

[54] BUILDING HEATING AND COOLING SYSTEM

[76] Inventor: Joseph F. Gazzo, 1303 McKinley Ave., Des Moines, Iowa 50315

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Primary Examiner—Charles Sukalo

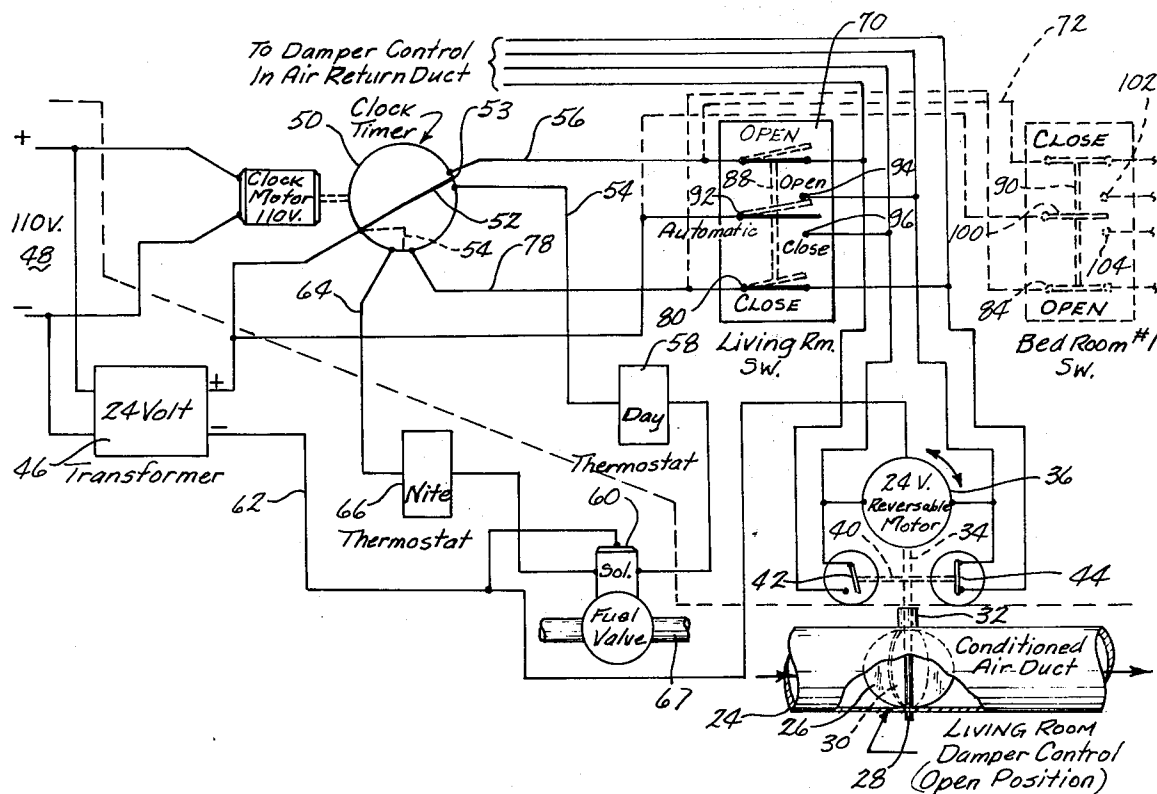
Attorney, Agent, or Firm—Zarley, McKee, Thomte & Voorhees

