

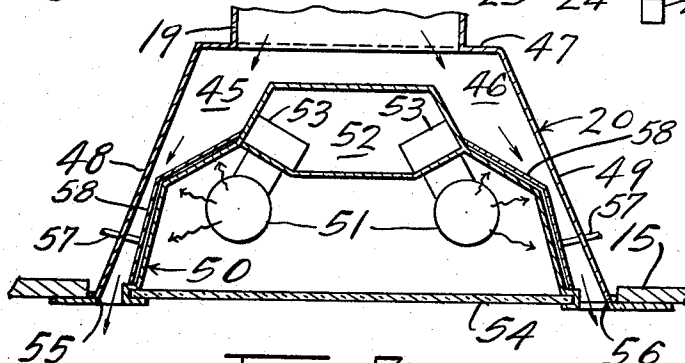
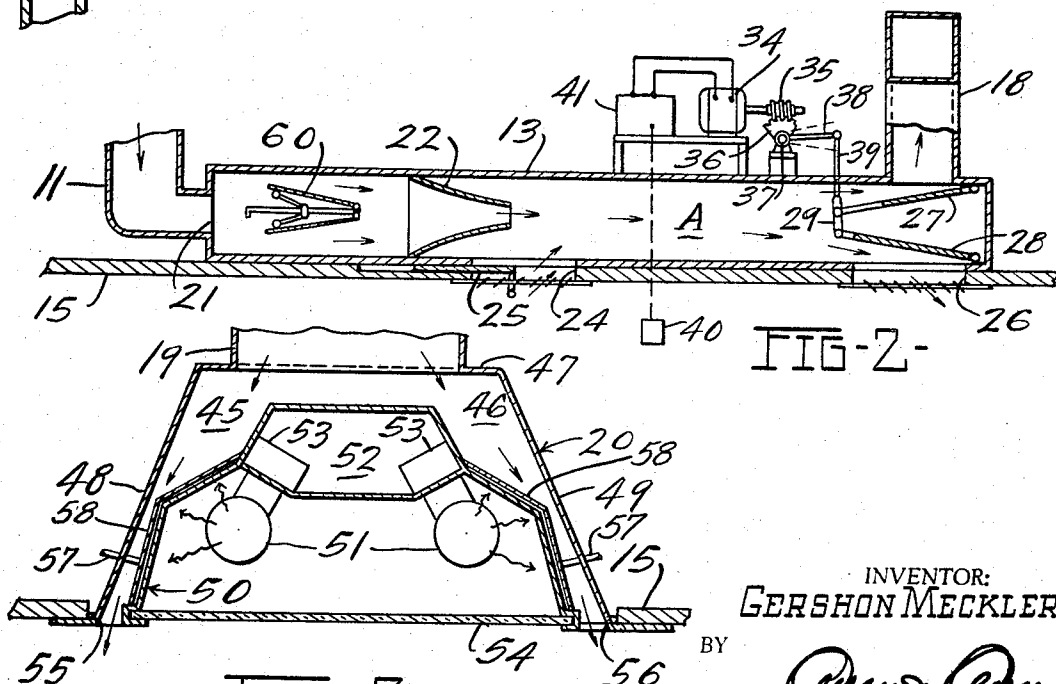
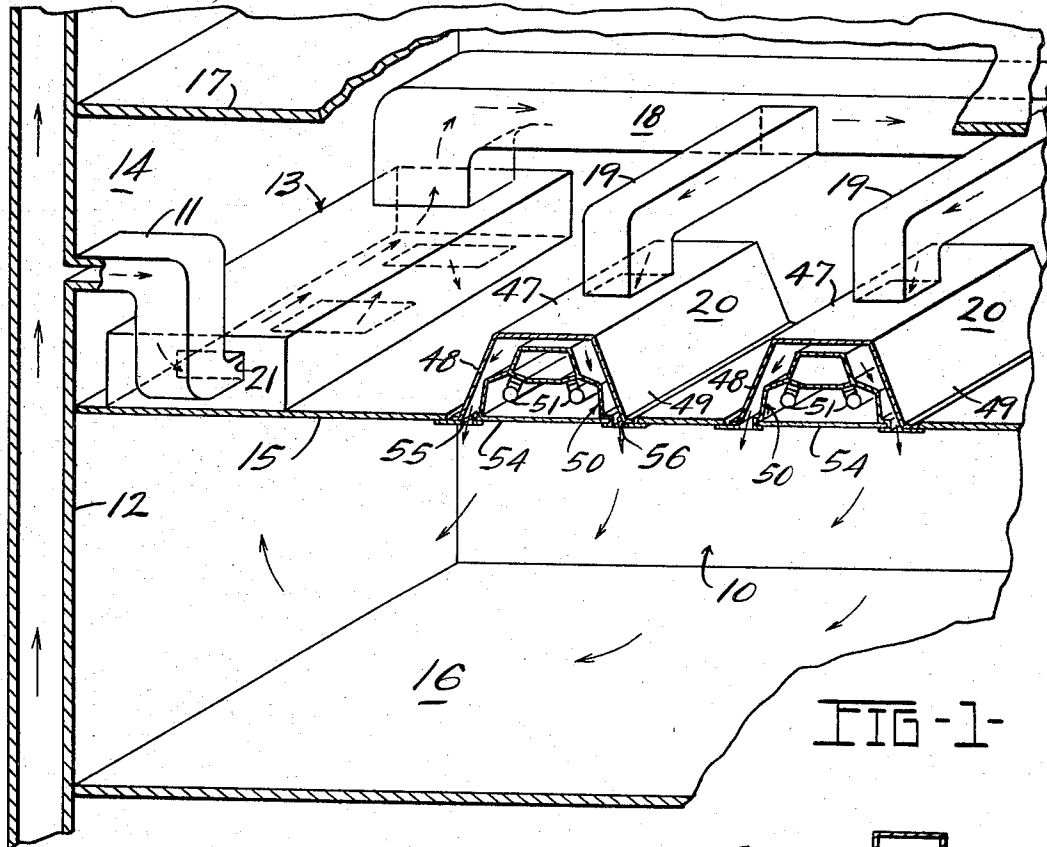
Jan. 7, 1969

