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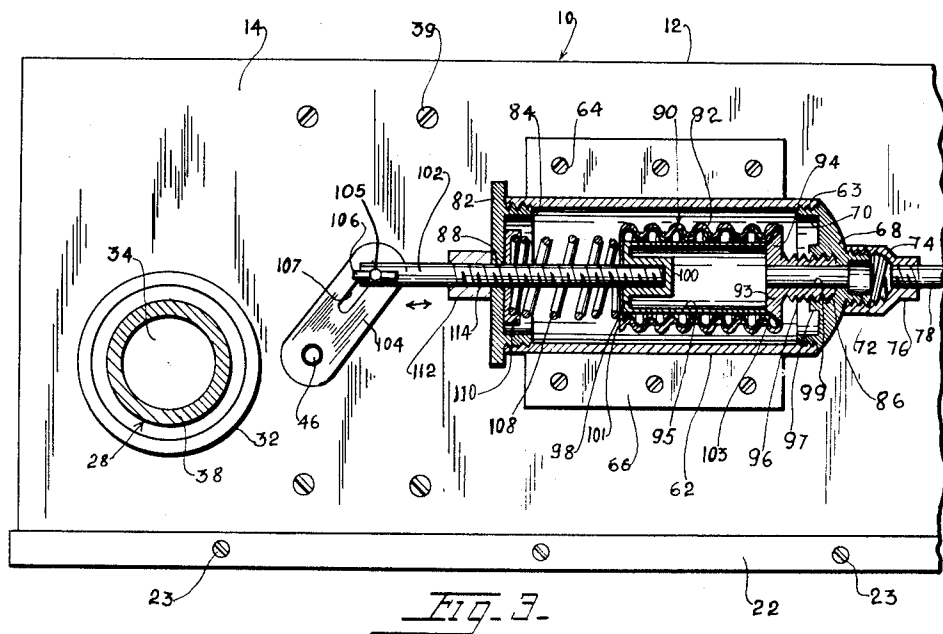
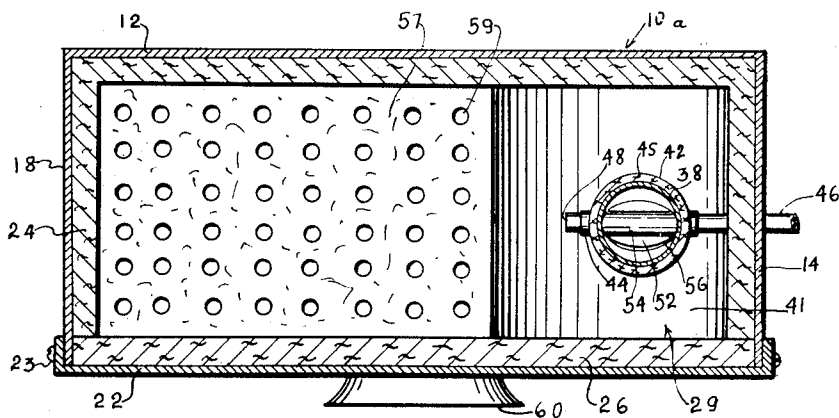
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AIR MIXING AND DISTRIBUTING UNITS