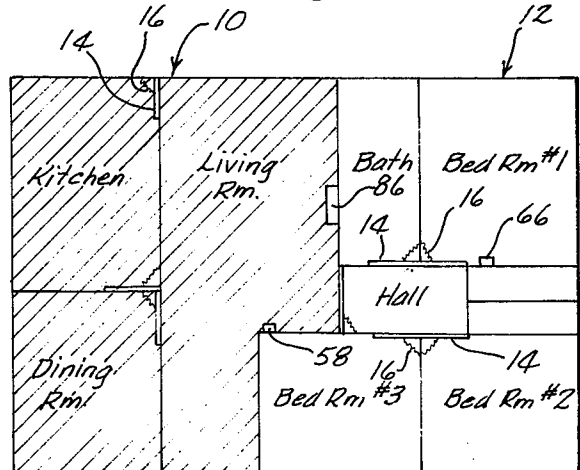
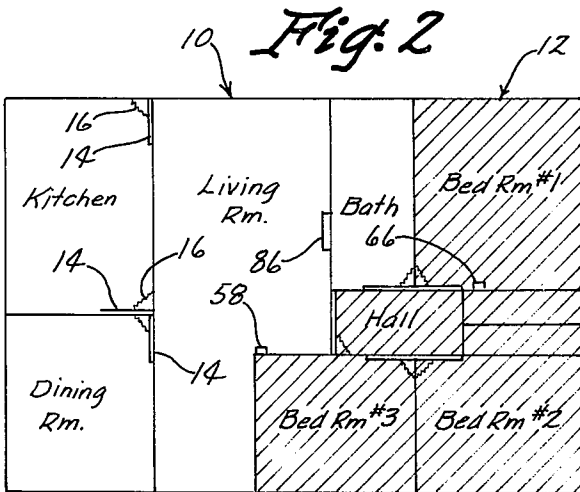
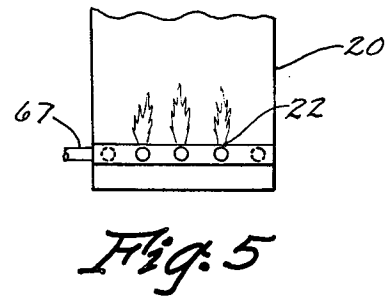
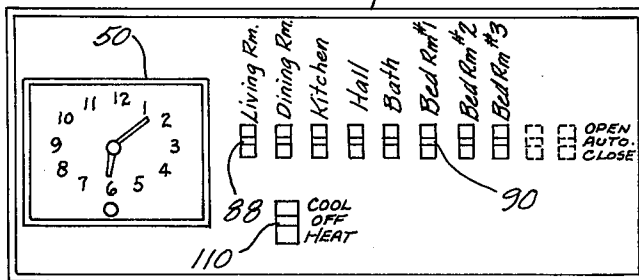
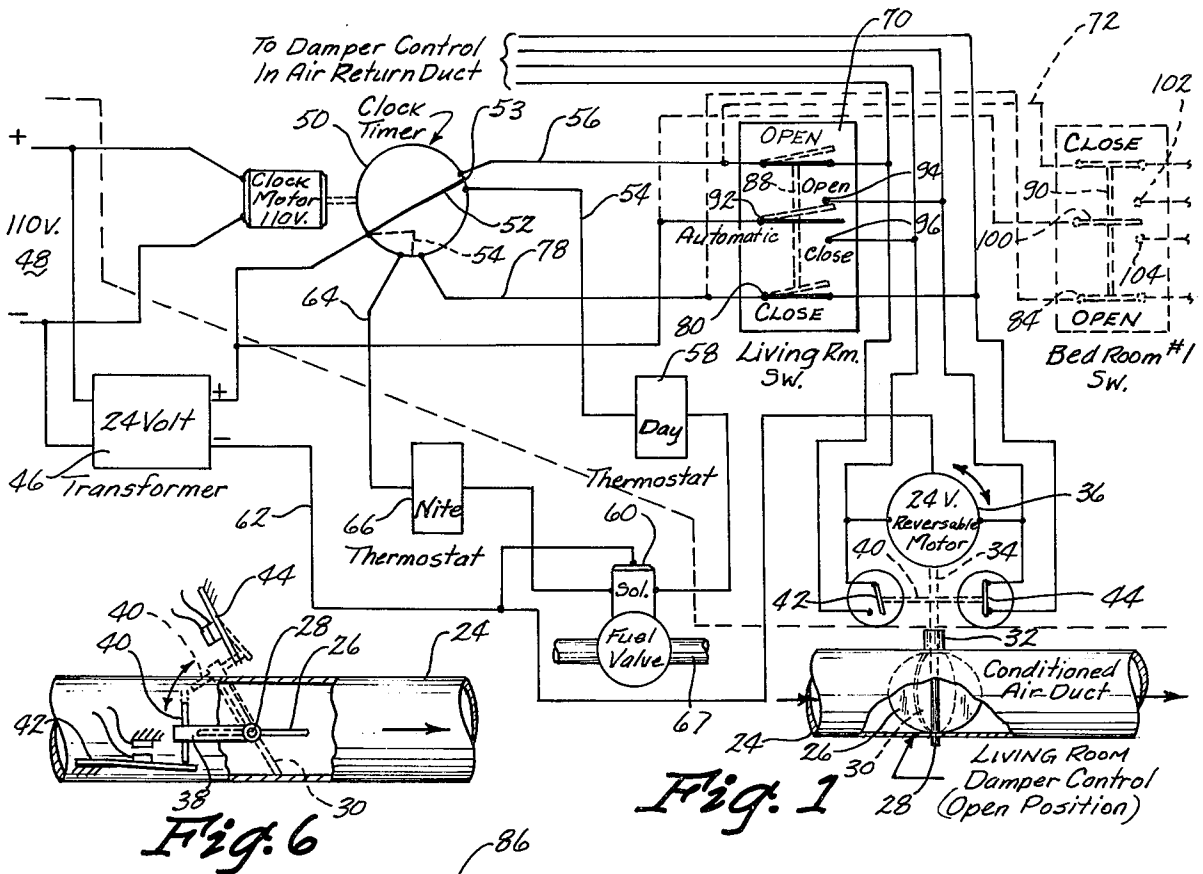
[57] ABSTRACT

