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Air Distribution Fan Recycling Control

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Rudd

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[54] **AIR DISTRIBUTION FAN RECYCLING CONTROL**

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[51] **Int. Cl.**[6] **F24F 7/00**; F24F 1/00

[52] **U.S. Cl.** **165/244**; 62/231; 236/49.3; 454/233; 165/270

[58] **Field of Search** ..... 236/49.3, 46 R; 454/256, 258, 229, 233; 165/16, 12; 62/231

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[57] **ABSTRACT**

An system for controlling the operation of the circulating fan of a closed central air conditioning(CAC) system is disclosed. The system periodically activates and deactivates only the circulating fan after a preselected delay time from the normal running of the cooling and heating modes of the CAC system. The preselected delay time is adjustable based on non thermostat parameters and include parameters such as room volume size to be ventilated and the number of occupants in the room. The control can periodically distribute and mix ventilation air or spot-conditioned (humidified, de-humidified, or cleaned) air while the CAC system is not running in the heating, cooling or constant fan modes. The cooling and heating modes of the CAC system operate independently of the fan recycling control.

18 Claims, 5 Drawing Sheets

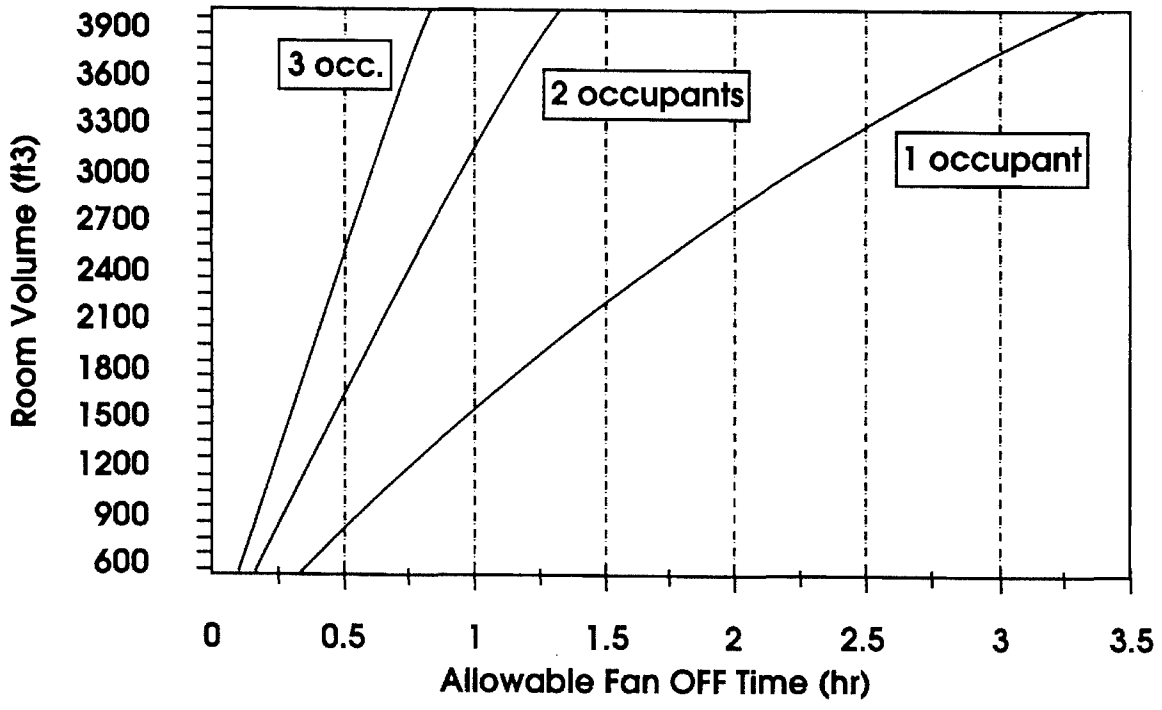
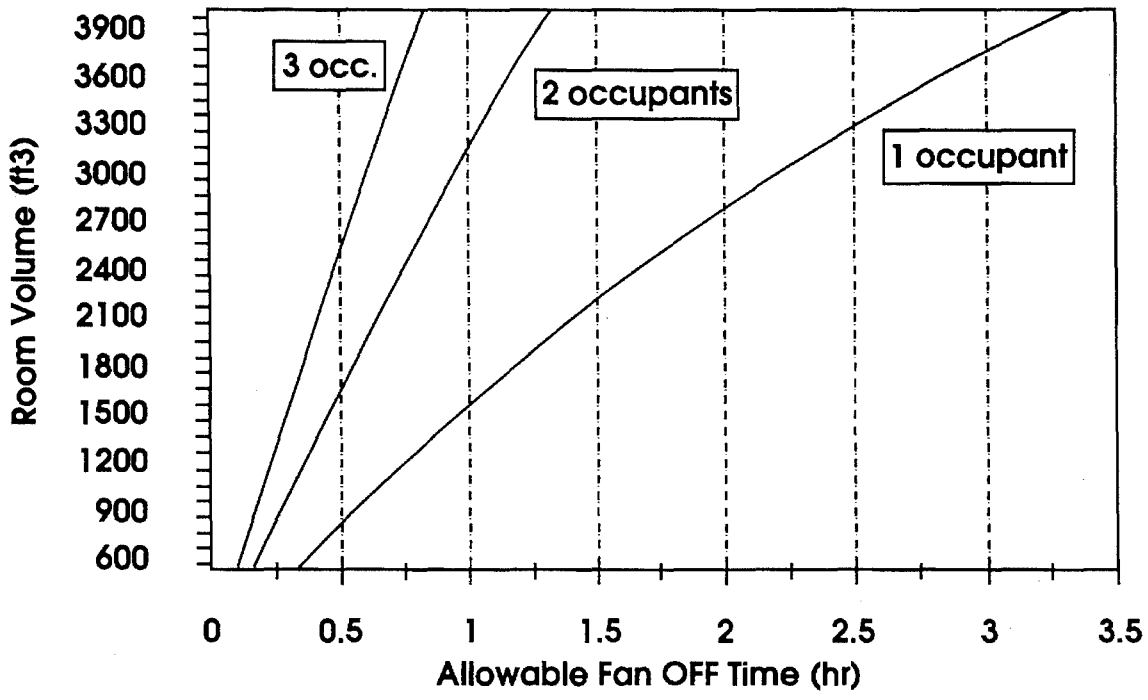


