Nov. 10, 1959 R. P. GOEMANN 2,912,231

AIR CONDITIONING STRUCTURE

Original Filed Feb. 24, 1954 4 Sheets-Sheet 1

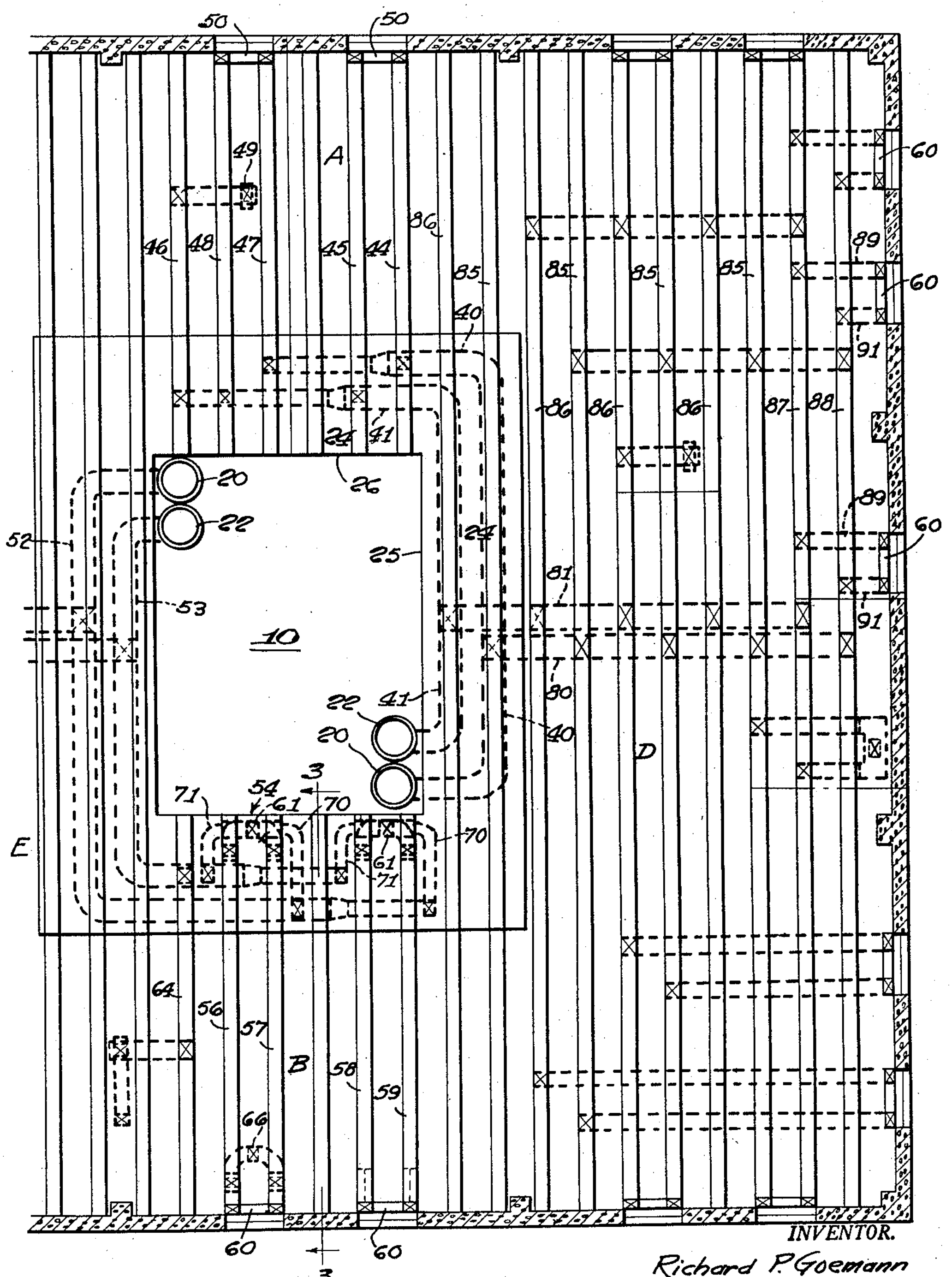

Fig. 1

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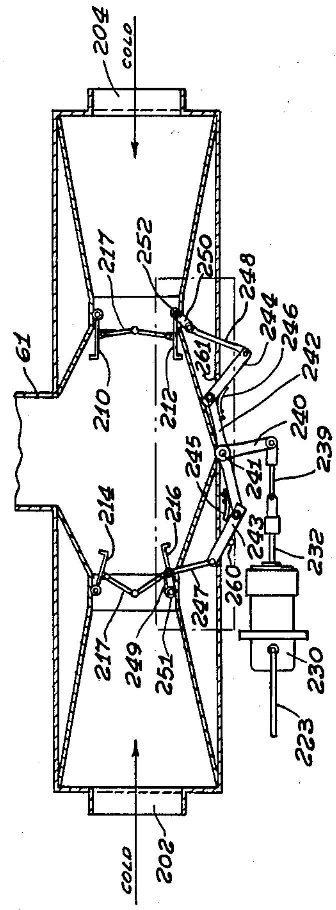

