Oct. 14, 1958 J. P. CONLAN 2,856,131

THERMOSTAT CONTROL AIR DISTRIBUTING UNIT

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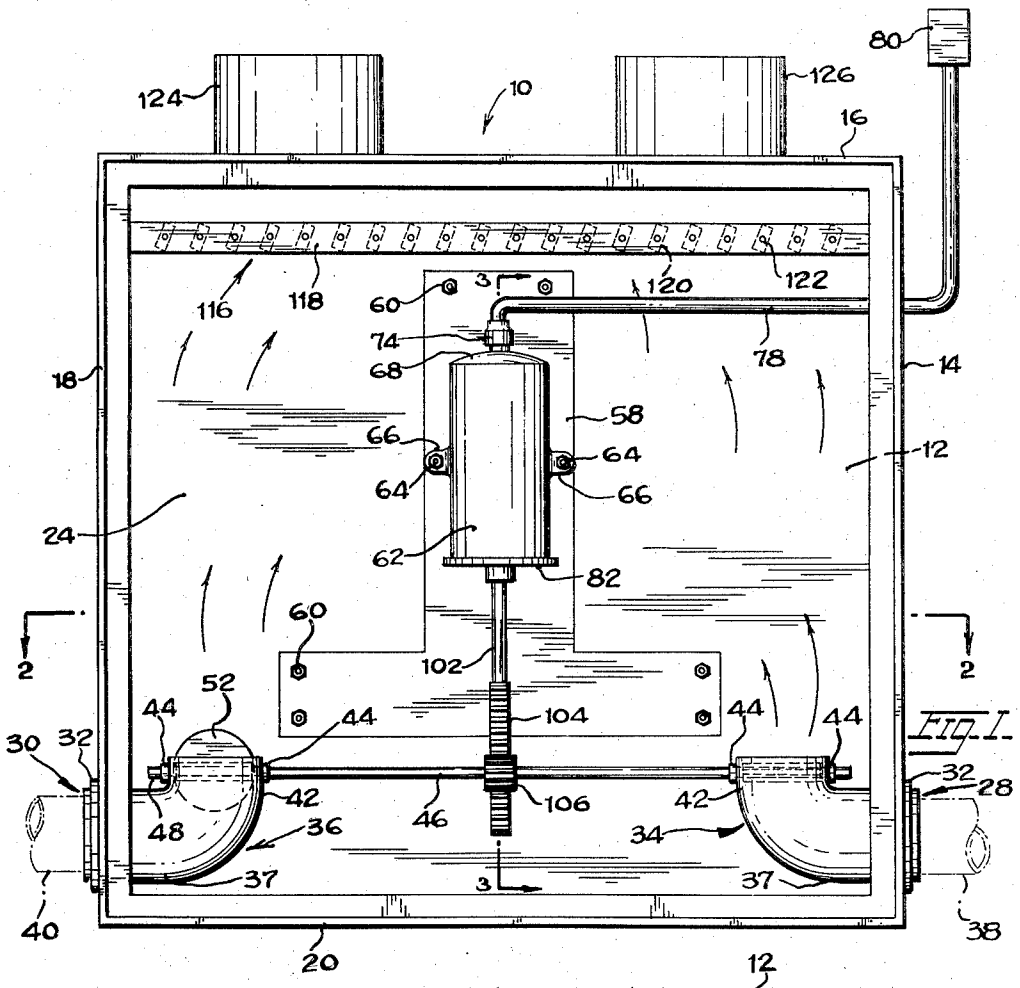


FIG. 1.

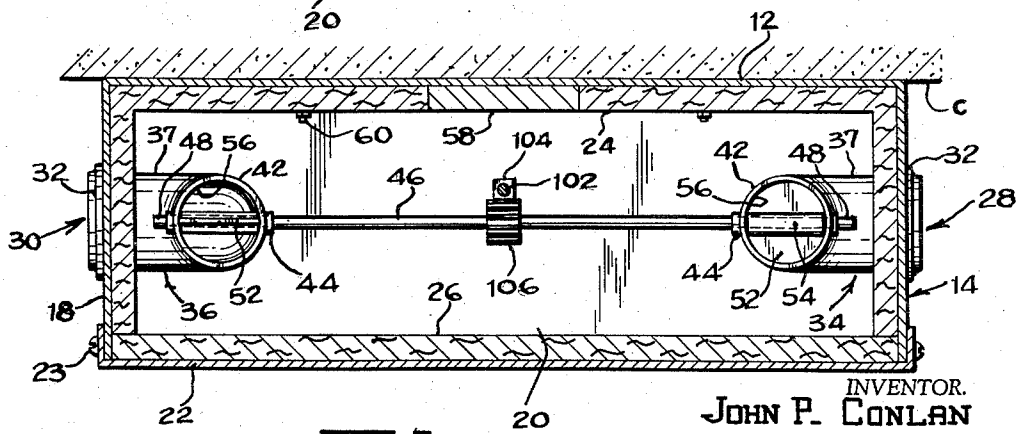


FIG. 2.

