May 15, 1962 E. H. PERSON 3,034,725

DAMPER CONTROL MECHANISM FOR AIR DISTRIBUTING UNITS

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FIG. 1

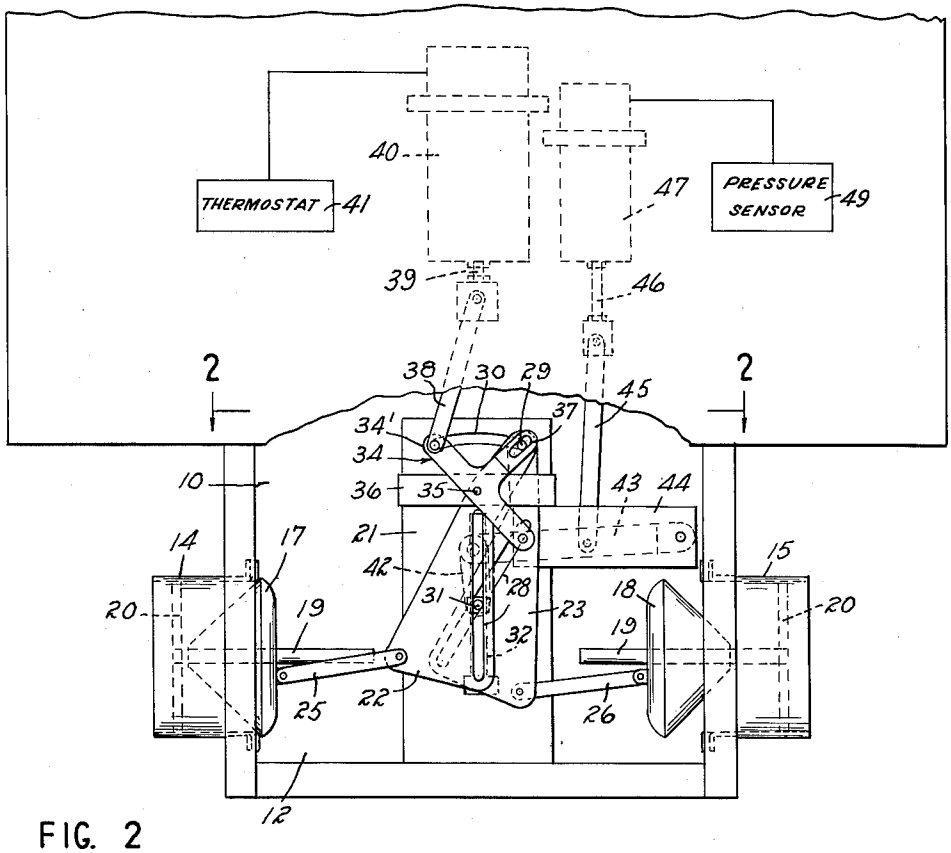
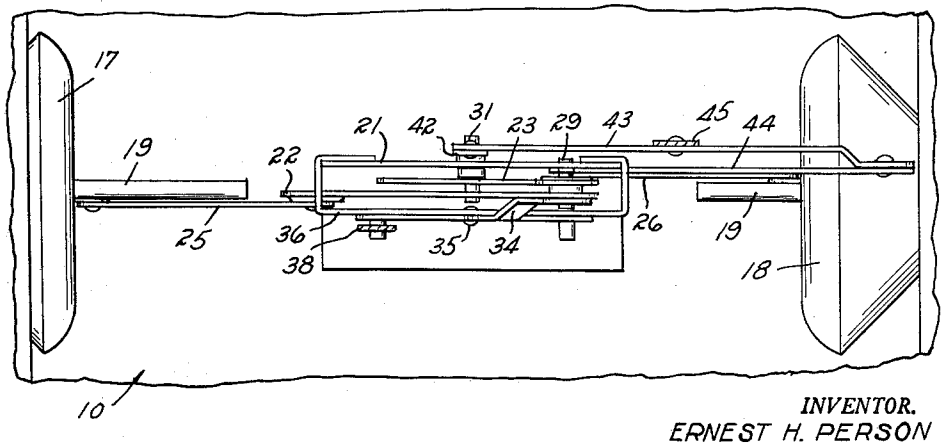