Fig. 8

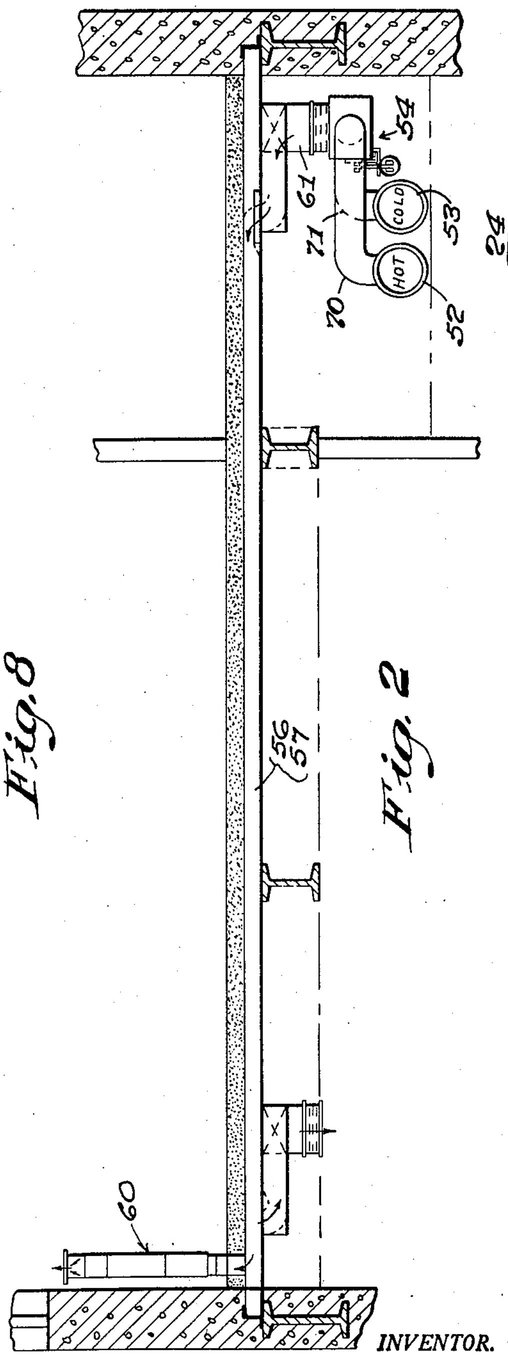

Fig. 2

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Fig. 