Figure 1


3900
3600
3300
3000
2700
2400
2100
1800
1500
1200
900
600
Room Volume (ft3)
3 occ.
2 occupants
1 occupant
0
0.5
1
1.5
2
2.5
3
3.5
Allowable Fan OFF Time (hr)

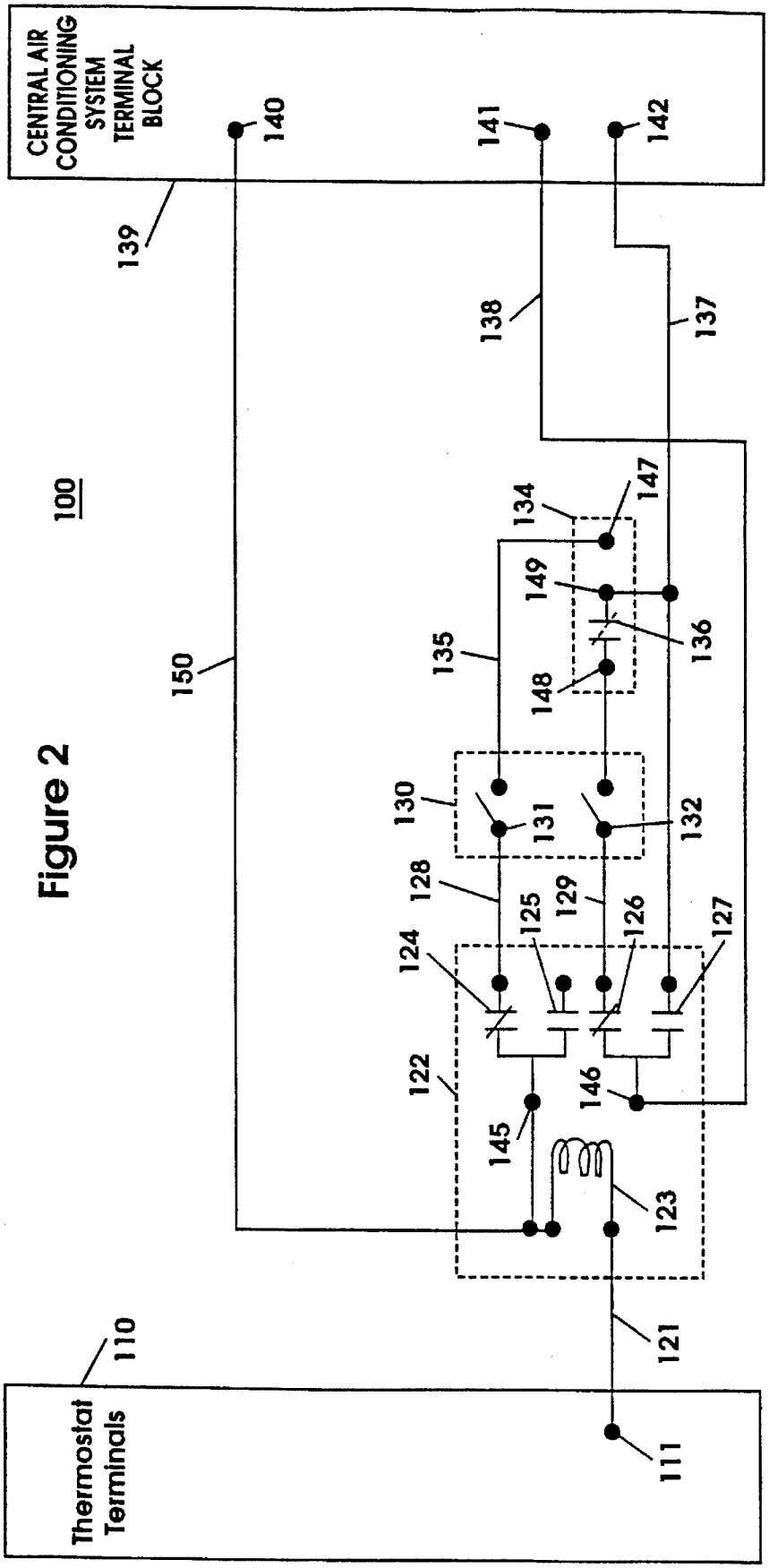
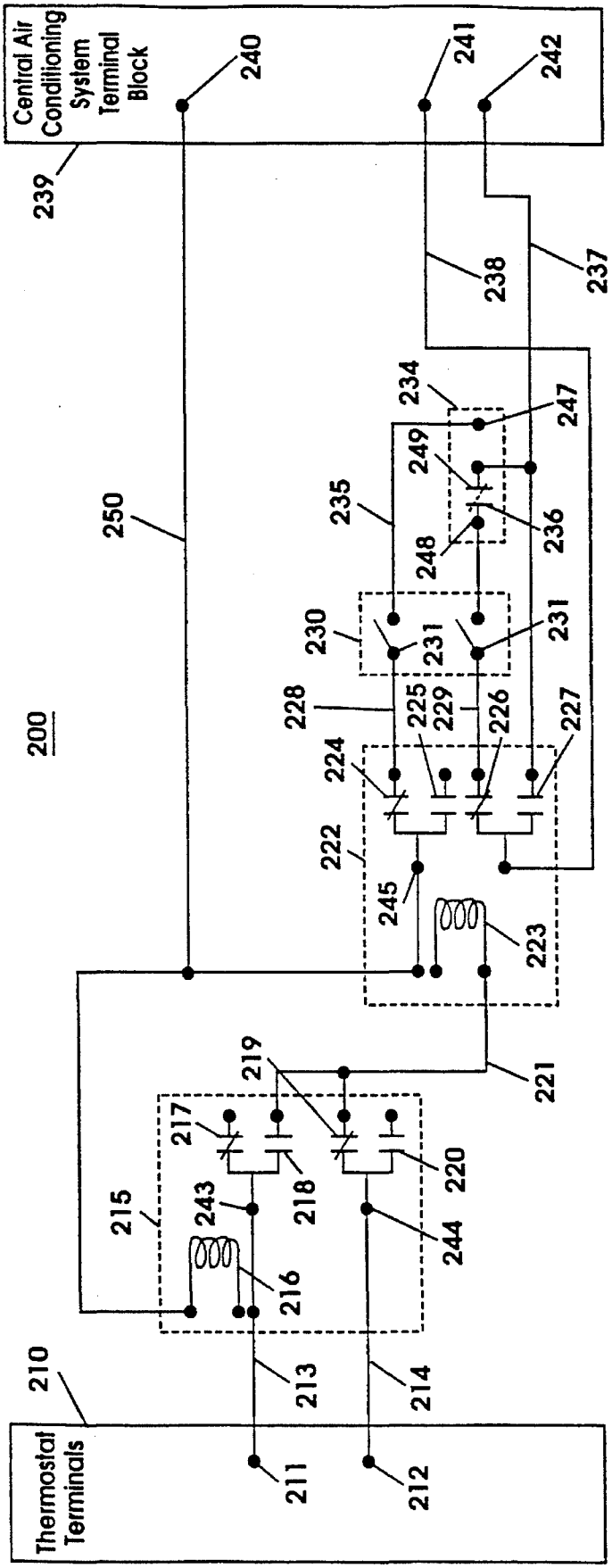

