiving compartments.

4. In an air conditioning apparatus for a zone, an air distributing unit comprising a closed box-like casing having a generally Y-shaped partition extending transversely between opposite longitudinal side walls of the casing and longitudinally from one transverse side wall to the bottom wall and thence from the bottom wall to the other transverse side wall of the casing so as to form two lower opposing air receiving compartments and an upper air mixing compartment having an outlet opening, one of said lower compartments having inlet means for receiving cold air and the other of said lower compartments having inlet means for receiving warm air, a tubular member extending between the arms of said Y-shaped partition and communicating at opposite ends with the lower opposing air receiving compartments, said

connection having an outlet opening formed in its upper wall portion between its ends that opens into the air mixing compartment, an interchangeable perforated cover plate detachably secured to said connection in a position overlying said connection wall opening so as to determine the total discharge area of said opening, damper means including a transversely disposed disc in said connection separating the side of the connection connected with said warm air receiving compartment from the side connected with the cold air receiving compartment, and means in said connection for moving said disc axially to vary proportionally the aperture means open to said warm and cold air receiving compartments.

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