3

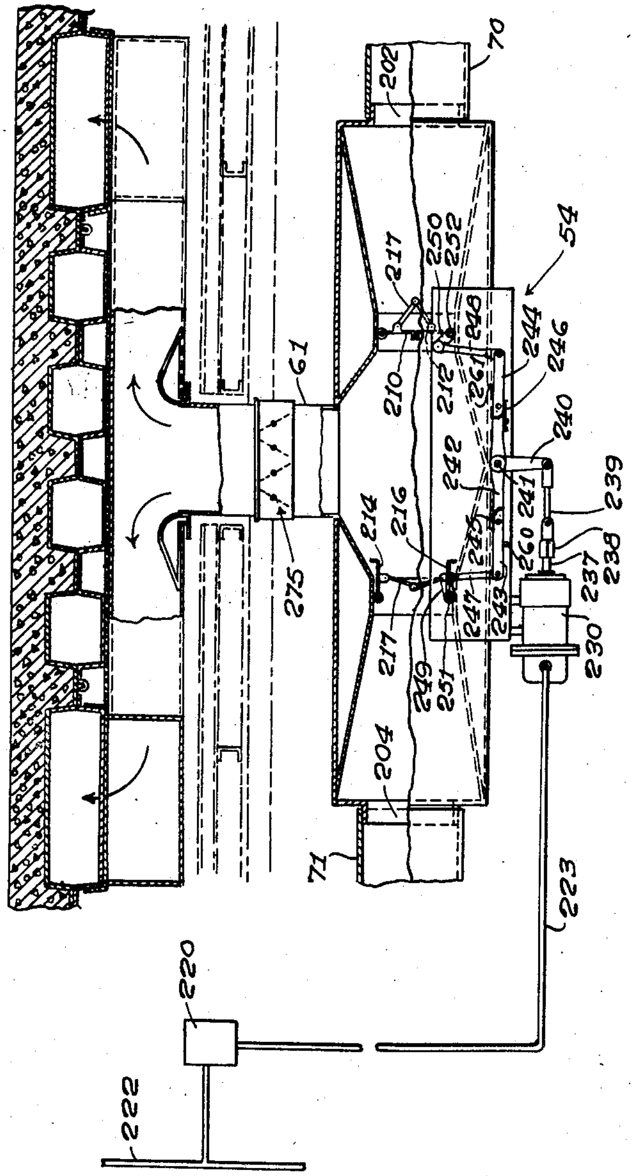
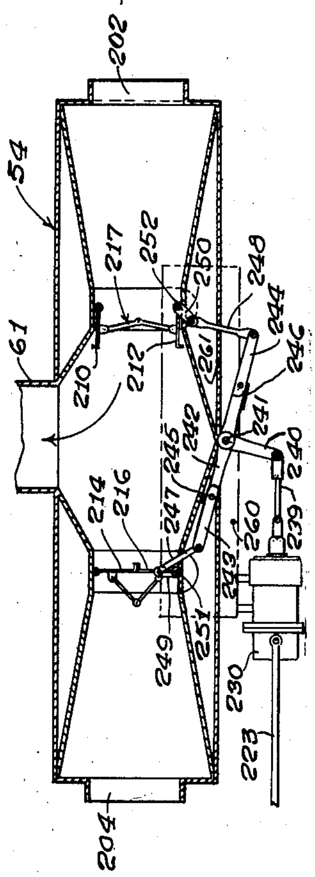