CENTRAL AIR CONDITIONING SYSTEM TERMINAL BLOCK
140
141
142
139
138
137
100
150
134
147
149
136
135
148
130
131
132
128
125
129
126
127
124
122
146
145
123
121
110
Thermostat Terminals
111

Figure 2

Figure 3


Central Air Conditioning System Terminal Block
239
240
241
242
238
237
234
247
249
235
250
236
248
230
231
231
228
225
229
226
227
224
222
245
223
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215
243
218
244
216
210
213
214
Thermostat Terminals
211
212
200

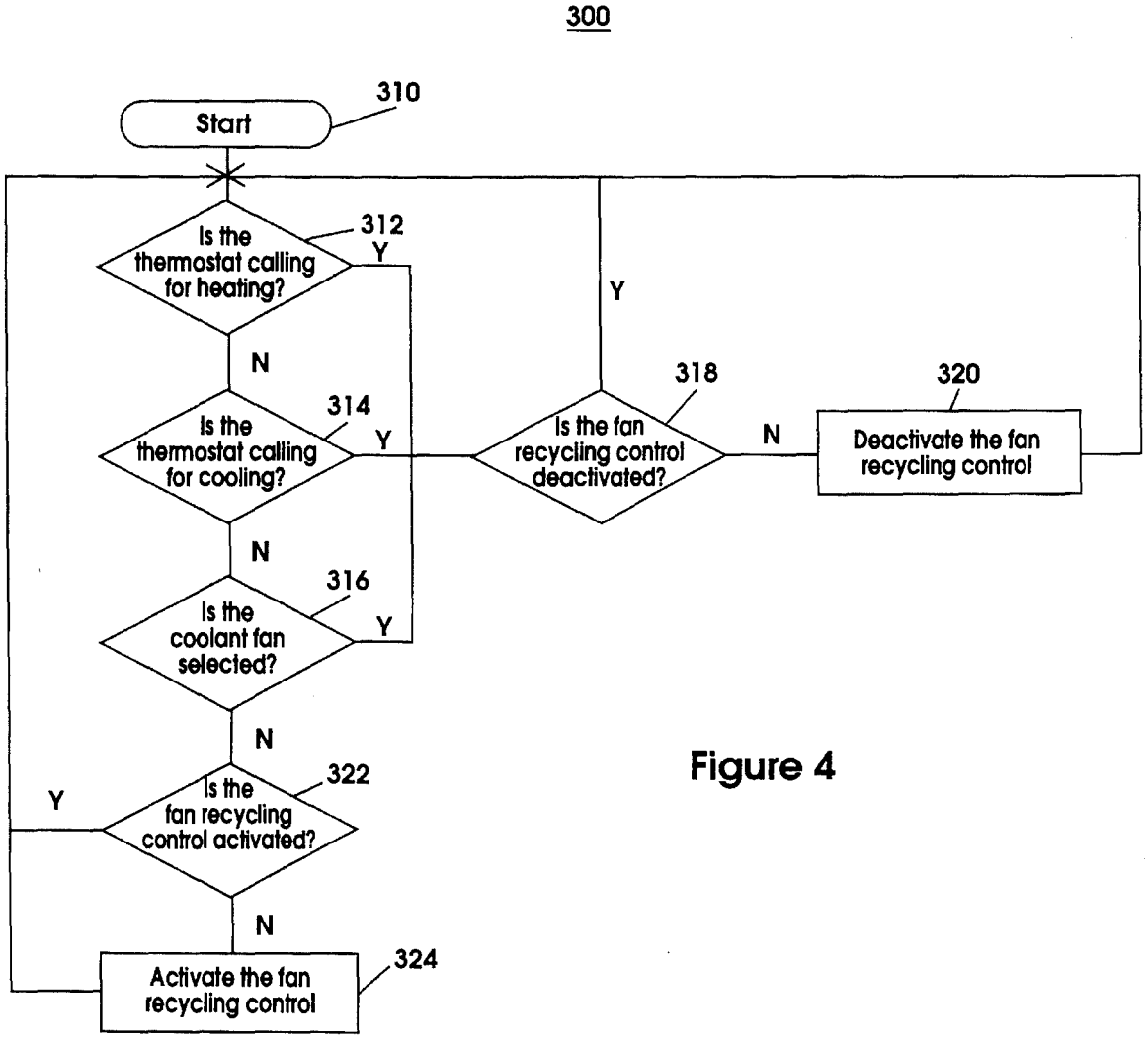
300
Start
310
Is the thermostat calling for heating?
312
Y
N
Is the thermostat calling for cooling?
314
Y
N
Is the coolant fan selected?
316
Y
N
Is the fan recycling control activated?
322
Y
N
Activate the fan recycling control
324
Y
Is the fan recycling control deactivated?
318
N
Deactivate the fan recycling control
320