G. MECKLER

3,420,439

COMFORT CONDITIONING SYSTEM

Filed Jan. 5, 1967



INVENTOR:
GERSHON MECKLER

BY

Gershon Meckler

ATT'YS.

1

2

3,420,439

COMFORT CONDITIONING SYSTEM

Gershon Meckler, Atlanta, Ga., assignor to Lithonia Lighting, Inc., Conyers, Ga., a corporation of Georgia

Filed Jan. 5, 1967, Ser. No. 607,508

U.S. Cl. 236—13

Int. Cl. F24f 7/04; F24f 13/06; G05d 23/275

4 Claims

ABSTRACT OF THE DISCLOSURE

A comfort conditioning system having a plurality of lighting fixture-heat exchangers in fluid communication with a fluid mixing box. Room or zone inlets and outlets are connected to the mixing box and a primary conditioned air inlet discharges into the mixing box. Control means, which respond to zone heat loads, are provided to supply a mixture of room return air and primary air directly to the room, or to first circulate the mixture to the lighting fixture-heat exchangers, or to circulate the mixture through a combination of both paths.

The present invention is an improvement of the systems disclosed in U.S. Patent No. 3,193,001, and in copending application Ser. No. 563,228, filed July 6, 1966.

A system according to the present invention is capable of providing zone temperature control notwithstanding variations in heat load, and without the necessity for varying the temperature of conditioned or primary air. It is also not necessary to vary the rate at which the conditioned air is supplied. Furthermore, the present invention eliminates the necessity for providing both hot air and cold air supply conduits to the zone which is being comfort conditioned.