Fig. 4



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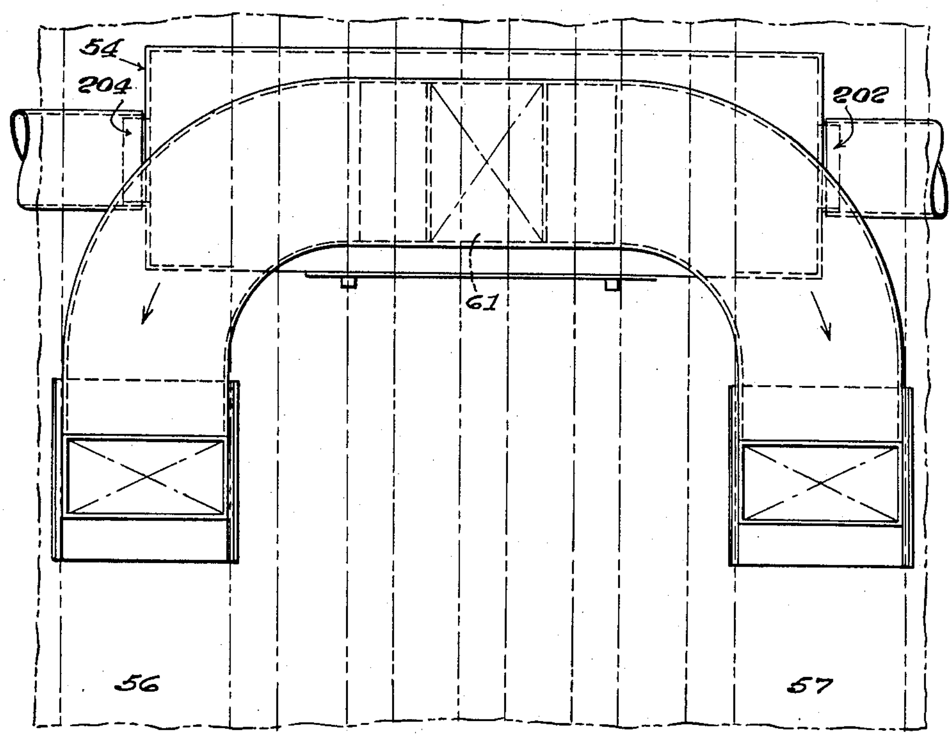
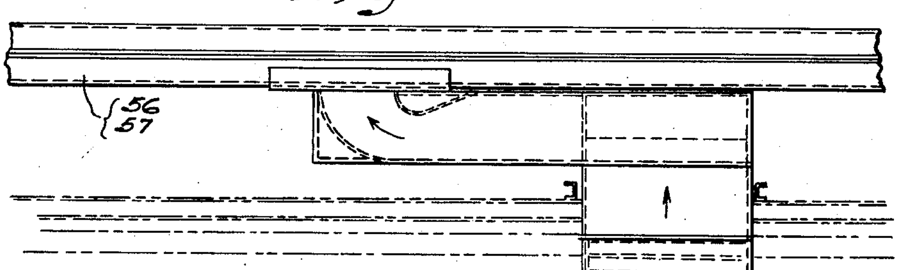


Fig. 5



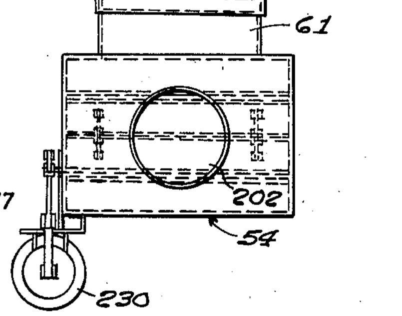


Fig. 6

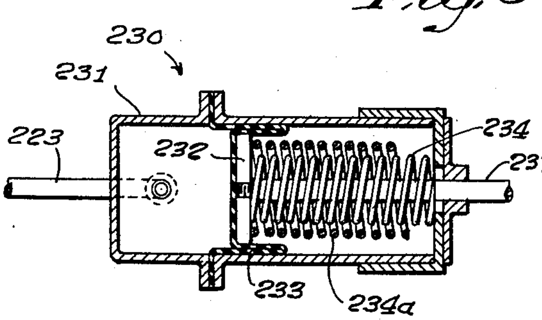


Fig. 7

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AIR CONDITIONING STRUCTURE

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Original application February 24, 1954, Serial No. 412,217, now Patent No. 2,729,429, dated January 3, 1956. Divided and this application December 9, 1955, Serial No. 552,037

7 Claims. (Cl. 257—286)

This invention relates to a novel building and air conditioning structure and also to apparatus for mixing two separate air streams.

One object of the invention is to provide a novel air conditioning structure embodying a cellular metal load supporting floor and in which provision is made for utilizing two selected floor cells for the distribution of air of predetermined condition and for controlling the discharge of air from said cells by novel mechanism to the end that the volume of air discharged may be increased when the system is operating under different conditions, such as in winter and in summer.