Filed Jan. 29, 1958

3 Sheets-Sheet 2



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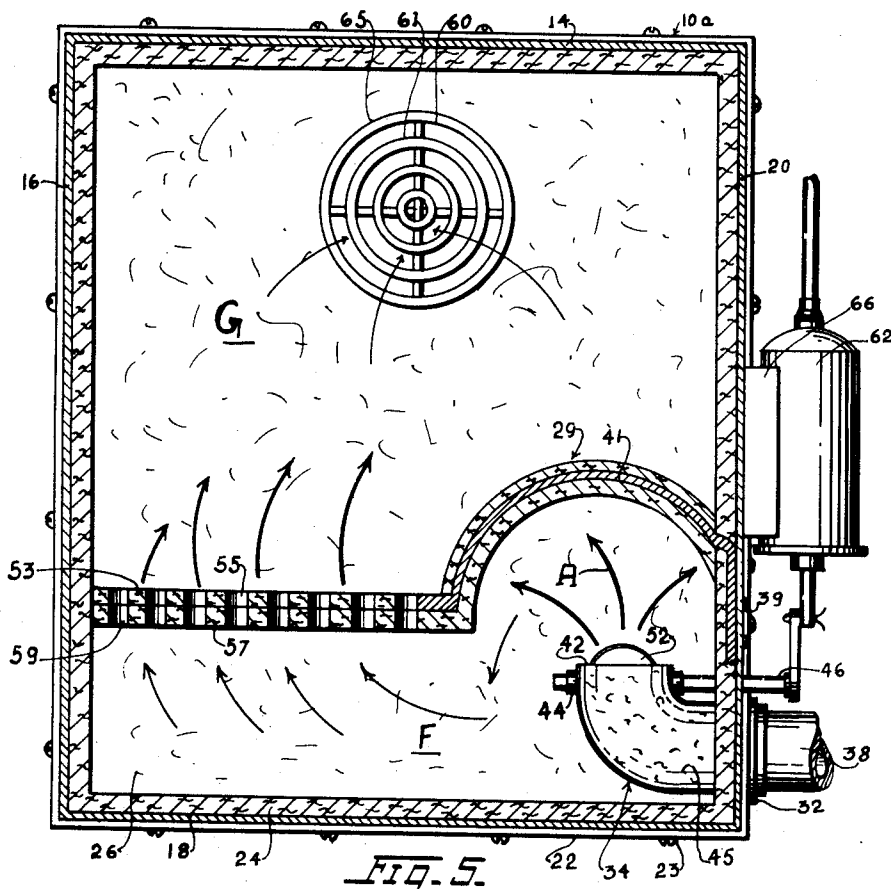


FIG. 5.

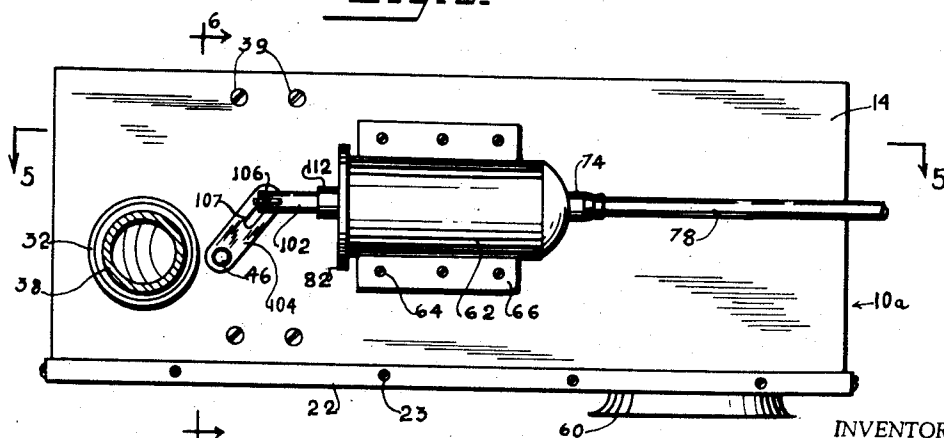


FIG. 4.

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AIR MIXING AND DISTRIBUTING UNITS

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3 Claims. (Cl. 98—38)

This invention relates generally to air distribution apparatus and more particularly to an air mixing and distribution unit for mounting on a supporting wall or ceiling and having a 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 an air mixer 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 an air mixer 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 with the air mixer 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 restrictions on the outside of the box in intake of hot or cold air to prevent same from entering the 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 planes of line 2—2 of Fig. 1, with the cover plate shown thereon.

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

Fig. 4 is a side view of another air distributor embodying the invention.

Fig. 5 is a plan sectional view taken on lines 5—5 of Fig. 4.

Fig. 6 is a sectional view taken on lines 6—6 of Fig. 4.