Figure 4

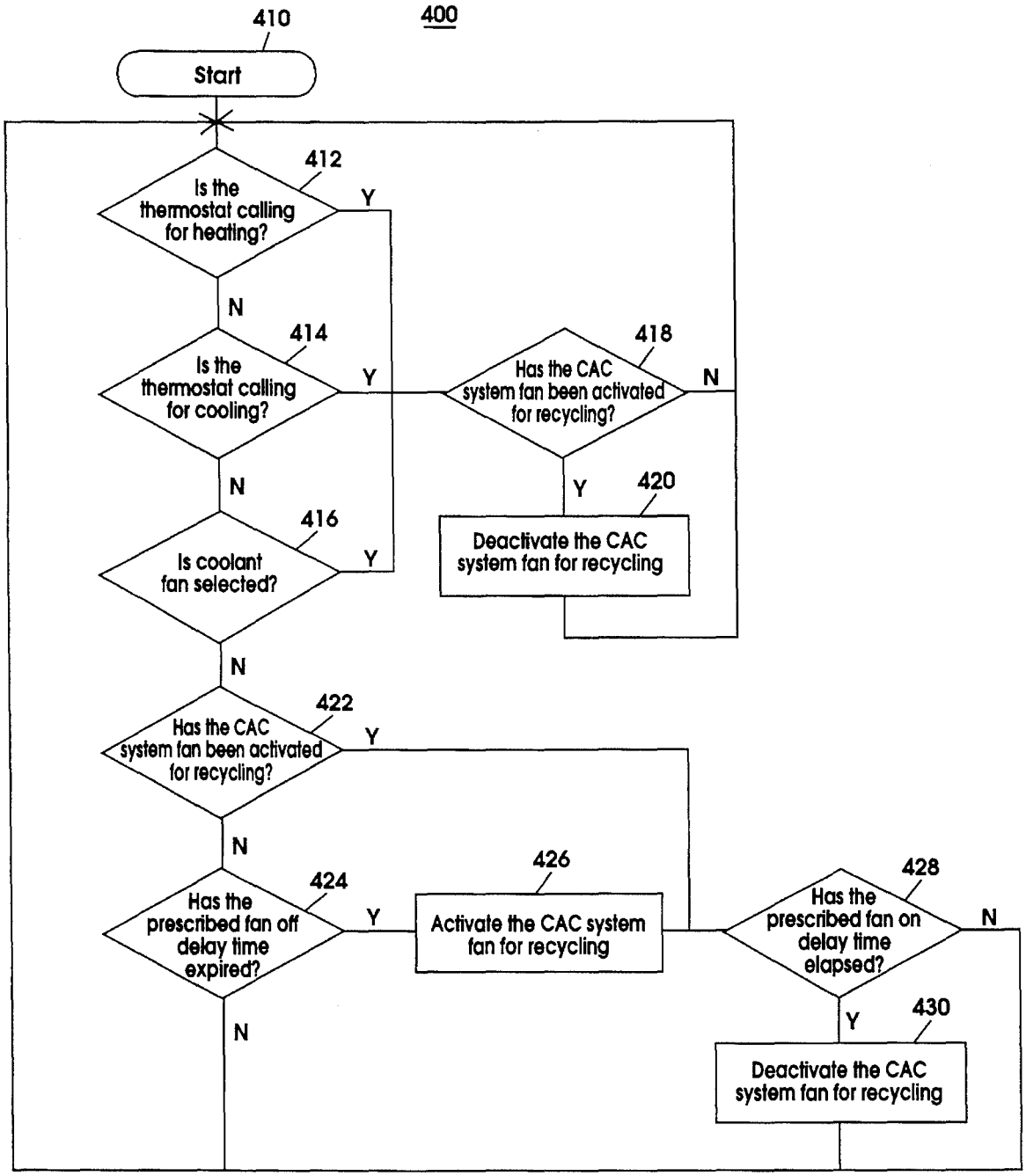
400
410
Start
412
Is the thermostat calling for heating?
Y
N
414
Is the thermostat calling for cooling?
Y
418
Has the CAC system fan been activated for recycling?
N
Y
420
Deactivate the CAC system fan for recycling
N
416
Is coolant fan selected?
Y
N
422
Has the CAC system fan been activated for recycling?
Y
N
424
Has the prescribed fan off delay time expired?
Y
426
Activate the CAC system fan for recycling
428
Has the prescribed fan on delay time elapsed?
N
Y
430
Deactivate the CAC system fan for recycling
N

Figure 5

AIR DISTRIBUTION FAN RECYCLING CONTROL

This invention relates to distributing air and in particular to a control for periodically energizing the air-distribution fan in a central air-conditioning system(CAC) having heating and/or cooling modes, in order to operate the fan for a selectable time period when the CAC system is not operating in the heating, cooling or constant fan modes. Wherein the recycling control operates the fan at periodic selected times that are dependent on the when the last cooling, heating, or constant fan mode had occurred.

BACKGROUND AND PRIOR ART

Current fans in Central Air Conditioning(CAC) systems for residential homes normally operate only when the CAC system is operating in a heating mode or a cooling mode. Alternatively, the fans in the CAC systems can be left in the on mode all the time. However, such a constant running of a fan system would constitute a waste of energy and power.

In CAC systems, a central heating or air cooling unit produces heated or cooled air. Normally, the heated or cooled air is directed from the heating or cooling unit through various ducts located throughout a building in order to place the heated or cooled air at desirable locations. Blowers, fans or air-type handlers generally are used to move the heated or cooled air through the ducts. Generally, thermostats are used to actuate the heating and cooling units. For example, when the air-temperature within a structure drips below a selected level, a thermostat can be adjusted to activate a heating mode when heating is desired. Likewise, when the air-temperature within a structure rises above a selected level, the thermostat can be adjusted to activate a cooling mode when cooling is desired. The CAC system is switched off when the interior air-temperature within the structure again reaches the desired selected temperature level.

Many CAC systems for heating and cooling structures use the thermostat to simultaneously activate both the fan along with the heating or cooling unit. In these systems the thermostat is usually used to simultaneously switch off both the fan and heating/cooling unit. In some heating CAC systems, the fan may continue to run after the heating unit has been shut off usually until residual heat in the heating unit has been removed. Alternatively, in some cooling CAC systems. the fan may continue to run after the cooling unit has been shut off to remove residual cool air from the cooling unit. However, no known systems exist that control the fan itself to turn on or off based on the last time the heating or cooling or constant fan modes have been activated.