A home includes a zone of rooms used in the daytime and a second zone includes rooms used in the evening. A furnace is provided for heating and cooling each of the rooms in each of the zones. A damper having a re-

versible motor is provided in each of the ducts applying conditioned air to each of the rooms. The fuel valve is controlled by separate thermostats for each of the zones in turn controlled by a clock timer. At the beginning of the evening period the clock timer closes a circuit through the reversible motors closing the dampers in the daytime rooms and opening the dampers in the nighttime rooms and also closing a circuit through the nighttime thermostat for operating the solenoid fuel valve. When the damper has moved to its open or closed position it opens a limit switch stopping the reversible motor. The other switch is closed and ready to make a circuit through the reversible motor at the beginning of the daytime period as set on the clock timer when a circuit will then be made again through the reversible motor closing the dampers in the rooms in the nighttime zone and opening the dampers in the rooms in the daytime zone. The circuit through the nighttime thermostat is now open and the daytime thermostat is closed for controlling the fuel valve. Similar dampers may be provided in the air return ducts if desired. A manual switch is provided for each damper which, when actuated, opens up the circuits including the clock timer thereby holding the dampers in either closed or opened positions as desired.

10 Claims, 6 Drawing Figures





BUILDING HEATING AND COOLING SYSTEM

The ordinary home generally heats all rooms substantially uniformly during the day and the night. The same is true if air conditioning is available. This system necessarily results in a waste of energy due to the fact that the rooms used during the daytime do not require conditioned air during the evening hours and conversely the bedrooms do not require conditioned air during the day hours.

The heating and cooling system of this invention provides conditioned air to these two zones on the basis of usage as controlled by a timer clock. Ducts leading from the furnace to each of the rooms include dampers which are automatically opened and closed in response to the operation of a reversible motor connected to the dampers and controlled by circuits including the timer clock. Circuits are also selectively made through the timer clock which include alternately thermostats for each of the two zones. If it is desired to continuously provide conditioned air to an individual room a switch may be operated that will cause the damper for that room to be opened and the circuits including the timer clock controlling that motor are also opened. Conversely, if it is desired to close off a room permanently a manual switch may be thrown which will cause the damper to move to a closed position and simultaneously open switches in the circuits including the timer clock and the reversible motor.

Existing homes may be converted to the heating and cooling system of this invention by addition of the reversible motors to the existing dampers. An additional thermostat will be required along with a control panel for the timer clock and manual control switches.

