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CONTROL FOR BLOWER MOTOR OF FURNACE AND AIR CONDITONER

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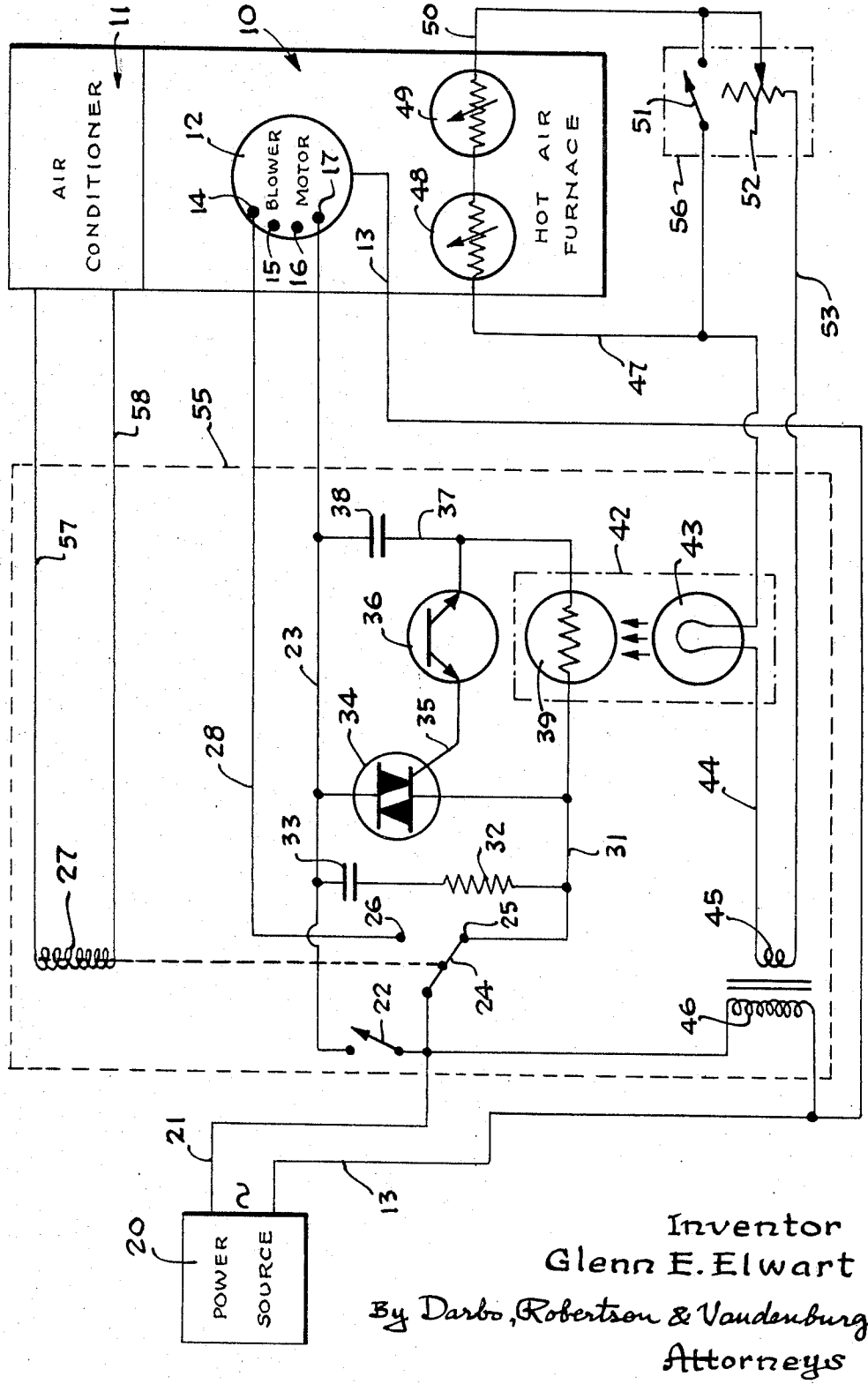

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CONTROL FOR BLOWER MOTOR OF FURNACE AND AIR CONDITIONER

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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 thermistors 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 thermistor 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.

A further advantage of the present invention as compared to previous proposals is that the manual adjustment which determines the motor speed in relation to particular furnace temperatures is a low voltage control thus, it can be placed at a remote location without the necessity of putting the wiring in conduit or the like for protective purposes.

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 override 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 purpose 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 blower motor connection **14**.

Contact **25** connects to a wire **31**. In series between wires **23** and **31** is a resistant **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 thermistors **48** and **49**. A wire **50** connects thermistor **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-

tioner 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 a SC45B and diac **36** could be a ST2. Module **43** comprises a 6 volt lamp **43** 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 **20** 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. The additional light falling on photocell **39** reduces the resistence 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 power source is connected directly to the high speed blower motor connection **14**. This gives the maximum air flow for the operation 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 point in the cycle 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;

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 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 varied.

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, and 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 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.

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 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.

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 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.

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.

References Cited

UNITED STATES PATENTS

3,317,136	5/1967	Stang et al.	236—78
3,367,408	2/1968	Moreland	165—27

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236—9, 10, 78; 318—334