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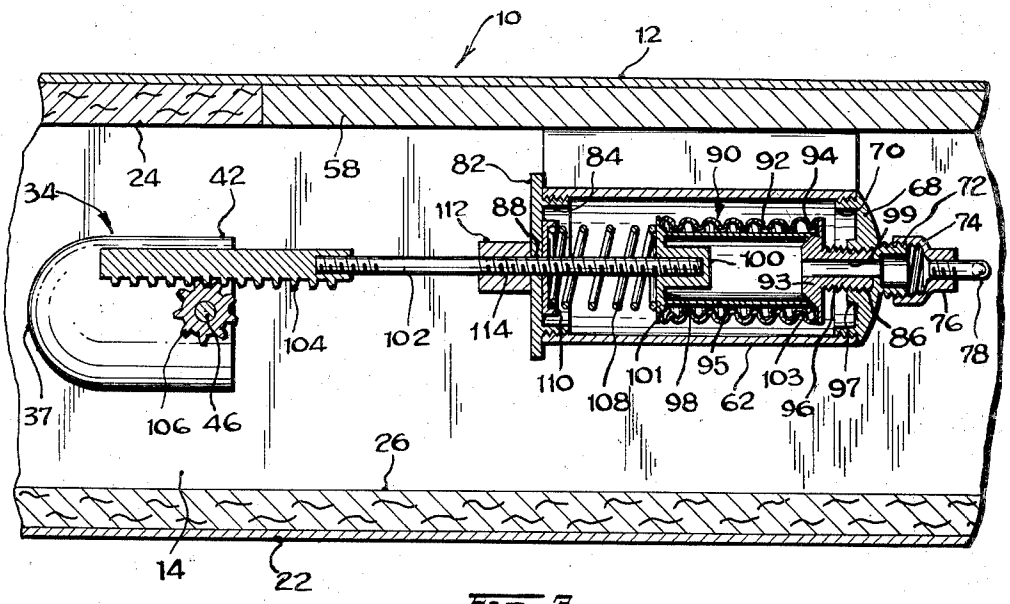


FIG. 7.

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THERMOSTAT CONTROL AIR DISTRIBUTING UNIT

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5 Claims. (Cl. 236—13)

This invention relates generally to air distribution apparatus and more particularly to an air distribution unit for mounting on a supporting wall or ceiling and having a novel fluid pressure controlled valve so that warm air and cool air may be simultaneously drawn thereinto, fully and swiftly intermixed and distributed to a selected room or building space, and further designed to effect the automatic selection of warm or cool air each to the exclusion of the other, again with the effective intermixing and distribution necessary for comfortable and efficient room or building air conditioning.

Important objects of the invention are:

First, to provide a unit as described that will respond immediately and accurately to the call of a room thermostat in a manner to produce continuous distribution of air at the necessary temperature to meet the call;

Second, to form a unit as described that will be a self-contained assembly readily mounted at any desired location on a ceiling or supporting wall;

Third, to form the device in such manner that it will be readily connected in previously installed air heating, cooling or conditioning systems;

Fourth, to provide an improved type of a combined fluid pressure and temperature responsive valve control device for use inside or outside the unit;

Fifth, to provide a device as stated that is particularly adapted for manufacture at low cost, that is simple in construction, efficient and trouble-free in operation, rugged, and composed of a minimum number of parts simply designed in a manner such that they will not readily get out of order.

Sixth, to provide a device that is designed in a manner to receive one hundred percent air flow, with no restriction on the outside of the box in hot or cold air intake to prevent same from entering box.

For further comprehension of the invention, and of the objects and advantages thereof, reference will be had to the following description and accompanying drawings, and to the appended claims in which the various novel features of the invention are more particularly set forth.

In the accompanying drawings forming a material part of this disclosure:

Fig. 1 is a bottom plan view of an air distribution apparatus made according to the invention, with the cover plate removed.

Fig. 2 is a sectional view taken on the plane of the line 2—2 of Fig. 1, with the cover plate shown thereon.

Fig. 3 is an enlarged view taken on the plane of the line 3—3 of Fig. 1.