FIG. 2



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FIG. 3

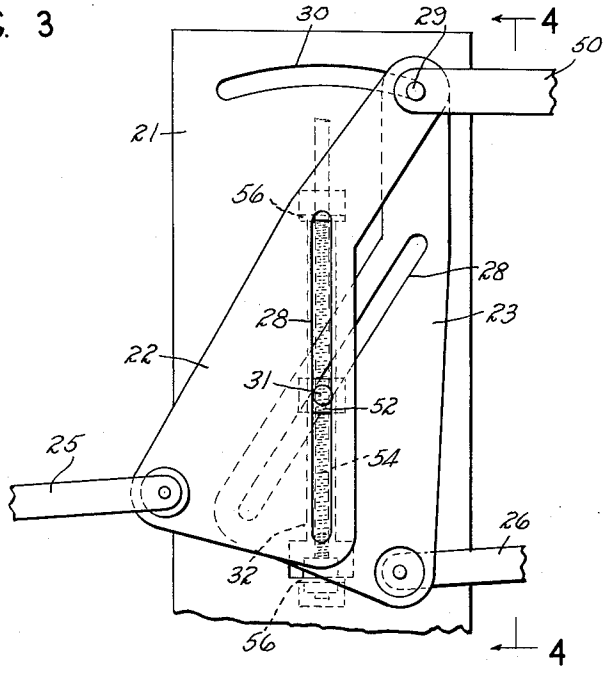
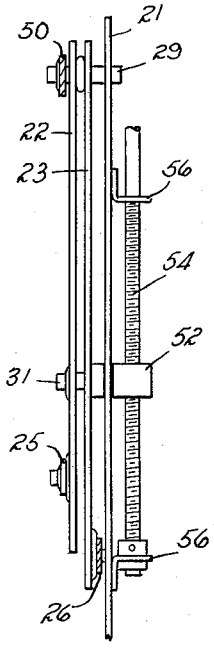


FIG. 4



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DAMPER CONTROL MECHANISM FOR AIR DISTRIBUTING UNITS

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9 Claims. (Cl. 236—13)

The present invention relates generally to air conditioning systems and, more particularly, to a damper control mechanism for use with air distributing units of the type which are supplied with both heated and cooled conditioned air from a central station. The function of the damper control mechanism of the present invention is to position the dampers of the unit to obtain a selected air temperature and static pressure.

A principal problem in connection with the proportioning of hot and cold air at the air distributing units or outlets of a central air conditioning system of the type referred to is that the pressure of the air supply at the individual room units or outlets will vary over a wide range depending, for example, upon the varying demands on the system throughout the various parts of the building. Therefore, it is desirable to provide a damper control which is responsive not only to temperature but also to static pressure.

An aim of the present invention is to provide a damper control mechanism for use with individual room units or outlets which is responsive to both static pressure and temperature and which integrates these factors so as to provide efficient and accurate regulation under widely varying conditions of operation.

A further aim of the invention is to provide a damper control mechanism of the type referred to which is simple in construction, inexpensive to manufacture, and which may be quickly and easily assembled into a compact structure comprising a minimum of parts and providing a long trouble-free service life.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth, and the scope of the application of which will be indicated in the appended claims.

In the drawings:

FIG. 1 is a fragmentary elevational view of an air distributing unit or outlet, partially cut away to show the damper control mechanism of the present invention installed therein;

FIG. 2 is an enlarged fragmentary cross-sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary elevational view of a portion of the mechanism of FIG. 1 showing a modification thereof; and

FIG. 4 is a fragmentary cross-sectional view taken along the line 4—4 of FIG. 3.

Referring first to FIGS. 1 and 2 of the drawings, the air distributing unit or outlet 10 which is utilized to illustrate the invention includes a plenum chamber 12 which is supplied with heated and cooled conditioned air through the opposed axially aligned inlets 14, 15. The inlets 14, 15 are adapted to be controlled, respectively, by the dampers 17, 18, each of which is slidably mounted on a guide rod 19 axially supported in the inlet by a bracket 20.

The damper control mechanism of the present invention is mounted on a stanchion 21 located intermediate the dampers 17, 18. Pivotally supported on the stanchion 21 in a manner to be more particularly described are a pair of control plates 22, 23 arranged in overlapping relationship. The lower left hand corner of plate 22 is connected by link 25 to the damper 17 while the lower right hand corner of plate 23 is connected by link 26 to the damper 18.

