Sept. 27, 1955 S. E. LYMAN 2,718,840

AIR CONDITIONING SYSTEM

Filed Aug. 4, 1951 2 Sheets-Sheet 1

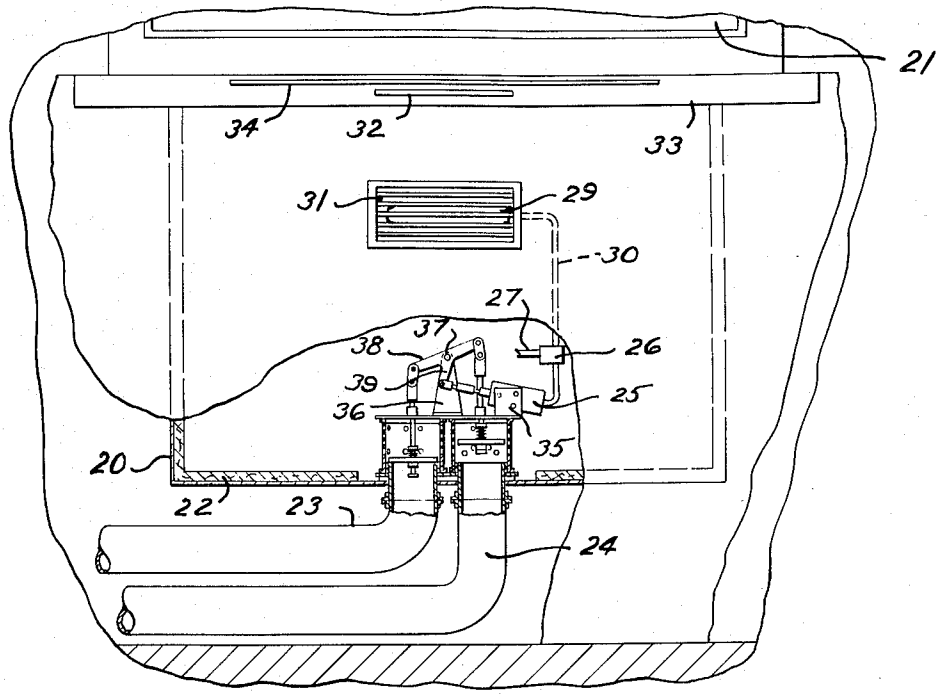


Fig. 1

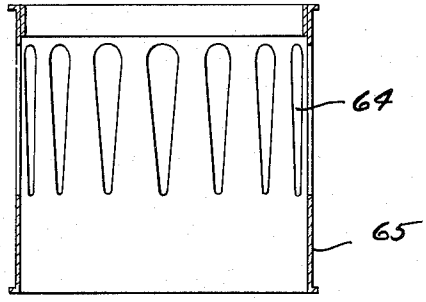


Fig. 4

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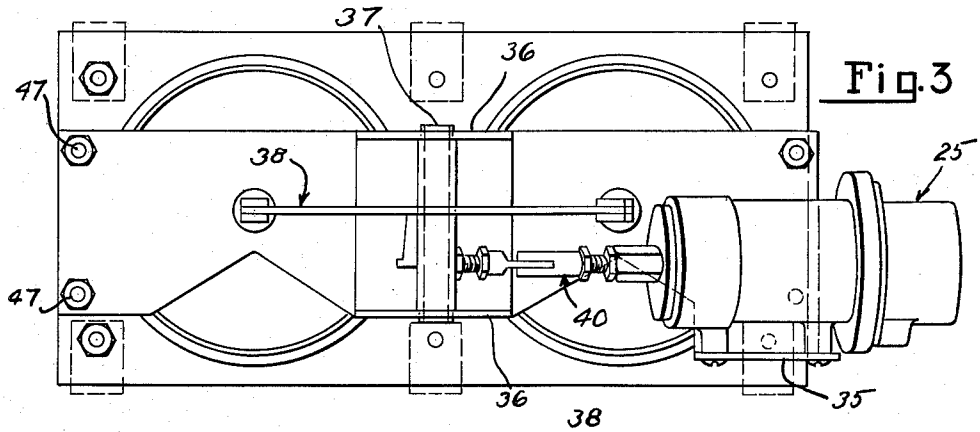