Referring to the drawings in detail, the apparatus may be mounted either upon a wall or ceiling. In the illustrated example, it is mounted upon the ceiling C. The apparatus includes a rectangular metal housing 10 having a back wall 12 attachable to the ceiling or other supporting surface, side walls 14, 16, 18, 20 projecting outwardly from the back wall, an open front, a cover plate 22 removably attached by screws 23 for normally closing the

open front, insulation 24 covering the back and side walls and insulation 26 on the cover plate.

Warm and cool air inlet openings 28, 30 are formed in opposed walls 14, 18, respectively, the openings being finished off with bearing rings 32 on the outer surfaces of the walls.

A pair of elbow pipes 34 and 36 are mounted in the housing 10 adjacent the wall 20 with one end 37 thereof being disposed parallel to wall 20 and being inserted into and through the openings 28, 30 in walls 14 and 18, respectively. The end 37 of pipe 34 is connected, for example, to a hot air inlet pipe 38 and the end 37 of the pipe 36, for example, to a cool air inlet pipe 40. The other ends 42 of the elbow pipes extend parallel to walls 14 and 18, respectively, and open into the interior of the housing. The ends 42 of the pipes are each formed with opposed bearing openings formed with tubular hub portions 44 therearound.

A shaft 46 extends across the housing between the open ends 42 of the elbow pipes, with its ends 48 extending through the bearing openings therein and across the spaces in said open ends, the ends of the shaft being journalled in the hub portions 44. A butterfly valve or damper is mounted in the opening in each end 42 of the elbow pipes 36 and 38. This damper includes a disc-shaped body or blade 52 having a central tubular bearing portion 54 across its center and receiving fixedly the end of the shaft so that upon turning of the shaft the disc or blade 52 rotates therewith. The inner surface of each end 42 of the elbow pipes is preferably lined with felt 56 to provide a seal between the disc-shaped body 52 and the elbow pipe.

The mechanism for turning the shaft 46 upon change of temperature in a room will now be described. Medially between the side walls 14 and 18 of the housing, a T-shaped supporting plate 58 is secured to the back wall 12 by bolts 60. An elongated cylindrical casing 62 is longitudinally mounted on the long leg of the plate and is secured thereto by bolts 64 passing through perforated ears 66 on the sides of the casing and extending into the plate 58. The casing is internally screw-threaded at one end and is closed at said end by a dome-shaped plate 68 having an externally threaded annular flange 70 threaded into said end.

The plate 68 is provided with an outwardly extending integral neck portion 72 which is externally screw-threaded for joining with an internally threaded cap 74. Cap 74 also is provided with an internally screw-threaded neck portion 76 for connecting the casing 62 to the threaded end of an air supply pipe 78, the other end of the pipe being connected to a room thermostat, shown diagrammatically at 80. The thermostat is of the type adapted to create varying air pressures in pipe 78 responsive to correspondingly varying temperatures impinging upon the thermostat. A flat plate 82 closes the other end of the casing. Plate 82 is formed with an annular externally threaded flange 84 coacting with the adjacent internally threaded end of the casing. Closure plate 68 is formed with an internally screw-threaded central opening 86 and the closure plate 82 is formed with a smooth-walled central opening 88.

Within the casing 62, there is an all metal bellows unit indicated generally at 90 and consisting of a tubular bellows body 92. The bellows body is closed at one end by a circular plate or disk 94, the end of the bellows body being adapted to seat on the peripheral edge of the plate. The plate is formed with a tapered boss 93 extending from the inner surface thereof and is formed with a nipple portion 96 extending from the opposite surface. The plate and nipple are formed with an axial passage 99. Nipple portion 96 is externally screw-threaded and

is seated in the internally screw-threaded socket portion formed in the hub portion **97** of the closure plate **68**, and in the opening **86** in said plate **68**. A hollow cylindrical or tubular member **95** extends through the bellows body **92** and is formed at one end with an integral wall or disk **98** formed with an annular flange **101**. The wall or disk **98** closes the other end of the bellows body with the end edge of the bellows body fastened on the flange **101**. The free end of the cylindrical or tubular body **95** is formed with an inwardly directed tapered bead **103** which seats on the tapered boss **93** of the plate **94**. The wall or disk **98** is formed at its center with an inwardly extending cylindrical socket portion **100** internally screw-threaded to receive the threaded inner end of a rod **102**. The rod extends outwardly of the casing **62** through the opening in the closure plate **82**. The outer end of the rod extends over and adjacent to the shaft **46** and is formed with rack teeth **104** thereat meshing with a spur gear **106** fastened to shaft **46** at its center. The wall or disk **98** and the cylindrical or tubular member **95** constitute a solid fixture for supporting one end of the bellows body **92**, the tubular member **95** also serving to guide the bellows in its movements.