Another object of the invention is to provide a novel structure of the apparatus for the purpose specified which, among other uses, is particularly suitable for use for premixing two separate conditioned air streams prior to the distribution of the resulting mixed and conditioned air stream into the portion of the building to be conditioned.

With these general objects in view and such others as may hereinafter appear, the invention consists in the novel building and air conditioning structure and in the novel apparatus for mixing two separate air streams hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings: Fig. 1 is a more or less diagrammatic plan view of one story of a multi-story building embodying the present air conditioning system in which the present air mixing apparatus may be used; Fig. 2 is a cross sectional view taken on the line 3—3 of Fig. 1 illustrating a portion of the building wherein warm air and cool air are mixed prior to entering the flooring cells; Fig. 3 is a cross sectional detail view of an air mixing unit connected to the flooring cells and automatic control mechanism for varying the mixture of warm and cool air; Fig. 4 is a cross sectional view of the mixing unit with the control mechanism in a different position of operation; Fig. 5 is a plan view of a dual connecting duct between the mixing unit and the two air conducting cells; Fig. 6 is a side elevation of the mixing unit shown in Fig. 3; Fig. 7 is a cross sectional detail through the air motor shown in Fig. 3; and Fig. 8 is a cross sectional view of the mixing unit with the automatic control mechanism in another position of operation.

The present invention contemplates apparatus for mixing two separate air streams, and the apparatus may be embodied with advantage in a multi-story building and air conditioning structure wherein provision is made for distributing air through a cellular load supporting structure from two sources of air. In the preferred form of air conditioning structure the air may be distributed properly conditioned and delivered to the present air mixing apparatus from separate risers and then modulated as it passes through the mixing apparatus to be delivered to and introduced in the cells of a cellular load supporting floor structure, and after passing therethrough may be delivered into the portion of the building to be conditioned through suitable outlets in the desired location in the building.

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Preferably the cellular load supporting floor may comprise the cellular metal floor illustrated in the United States patent to Young No. 1,867,433, and the present mixing apparatus may be embodied in the complete multi-story and air conditioning structure disclosed in my co-pending application, Serial No. 412,217, filed February 24, 1954, and now Patent No. 2,729,429, granted January 3, 1956, of which the present application is a division.

Referring now to the drawings and particularly to Fig. 1, which illustrates in plan view a sufficient portion of one of the floors of a multi-story building embodying the present air conditioning and distributing systems to enable the invention to be understood, **10** represents the usual building service core or vertical shaft which may extend upwardly from the basement of the building to the upper story thereof and through which elevators and other services are extended from the basement and which may be distributed to the desired locations within the building.

For purposes of illustration the air conditioning and distributing system is herein shown as comprising a system in which provision is made for conducting a supply of heated air upwardly through one set of risers or vertical supply ducts **20** located at opposed corners of the service core, and cold air is conducted upwardly through a second set of risers or vertical supply ducts **22** similarly located. Customarily in multi-story buildings a corridor indicated at **24** is arranged to extend along at least one side **25** and one end **26** of the service core or vertical shaft **10**, and in most instances such a corridor extends completely around the service core. In one embodiment of the air conditioning system generally illustrated in Fig. 1 hot and cold air is supplied to selected of a plurality of the cells in the portions of the floor opposite the ends of the service core, and which portions are designated A and B in Fig. 1, through duct connections, as will be described, from the respective sets of the hot and cold air risers **20**, **22** in the service core. In order that the major portion of the portions A and B of the building may be of maximum height between ceiling and floor I prefer to run the connecting ducts or headers **40**, **41** from one set of hot and cold risers **20**, **22** through the sections of the corridor along one side and one end of the service core. As shown in Fig. 2 the hot and cold air connecting ducts **40**, **41** are hung at near the ceiling of the corridor and are connected, as indicated in Figs. 1 and 2, to selected floor ducts **44**, **45** and also to as many other similar ducts as **47**, **48**, depending upon the window spacing at the part of the periphery of the building to which the floor cells run from the end of the corridor. As indicated in Fig. 1, the part of the ducts **40**, **41** beyond the connector to the floor cells **44**, **45** may be reduced in sectional dimensions, and as indicated, the cold air duct **41** may be connected to a separate floor cell **46** from which cold air may be discharged through an outlet **49** at a point midway between the corridor and outer wall of the building as shown. From inspection of Fig. 1 it will be seen that the hot and cold air may be conducted through any number of the selected floor cells to distribute the air to near the outer building wall, preferably at the windows. The separate supplies of hot and cold air are separately discharged from the floor cells and mixed in the outlet boxes **50** erected at an immediately below the window openings at the outer wall of the building so that air of the desired temperature may be discharged into the room at the various outlet locations.