Fig. 3

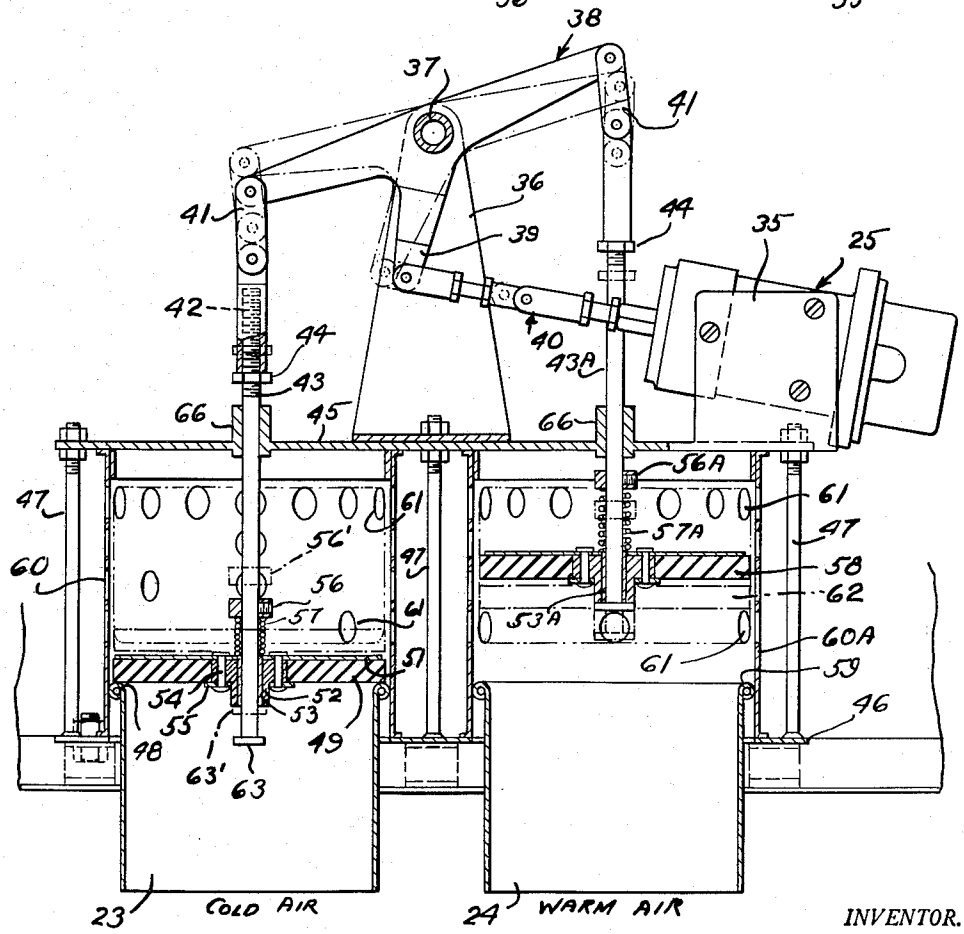


Fig. 2

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2,718,840

Patented Sept. 27, 1955

2,718,840

AIR CONDITIONING SYSTEM

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Application August 4, 1951, Serial No. 240,428

5 Claims. (Cl. 98—38)

This invention relates to air conditioning apparatus and especially to a regulating arrangement for mixing conditioned air before it is admitted into the zone or room.

One of the problems in prior conditioning devices, especially where air is supplied under high pressure, has been objectionable noise in the room due to the conditioning device. Also, when the regulating means controlling the proportionate amount of warm and cold air is operated in response to temperature in the room being conditioned, it is desirable to prevent an upset of the existing conditions because of said change. The problem particularly arises if a closer damper is opened at a time when the other damper already is open. The total amount of air fed from the cold air duct and the warm air duct at any one time should be controlled so that there cannot be a sudden and critical increase beyond a predetermined amount of the total air fed into the room at any one instant. If the total amount of air is not limited, the aforementioned undesirable noise and upset conditions will occur.

As a closed valve is opened, there is a change in the static and velocity head relationship and this is particularly true when a relatively small supply pipe carrying air at relatively high pressure is involved.

One of the objects of the invention is to provide an improved easily adjustable damper arrangement for proportioning the air admitted to a zone or room and wherein objectionable noise and upset conditions will be reduced to a minimum.

The present invention can be employed in conjunction with low pressure air conditioning systems, but it is particularly useful when it is employed with high pressure arrangements. It can be used as described hereinafter, in conjunction with window box type units or ceiling units. Merely as an example, the contemplated high pressure system can be one in which the size of the ducts leading to the dampers controlling air supply to a distributing unit can have a maximum diameter of about 2" to 6" or its equivalent, the pressure being about 2" of water static pressure, and the potential velocity of air in the air ducts being between about 1500 and 3500 feet per minute. The maximum diameter may be as high as 10" for a ceiling type unit.

When using high pressure or high velocity air, pressure reducing zone control distributing units are required. The zone control pressure reducing distributing units can have cold and warm conditioned air fed thereto from one or a plurality of central air conditioning devices.