Standards enacted in 1989 by the American Society of Heating, Refrigeration and Air-conditioning Engineers(ASHRAE) such as the 62 fresh air standard now require 15 cubic feet of outside air per person which translates to approximately 0.35 air changes per hour for residential buildings. The ASHRAE further includes an air quality standard which recommends a maximum concentration of CO_2 of 1000 ppm(parts per million).

The Manufactured Home Construction and Safety Standards set forth by the U.S. Department of Housing and Urban Development(HUD) has enacted new standards for manufactured homes that take effect in October of 1994. The HUD standards require fresh air ventilation systems for all manufactured housing in the United States. These ventilation systems must distribute outdoor air throughout the conditioned living space. Some ventilation systems require the installation of supply ducts separate from those of the CAC system, to distribute ventilation air. The separate ventilation supply ducts are potentially an unnecessary additional expense.

SUMMARY OF THE INVENTION

The first objective of the present invention is to provide a control system for using the existing circulating fan and supply ducts of a normal central air conditioning system-(CAC) for the periodic distributing and mixing of ventilation air throughout the air space served by the CAC system while the CAC system is not running in the heating, cooling or constant fan modes, where the periodic ON/OFF control of the fan is dependent on the time since the last fan operation, and where ventilation air is usually outdoor fresh air having a better air quality than indoor air, and provided that ventilation air is not otherwise distributed throughout the conditioned space by separate supply ducts and the fan.

The second object of this invention is to provide a control system for using the existing circulating fan and supply ducts of a normal central air conditioning system for the periodic distributing and mixing of spot-conditioned air throughout the air space served by the CAC system while the CAC system is not running in the heating, cooling or constant fan modes, where the periodic ON/OFF control of the fan is dependent on the time since the last fan operation, where spot-conditioned air can be humidified air or dehumidified air or cleaned air, and provided that the spot-conditioned air is not otherwise distributed throughout the conditioned space by separate supply ducts and the fan.

The third object of this invention is to provide a control system for using the existing circulating fan supply ducts of a normal central air conditioning system for the periodic averaging of the temperature of air throughout the air space served by the CAC system while the CAC system is not running in the heating, cooling or constant fan modes, and where the periodic ON/OFF control of the fan is dependent on the time since the last fan operation.

The fourth object of this invention is to provide a control system for using the existing circulating fan and supply ducts of a normal central air conditioning system for the periodic averaging of the humidity of air throughout the air space served by the CAC system while the CAC system is not running in the heating, cooling or constant fan modes, and where the periodic ON/OFF control of the fan is dependent on the time since the last fan operation.

The fifth object of this invention is to provide a control system for using the existing circulating fan and supply ducts of a normal central air conditioning system for the periodic remixing of existing air throughout the air space served by the CAC system while the CAC system is not running in the heating, cooling or constant fan modes, and where the periodic ON/OFF control of the fan is dependent on the time since the last fan operation.

The sixth object of this invention is to provide a system for periodically averaging the CO_2 air quality in a residential home that has a CAC system depending on a selectable time since the CAC system fan last operated, in order to keep the concentration of CO_2 to be less than 1000 ppm.

A fan recycling control for a CAC system is disclosed. The recycling control is energized when the Central Air Conditioning(CAC) system thermostat switch is open. The recycling control is used when there is no call by the CAC

system for heating, cooling or a constant fan mode condition which would energize the CAC system fan.

In a preferred embodiment, a Central Air Conditioning system stays in an on mode status by sending out heated or cooled air with the circulating fan operating until a desired temperature is reached. At this selected thermostat temperature, the CAC system and circulating fan shuts off. The subject invention starts only the circulating fan after a preselected delay (an OFF delay) has occurred. Only the fan then operates to circulate air for a preselected time period(ON time). The preselected OFF delay is adjustable based on either or both the volume size of the air spaces served by the CAC system and/or by the number of people in the space served by the CAC system. The preselected ON time is adjustable based on the flow rate of the fan and the volume of the air spaces served by the CAC system. Thus, the fan recycling control will periodically turn the CAC system fan ON and OFF until the thermostat switch on the CAC system reactivates either the cooling or heating modes, or the constant fan mode is selected, at which time the fan recycling control is de-energized.

Installation of the invention would generally require removal of the front cover of the CAC system cabinet to expose the CAC system control terminal block. The terminal block is the general location where all external CAC system control wiring terminals are inside the CAC system cabinet.

The recycling control system invention can be effective on many different types of Central Air Conditioning(CAC) systems. For example, the invention can be equally applied to a cooling only CAC system, a cooling CAC system with electric heat, a heat pump CAC system, a closed gas or off furnace system, and any combination of these systems.

Further objects and advantages of this invention will be apparent from the following detailed description of a presently preferred embodiment which is illustrated schematically in the accompanying drawings.

BRIEF DESCRIPTION OF THE FIGURES

FIG. **1** shows a graph representing the adequate delay time a fan system could stay off based on the number of sedentary occupants and the volume of a room to be ventilated that will most generally experience the fastest increase in CO_2 concentration.

FIG. **2** shows a first preferred embodiment of the air distribution recycling control system for a CAC system that will always energize the CAC system fan through the fan relay terminal when there is a call for heating, cooling or constant fan mode operation.

FIG. **3** shows a second preferred embodiment of the air distribution recycling control system for a CAC system that does not always energize the CAC system fan through the fan relay terminal on the CAC system terminal block when there is a call for heating or cooling modes.

FIG. **4** illustrates an algorithm for activating and deactivating the air distribution system fan recycling control by a microprocessor.

FIG. **5** illustrates an algorithm for providing the same function as the fan recycling control by a microprocessor control.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Before explaining the disclosed embodiment of the present invention in detail it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown since the invention is capable of other embodiments. Also, the terminology used herein is for the purpose of description and not of limitation.

FIG. **1** shows a graph representing the adequate delay time a fan system could stay off based on the number of sedentary occupants and the volume of a room to be ventilated that will most generally experience the fastest increase in CO_2 concentration.