As illustrative of the use of the present air mixing apparatus in the complete air conditioning system above described and which is generally illustrated in Fig. 1, provision is made for distributing air to the portions B of the building, and for purposes of illustration a system is shown wherein the hot and cold air is mixed to a predetermined temperature before being introduced into the floor cells. As shown in Fig. 1, air streams from the second set of the hot and cold air risers 20, 22 located in the opposite corner of the service core are led through distributing ducts 52, 53 into specially designed mixing chambers 54 erected in the part of the corridor along the second end of the service core, as illustrated in Figs. 1 and 2, so that from the mixing chambers 54 air of the required temperature may be introduced through connecting ducts 61 into selected and spaced floor cells 56, 57 and 58, 59 running from the corridor in a direction at right angles to the end of the service core and terminating under windows at the periphery of the building where the air is discharged from outlets 60 into the room. As shown in Fig. 1, the cold air may be connected to a separate floor cell 64 from which cold air may be discharged at one or more points intermediate the corridor and the outer wall of the building. In some instances selected cells 56, 57, 58, 59 may be connected to ceiling outlets 66 from which the air may be discharged into the building at the story below the floor. These ceiling outlets may take special forms, as will be hereinafter described.

In order to distribute the hot and cold air from two sets of the connecting ducts 40, 41 located in the corridor to the portions of the building indicated generally at D and E wherein the floor cells extend parallel the sides of the service core 10, it is preferred to employ a pair of air supply header ducts 80, 81, as shown in Fig. 1, connected to selected floor cells in each of the portions of the floor D and E. For illustrative purposes the system of air distribution has been shown and will be described only for the section D of the floor. These header ducts 40, 41 may be connected with the hot and cold air risers 20, 22, as indicated in Fig. 1, and the hot air is led into selected, and as herein shown, alternate floor cells 85 and the cold led into intermediate and alternate floor cells 86. The header ducts 80, 81 are preferably extended to the two outer floor cells 87, 88 nearest the wall of the building so that the hot and cold air may be distributed lengthwise of the outer wall, and connection is preferably made at each window location by conduits 89, 91 from these distributing cells 87, 88 to outlet boxes indicated at 60 located at some of the windows.

From an inspection of Fig. 1 it will be observed that in the half portion of the section D of the floor I have illustrated one arrangement of air distributing ducts, and in the second section of the portion D of the floor I have illustrated a different arrangement of distributing ducts for distributing the air to the sill boxes. It will be understood that this showing is for illustrative purposes only, and in some instances I may prefer to utilize either system in the entire portion D of the floor and also in the entire portion E of the floor.

Referring now to Figs. 3, 4 and 8 which illustrate the operating damper and control mechanism of the preferred form of the present mixing apparatus, the unit is provided with two entrance openings 202, 204. During normal use one opening 202 will, as indicated in Figs. 1 and 3, be connected by the connecting duct 70 to the hot air distributing duct 52 hung in the corridor and through which hot air is conducted from the hot air riser 20 and led into the mixing chamber. Similarly, cold air is led into the opposite end opening 204 of the mixing chamber through the opening duct connections including the duct 71. The flow of hot and cold air from the openings 202, 204 is controlled by two sets of dampers, one set comprising an upper damper 210, and a lower damper 212, and the other set upper and lower dampers 214, 216. The upper and lower dampers of each set are connected by toggle linkage 217, as shown.