In a preferred arrangement of the invention, cold and warm air ducts are connected to a pressure reducing zone control distributing unit, dampers being provided for each unit. The dampers can be operated by a damper motor, which in turn can be controlled by a suitable room or zone thermostat. The damper motor can be connected to the damper by yieldable mechanism in the connections of the damper motor and dampers so that when a closed valve is to be opened in response to a condition change, travel of the other valve from an open toward a closed position

will take place before the closed valve opens. In the present invention, further air control means is provided surrounding the damper and located adjacent the duct outlet for cooperating with the dampers in metering or controlling the flow of air to the pressure reducing distributing unit. The damper motor may be a conventional air motor or may be an electric motor.

This invention is an improvement over that disclosed in applicant's copending application, Serial No. 158,840, filed April 28, 1950, now Patent No. 2,620,983. These and other objects, advantages and features of the invention will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

Figure 1 is a fragmentary view, with a portion cut away, depicting a window box type of zone control distributing unit, the right or warm air valve being illustrated in fully open position;

Figure 2 is an enlarged view partially in section of the damper means of Figure 1;

Figure 3 is a top view of Figure 2;

Figure 4 is a modified form of the air control means surrounding the duct such as illustrated in Figures 1 to 3.

The invention will be described in conjunction with a window box type of zone controlling distributing unit wherein the unit is located under the window of a building. It can be used, however, in conjunction with ceiling or other distributing units.

Casing **20** may be located under window **21**, the casing having a suitable sound absorbing material **22** in the inside thereof if desired. Cold air supply duct **23** can be connected with the casing, said duct being connected with the cold air conduit of a central air conditioning apparatus. Warm air duct **24** is shown approximately the same size as cold air duct **23** but it normally is not quite as large. For example, it may be about 80% of the size of the cold air duct. The warm air duct can be suitably joined with the central air conditioning apparatus warm air conduit.

Damper motor **25** may be of any suitable type such as a conventional diaphragm operated air motor. Pressure relay **26** may have control air pipe **27** connected thereto, the relay being controlled by thermostat **29** through line **30**. Thermostat **29** may be located in a duct leading between an intake grille **31** and an outlet passage **32** in the top **33** of the window box casing **20**. The window box casing **20** may have a slot **34** therein for discharging the mixed air at reduced pressure into the room.

Air issuing from outlet slot **34** will cause air to be drawn or aspirated through grille **31** and over the thermostat. It is to be understood that the thermostat may be located as desired in the zone to be controlled.

The damper motor **25** can be adjustably mounted on frame **35**, brackets **36** having a suitable shaft **37** arranged therebetween upon which is mounted connecting arm means **38**. Connecting arm means **38** may have a lever arm **39** with a suitable link **40** (Figs. 2 and 3) connecting it with the piston in the damper motor **25**.

The outer ends of arm means **38** have pivotally mounted thereon clevises or link members **41**, the link members having a screw-threaded aperture **42** therein for adjustably receiving the threaded ends of connecting rods **43**. Lock nuts **44** can be used on said rods for locking them in place after they are adjustably positioned therein.

Rods or plungers **43** may be guided in bushings **66** in plate **45**, plate **45** being secured in place on frame **46** by means of bolts **47**.

Cold air conduit **23** is positioned in frame **46** and can have a seat **48** upon which the valve or damper element **49** may rest so as to close off the cold air conduit. Valve element **49** may be of a suitable valve material such as sponge rubber, or the like.

The valve element 49 can be held by a valve plate 51 which is fastened to guide 52 having a bushing 53 therein for guiding rod 43. The valve assembly is held together by rivets or fastening means 54 passing through suitable apertures in plate 51 and ring 55. Adjustable collar 56 is mounted on rod 43, the collar serving as an abutment for spring 57 which has one end in abutting relationship with plate 51 and also serving to govern the overtravel of rod or plunger 43 relative to the closed valve assembly.

Warm air duct 24 has a damper arrangement which is similar to that described for the cold air duct. Valve or damper element 58 can cooperate with seat 59 to close off the warm air from duct 24. Rod 43A has a collar 56A serving as an abutment for spring 57A, similar to collar 44, rod 43A being guided in bushing 53A in the same manner as described for the cold air damper.

Cylindrical or suitably shaped air control elements 60, 60A are arranged surrounding the opening of ducts 23 and 24 respectively and also surrounding the paths of dampers 49 and 50. The air control elements 60 and 60A may have a plurality of rows of apertures 61 therein, only a few of the apertures being illustrated in Figure 2 in order to simplify the drawing. The valve elements 49 and 58 cooperate with their respective air control means after having opened their conduits so as to suitably control the passage of air into the pressure reducing distributing means.

Yieldable means including rods 43, 43A and springs 57, 57A connecting the damper motor with the dampers can be arranged so that when one of the dampers is fully opened and the damper motor calls for the other conduit to be opened, the fully opened damper will be closed a predetermined amount before the closed damper is opened.