Referring to Figs. 1—3 of the drawings in detail, the device may be mounted either upon a wall or ceiling. In

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the illustrated example, it is mounted upon the ceiling C. The device includes a rectangular sheet metal casing or 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, and a cover plate 22 removably attached by screws 23 for normally closing the open front. Insulation 24 covers the back and side walls and insulation 26 is disposed inside the cover plate 22. The insulation is preferably a thick layer of fibrous material such as Fiberglas which may be cemented to the supporting metal surfaces.

Warm and cool air inlet openings 28, 30 are formed in opposed walls 14, 18, respectively, the openings being finished off with sealing 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 ends 37 thereof being disposed parallel to wall 20. The pipes are 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. Pipes 34 and 36 are covered with fibrous insulation 45.

A shaft 46 extends across the housing between the open ends 42 of the elbow pipes, and through hubs 44. The end 48 of the shaft terminates just beyond pipe 36. The shaft is journaled in the hub portions 44. A butterfly valve or damper is mounted in the opening in each end 42 of the elbow pipes 34 and 36. This damper includes a disc-shaped body or blade 52 having a central tubular bearing portion 54 across its center and receiving fixedly the body of the shaft so that upon turning of the shaft the disc or blade 52 rotates therewith. The inner surface 56 of each end 42 of the elbow pipes is preferably lined with felt to provide a seal between the disc-shaped body 52 and the elbow pipe.

A pair of curved baffles 27, 29 each including a baffle plate 31 are disposed in front of the ends 42 of the elbow pipes 34 and 36. The plates have flat base portions 33 secured by rivets 39 to the sides 14 and 18 of the housing. The curved portions of the plates are covered with layers of fibrous insulation material 41. The baffles are so shaped that air passing out of the ends 42 of the inlet pipes is directed into the baffles as indicated by arrows A. The air is guided by the baffles toward side 20 and is mixed in the central area B. The thoroughly mixed air stream then passes at D between the baffles. The air stream divides at E and leaves the casing via outlet pipes 50 and 51 mounted in side 16 of the housing.

The mechanism for turning the shaft 46 upon change of temperature in a room will now be described. On the side wall 14 of the housing, a supporting plate or block 66 is secured by bolts 64. An elongated cylindrical casing 62 is longitudinally mounted on the plate 66 and is secured thereto by welding or the like. The casing is internally screw-threaded at one end 63 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 in Fig. 1. The thermostat is of a

conventional type adapted to create varying air pressures in pipe 78 responsive to correspondingly varying ambient temperatures of air 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 94. The plate 94 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 94 and nipple 96 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 and 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 rod 102 is spaced from shaft 46 and is formed with a hole 105 at its end. A link 104 is pivotally secured to the end of the rod by a cotter pin 106 which passes through a slot 107 in the link and through hole 105. Link 104 is secured to the end of the shaft 46. 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 and 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 and 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 from being forced back through the air passage 99 in the plate 94 and nipple por-

tion 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 pivoting link 104 and turning the shaft 46 which in turn actuates the damper blades 52 in the pipes 34 and 36. The damper blades are arranged in mutually perpendicular planes so that when the disk-shaped body of one of them is disposed across the opening in its restrictive pipe to close said pipe, the disk-shaped body 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 passes into the housing. 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 so that cool air enters the housing.

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.

When the thermostat is not calling for higher or lower air temperatures and is neutrally positioned, both the warm and cool air inlets are partially open so that warm and cool air will be drawn through both inlets and will be mixed by reflection from the baffles 27 and 29. Then the mixed air passes the baffles and flows out of the housing through outlet conduits 50 and 51. These outlets have cross-sectional areas considerably greater than the inlets so that the air passes with reduced velocity out of the housing.

The operation is wholly quiet because of the sound-absorbing nature of the insulation 24, 26, 41 and 45, as well as reduced velocity and pressure at which the air leaves the mixing device.