Provision is made for operating the dampers from a thermostat 220 of the well known pressure actuated type now being manufactured by several of the leading manufacturers. As indicated in Fig. 3, the thermostat 220 is supplied with air pressure from the supply line 222 connected with a compressor or other source of air under pressure, and is also connected by a line 223 with a damper operating motor indicated at 230. As shown in detail in Fig. 7, the motor 230 comprises a cylinder 231 having a piston 232 connected in sealed relation to the cylinder by a rolling rubber sleeve or diaphragm 233 and capable of sliding in the cylinder in accordance with variations in air pressure in the head end of the cylinder and to which the line 223 is connected. The second end of the cylinder is provided with two coil springs; one spring 234 controls the piston movement for a portion of the travel and, for example, may be of a strength to oppose piston movements corresponding to air pressure variations of from 5 to 10 lbs., per sq. in., assuring a supply of air pressure to the thermostat of 15 lbs. per sq. in., and the second spring 234*a* is of shorter length and arranged to become operative and control the continued piston movement within a range, for example, of from 10 to 15 lbs.

The piston is connected by a piston rod 237 through an adjusting nut 238 on a link 239 to an arm 240 on a shaft 241 upon which a three sectioned operating lever 242 is secured to rock therewith. The two end sections 243, 244 of the lever are arranged to break in opposite directions against leaf springs 245, 246 during pivotal movement of the shaft 241, as will be described. Each end section 243, 244 is connected by a link 247, 248 to a short arm 249, 250 fast on shafts 251, 252 respectively to which the lower dampers 212, 216 are fixed. Pins 260, 261 are provided to effect breaking of the end sections, as will be described.

As above set forth, during normal use, as for example in winter when it is desired to increase the temperature of the cold air by the mixture of hot air and during which period the pressure actuated thermostat functions between one set of limits, as for example between 5 and 10 lbs. pressure under a supply line pressure of 15 lbs., the damper operating mechanism functions to move the dampers between the position shown in Fig. 4 and that shown in Fig. 3 and to modulate the mixture of hot and cold air in response to the movements of the three section operating lever as a rigid member between such limits. In this way the correct proportioning of hot and cold air is obtained in the central mixing chamber. From the latter, as shown in Fig. 3, the air passes through a set of throttling dampers 275 which may be manually set to throttle the air from a higher to lower pressure, just before the air is delivered into the floor cells, as shown in Fig. 3.

The present damper operating mechanism is arranged so that by increasing the operating air pressure in the supply line, as for example to 30 lbs./sq. in. by adjustment of the compressor, then the piston of the damper motor can be made to effect further movement to the right viewing Fig. 3 to a maximum position of Fig. 8 where the set of dampers 210, 212 are again opened, while the other set moves to an intermediate but substantially open position. In this manner both hot and cold air ducts are opened to supply an increased volume of air so that in summer the capacity of the two ducts of the dual system can be used when the conditions call for increased cooling.

From the description thus far it will be observed that the present novel air conditioning and building structure wherein the floor cells are used as conduits for the distribution of air to be discharged at different points in the buiding effects economies in the space consumed by duct work. The provision of the novel dampers and damper operating mechanism controlling the discharge of air from each of two floor cells of the air distributing structure enables the air being discharged to be controlled as to temperature and other conditions by the opposed movement of the dampers, and also to enable the dampers to be moved into substantially open position when the system is operating under a different set of conditions to thereby enable the volume of air being discharged into the building to be increased without increasing the cross sectional dimensions of the two floor cells. For example, in winter operation where two selected floor cells are used to distribute hot and cold air, the damper operating mechanism functions to modulate this air so that one damper is being moved to a closed position while the other is being opened, thus proportioning the hot and cold air as required. When operating under a different set of conditions, as for example in summer operation, the volume of cold air can be substantially increased and in many instances nearly doubled as compared to the volume of air being supplied through the single cold air floor cell, and this is accomplished by the damper operating mechanism and the simple adjustment of the operation of the control system.