This can be accomplished, for example, as illustrated in Figure 2, cold air damper 49 being shown completely closed and spring 57 being shown compressed. As the damper motor turns the lever arrangement 38 clockwise to the dot-dash position, damper 58 will be moved until it assumes the dot-dash position 62. During this movement, abutment 63 on plunger 43 will move upwardly to the dot-dash position 63' at which time the collar 56 will have moved upwardly to the dot-dash position 56'. When this point is reached, further movement of the motor will open damper 49 because of the contact of abutment 63 with guide 52. It is apparent, however, that such will not occur until damper 58 has moved from a fully open position to position 62.

The initial opening of the damper 49 is arranged so that the apertures in air control element 60 will control the flow of air from conduit 23 in such a manner as to prevent an upset of conditions in the room and so as to prevent noise reaching the room.

An alternate form of air control element or cylinder is illustrated in Figure 4 wherein the rows of apertures of Figure 2 can be replaced by tapered slots 64 in the walls 65. It is possible to change the relationship of the parts by changing the lengths of connections and changing the relative positions of the stop collars 56 and 56A.

It is to be understood that variations may be made in the details of construction without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In an air conditioning apparatus for a zone, the combination including a warm air inlet duct and a cold air inlet duct, a damper for each duct, thermostatically controlled damper operating means, connecting means between said operating means and said dampers for moving one of said dampers toward closing position while moving the other toward open position, each of said connecting means being movably engaged with its damper, yieldable means in each of said connections providing for travel of one of said connections relative to its damper when the damper is closed and before it is opened as the other damper is moved toward a closing position limiting the total volume of air admitted from said ducts as the dampers are operated, and valve members surrounding the path of travel of each damper, said valve members having air control apertures therein in the path of the air and in close proximity to said dampers cooperating with said dampers for controlling the flow of air into said zone.

2. In a high pressure air conditioning apparatus, the combination including a pressure reducing box, a high pressure warm air inlet duct in fluid communication with said box and a high pressure cold air inlet duct in fluid communication with said box, a damper for each duct, thermostatically controlled damper operating means, connecting means between each of said operating means and said dampers for moving one of said dampers toward closing position while moving the other toward open position, each of said connecting means being movably engaged with its damper, yieldable means in said connections providing for travel of one of said connections relative to its damper when the damper is closed and before it is opened as the other damper is moved toward a closing position limiting the total volume of air admitted from said duct at any instant while the dampers are being operated, and means cooperating with said dampers and in the path of the flow of air from said ducts to said box controlling flow of air from a duct into said box after its damper has moved to admit air from its duct to the box.

3. In an air conditioning apparatus, the combination including a pair of dampers, a pair of ducts controlled by said dampers, a damper operating motor, a pivoted arm connected to its respective motor, plungers connecting said arm to said damper for moving one of said dampers toward closing position while moving the other toward opening position, each of said plungers being movably engaged with its damper an abutment on each plunger engageable with its damper, a spring acting on each damper normally urging each abutment into contact with its respective damper, each of said springs being yieldable as its respective damper is closed, said spring for its respective damper being in yielded condition when the other damper is in full open position, so that as the damper motor is operated to open a closed damper, the open damper will close from its full open position before the closed damper is engaged by the abutment on its plunger, adjustable motion limiting means on each of said plungers engageable with a damper to limit motion of the plunger, and valve means surrounding each duct and cooperating with its damper in controlling flow of air therefrom, each valve means having apertures therein.

4. In an air conditioning apparatus, the combination comprising an air distributing means, a pair of air supply ducts and dampers therefor, a plunger slidably connected to each damper, condition responsive means connected to said plunger for each damper, yieldable spring means for overtravel of a plunger after its damper has been closed, adjustable abutment means on each plunger limiting said overtravel, said overtravel governing the amount the other damper closes as the closed damper is opened and limiting the total amount of air supplied at any time while the dampers are being operated, and means surrounding each damper, said means having apertures therein cooperating with its damper for controlling admission of air from its duct into said air distributing means.

5. In an air conditioning apparatus for a zone, the combination including a warm air inlet duct and a cold air inlet duct, a damper for each duct, thermostatically controlled damper operating means, connecting means between said operating means and each of said dampers for moving one of said dampers toward closing position while moving the other toward opening position, each of said connecting means being movably engaged with its

damper yieldable means in said connection providing for travel of one of said connections relative to its damper when the damper is closed and before it is opened as the other damper is moved toward a closing position limiting the total volume of air admitted from said duct at any instant while the dampers are being operated and air control valve members surrounding said ducts adjacent said dampers and in close proximity thereto, said air control members having tapered apertures therein cooperating with said dampers to control flow of air from an opened duct to said zone.

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