Using FIG. **1**, the recycle control delay time for the fan system of an entire residence would be set based on the room that is expected to have the smallest ratio of air volume to the number of occupants in the room. For example, if a masterbedroom has a volume of 1,600 cubic feet($ft.^3$) and two occupants, the volume to occupancy ratio would be 1,600/2=800. Using FIG. **1**, a 1,600 $ft.^3$ volume room holding two occupants would have a delay time of 0.5 hours or half an hour. Therefore, the selectable time delay on the fan recycle control should activate the fan only ½ hour after the last fan operation. If one person was in the room, the delay time would be approximately 1 hour. Consequently, if a maximum of three people were in the room, the delay time would be approximately ¼ of an hour.

In residential homes where more than one CAC system exists to serve separate zones, each CAC system can have its own fan recycling control. And each control can be set accordingly to this same above described standard for one fan system that is used for an entire home.

First Embodiment.

FIG. **2** shows a first preferred embodiment of the air distribution recycling control system **100** for a CAC system that will always energize the CAC system fan through the fan relay terminal when there is a call for heating, cooling or constant fan mode operation. The components of FIG. **2** will now be described.

Referring to FIG. **2**, component **110** refers to the thermostat enclosure for housing terminal connection contacts, which include fan contact **111**, often marked as G on a thermostat. **121** is wire connecting contact, **111**, G, to the power input side of the 24 Vac relay coil, **123** Element **122** is a double-pole double-throw relay with 24 Vac coil, **123**. Component **124** is a normally closed (NC) contact. **125** is a normally open (NO) contact. **126** is a normally closed (NC) contact. **127** is a normally open (NO) contact. **128** refers to the wire connecting contact **124** to switch **131** described below. **129** connects **126** to **132**. **130** is a double-pole single-throw switch. **131** refers to pole **1** of switch, **130**. Component **132** refers to pole **2** of switch, **130**. **134** is a solid-state recycling timer. **135** refers to the wire connecting pole, **131** to common side of timer, **134**. **136** is a solid-state switch. **137** is a wire connecting power terminal, **149**(described below) and contact, **127** to fan control terminal, **142**. **138** refers to the wire connecting pole, **146**(described below) to power terminal, **41** (described below. **139** is the CAC system terminal block enclosure. Component **140** refers to the 24 Vac common terminal of the CAC system terminal block. **141** is the 24 Vac power terminal of CAC system terminal block. Component **142** refers to the fan control terminal of the CAC system terminal block. **143** is pole **1** of element **115**. Element **144** is pole **2** of element **115**. **145** is pole **1** of box, **122**. Component **146** is pole **2** of box, **122**. Component **147** is the common terminal of **134**. Component **148** is the power terminal of **134**. Component **149** is the switched power terminal of **134**. Element **150** refers to the wire connecting the common side of Vac coil., **123** to common terminal, **140**.

The operation of the components in FIG. **2** will now be described for CAC systems which always energize the system fan through the fan control terminal **142**. Referring to FIG. **2**, the air distribution system fan recycling control is electrically wired between the thermostat and the central air conditioning (CAC) system terminal block. Specifically, that is between the fan control line of the thermostat and the fan control line and the 24 Vac power supply(line **1** and common) of the CAC system terminal block. When the thermostat fan control line **121** is energized, the 24 Vac coil **123** closes contact **127** which allows current to flow to the fan terminal **142** on the CAC system terminal block. At the same time, contacts **124** and **126** are opened which de-energizes and resets the solid-state recycling timer **134**. When the thermostat fan control line **121** is de-energized, the 24 Vac coil **123** is de-energized and the contact **127** opens, cutting off current flow to the fan control terminal **142**. At the same time, contacts **124** and **126** close, which energizes the solid-state recycling timer, **134**. While the recycling timer **134** is energized the timer will continuously cycle through a pre-selected OFF delay, during which time the fan control terminal **142** is de-energized, and a pre-selected ON delay, during which time the fan control terminal **142** is energized.

FIG. **3** shows a second preferred embodiment of the air distribution recycling control system for a CAC system that does not always energize the CAC system fan through the fan relay terminal on the CAC system terminal block when there is a call for heating or cooling modes. The components of FIG. **3** will now be described.

Component **210** is the thermostat enclosure. **211** is the fan control terminal, G, of the thermostat. **212** the heat control terminal, W, of the thermostat. Component **213** is the wire connecting terminal **211**, to the power input side of the 24 Vac relay coil, **216** and pole **1**,**243** of the double-pole double-throw relay (DPDT), **215**. Element **214**, is the wire connecting terminal **212** to pole **2**, **244** of the DPDT relay, **215**. Component **216** is the 24 Vac coil. **217** is the normally closed (NC) contact. **218** is the normally open (NO) contact. **219** is normally closed (NC) contact. **220** is the normally open (NO) contact. **221** is the wire connecting contact **218**, and contact **219** to the power input side of the 24 Vac relay coil, **223**. Component **222** is the double-pole double-throw relay with 24 Vac coil, **223**. Component **224** is a normally closed (NC) contact. **225** is a normally open (NO) contact. **226** is a normally closed (NC) contact. **227** is a normally open (NO) contact. **228** refers to a wire connecting contact **224**, to switch **231**. **229** is the wire connecting contact **226**, to switch **232**. Component **230** is a double-pole single-throw switch that includes pole **1** and pole **2**. Component **233** is the wire connecting pole **2**, **232** to power input side of solid state recycling timer, **234**. Component **237** refers to a wire connecting terminal **249** and contact **227** to fan control terminal **242**. Component **238** is a wire connecting pole **2**, **246** to terminal **241**. Component **239** signifies the CAC system terminal block enclosure. **240** is the 24 Vac common terminal of CAC system terminal block. **241** is the 24 Vac power terminal of CAC system terminal block. **243** refers to pole **1** of relay **215**. **244** refers to pole **2** of relay, **215**. **245** is pole **1** of relay, **222**. **246** is pole **2** of relay, **222**. Component **247** is the common terminal and **248** is to power terminal of timer **234**. **249** is the switched power terminal of timer **234**. Wire **250** connects the common side of coil **216** and coil **223** to common terminal **240**.

