CONTROL FOR BLOWER MOTOR OF FURNACE AND AIR CONDITIONER

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8 Claims

ABSTRACT OF THE DISCLOSURE

The blower motor is energized from an alternating current source through a triac controlled by a diac. The resistance for determining at what point in the alternating current cycle the diac turns the triac on is a cadmium sulfide photocell. The photocell is illuminated by a low voltage lamp connected in series with a thermistor, a manually operable variable resistance and a low voltage transformer secondary. The thermistor is positioned to sense the furnace temperature. A double-throw relay is actuated by the air conditioner to connect the blower motor directly to the line rather than through the triac when the air conditioner is operating.

Background of the invention

While it has been proposed to use thermostats to sense the furnace temperature and control the operation of a diac triggering a triac, these have the disadvantage that the resistance variation in the thermostat does not change sufficiently to result in substantial speed variation of the blower motor. It is desirable to have a substantial range of variation so that a single unit can be adapted to the variety of conditions that will exist in various heating installations. In one house the slow speed operation to maintain a nominal amount of air circulation when the furnace is not in operation may be substantially larger or smaller than it will be in another installation. Similarly, as the furnace warms up and increased air circulation is desired, it may be important to have the motor speed up to a greater level at a particular furnace temperature than it will be in another installation. Through the use of the present invention the range of resistance variation in proportion to change in the furnace temperature is amplified as compared to existing systems.

Further objects and advantages will become apparent from the following description.

Summary of the invention

The present invention relates to an automatic control for regulating the speed of the blower motor of a hot air heating system and includes an overrides operated by an air conditioner in the system so that when the air conditioner is on, the blower motor is operated at top speed.

Description of the drawing

The drawing is a schematic illustration of an embodiment of the invention.

Description of the specific embodiment

Although the following disclosure offered for public dissemination is detailed to ensure adequacy and aid understanding, this is not intended to prejudice that pur-pose of a patent which is to cover each new inventive concept therein no matter how others may later disguise it by variations in form or additions or further improvements. The claims at the end hereof are intended as the chief aid toward this purpose; as it is these that meet the requirement of pointing out the parts, improvements, or combinations in which the inventive concepts are found.

The drawing illustrates a combination hot air furnace generally 10 and air conditioner generally 11 such as might be employed in the ordinary residence. Air is circulated through the furnace, air conditioner and residence by means of a blower (not shown) driven by a blower motor 12. Such motors are generally of the shaded pole or capacitor run type, particularly in the more recent blowers having the motor an integral part of the blower. One side of the line is connected directly to the motor by wire 13. The other motor connection is formed by a series of taps, e.g., tap 14 being the high speed connection, tap 15 being the medium high speed connection, tap 16 being the medium low speed connection and tap 17 being the low speed connection. The furnace 10 has a heating unit controlled by a house thermostat, neither of which is shown. Likewise the air conditioner is controlled by a house thermostat, not shown.

The control system and the blower motor 12 are energized from the usual 110 volt 60 cycle electrical system represented by power source 20. This of course feeds the incoming lines 13 and 21. A manually operable switch 22 is connected to line 21 and to wire 23 leading to motor connection 17. A contactor 24 of a relay, which includes contacts 25 and 26 and solenoid 27 also is connected to line 21. A wire 28 connects contact 26 to the motor connection 14.

Contact 25 connects to a wire 31. In series between wires 23 and 31 is a resistor 32 and a capacitor 33. A bi-directional triode thyristor, a controllable current regulating device commonly referred to as a triac, 34 also is connected across wires 23 and 31. The gate 35 of the triac is connected to a bilateral trigger diode, commonly referred to as a diac, 36. Diac 36 also is connected to wire 37. A capacitor 38 connects wire 37 and wire 23. Connected between wires 31 and 37 is a cadmium sulfide photocell 39.

Photocell 39 is a part of a package 42, as indicated by the dot dash lines, which also includes a low voltage lamp 43. A wire 44 connects one side of lamp 43 to one side of the primary 45 of a voltage dropping transformer. The primary 46 of the transformer is connected across the lines 13 and 21. A wire 47 connects the other side of lamp 43 to the first of two series connected thermostats 48 and 49. A wire 50 connects thermostats 49 to a switch 51 and to a variable resistance 52. Variable resistance 52 is connected to primary 45 by a wire 53.

As indicated by dashed lines 55 and 56 the control apparatus may be assembled in two packages. One package 55 is mounted at or adjacent the furnace and air conditioner. The other package 56 can be mounted at a remote location, as for example, adjacent the house thermostats. Of course, packages 55 and 56 can be a single unit. Wires 57 and 58 connect solenoid 27 to the air condi-
toner so that when the air conditioner is operated solenoid 27 is energized and when the air conditioner is not in operation solenoid 27 is de-energized (the illustrated position of switch 24). In the usual event, solenoid 27 will be a low voltage solenoid, e.g. 28 volts, and is energized by the low voltage circuit connecting the air conditioner and the house thermostat, not shown.

As further illustration of a specific embodiment wherein motor 12 is a 110 volt A.C. motor, capacitor 33 is 0.022 microfarad, 200 volts, and capacitor 38 is 0.047 microfarad, 200 volts. Resistor 32 is 30 ohms. Triac 34 could be an SC45B and diac 36 could be a 512T. Module 43 comprises a 6V lamp and a photocell 39 having a dark resistance of 100 meg. ohms with a full brightness resistance of 50 ohms. Variable resistor 52 is 500 ohms. Thermistors 48, 49 each have a cold resistance of 100 ohms. Six volts are delivered at transformer secondary 45.