Air conditioning systems for large buildings must be designed so that the system has sufficient capacity to handle peak loads. These generally occur in the late afternoon in the summertime. The volume of primary air or conditioned air which must be supplied to handle the peak load, or any load for that matter, is dependent upon the temperature of the primary air, i.e., the lower the temperature of the primary air, the less volume of air is needed to cool a particular room or zone.

The colder the air can be delivered, the less duct space is needed to carry the air. Considerable savings can be realized in the construction of buildings by minimizing ducting. A limiting factor on the temperature at which primary air can be delivered, however, is that when the air is delivered to a room below a temperature of approximately 60° F., it results in discomfort to the occupants of the room.

It is a further object of the invention to provide a system wherein primary conditioned air is mixed with circulated room air, and is thereafter, depending upon the thermal load in the zone, either circulated directly through the room, or is first circulated through one or more lighting fixture-heat exchangers and then circulated through the room, or is circulated through a combination of both paths to the room.

Other objects and advantages will be apparent from the description which follows, reference being made to the accompanying drawings, in which:

FIG. 1 is a partially schematic view in perspective, with parts broken away to show details of a system according to the invention;

FIG. 2 is a partially schematic vertical sectional view of the mixing box shown in FIG. 1; and

FIG. 3 is an enlarged vertical sectional view of one of the lighting fixtures shown in FIG. 1.

Detailed description

Referring now in more detail to the drawings and in particular to FIG. 1, an air conditioning system according to the invention is generally indicated by the reference number 10. The system 10 includes a duct 11 through which primary or conditioned air from a riser 12 is delivered to an air mixing means or mixing box 13. The mixing box 13 is positioned within a plenum 14 between a false ceiling 15 for a zone or room 16 and a floor 17 of a room above (not illustrated). A header conduit 18 from the mixing box 13 and supply conduits 19 lead to a plurality of combination illuminating-heat exchanger-air supply outlets 20, hereinafter for simplicity referred to as lighting fixtures.

Referring to FIG. 2, conditioned or primary air from the supply duct 11 enters the mixing box 13 through a supply inlet 21 and flows from left to right, as shown in FIG. 2, through a nozzle 22, a mixing region A, and then either through an air outlet 26 into the room, or on through header conduit 18 leading to the lighting fixtures 20. Flow of primary air through the nozzle 22 tends to induce a flow of air from the room 16 through a room inlet 24 which communicates with the mixing box 13. The room inlet 24 is provided with a slidable cover plate 25 which opens in a direction opposite to the air flow in the mixing box 13. The cover plate 25 regulates the effective area of the room inlet 24. The flow of air through the room inlet 24 is mixed within the mixing region A with the primary air and then flows through a room air outlet 26 or through the header conduit 18. The flow of air through the outlet 26 and through the header conduit 18 is regulated by cooperating dampers 27 and 28 which are pinned for vertical movement to the mixing box 13. The opposite ends of the dampers 27 and 28 are pinned by a vertical strap 29. In the damper position shown in FIG. 2, air can flow both through the room outlet 26 and through the header conduit 18. This is an appropriate position for the dampers when the thermal load on the room 16 is intermediate.