The timer clock may be set as desired but conveniently would be set to provide conditioned air to the zones in advance of use by occupants of the house.

It is apparent that utilization of the heating and cooling system of this invention will result in substantial savings in fuel throughout the entire year as only the rooms in the house that are actually being used are heated or cooled.

This invention consists in the construction, arrangements and combination of the various parts of the device, whereby the objects contemplated are attained as hereinafter more fully set forth, specifically pointed out in the claims, and illustrated in the accompanying drawings in which:

FIG. 1 is a diagrammatic electrical schematic drawing of the heating and cooling system of this invention.

FIG. 2 is a plan view of the master control panel.

FIGS. 3 and 4 are floor plans for a typical house showing the rooms included in each of the zones which will be ultimately provided with conditioned air.

FIG. 5 is a side elevation diagrammatic view of a furnace burner unit, and

FIG. 6 is a fragmentary side elevation view of the damper in the living room conditioned air duct as taken along line 6 - 6 in FIG. 1.

The heating and cooling system of this invention is incorporated into a home having a floor plan as seen in FIGS. 3 and 4. The shaded areas in FIGS. 3 and 4 represent zones 1 and 2, respectively, and these zones are referred to by the reference numerals 10 and 12. It is seen that zone 1 sometimes referred to as the "day" zone includes the kitchen, dining room and living room while zone 2 sometimes referred to as the "night" zone

includes the sleeping quarters or bedrooms. It is further seen that each of the rooms are provided with doors 14 to maintain zones 1 and 2 isolated from each other. Each of the doors include spring means 16 to maintain them in the normally closed condition.

The house on which this system is utilized will include a conventional furnace which may have air conditioning equipment incorporated therein and will include a burner 20, as seen in FIG. 5, having burner elements 22. Each of the rooms will be connected to the furnace by ducts such as the duct 24 for providing conditioned air to the living room. Return ducts may also be conventionally provided. Each of the ducts will include a damper 26 rotatable on a shaft 28 to open and close the duct as seen in FIG. 1 wherein the duct for the living room is illustrated. The solid-line position indicates an open position while the dash-line position 30 illustrates a closed position. The shaft 28 is connected by coupling 32 to the shaft 34 of a reversible motor 36. Outside of the duct 24 on the shaft 28 is an arm 38 which carries an actuating element 40 for engagement with limit switches 42 and 44 as the damper moves between open and closed positions. The actuating element 40 is adjustable so that the contact with the switches 42 and 44 may be controlled as desired. The switches are normally closed and thus are opened by the damper upon completion of a move from one position to another.

The reversible motor 36 is operated off a 24 volt transformer 46 connected to a 110 power source 48. The transformer is connected to a clock timer 50 which includes alternate circuits 52 and 54 through it. The solid line circuit 52 is connected to a terminal 53 in turn connected to what is referred to as first and third circuits 54 and 56. The first circuit 54 includes the day thermostat 58 which in turn is connected to the fuel valve solenoid 60 which is provided with a return line 62 to the transformer 46. A second circuit 64 is connected to a night thermostat 66 in turn connected to the fuel valve solenoid 60. The fuel line 67 is, of course, connected to the burner 20.

Referring again to the third circuit 56, it is seen that it includes a normally closed switch 70 which is connected to the normally closed limit switch 42 shown held open by the damper actuating element 40 in FIGS. 1 and 6. A line 72 is connected to the third circuit 56 between the switch 70 and the clock timer 50 and is connected to a normally closed switch 74 in turn connected to a reversible motor (not shown) for the bedroom No. 1 damper. It is seen that the dampers in the ducts for rooms in zone 1 will be opening when the dampers in rooms in zone 2 will be closing and vice versa. Thus it is seen that the third circuit 56 serves to open the daytime dampers and close the nighttime dampers. The fourth circuit 78 is connected to a switch 80 in turn connected to the limit switch 44 seen closed in association with the open damper 26 in FIG. 1. A clock timer 50 is also connected through the third circuit 56 to a switch 84 for the bedroom No. 1 damper. It is understood that the living room switches 70 and 80 and damper operation are similar for all of the daytime or zone 1 rooms while the nighttime switches 74 and 84 for bedroom No. 1 are similarly equivalent for the nighttime rooms in zone 2. Thus when the dampers in the daytime zone 1 rooms are open the dampers in the nighttime rooms of zone 2 are closed and vice versa.