Each of the control plates 22, 23 has a longitudinal slot 28 and is pivotally attached at its upper extremity to a pivot pin 29 which is slidably mounted in the arcuate slot 30 in the stanchion 21. The slots 28 slidably and pivotally engage a second pivot pin 31 which is slidably mounted in a vertical slot 32 in the stanchion 21.

In accordance with the invention, the position of pivot pin 29 is adjusted responsive to the selected temperature and the position of pivot pin 31 is adjusted responsive to selected static pressure. In the embodiment of FIGS. 1 and 2, the adjustment of pivot pin 29 is accomplished by means of a T-shaped crank 34 pivotally mounted at 35 on the bracket 36 and having an elongated slot 37 engaging the pin 29. Either arm of the crank 34 can be connected as desired for manual or automatic actuation. In the specific embodiment the arm 34′ is connected by link 38 to the piston rod 39 of a motor 40 of conventional type commonly used in air conditioning units and controlled in the well-known manner by a thermostat positioned in the plenum chamber and diagrammatically shown at 41.

The pivot pin 31 is connected by link 42 to the end of a lever 43 which is pivotally supported at its outer end on a bracket arm 44 projecting outwardly from the stanchion 21. The lever 43 can be connected as desired for actuation manually or automatically. In the specific embodiment, the lever 43 is connected intermediate its ends by link 45 to the piston rod 46 of a motor 47 of conventional type that is controlled in the well-known manner by a static pressure sensing device located in the plenum chamber and diagrammatically shown at 49.

The operation of the mechanism will be apparent from the above description together with the following explanation. Assuming first that the pivot pin 31 is in a fixed stationary position, movement of the pivot pin 29 within the confines of slot 30 will cause the control plates 22, 23 to pivot simultaneously in unison about the pivot pin 31 thus progressively opening one of the dampers and closing the other until the desired temperature is attained. Conversely, assuming the pivot pin 29 to be in fixed stationary position, movement of the pin 31 within the confines of vertical slot 32 will serve to pivot the control plates 22, 23 relative to each other in opposite directions thus progressively increasing or decreasing the total opening provided by the dampers 17, 18 until the desired static pressure in the plenum chamber is attained.

A particular advantage of the mechanism of the present invention is that the adjustment of either the pivot pin 29 or the pivot pin 31 will not disturb the balance which has been set by the other. For example, in FIG. 1 the mechanism is shown with the pivot pin 29 at one extreme of the slot 30 thus setting the mechanism for maximum or minimum temperature depending upon which of the inlets 14, 15 is providing the heated air and which is providing the cooled air. In this position of the mechanism, the damper 17 is entirely closed and the longitudinal slot of plate 22 is in a vertical position. Accordingly, any adjustment of the pivot pin 31 for purposes of adjusting static pressure will not open the damper 17 and thus will not vary the temperature. On the other hand, the longitudinal slot of plate 23 is now in its most inclined position so that maximum adjustment of the open damper 18 is attained to provide the desired pressure regulation. As the pivot pin 29 is progressively moved to the left, the longitudinal slot of plate 22 becomes progressively more inclined while the longitudinal slot of plate 23 becomes less inclined until the opposite extreme is reached with the slot of plate 23 in vertical position and the slot of plate

22 in its most inclined position. The result is that at all intermediate positions of the pin 29 the dampers 17, 18 can be moved by adjustment of pin 31 in proportion to their relative original setting thus maintaining the same relationship of the opening of damper 17 to the opening provided by damper 18 and thereby effecting no change in the resultant temperature in the plenum chamber. Conversely, the adjustment of the setting of pin 29 to vary the temperature causes the plates 22, 23 to pivot in unison so that the total opening of dampers 17, 18 remains substantially constant. The amount of movement imparted to dampers 17, 18 by varying the setting of pin 29 will vary in accordance with the position of pin 31 so that when the dampers 17, 18 are close to the inlets 14, 15 the movement will be correspondingly small and when the dampers 17, 18 are spaced at greater distances from the inlets 14, 15 the movement will be correspondingly increased. Thus the movement of the dampers 17, 18 in response to temperature regulation is automatically adjusted to compensate for the pressure regulation setting with the result that the pin 29 can always be moved throughout the full range of the arcuate slot 30.