The bellows body **92** is formed of stainless steel and has a long life and a high resistance to heat or chemical action. It will withstand an internal pressure of 250 pounds per square inch. It may also be made of brass or bronze.

A compression spring **108** encircles the inner end of rod **102** and is interposed between a seat **110** on the closure plate **82** of casing **62** and the closure disk **98** of the bellows body **92** for urging the bellows body to contracted condition. At the same time, the spring forces the beaded portion **103** of the tubular member **95** onto its seat on the tapered boss **93** of plate **94**. A nut **112** mounted on a threaded portion **114** of the rod **102** outwardly of the casing **62**, adjacent closure plate **82**, is adapted to move the rod **102** longitudinally in order to adjust the tension of the spring.

It will be noted that the centrally open plate **94**, nipple **96**, plate **68** and cap **74** define an air line connecting the end of the air supply pipe **78** with the interior of the bellows body **92**.

In case the bellows body **92** develops a leak, the cylindrical or tubular member **95** seals off the bellows body so that pressure cannot build up inside the bellows body as the spring **108** will push the bellows body and tubular member **95** whereby the beaded portion **103** of the tubular member impinges against the tapered boss **93** of plate **94** forming a seal at this point and thus preventing any outside air or foreign matter to be forced back through the air passage **99** in the plate **94** and nipple portion **96** to the thermostat which would interfere with the operation of the apparatus.

The operation of the apparatus is as follows:

When the thermostat **80** in the room registers at a set temperature, the air will pass through the pipe **78**, the cap **74**, plate **68**, nipple **96** and plate **94**, into the tubular member **95**, causing the bellows body **92** to expand, pushing the rod **102** outwardly thereby turning the shaft **46** which in turn actuates the dampers **52, 52** in the pipes **34** and **36**. The dampers are arranged so that when the disk-shaped body or blade of one of them is disposed across the opening in its respective pipe to close said pipe, the disk-shaped body or blade in the opening in the other pipe is oppositely positioned, that is, disposed parallel to the axis of the pipe end, in open position. Therefore, assuming, for example, that the thermostat calls for more heat, the rod **102** is displaced to an extent such as to open the warm air inlet while at the same time closing the cool air inlet. Warm air is lead into the housing heater, not shown. When the thermostat calls for cooling air, the rod **102** is oppositely shifted to open the cool air inlet **30**, and to close the warm air inlet **28**. The air is drawn through either inlet by aspiration caused by suction fans or the like, not shown, arranged to draw air out of the housing through a pair of outlet ducts to be described.

When the room cools to seventy degrees, for example, the thermostat releases air which exhausts itself from bellows **90** through plate **94**, nipple **96**, plate **68**, cap **74**, pipe **78** to the thermostat. In this operation, bellows **90** contracts with the help of spring **108**.

Within the housing **10** is an air mixing assembly **116** comprising a frame **118** pivotally supporting vanes **120** by means of pivots **122** extending through aligned openings in the frame.

Extending from wall **16** are spaced outlet conduits **124** and **126** to which distribution ducts, not shown, are connectible. The warm air inlet duct **38** is connected between the warm air inlet **28** and the heat supply. The cool air inlet is opened to the room to receive ambient air. When the thermostat is not calling for higher or lower air temperatures in the manner previously discussed and is neutrally positioned, both the warm and cool air inlets are partially open so that air will be drawn through both as shown in Fig. 1, with the currents intermixing in advance of the mixing assembly **116**. Then the air is drawn through the assembly causing the air to be even more thoroughly intermixed before passage into conduits **124** and **126**.

While I have illustrated and described the preferred embodiment of my invention, it is to be understood that I do not limit myself to the precise construction herein disclosed and that various changes and modifications may be made within the scope of the invention as defined in the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by United States Letters Patent is:

1. An air distribution apparatus comprising a rectangular-shaped housing having warm and cool air inlets in respectively opposite side walls thereof and outlets in another of its walls, elbow pipes in the housing connected at one end to said inlets, damper means in the other end of said elbow pipes, means movably mounted within the housing connecting the respective damper means for conjoint operation thereof, and temperature responsive means for moving the connecting means to operate the damper means, said damper means comprising like, rotatable disc-shaped plates in the free end of the elbow pipes, said connecting means including a shaft with its ends journalled in the free ends of said elbow pipes and fixed to said disc-shaped plates, a gear fixed on said shaft intermediate its ends, said temperature responsive means including a bellows in the housing, a rod operatively connected at one end to said bellows, and rack teeth on the other end of said rod intermeshing with the gear on said shaft for turning the shaft.

