AUTOMATIC DAMPER ON REGISTER FOR COMBINATION HEATING-COOLING SYSTEM

Inventor: Charles H. Byrne, 540 Orange Ave., South San Francisco, Calif. 94080

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Primary Examiner—Edward J. Michael
Attorney—Berman, Davidson & Berman

ABSTRACT

An airflow-controlling damper mechanism consisting of a fixed frame in which a damper flap frame is rotatably mounted. The flap frame has damper segments pivoted therein on radial axes. A drive shaft is journaled axially in the fixed frame and has a drive gear meshing with gear segments carried by the damper segments. Respective thermoresponsive torsion springs connect the flap frame and the drive shaft through the fixed frame, one being responsive to the temperature of incoming air and the other being responsive to the temperature of room air, whereby to open or close the damper segments in accordance with the relative temperatures of the incoming air and the room air.

10 Claims, 3 Drawing Figures
This invention relates to automatic dampers, and more particularly to a damper mechanism for automatically controlling the flow of heating or cooling air into a room in accordance with the relative temperatures of the incoming air and the room air.

The main object of the invention is to provide a novel and improved automatic air damper mechanism especially adapted for room heating or cooling systems, the mechanism being relatively simple in construction, being easy to install and being completely self-operated.

A further object of the invention is to provide an improved automatic air damper mechanism for controlling the supply of heating or cooling air to a room, the mechanism being inexpensive to manufacture, being durable in construction and being reliable in operation.

A still further object of the invention is to provide an improved automatic airflow-controlling damper mechanism which responds accurately to the relative temperatures between the air flowing into a room and the room air and which controls such flow in accordance with the relative temperature of the lower part air and the room air, the mechanism involving very few parts, being easily adjustable for optimum operation, and being designed to operate over long periods of time without requiring any adjustment or other maintenance.

Further objects and advantages of the invention will become apparent from the following description and claims, and from the accompanying drawings, wherein:

FIG. 1 is a top plan view of an improved airflow-controlling damper mechanism constructed in accordance with the present invention, shown installed in a ceiling aperture.

FIG. 2 is a transverse vertical cross-sectional view taken substantially on line 2--2 of FIG. 1.

FIG. 3 is a transverse vertical cross-sectional view taken substantially on line 3--3 of FIG. 1.

Referring to the drawings, 11 generally designates an improved automatic airflow-controlling damper mechanism constructed in accordance with the present invention. The mechanism 11 is arranged to be mounted in a suitable wall aperture, for example, in an aperture 12 provided in the ceiling 13 of a room whose temperature is to be controlled and to which air at a required temperature is to be furnished through the damper mechanism. Thus, the aperture 12 may be circular, as illustrated, or alternatively, may have any desired shape.

Rigidly secured in the lower portion of the aperture 12 so that it is almost at the same level as the bottom surface 14 of the ceiling member 13 is a generally circular supporting frame 15 provided with the radially extending arms 16 which are rigidly secured at their inner ends to a central vertical support sleeve 17, said sleeve being provided at its intermediate portion with an outwardly projecting annular rib or flange 18 to which the inner ends of the radial arms 16 are rigidly secured in any suitable manner, as by welding, or the like.

Axially journaled in the sleeve 17 is a vertical drive shaft 19 to the top end of which is rigidly secured a large drive gear 20. The bottom end of the shaft 19 is provided with a knob 21 which is threadedly engaged on the bottom end of the shaft 19 but which may be locked in an adjusted position thereon by means of a set screw 22 threadedly in the knob 21 and being clampingly engageable at its inner end with the shaft 19.

Designated at 23 is a thermoresponsive torsion spring, of suitable thermally sensitive material, namely, material which expands or contracts markedly in response to changes of temperature, the helically coiled member 23 being engaged around the lower portion of the sleeve member 17 with its top end rigidly connected at 24 to the flange 18 and with its bottom end rigidly connected at 25 to the periphery of the knob 21. Thus, the knob 21 and the shaft 19, locked thereto will rotate in response to changes of temperature sensed by the thermoresponsive torsion spring 23. Thus, the spring 23, which projects downwardly into the room, is responsive to the air temperature in the room, and will rotate knob 21 and shaft 19 in accordance with changes in the room air temperature. As will be presently described, the rotation of gear 20, fixedly secured to the shaft 19 produces a desired compensating action with respect to the flow of air into the room.

Designated at 26 is a generally circular damper flap frame which has a plurality of inwardly extending radial arms 27 which are rigidly secured at their inner ends to a bearing ring 28 surrounding the upper portion of sleeve 17 and rotatably supported on the flange 18. As shown in FIG. 1, the radial arms 27 may be substantially in registry with the radial arms 16 of the fixed frame 15 under normal conditions.

Disposed in the sector-shaped apertures defined between the arms 27 are respective damper flaps 29 which are provided with radial shafts 30 which project inwardly and which are journaled radially in the bearing ring 28, the shafts 30 being located on axes centered relative to the radial side edges of the damper flaps, namely, being centered relative to the sector-shaped apertures defined between the adjacent radial arms 27 containing the flaps. Thus, the flaps may rotate with their shafts in said apertures to as to vary the degree of opening of the apertures and to thereby regulate the flow of air therethrough. Each flap 29 is provided at its inner end concentric with its shaft 30 with a semicircular gear segment 31 which rises vertically therefrom, namely, perpendicular to its associated shaft 30 and which meshes with the horizontal gear 20, as is substantially shown in FIG. 2. Thus, rotation of gear 20, as previously described, resulting from temperature effects acting on the thermoresponsive helical spring 23 will cause the flaps 29 to rotate around the axes of their respective shafts 30 and vary the associated airflow passages.