With power supplied from source 29 and the switches in the position illustrated in the drawing, the slider of variable resistor 52 is adjusted to give the desired low speed when the furnace is cold. When the furnace burner turns on and commences heating up the furnace, this decreases the resistance of thermistors 48, 49 so that the brightness of lamp 43 increases. This additional light falling on photocell 39 reduces the dark current of that photocell so that the trigger action provided by diac 36, causes triac 34 to turn on earlier during each half of the sine wave of the alternating current. This increases the amount of current flow through triac 34 to additionally energize motor 12 and cause it to speed up. Thus the resistance of thermistors 48, 49 drop as a function of the furnace temperature. The amount of light emitted by lamp 43 increases as a function of the furnace temperature; the resistance of photocell 39 decreases as a function of furnace temperature; and the current to motor 12 increases as a function of furnace temperature.

It may be necessary to make provision to dissipate heat from unit 55 and particularly from triac 34. This problem of course will vary with the application. One way of doing it is to mount unit 55, other than switch 22, in the cold air return of the furnace 10. Wires 23 and 28 can be variously connected to motor connections 14-17 depending upon the ranges of speeds that are desired for blower motor 12.

When air conditioner 11 goes on solenoid 27 is energized. This moves contactor 24 to contact 26 so that line 21 from the source power is connected directly to the high speed blower motor connection 14. This gives the maximum air flow through the furnace of the air conditioner. When the air conditioner stops running solenoid 27 de-energizes so that contactor 24 drops back to contact 25 and thereafter there is low speed operation of blower motor 12 to maintain air circulation within the residence. By closing switch 51, the motor speed can be regulated directly by variable resistance 52 which is manually operable. Switch 22 can be closed to override the automatic control unit.

I claim:

1. In a system for controlling the ambient conditions in a house having a hot air heating system including a blower motor and means connected to the motor and to an alternating current power source to vary the speed of the blower motor comprising a controlled current regulating device, a triggering device connected to the regulating device for controlling the regulating device and a variable resistance device connected to the triggering device to determine at what percentage of the alternating current said triggering device will actuate the controlled regulating device to pass current to the motor, the improvement comprising:

said variable resistance device being a photocell; said variable light emission means positioned to actuate said photocell; and control means connected to said light emission means and having a portion positioned to sense the temperature in the furnace to regulate the light emitted as a function of the furnace temperature; whereby the variable resistance device will vary in resistance as a function of the furnace temperature and will actuate the regulating device as a function of the furnace temperature.

2. In a system as set forth in claim 1, wherein said control means comprises:

a comparatively low voltage lamp as compared to the voltage of said source; a voltage dropping transformer having a primary connected to said source and a low voltage secondary; said portion of said control means includes being a variable resistance, heat sensitive element; means forming a series circuit through said secondary, said lamp and said element; and a manually operable variable resistance connected to said element to permit the effect of the element on the lamp to be manually regulatable.

3. In a system as set forth in claim 2, wherein said regulating device is a triac, said triggering device is a diac and said element comprises a thermistor.

4. In a system as set forth in claim 3, wherein said manually operable variable resistance is in series with said element, wherein said control means includes a manually operable switch in parallel with said element, whereby when said switch is closed the speed of the motor may be regulated by said variable resistance independently of the resistance of the element.

5. In a system as set forth in claim 4 having an air conditioner communicating with the furnace with the movement of the air through the air conditioner being actuated by said motor, wherein said system includes a relay with a solenoid and a switch actuated by the solenoid between a first and a second position, said relay being connected to the air conditioner so that the switch is in the first position when the conditioner is not operating and in the second position when the conditioner is operating, said switch being connected to the source, the motor and the regulating device so that when in the first position the motor is energized through the regulating device, and when in the second position the motor is energized from said source independently of the regulating device.

6. In a system as set forth in claim 3 having an air conditioner communicating with the furnace with the movement of the air through the air conditioner being actuated by said motor, wherein said system includes a relay with a solenoid and a switch actuated by the solenoid between a first and a second position, said relay being connected to the air conditioner so that the switch is in the first position when the conditioner is not operating and in the second position when the conditioner is operating, said switch being connected to the source, the motor and the regulating device so that when in the first position the motor is energized through the regulating device and when in the second position the motor is energized from said source independently of the regulating device.

7. In a system as set forth in claim 2 having an air conditioner communicating with the furnace with the movement of the air through the air conditioner being actuated by said motor, wherein said system includes a relay with a solenoid and a switch actuated by the solenoid between a first and a second position, said relay being connected to the air conditioner so that the switch is in the first position when the conditioner is not operating and in the second position when the conditioner is operating, said switch being connected to the source, the motor and the regulating device so that when in the first position the motor is energized through the regulating device and when in the second position the motor is energized from said source independently of the regulating device.

8. In a system as set forth in claim 1 having an air conditioner communicating with the furnace with the move-
ment of the air through the air conditioner being actuated by said motor, wherein said system includes a relay with a solenoid and a switch actuated by the solenoid between a first and a second position, said relay being connected to said air conditioner so that the switch is in the first position when the conditioner is not operating and in the second position when the conditioner is operating, said switch being connected to the source, the motor and the regulating device so that when in the first position the motor is energized through the regulating device and when in the second position the motor is energized from said source independently of the regulating device.

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