2. An air distribution apparatus comprising a rectangular-shaped housing having warm and cool air inlets in respectively opposite side walls thereof and outlets in another of its walls, elbow pipes in the housing connected at one end to said inlets, damper means in the other end of said elbow pipes, means movably mounted within the housing connecting the respective damper means for conjoint operation thereof, and temperature responsive means for moving the connecting means to operate the damper means, said damper means comprising like, rotatable disc-shaped plates in the free ends of the elbow pipes, said connecting means including a shaft with its ends journalled in the free ends of said elbow pipes and fixed to said disc-shaped plates, a gear fixed on said shaft intermediate its ends, said temperature responsive means including a hollow casing in the housing, a bellows in said casing, an air supply line operatively connected to one end of said bellows, a thermostat connected to the other end of said supply line, a rod operatively connected at one end to the other end of said bellows, and rack teeth on the other end

of said rod intermeshing with the gear on said shaft for turning the shaft.

3. An air distribution apparatus comprising a rectangular-shaped housing having warm and cool air inlets in respectively opposite side walls thereof and outlets in another of its walls, elbow pipes in the housing connected at one end to said inlets, damper means in the other end of said elbow pipes, means movably mounted within the housing connecting the respective damper means for conjoint operation thereof, and temperature responsive means for moving the connecting means to operate the damper means, said damper means comprising like, rotatable disc-shaped plates in the free ends of the elbow pipes, said connecting means including a shaft with its ends journalled in the free ends of said elbow pipes and fixed to said disc-shaped plates, a gear fixed on said shaft intermediate its ends, said temperature responsive means including a hollow casing in the housing, a bellows in said casing, an air supply line operatively connected to one end of said bellows, a thermostat connected to the other end of said supply line, a rod operatively connected at one end to the other of said bellows, and rack teeth on the other end of said rod intermeshing with the gear on said shaft for turning the shaft, and spring means interposed between the end of the casing and one end of the bellows for urging said bellows to contracted condition.

4. An air distribution apparatus comprising a rectangular-shaped housing having warm and cool air inlets in respectively opposite side walls thereof and outlets in another of its walls, elbow pipes in the housing connected at one end to said inlets, damper means in the other end of said elbow pipes, means movably mounted within the housing connecting the respective damper means for conjoint operation thereof, and temperature responsive means for moving the connecting means to operate the damper means, said damper means comprising like, rotatable disc-shaped plates in the free ends of the elbow pipes, said connecting means including a shaft with its ends journalled in the free ends of said elbow pipes and fixed to said disc-shaped plates, a gear fixed on said shaft intermediate its ends, said temperature responsive means including a hollow casing in the housing, a bellows in said casing, an air supply line operatively connected to one end of said bellows, a thermostat connected to the other end of said supply line, a rod operatively connected at one end to the other end of said bellows, rack teeth on the other end of said rod intermeshing with the gear on said shaft for turning the shaft, spring means interposed between the end of the casing and one end of the bellows for urging said bellows to contracted condition, said rod having an externally threaded portion intermediate its ends outwardly of the casing, and a nut on said threaded portion for moving said rod longitudinally to tension the spring means.

5. An air distribution apparatus comprising a rectangular-shaped housing having warm and cool air inlets in respectively opposite side walls thereof and outlets in another of its walls, elbow pipes in the housing connected at one end to said inlets, damper means in the other end of said elbow pipes, means movably mounted within the housing connecting the respective damper means for conjoint operation thereof, and temperature responsive means for moving the connecting means to operate the damper means, said damper means comprising like, rotatable disc-shaped plates in the free ends of the elbow pipes, said connecting means including a shaft with its ends journalled in the free ends of said elbow pipes and fixed to said disc-shaped plates, a gear fixed on said shaft intermediate its ends, said temperature responsive means including a hollow casing in the housing, a bellows in said casing, an air supply line operatively connected to one end of said bellows, a thermostat connected to the other end of said supply line, a rod operatively connected at one end to the other end of said bellows, and rack teeth on the other end of said rod intermeshing with the gear on said shaft for turning the shaft, said air supply line including a closure plate closing one end of the casing, said closure plate having a central opening, a neck portion extending outwardly of said opening, a closure disc closing the adjacent end of the bellows, said disc having a central opening, a nipple on said disc communicating with the opening in the disc, a cap on said neck portion of the closure plate, said cap having a central opening, and an air supply pipe having one end connected to said cap at its central opening, and its other end to an air supply.

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