This application is a division of my copending application, Serial No. 412,217, filed February 24, 1954, and now Patent No. 2,729,429, granted January 3, 1956.

Having thus described the invention, what is claimed is:

1. Apparatus for mixing two separate air streams for use in air conditioning a given zone in a building comprising: a housing provided with two separate air inlets for receiving air streams of predetermined condition, said housing having a mixing chamber communicating with said inlets and having an outlet for supplying air from said mixing chamber for air conditioning said zone, separate dampers in each of said inlets for controlling the relative volume of air from said air streams admitted into said chamber through said inlets, damper operating mechanism including a lever mounted to pivot about a point intermediate its ends and means connecting each end of said lever, with a different one of said dampers, and means for actuating said lever to effect closing movement of one damper and opening movement of the other damper during a given set of conditions and to actuate said lever to effect opening movement of both dampers during another given set of conditions.

2. Apparatus as defined in claim 1 wherein the damper operating mechanism is adjustable and thermostatically controlled.

3. Apparatus as defined in claim 1 wherein the damper operating mechanism is controlled by a pressure actuated thermal sensing device.

4. Apparatus as defined in claim 1 wherein the damper operating mechanism is controlled by a thermal sensing device.

5. Apparatus for mixing two separate air streams for use in air conditioning a given zone in a building, comprising: a housing provided with two separate air inlets for receiving air streams of different predetermined condition, said housing having a mixing chamber communicating with said inlets and having an outlet for supplying air from said mixing chamber for air conditioning said zone, dampers in each of said inlets for controlling the relative volume of said air streams admitted into said mixing chamber through said inlets, and damper operating

mechanism comprising linkage including a pivotally mounted two-armed lever operatively connected to said dampers and arranged to effect opposed movement of the dampers during one set of conditions, each of said arms having a pivotally jointed outer section and means resiliently retaining said outer sections in alignment with their respective arms during said one set of conditions, and stop means engageable with said outer sections to effect rocking thereof relative to their arms, whereby to effect movement of the dampers into substantially open position during a second set of conditions to thereby enable the volume of air introduced into said zone to be increased.

6. Apparatus for mixing two separate air streams for use in an air conditioning system in a building comprising a housing provided with two separate air inlets, a mixing chamber within the housing communicating with said inlets, separate damper means controlling the flow of each air stream into the mixing chamber, and thermostatically controlled damper operating mechanism for controlling the proportioning of the air streams being mixed, said housing being provided with a discharge outlet from the mixing chamber, said damper operating mechanism including a thermostatically controlled air motor and means comprising a linkage connected between the air motor and the dampers for effecting opposed movement of the dampers during one set of thermal conditions and effecting movement of both dampers into substantially open position during a second set of thermal conditions.

7. Apparatus for mixing two separate air streams for use in an air conditioning system in a buiding having air carrying floor cells comprising a housing provided with two separate air inlets, a mixing chamber within the housing communicating with said inlets and with said floor cells, a supply duct connected to each inlet, separate damper means controlling the flow of each air stream into the mixing chamber, and damper operating mechanism comprising linkage including a pivotally mounted two-armed lever operatively connected to said dampers and arranged to effect opposed movement of the dampers during said one set of conditions, each of said arms having a pivotally jointed outer section and means for resiliently retaining the outer sections in alignment with their respective arms during one set of conditions, and stop means engageable with said outer sections to effect rocking thereof relative to their arms, whereby to effect movement of the dampers into substantially open position during a second set of conditions to thereby enable the capacity of air being introduced into the floor cells to be increased without increasing the cross sectional dimension of the supply ducts.

References Cited in the file of this patent

UNITED STATES PATENTS

2,705,595	Carlson et al.	Apr. 5, 1955
2,708,568	Marshall	May 17, 1955