Referring to FIG. 2, the positions of the dampers 27 and 28 are controlled by a motor 34 which mounts a worm 35 on its output shaft. When the worm 35 is driven, a sector 36 is rotated about a shaft 37. An arm 38 is fixed to the shaft 37 and rotation of the shaft 37 moves the free end of the arm 38 upwardly or downwardly, depending upon the direction of rotation of the worm 35. The limits of movement of the arm 38 are indicated by the dashed lines in FIG. 2. The free end of the arm 38 is pivotally connected to a rod 39 which in turn is pinned to the strap 29. The clockwise rotation of the arm 38 causes downward movement of the strap 29 and the dampers 27 and 28. One limit of movement is where the damper 28 fully closes the room air outlet 26. This is the damper position when maximum heating of the admixed air is desired. Counterclockwise rotation of the arm 38 moves the dampers 27 and 28 upwardly, the limiting position being one where the damper 28 fully closes the entrance to the header conduit 18. This position is desired when no heating of the admixed air is needed. The motor 34 is reversible and is controlled, as shown in FIG. 2, by a thermocouple 40 which senses the dry bulb temperature in the room 16 as distinguished from the temperature of air discharged from the room outlet 26. The thermocouple 40 transmits a signal to a motor controller 41 which operates the motor 34 to position the cooperating dampers 27 and 28 at their lower limit when maximum heating is required, at their upper limit when minimum heating is required, or at any required intermediate position when intermediate heating is required.

The lighting fixtures-heat exchangers 20 used to heat

the admixed air can be of any desired type. Preferably, the lighting fixture 20 includes opposed air supply passageways 45 and 46 which are defined between a top wall 47, opposed sidewalls 48, 49 and an inner troffer 50. End walls (not shown) are provided at the opposed ends of the lighting fixture 20.

The troffer 50 is preferably constructed of a heat conductive material. Heat from a plurality of lamps 51 is transferred to the air streams passing through the passageways 45 and 46.

Preferably heat exchange means, for example, fluid conduits 57 containing cooled water for circulation through a passage 58, are provided adjacent the walls of the troffer 50 to remove waste heat from the lamps 51 when such heat is not required to heat the air streams within the passageways 45 and 46.

The troffer 50 includes an electrical conduit chamber 52 which in turn mounts a plurality of lamp sockets 53. The lamps 51 depend from the lamp sockets 53. A light diffusing panel 54 is removably positioned at the bottom of each lighting fixture 20.

Elongated slots 55 and 56 are provided along the bottom sides of the lighting fixture 20 adjacent the diffusing panel 54. The slots 55 and 56 are in fluid communication with the passageways 45 and 46. Heated admixed air passes through the elongated slots 55 and 56 into the zone or room 16. Of course, the discharge slots 55 and 56 may be of any configuration and may consist of, for example, a plurality of longitudinally spaced holes (not shown).

The optimum volume of primary conditioned air, per unit of time, to be delivered to the room 16 will be dependent upon many factors, including the heat load on the room from all sources, the magnitude of the variation in heat load, e.g., that attributable to outside conditions, including ambient dry bulb temperature and solar load, as well as that attributable to occupancy of the room.

The mixing box 13 includes a damper 60 of the umbrella type which can be driven from the retracted position, shown in solid lines in FIG. 2 to the full open position (not shown). The damper 60 may be operated either manually or automatically. For automatic operation a bellows-compressed air unit (not shown) may be used.

The invention is capable of providing zone control over temperature notwithstanding variations in thermal load, and without the necessity for varying the temperature or rate of the primary air. However, the system is also applicable where primary air is delivered at a varying rate or temperature.

It will be apparent that a system according to the invention enables individual zone or room control of temperature even though only one stream of conditioned primary air is supplied. This is possible because the system utilizes what may be denominated local, controlled heating means as required. As noted above, excessively cold conditioned air cannot be used in an air conditioning system because if it is delivered directly to the space to be conditioned, a condition of discomfort is the consequence. However, in the system of the invention, primary conditioned air is always mixed with room air, e.g., at about 75° F. dry bulb temperature, and this in turn is either heated by passing it over the lighting fixtures 20 or is discharged directly to the room 16 depending on zone thermal requirements. Accordingly, the mixture of air delivered from the mixing box 13 through the room outlet 26 or through the lighting fixture slots 55 and 56 is always at a temperature appreciably higher than that of the primary conditioned air itself. This means that the conditioned primary air can be at a temperature sufficiently low that it would cause discomfort if delivered directly to the room 16 and, therefore, a lower primary air rate is required to perform any given air conditioning function. The system enables the use of risers and ducts of minimum size to carry conditioned air, minimizing the dead space in the building needed to accommodate the ductwork.