The operation of the components in FIG. **3** will now be described for CAC systems which do not always energize the system fan through the fan control terminal **142**. Referring to FIG. **3**, the air distribution system fan recycling control is electrically wired between the thermostat **210** and the central air conditioning (CAC) system terminal block **239**. Specifically, that is between the fan control line **211** and the heat control line **212** of the thermostat and the fan control line **211** and the 24 Vac power supply **216** (line **1** and common) of the CAC system terminal block **239**. When the thermostat fan control line **213** is energized, the 24 Vac coil **216** closes contact **218** and opens contact **219**, which energizes the 24 Vac coil **223** and blocks current flow back through the thermostat heat control line **214**. When the thermostat heat control line **214** is energized, the 24 Vac coil **216** remains de-energized and the 24 Vac coil **223** is energized through normally closed contact **219**, while normally open contact **218** blocks current flow back through the thermostat fan control line **213**. When the line **221** is energized, the 24 Vac coil **223** closes contact **227** which allows current to flow to the fan terminal **242** on the CAC system terminal block **239**. At the same time contacts **224** and **226** are opened which de-energizes and resets the solid-state recycling timer **234**. When the line **221** is de-energized, the 24 Vac coil **223** is de-energized and the contact **227** opens, cutting off current flow to the fan control terminal **242**. At the same time, contacts **224** and **226** close, which energizes the solid-state recycling timer, **234**. While the recycling timer **234** is energized, the timer will continuously cycle through a pre-selected OFF delay, during which time the fan control terminal **242** is de-energized, and a pre-selected ON delay, during which time the fan control terminal **242** is energized.

The subject invention of FIGS. **1–3** can be applied to a microprocessor based control. FIG. **4** illustrates an algorithm for activating and deactivating the air distribution system fan recycling control by a microprocessor. The algorithm of FIG. **5** can be programmed in a microprocessor based thermostat and the like to effect the same control function as the air distribution system fan recycling control of FIG. **2** and FIG. **3**.

The algorithm of FIG. **4** will now be described. The algorithm to activate the air distribution system fan recycling control using a microprocessor based thermostat or other microprocessor control starts at **310**. At **312**, **314**, and **316** the program checks if the thermostat is calling for heating, cooling or constant fan, respectively. If any of those modes are active, the program goes to **318** where it checks if the fan recycling control has already been deactivated. If it has, the program loops back to **312**, if it hasn't the program deactivates the fan recycling control and loops back to **312**. If neither heating or cooling or constant fan mode is active the program loops back to **312**, if it hasn't, the fan recycling control is activated at **324** and the program loops back to **312**.

The algorithm of FIG. **5** will now be described. The algorithm to replace the air distribution system fan recycling control of FIG. **2** and FIG. **3** with a microprocessor based control starts at **410**. At **412**, **414**, and **416** the program checks if the thermostat is calling for heating, cooling or constant fan, respectively. If any of those modes are active, the program goes to **418** where it checks if the CAC system has been activated for recycling. If it has not, the program loops back to **412**, if it has, the program deactivates the CAC system fan for recycling and loops back to **412**. If neither heating or cooling or constant fan mode is active, the program goes to **422** to check if the CAC system fan has been activated for recycling. If it has, the program goes to **428** to check if the prescribed FAN ON time delay has elapsed. If it has not elapsed, the program loops back to **412**, if it has elapsed, the program deactivates the CAC system fan for recycling and loops back to **412**. If the CAC system fan has not been activated at **422**, the program goes to **424**

to check if the prescribed FAN OFF delay time has expired. If it has not expired, the program loops back to **412**. If the FAN OFF time has expired, the program goes to **426** to activate the CAC system fan for recycling, then to **428** as described above.

Although FIG. **2** and FIG. **3** show both electromechanical and solid-state components, the subject invention could be made with all solid-state components.

Although the graph of FIG. **1** shows room volumes from 600 up to 4,000 $ft.^3$ and occupants of one to three, the graph can be increased and decreased for other values.

While the invention has been described, disclosed, illustrated and shown in various terms of certain embodiments or modifications which it has presumed in practice, the scope of the invention is not intended to be, nor should it be deemed to be, limited thereby and such other modifications or embodiments as may be suggested by the teachings herein are particularly reserved especially as they fall within the breadth and scope of the claims here appended.

I claim:

1. A fan recycling control apparatus for a central air conditioning(CAC) system comprising:

a circulating fan;

a central air conditioning system with ducts to distribute cooled and heated conditioned air throughout a building;

a thermostat for activating and deactivating both the central air conditioning system and the circulating fan; and

a recycle control for periodically activating and deactivating only the circulating fan after a preselected time period, since the central air conditioning system or the circulating fan have been deactivated.

2. The recycling control apparatus of claim **1**, where the air conditioning system includes:

a cooling only mode.

3. The recycling control apparatus of claim **1**, where the air conditioning system includes:

a cooling mode and a electric heat mode.

4. The recycling control apparatus of claim **1**, where the air conditioning system includes:

a heat pump.

5. The recycling control apparatus of claim **1**, where the air conditioning system includes:

a gas heat source.

6. The recycling control apparatus of claim **1**, where the air conditioning system includes:

an oil heat source.

7. The recycling control apparatus of claim **1**, where the preselected time period includes:

a time delay based on number of occupants within the building to be ventilated.

8. The recycling control apparatus of claim **1**, where the preselected time period includes:

a time delay based on volume dimensions of the building to be ventilated.

9. The recycling control apparatus of claim **1**, where the preselected time period includes:

a time delay based on both number of occupants and volume dimensions of an air-space to be ventilated.

10. A method of mixing air throughout a building when not running a heating and cooling air conditioning system comprising the steps of:

shutting off both cooling and heating modes on an air-conditioning system;

activating a circulating fan only after preselected delay time periods, wherein each the delay time periods is adjusted based on nontemperature conditions, wherein the nontemperature conditions are chosen from at least one of:

volume dimensions of an air-space to be ventilated and number of occupants of the air-space to be ventilated.

11. The method of claim **10**, wherein each of the delay time period is selected from:

a range of approximately 20 minutes to approximately 3 hours for a room having volume dimensions between 600 to 3800 cubic feet, when 1 occupant is within the room.

12. The method of claim **10**, wherein each of the delay time period is selected from:

a range of approximately 12 minutes to approximately 1 and ¼ hours for a room having volume dimensions between 600 to 3800 cubic feet, when 2 occupants are within the room.