In the form of the invention shown in Figs. 4-6, the several parts are numbered identically with corresponding parts of the device of Figs. 1-3. Only a single inlet pipe 34 and curved baffle 29 are employed. The outer end of the baffle is joined to a flat baffle plate 53 having a plurality of holes 55 therein uniformly distributed over its area. The forward side of the plate carries a layer 57 of fibrous insulation material. This layer has holes 59 registering with holes 55. The baffle assembly is located near side 18 of the housing and defines a chamber F into which air is directed from the baffle 29. A larger chamber G is defined between the baffle and the remainder of the interior of the housing. An air diffuser 60 provided with annular louvers 61 is disposed in an opening 65 in the cover 22. This diffuser serves as an air outlet from the casing.

In operation, the air distributor 10^a serves primarily as a velocity and pressure reducer for air derived from a high pressure source and passing into the housing through inlet 34. Shaft 46 terminates at 48 near the inner hub 44 on the inlet. The rotation of shaft 46 is controlled by the movement of rod 102 in the same manner as described above, so that the single damper plate 52 controls the flow of air into the housing. The insulation linings of the baffles and housing and the holes 55 and 59 serve as sound mufflers or absorbers. The outlet 60 provides a considerably larger passage for air to leave the housing than the narrow passage through inlet pipe 38. Thus, the air leaving the outlet is lowered in velocity and pressure and is silenced while the diffuser distributes the air uniformly in all directions.

This application is a continuation in part of my co-

pending application Serial No. 639,545, filed February 11, 1957.

While I have illustrated and described the preferred embodiments of my invention, it is to be understood that I do not limit myself to the precise constructions 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 mixing and distributing apparatus, comprising a rectangular housing having a back wall and side walls and open at the front, a removable cover plate over the opening in the front of the housing, opposed side walls having opposed openings at one end of the housing, air inlet pipes in said openings, one of the side walls connecting said opposed side walls having outlet openings therein, outlet pipes fitted in said outlet openings, elbow pipes inside the housing connected at one end to the air inlet pipes, said inlet pipes opening toward the outlet openings, butterfly valves rotatably mounted in the open ends of the elbow pipes, said valves arranged in mutually perpendicular planes, means for rotating said valves, and baffle plates secured to said opposite side walls and closely spaced inwardly of the open ends of the elbow pipes said plates being curved with the concave sides thereof extending over the open ends of the elbow pipes to deflect air from said elbow pipes toward the adjacent side wall opposed to the side wall having the outlet openings, said latter side wall deflecting the air toward the outlet openings, said deflected air being mixed in the space between the baffle plates and discharged through the outlet openings into the outlet pipes.

2. An air mixing and distributing apparatus as defined in claim 1, wherein the walls and cover of the housing are lined with and the elbow pipes and baffle plates are covered with noise deadening fibrous material.

3. An air distributing apparatus, comprising a rectangu-

lar housing having end and side walls, one side wall adjacent one end wall having an air inlet, another side wall adjacent the other end wall having an air outlet, said outlet having a total cross-sectional area exceeding the total cross-sectional area of said inlet so that the air leaves said outlet at lower velocity than it enters said inlet, an elbow pipe in the housing connected at one end to the inlet, the other end of the pipe opening toward said other end wall, a disk plate in the open end of the pipe, shaft means movably mounted within the housing and connected at one end to the disk plate for turning the same in said elbow pipe and controlling flow of air therethrough, means for moving said shaft, an air deflecting and dividing unit in the housing, spaced from the other end wall and extending from one side wall to the opposed side wall of the housing, said unit including a flat baffle wall extending from one side wall and a curved baffle plate extending from the opposed side wall, said baffle plates joined substantially midway the width of the housing, said flat baffle plate having spaced openings, said curved baffle plate being curved so that its concave side extends over the opening in the elbow pipe for deflecting air toward the adjacent one end wall of the housing and through the openings in the flat baffle plate to the outlet, and fibrous sound absorbing material covering said walls, elbow pipe and said air deflecting and dividing unit.

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