Substantial savings in construction costs result from the utilization of the present system within a new building structure.

It will be apparent that various changes and modifications can be made from the specific details set forth herein without departing from the spirit and scope of the invention as defined in the appended claims, and that, in its essential details, the invention constitutes an air conditioning system which comprises, in combination, an air supply conduit having at least one air outlet into a room. Means forming an air inlet passage are provided from the room to the conduit. Means for supplying a primary flow of conditioned air to the air supply conduit are also provided. When conditioned or primary air is so supplied, it tends to cause a flow of room air through the inlet passage; to cause mixing of the flow of air with the primary air in the supply conduit; and to cause subsequent discharge of the mixture to the room through the air inlet or through a lighting fixture-heat exchanger device. Means for controlling the relative proportions of the flow of air through the air outlet and the illuminating and the lighting fixture are also included in a system constructed according to the present invention.

What I claim is:

1. A system for conditioning air within a zone comprising, in combination, air mixing means having a first air outlet into the zone and a second air outlet, at least one lighting fixture positioned adjacent the zone, said lighting fixture including heat exchange means for removing excess heat, said lighting fixture being in fluid communication with said second air outlet, means forming an air inlet passage from the zone to said air mixing means, means for supplying a primary flow of conditioned air to said air mixing means, said primary flow supply means being effective when conditioned air is so supplied to tend to cause a flow of zone air through said air inlet passage and effective to cause mixing of the flow of zone air with the primary conditioned air in said air mixing means and subsequent discharge of the mixture to the zone through said first air outlet, said second air outlet and said lighting fixture, whereby the mixture is heated by said lighting fixture prior to entering the zone, and damper means for controlling the relative proportions of the flow of the mixture through said first and second air outlets.

2. A system for conditioning air within a room, said system comprising, in combination, an air mixing box having at least one air outlet into the room and an outlet to an air supply conduit in fluid communication with at least one lighting fixture, said lighting fixture defining an air passageway and being effective to transfer heat to an air stream within such passageway, means forming an air inlet passage from the room to said mixing box, means for supplying a primary flow of conditioned air to said mixing box, and effective, when conditioned air is so supplied, to tend to cause a flow of room air through such air inlet passage and to cause mixing of the flow of room air with the primary conditioned air in said mixing box, damper means for controlling the relative proportions of the admixed air entering said room air outlet and said air supply outlet, and heat exchange means for removing excess heat from said light fixture.

3. The system for conditioning air as defined in claim 2, including control means effective to regulate said damper means, said control means comprising temperature responsive means for sensing the instantaneous temperature within the room, motor means operatively connected to said damper means and to said temperature responsive means, whereby when the room temperature falls below a predetermined temperature level, said control means regulates said damper means to increase the relative proportion of admixed air flow through said air supply outlet which is in communication with said lighting fixture, and whereby, when the room temperature rises above

5

the predetermined temperature level, said control means regulates said damper means to increase the relative proportion of admixed air flow through said air outlet leading directly to the room.

4. The system for conditioning air of claim 2 which further includes means for regulating the rate of the primary flow of conditioned air through said air mixing box.

References Cited

UNITED STATES PATENTS

2,575,907 11/1951 Carlson ----- 236—13 XR

10

6

2,884,228	4/1959	Jorgensen -----	165—103
3,065,686	11/1962	Geocaris -----	98—40
3,114,505	12/1963	Kennedy -----	236—13
3,318,225	5/1967	May -----	236—13 XR
3,361,157	1/1968	Schoch.	

ROBERT A. O'LEARY, *Primary Examiner*.
M. A. ANTONAKAS, *Assistant Examiner*.

U.S. Cl. X.R.

236—49; 98—38, 40; 165—53