In the embodiment shown in FIGS. 3 and 4 of the drawings, a different arrangement has been shown for adjusting the position of the pivot pins 29, 31. In this embodiment, the crank 34 is eliminated and substituted therefor is a horizontal link 50 for manual actuation or attachment to a thermostatically controlled motor (not shown). The pin 31 is mounted on a traveling nut 52 supported on the threaded rod or cable 54 which is journaled in brackets 56 on the rear of the stanchion 21. The position of pin 31 is thus adjusted by turning the rod or cable 54 manually or by a motor operated by a static pressure sensing control (not shown). In all other respects, the mechanism is the same as in FIGS. 1 and 2.

It will thus be seen that there has been provided in accordance with the invention, a damper control mechanism permitting both temperature and static pressure regulation and which combines these functions in an integrated system which affords efficient and effective performance under widely varying operating conditions. The mechanism is simple and inexpensive in construction being formed in large part of sheet metal stampings and is constructed and arranged for trouble-free service over long periods of operation. The control is compact and easy to install and is adapted to be connected for operation in a variety of ways to meet the needs of the particular installation.

As the specific embodiment of the invention will be subject to variation and modification by one skilled in the art, all such variations and modifications are intended to be included within the scope of the invention.

I claim:

1. In an air distributing unit, a plenum chamber having a pair of inlets for receiving air at differential temperatures and varying pressures, a damper for each inlet movable in a closing and in an opening direction relative to the inlet, a pair of levers connected individually to the dampers, a first pivot point for each of said levers, a second pivot point for each of said levers, said second pivot point being movable relative to said first pivot point, means for adjustably positioning said first pivot point thereby to move said levers about said second pivot point to move one of said dampers in an opening direction and the other of said dampers in a closing direction when said second pivot point is fixed in position, and means for moving said second pivot point thereby to vary the moment arm of said levers and to cause simultaneous movement of said dampers in the same control direction when said first pivot point is fixed in position.

2. In an air distributing unit, a plenum chamber having a pair of inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet movable in a closing and in an opening direction, a pair of overlapping lever plates, first means individually connecting each of said lever plates at one end thereof to one of said dampers, said means being adapted to actuate the dampers, means forming a movable pivotal connection between opposite ends of the lever plates, means positioning the pivotal connection to move the dampers in different control directions to control the mixed air temperature, pivot means adjustably supporting the plates and movable toward and away from said pivotal connection, and means to position the movable pivot means to vary the moment arm of the lever plates to effect movement of the dampers in similar control directions and thus to control the mixed air pressure.

3. In an air distributing unit, a plenum chamber having a pair of inlets for receiving air at differential temperatures and varying pressures, a damper for each inlet mounted for movement in a closing and in an opening direction relative to the inlet, a pair of overlapping lever plates having overlying angularly related slots, first means connecting each of the lever plates to one of the dampers and adapted to move the dampers upon movement of the connected lever plate, a pivot for the lever plates disposed in the intersection of the slots, means for varying the location of the pivot comprising a traveling nut secured to the pivot and a rotatable threaded member engaged by the nut, a pivoted connection between the plates spaced from said pivot and on the side of the pivot opposite from said first means, and means for moving the pivotal connection, said first means adapted to actuate the dampers in opposite control directions upon movement of one of the pivots and to actuate the dampers in the same control direction upon movement of the other of said pivots.

4. In an air distributing unit, a plenum chamber having a pair of inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet mounted for movement in a closing and in an opening direction relative to the inlet, a supporting member having angularly related slots, a first pivot mounted for movement in one of said slots, means for positioning the first pivot responsive to mixed air temperature, a second pivot mounted for movement in the other of said slots, means for positioning the second pivot responsive to mixed air pressure, a pair of overlapping lever plates pivotally connected to said first pivot and having overlying angularly related slots engaging the second pivot, and means connecting one of the plates to one of the dampers and connecting the other of the plates to the other of the dampers, said connecting means actuating said dampers in opposite control directions upon movement of said overlapping lever plates in accordance with movement of said first pivot thereby to control mixed air temperature and in the same control direction upon movement of said overlapping plates in accordance with movement of said second pivot thereby to control mixed air pressure.