Designated at 32 is a second helical thermoresponsive spring which surrounds the upper portion of the sleeve member 17 and which has its top end rigidly secured to the top portion of the sleeve member at 33 and its bottom end rigidly secured to one of the arms 27 at 34. Thus, expansion or contraction of the thermoresponsive torsion spring 32 will cause the damper flap frame 26 to rotate relative to the fixed frame 15, and assuming the lower torsion spring 23 to be in a stable condition, will thereby cause the flaps 29 to be rotated because of the cooperation between the gear segments 31 and the horizontal gear 20.

The plane of the arms 27 is spaced sufficiently above the plane of the arms 16 so that the flaps 29 can rotate freely without interference with arms 16 through the normal range of operation of the flaps.

FIG. 1 merely represents a normal condition wherein the arms 16 are in registry with the arms 27, with the flaps 29 in horizontal closed position.

In the typical installation illustrated in the drawings, the device 11 is mounted in the ceiling 13 to control the flow of air from a suitable source downwardly into the room below the ceiling. The upper temperature-sensitive torsion member 32 is thus exposed to the air from the source, whereas the lower temperature-sensitive torsion member 23 is exposed to the air in the room. When the temperature of the air in the room is at its design temperature (approximately 70°F) and the temperature of the supply air is at its design temperature (approximately 150°F) the effects generated by the temperature-sensitive torsion members 23 and 32 balance each other so that the vanes 29 remain horizontal, namely, in closed position.

The vanes 29 open in response to an unbalance in design temperature conditions. Thus, when the air in the room is at a lower temperature than its design temperature, the torsional reactions are unbalanced, providing an action which causes the vanes 29 to be rotated in the same direction from their horizontal positions to a degree in accordance with the degree of unbalance, thereby allowing warm air from the source to flow downwardly into the room through the passages provided by the opening of the vanes. The vanes will automatically close as the temperature of the room approaches its design temperature.
Conversely, during the cooling cycle, when the temperature in the room is substantially higher than its design temperature, a torsional unbalance is created due to the reactions of the temperature-responsive torsion members 23 and 32 which again causes the vanes 29 to operate in accordance with the degree of unbalance, rotating from their normal closed and horizontal positions in directions opposite to the directions of rotation for the heating cycle above described. Thus, cooling air from the source will be admitted into the room through the passageway defined by the opening of the vanes, and the cool air will continue to flow into the room until the effect of the room air temperature balances with the effect of the incoming air temperature. Under these conditions, vanes 29 will be again closed, cutting off the airflow through the device.

It will therefore be apparent that the airflow-controlling damper mechanism 11 can be used in an installation which provides both air heating and air cooling of a room. Thus, the device is particularly suited for installations wherein the same duct system is employed for heating and cooling.

The device may be adjusted, as required, by changing the position of the knob 21 on the shaft 19. This can be done by first disengaging the setscrew 22, which allows the knob 21 to be rotated on the threaded portion of shaft 19. After the knob 21 has been rotated to its desired position of adjustment, it can be locked in this position by tightening the setscrew 22. Since the rotation of the shaft 19 by the knob 21 is transmitted to the vanes 29 by the gear 20 and the gear segments 31, the knob 21 can be adjusted so that the vanes 29 are in their horizontal closed positions at designed normal positions, namely, when balancing temperatures exist on the opposite sides of the airflow openings of the damper support member 26.

While a specific embodiment of an improved airflow-controlling damper mechanism has been disclosed in the foregoing description, it will be understood that various modiﬁcations within the spirit of the invention may occur to those skilled in the art. Therefore, it is intended that no limitations be placed on the invention except as deﬁned by the scope of the appended claims.

What is claimed is:

1. An airflow-controlling damper mechanism comprising frame means adapted to be fixedly secured in an aperture, a damper flap support, means mounting said damper flap support on said frame means for rotation substantially parallel thereto, said flap support having an airflow opening, a damper flap means pivoted to said flap support adjacent said opening, means rotating said flap means responsive to rotation of said flap support relative to said frame means, and temperature-sensitive means drivingly connected to said flap support.

2. The airflow-controlling damper mechanism of claim 1, and wherein said temperature-sensitive means is located on one side of said opening, and further temperature-sensitive means on the other side of said opening drivingly connected to said flap means.

3. The airflow-controlling damper mechanism of claim 2, and wherein said first-named temperature-sensitive means is drivingly connected between said frame means and said flap support.

4. The airflow-controlling damper mechanism of claim 3, and wherein said damper flap support is generally circular and said flap means is pivoted on a substantially radial axis on said flap support.

5. The airflow-controlling damper mechanism of claim 4, and wherein said frame means is provided with a pivot post member and said damper flap support is journaled on said pivot post member.

6. The airflow-controlling damper mechanism of claim 5, and wherein said first-named temperature-sensitive means comprises a helical temperature-sensitive torsion member surrounding said pivot post member on said one side of the airflow opening and being connected between the frame means and the damper flap support.

7. The airflow-controlling damper mechanism of claim 6, and wherein said further temperature-sensitive means comprises a second helical temperature-sensitive torsion member surrounding said pivot post member on said other side of the airflow opening and being connected between said frame means and the flap means.

8. The airflow-controlling damper mechanism of claim 7, and wherein said flap means is provided with an upstanding gear segment normal to its axis of rotation and said pivot post member is provided with an axial shaft journaled therein carrying a drive gear meshing with said gear segment, said shaft being connected to said frame means through said second torsion member.

9. The airflow-controlling damper mechanism of claim 8, and wherein one end of the first-named torsion member is connected to said pivot post member and the other end of the first-named torsion member is connected to said damper flap support.

10. The airflow-controlling damper mechanism of claim 9, and wherein said shaft is provided with a knob member adjustably secured thereon, one end of the second torsion member being connected to said pivot post member and the other end of said second torsion member being connected to said knob member.