13. The method of claim **10**, wherein each of the delay time period is selected from:

a range of approximately 10 minutes to approximately ¾ of an hour for a room having volume dimensions between 600 to 3800 cubic feet, when 3 occupants are within the room.

14. The method of claim **10**, further including the step of:

turning on the heating and the cooling modes of the air-conditioning system when a temperature threshold has been reached.

15. An automated fan recycling control apparatus for a central air conditioning(CAC) system comprising:

a circulating fan;

a central air conditioning system with ducts to distribute cooled and heated conditioned air throughout a building;

a thermostat for activating and deactivating both the central air conditioning system and the circulating fan; and

a recycle control for periodically activating and deactivating only the circulating fan after a preselected time period based on selected nontemperature conditions, since the central air conditioning system or the circulating fan have been deactivated, and wherein the nontemperature conditions are chosen from at least one of:

volume dimensions of an air-space to be ventilated and number of occupants of the air-space to be ventilated.

16. The automated fan recycling control apparatus of claim **15**, wherein the preselected time period is selected from:

a range of approximately 20 minutes to approximately 3 hours for a room having volume dimensions between 600 to 3800 cubic feet, when 1 occupant is within the room.

17. The automated fan recycling control apparatus of claim **15** wherein the preselected time period is selected from:

a range of approximately 12 minutes to approximately 1 and ¼ hours for a room having volume dimensions between 600 to 3800 cubic feet, when 2 occupants are within the room.

18. The automated fan recycling control apparatus of claim **15**, wherein the preselected time period is selected from:

a range of approximately 10 minutes to approximately ¾ of an hour for a room having volume dimensions between 600 to 3800 cubic feet, when 3 occupants are within the room.

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US005547017B1

REEXAMINATION CERTIFICATE (4219th)

United States Patent [19] [11] **B1 5,547,017**

Rudd [45] Certificate Issued **Nov. 28, 2000**

[54] **AIR DISTRIBUTION FAN RECYCLING CONTROL**

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[52] **U.S. Cl.** **165/244**; 62/231; 165/270; 236/49.3; 454/233

[58] **Field of Search** 236/11, 49.3; 62/180; 165/267, 214

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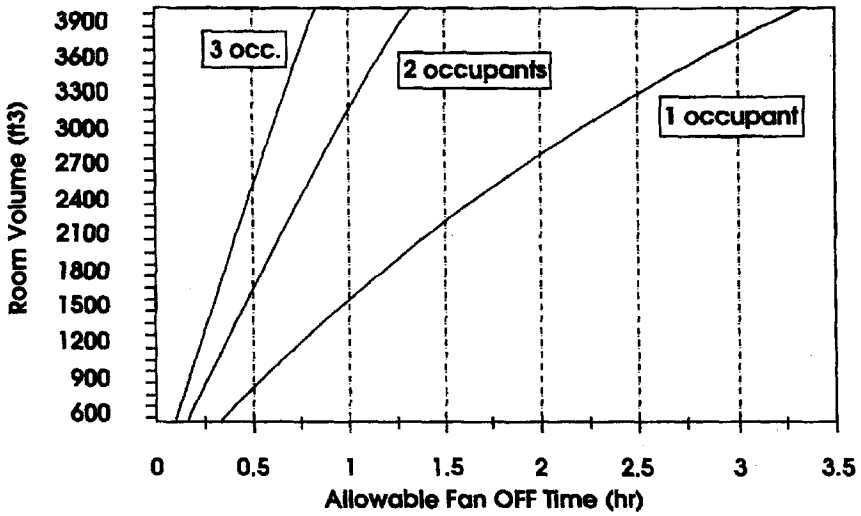
Primary Examiner—William Wayner

[57] **ABSTRACT**

An system for controlling the operation of the circulating fan of a closed central air conditioning(CAC) system is disclosed. The system periodically activates and deactivates only the circulating fan after a preselected delay time from the normal running of the cooling and heating modes of the CAC system. The preselected delay time is adjustable based on non thermostat parameters and include parameters such as room volume size to be ventilated and the number of occupants in the room. The control can periodically distribute and mix ventilation air or spot-conditioned (humidified, de-humidified, or cleaned) air while the CAC system is not running in the heating, cooling or constant fan modes. The cooling and heating modes of the CAC system operate independently of the fan recycling control.



REEXAMINATION CERTIFICATE ISSUED UNDER 35 U.S.C. 307

THE PATENT IS HEREBY AMENDED AS INDICATED BELOW.

Matter enclosed in heavy brackets [ ] appeared in the patent, but has been deleted and is no longer a part of the patent; matter printed in italics indicates additions made to the patent.

AS A RESULT OF REEXAMINATION, IT HAS BEEN DETERMINED THAT:

The patentability of claims **10–14** is confirmed.

Claims **1** and **15** are determined to be patentable as amended.

Claims **2–9** and **16–18**, dependent on an amended claim, are determined to be patentable.

1. A fan recycling control apparatus for a central air conditioning (CAC) system comprising:

a circulating fan;

a central air conditioning system with ducts to distribute cooled and heated conditioned air throughout a building;

a thermostat for activating and deactivating both the central air conditioning system and the circulating fan; *said activating causing a continuous fan operation, said deactivating causing no fan operation, said thermostat further having a selectable constant fan mode,* and

a recycle control for periodically activating and deactivating only the circulating fan after a preselected time period, since the central air conditioning system *has been deactivated*, or the circulating fan **[**have**]** *has* been deactivated *from the selectable constant fan mode.*

15. An automated fan recycling control apparatus for a central air conditioning (CAC) system comprising:

a circulating fan;

a central air conditioning system with ducts to distribute cooled and heated conditioned air throughout a building;

a thermostat for activating and deactivating both the central air conditioning system and the circulating fan; *said activating causing a continuous fan operation, said deactivating causing no fan operation, said thermostat further having a selectable constant fan mode*, and

a recycle control for periodically activating and deactivating only the circulating fan after a preselected time period based on selected non-temperature conditions, since *either* the central air conditioning system *has been deactivated* or the circulating fan **[**have**]** *has* been deactivated**[**,**]** *from the selectable constant fan mode* and wherein the non-temperature conditions are chosen from at least one of:

volume dimensions of an air-space to be ventilated and number of occupants of the air-space to be ventilated.

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