Manual operation of the dampers is possible through use of a master control panel 86 having three positioned actuators for operating the dampers between open and closed and automatic positions. Representative of these actuators are the ones for the living room and bedroom No. 1 referred to by the reference numerals 88 and 90, respectively. It is seen that the switches 70 and 80 are linked together by the actuator 88 as well as a switch 92 movable between open and closed positions 94 and 96, respectively. The switch 92 connected directly to the transformer 46 is in turn connected to the limit switches 42 and 44. Thus it is seen that moving the actuator 88 to the center automatic position renders the switch 92 inoperative and closes the switches 70 and 80 and conversely when the actuator 88 is moved either to an up open position or a down closed position for contact with the terminals 94 and 96, respectively, the switches 70 and 80 are moved to open positions. In the case of the zone 2 dampers, as illustrated by the bedroom No. 1, the switch 100 is movable between contacts 102 and 104 for closing and opening the damper respectively and simultaneously opening the switches 74 and 84.

Thus in operation it is seen that an existing heating system can be modified to incorporate this invention therein by providing on each of the dampers a reversible motor 36 and the associated limit switches 42 and 44 through the use of the coupling 32 connecting the shaft 34 to the damper shaft 28. An additional second thermostat such as the night thermostat 66 is connected to the solenoid fuel valve 60 for controlling it in response to the clock timer 50 which is added to the system along with the switches 70, 80 and 92 for the living room damper 26 which is representative of each of the other rooms in both zones 1 and 2. The clock timer is of a conventional design and provides alternate circuits through it according to a programmed schedule. Thus the daytime circuits 1 and 3 would be connected to the transformer through the conductor 52 in the clock timer 50 during daytime hours such as 7:00 A.M. to 10:00 P.M., and the conductor 54 would connect the transformer 46 to the third and fourth circuits for nighttime operation during the hours 10:00 P.M. through 7:00 A.M.

As seen in FIG. 1, a circuit is made from the transformer through the clock timer via the conductor 52 to the first and third circuits 54 and 56 thus placing in operation the daytime thermostat 58 for controlling the solenoid valve 60. At this time the nighttime second and fourth circuits are open due to the open condition of the conductor 54 in the clock timer. The third circuit 56 including the closed switch 70 is as shown open at the damper 26 by virtue of the switch 42 being held in an open position by the actuator element 40. At the beginning of the daytime period at for example 7:00 A.M., the damper 26 moved from a closed position to an open position thereby at the completion of that movement the switch 42 was opened by the actuator element 40 thus energizing the fourth circuit to close the damper at the beginning of the nighttime period at 10:00 o'clock when the second and fourth circuits are closed through the timer 50. Thus at 10:00 o'clock the fourth circuit including the switch 80, which is shown closed, would energize the reversible motor 36 through the limit switch 44 which is closed to operate the motor and move the damper 26 to the closed position indicated by the reference numeral 30 and the turning of

the damper would be stopped by the actuating element 40 opening the switch 44 and simultaneously allowing the switch 42 to move to its normally closed position whereupon at 7:00 A.M., the procedure would be repeated and the first and third circuits would be energized with the motor 36 being operated by the third circuit 56 through the limit switch 42 now closed. When the damper 26 had moved to its open position it would again open the switch 42 to stop the motor 36 and simultaneously close the switch 44 readying the system for closing the damper come 10:00 o'clock in the evening. As previously indicated, the dampers for the zone 2 nighttime rooms are operating 180° out of phase and are closed when the zone 1 dampers are opened and open when the zone 1 dampers are closed.