5. In an air distributing unit, a plenum chamber having a pair of opposed axially aligned inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet, means mounting each of the dampers for movement toward and away from its associated inlet, a first pivot mounted for movement generally in the same direction as the axis of the inlets, means for positioning the first pivot responsive to mixed air temperature, a pair of lever plates pivotally connected to the first pivot, means connecting each of the lever plates to one of the dampers, said plates having overlying angularly related slots, a second pivot disposed in said slots and mounted for movement transversely of the axis of the inlets, and means for positioning the second pivot responsive to mixed air pressure, said connecting means actuating said dampers in the opposite control direction upon movement of said lever plates first pivot thereby to effect

control of mixed air temperature and in the same control direction upon movement of said lever plates in accordance with movement of said second pivot thereby to control mixed air pressure.

6. In an air distributing unit, a plenum chamber having a pair of inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet mounted for movement in a closing and in an opening direction relative to the inlet, a supporting member having a transverse slot and a longitudinal slot, a movable pivot disposed in each of said slots, a pair of overlying lever plates pivotally connected at one end to the one of the movable pivots in the transverse slot and having intersecting angularly related slots engaging the other of the movable pivots, means connecting the end of each lever plate opposite the said one of the movable pivots to one of the dampers, means for moving said one of the movable pivots to effect movement of the lever plates and dampers in opposite control directions to effect control of the mixed air temperature, and means for moving the said other of the movable pivots to effect movement of the lever plates and dampers in the same control direction thereby to effect control of the mixed air pressure.

7. In an air distributing unit, a plenum chamber having a pair of opposed axially aligned inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet, means mounting each of the dampers for movement in an axial direction toward and away from its associated inlet, a supporting member intermediate the dampers having a first slot generally parallel to the axis of the dampers and a second slot transverse thereof, a first movable pivot disposed in the first slot, means for moving the first movable pivot along the first slot, a second movable pivot disposed in the second slot, means for moving the second movable pivot along the second slot, a pair of overlapping lever plates pivotally connected to the first movable pivot and having overlying angularly related slots engaging the second movable pivot, and means connecting each of the lever plates to one of the dampers, movement of said lever plates and said connecting means actuating said dampers in the opposite control direction upon movement of said first pivot to effect control of mixed air temperature, movement of said lever plates and connecting means actuating said dampers in the same control direction upon movement of said second pivot to effect control of mixed air pressure.

8. In an air distributing unit, a plenum chamber having a pair of opposed axially aligned inlets for receiving and mixing air at differential temperatures and varying pressures for discharging through an outlet, a damper for each inlet, means mounting each of the dampers for movement in an axial direction toward and away from its associated inlet, a supporting member intermediate the dampers having an arcuate slot extending generally in the same direction as the axis of the inlets and having a second slot extending transversely of the axis, a first movable pivot disposed in the arcuate slot, means for moving the pivot along the arcuate slot responsive to variations in mixed air temperature, a second movable pivot in the second slot, means for moving the second movable pivot along the second slot responsive to variations in mixed air pressure, a pair of overlapping lever plates pivotally suspended from the first movable pivot, said lever plates having overlying angularly related longitudinal slots engaging the second movable pivot, and a link connecting the free end of each of the lever plates on the opposite side of said slots from said first pivot to one of the dampers whereby movement of the first pivot will move the lever plates and the dampers in the opposite control directions thereby to control mixed air temperature and movement of the second pivot will move the lever plates and dampers in the same control direction thereby to effect control of mixed air pressure.

9. In an air distributing unit, a plenum chamber having a pair of inlets for receiving air at differential temperatures and varying pressures, a control damper for each inlet movable in an opening and a closing direction, a first pivot movable between two extremes, means operating said first pivot, a pair of lever plates pivotally supported on said first pivot having overlying angularly related slots, a second movable pivot engaging said slots, means moving said second pivot in a path to actuate said lever plates about said first pivot at different angular rates, the said path having a configuration such that when the first pivot is at one of its extreme positions the second pivot will not actuate one of said lever plates and when in the other extreme position the second pivot will not actuate the other of said lever plates, and means individually connecting the dampers to the lever members, said connecting means adapted to actuate the dampers in opposite control directions when the levers are actuated by said first pivot and in the same control direction when actuated by said second pivot.

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