The night thermostat 66 is seen in FIGS. 3 and 4 as being located in bedroom No. 1 and could conveniently be located in either of the other zone 2 bedrooms while the daytime thermostat 58 is located in the living room as a matter of convenience. The control panel 86 is located in either zone 1 or 2 but is shown in living room as a matter of convenience. A conventional actuator 110 on the control panel 86 is provided for providing cooling or heating as is required. This switch can also be moved to an off position to make the system inoperative.

It can be appreciated that through use of the selective heating and cooling system of this invention it will be possible to use smaller heating and cooling units since ordinarily at any one time only approximately half of the house is being heated or cooled. Therefore, as indicated in FIG. 5, a conventional burner having five heating elements 22 could be reduced in size by eliminating some of the elements such as indicated by the dash line outer elements leaving the three middle elements. Air conditioning requirements would be reduced correspondingly.

I claim:

1. A building heating and cooling system for providing conditioned air alternately to two zones of the building comprising,
 - a conditioned air source having an electrical control means movable between open and closed positions,
 - an output conditioned air duct connected between each zone and said air source,
 - a damper in each duct having a reversible motor for moving said damper between open and closed positions,
 - a pair of limit switches alternately opened and closed by said damper as it moves between said open and closed positions,
 - a thermostat for each zone,
 - a clock timer connected to an electrical power source and including alternate circuits there-through for operating said damper motors,
 - a first circuit for operating said electrical control means including said power source, one timer circuit, a thermostat for one zone and said electrical control means,
 - a second circuit for operating said electrical control means including said power source, the other timer circuit, the thermostat for the other zone and said electrical control means whereby said electrical control means at times set on said timer is operated by said one circuit and at other times by said second circuit,

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a third circuit for operating said damper motors and opening said dampers in one zone and closing them in the other zone including said electrical power source, said one timer circuit, one of said limit switches and said damper motor,

a fourth circuit for operating said damper motors and closing said dampers in one zone and opening them in the other zone including said electrical power source, the other timer circuit, the other of said limit switches and said damper motor whereby at times said conditioned air source supplied conditioned air only to said one zone of said building having dampers open and at other times supplies air only to said other zone having dampers open.

2. The structure of claim 1 wherein return air ducts extend between said zones and said conditioned air source and motor operated dampers are provided in said ducts for operation with the dampers in said output ducts whereby said dampers in said output and return ducts are simultaneously either open or closed for each zone.

3. The structure of claim 1 wherein fifth and sixth circuits are provided for manually operating said dampers in each of said zones, said fifth and sixth circuits each including said power source, a normally open switch, and said damper motor and means for rendering said fourth and fifth circuits inoperative whereby selected dampers in each zone can be maintained continuously selectively open or closed independently of said timer.

4. The structure of claim 3 wherein said means for rendering said third and fourth circuits inoperative includes a linkage means connecting said normally open switches to normally closed switches in said third and fourth circuits and upon said normally open switches

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being actuated to a closed position said normally closed switches are moved to an open position.

5. The structure of claim 1 wherein said first circuit of said clock timer is open during night hours and closed during day hours and said second circuit is closed during night hours and open during day hours.

6. The structure of claim 1 wherein said electrical control means for said conditioned air source is further defined as a solenoid valve in a fuel line connected to said conditioned air source further defined as a furnace having a burner for hot air and an air conditioner for cool air.

7. The structure of claim 1 wherein said first zone is further defined as including the day living rooms of a house and the second zone includes the evening rooms.

8. The structure of claim 1 wherein said limit switches are normally closed and said damper upon reaching an open position actuates said one limit switch in said third circuit to an open position thereby opening the third circuit and stopping the damper motor, and said damper upon reaching a closed position actuates said other limit switch in said fourth circuit to an open position thereby stopping the damper motor.

9. The structure of claim 8 wherein said dampers include a shaft extending outwardly of said duct and an actuating arm is provided on said shaft to move therewith and said limit switches are positioned in the path of said actuating arm for alternate engagement therewith as said damper moves between said open and closed positions.

10. The structure of claim 9 wherein a coupling is provided on said shaft and is connected to the output shaft of said reversible motor.

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