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Becker

[11] **3,731,056**

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[54] **SUPPLEMENTAL HEATER UNIT FOR AIR CONDITIONER OF THE DUAL BLOWER TYPE**

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[52] **U.S. Cl.** **219/361,** 62/426, 165/29, 165/65, 165/122, 219/366, 219/370, 219/374

[51] **Int. Cl.**.....**H05b 1/00,** F24h 3/04, F25b 29/00

[58] **Field of Search**.....165/14, 16, 22, 26, 165/27, 24, 29, 50, 59–65, 121, 122; 219/359, 361, 365–370, 374, 375, 376; 62/262, 429, 426

[56] **References Cited**

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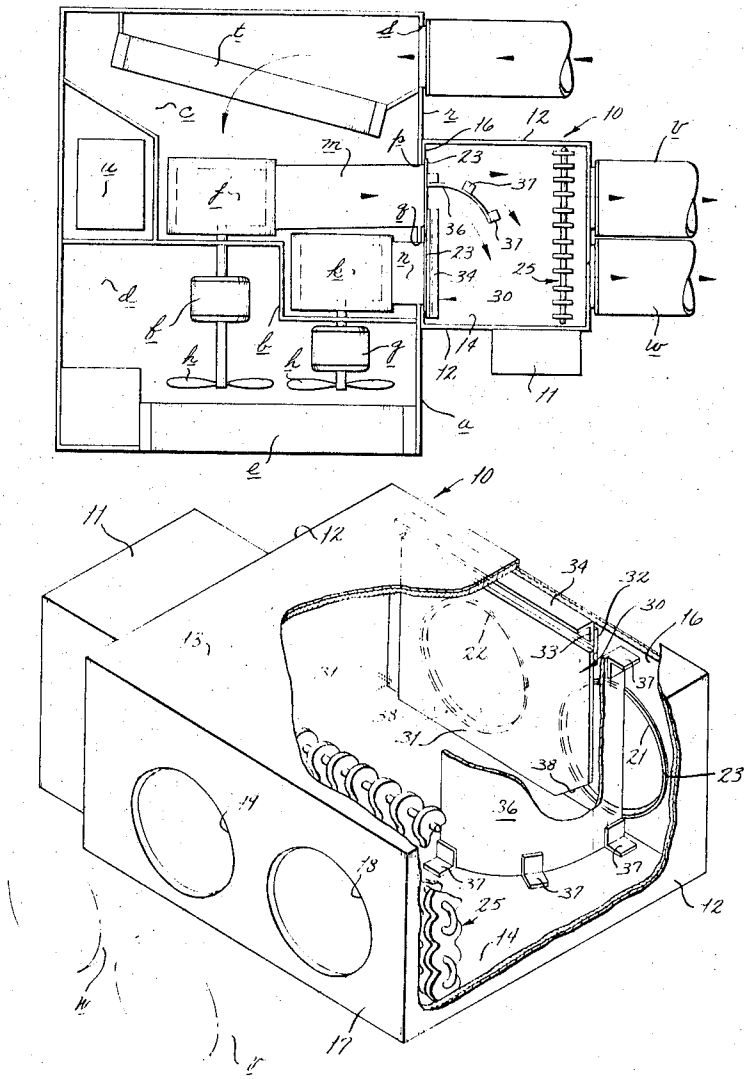
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Primary Examiner—A. Bartis
Attorney—Jerome A. Gross

[57] **ABSTRACT**

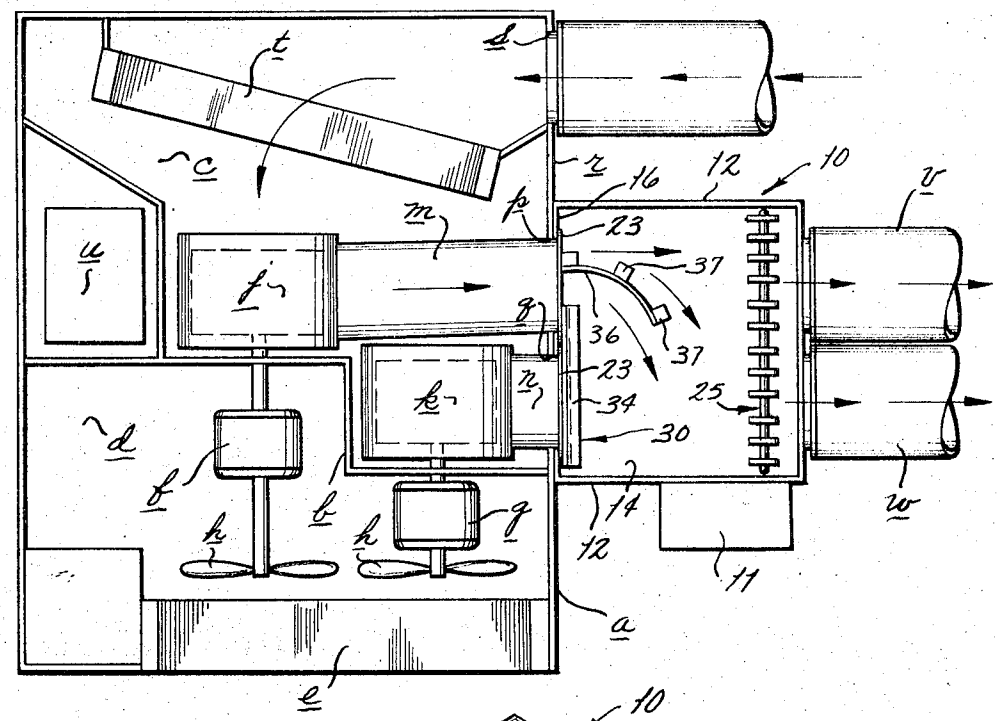
A supplemental heater unit for an air conditioner of the dual blower type, provides reduced air delivery while the heater is energized. The heater unit has an air casing with separate inlets from the two blowers. When only one blower of the air conditioner is powered, an atmospheric damper closes automatically across the inlet from the unpowered blower, preventing re-circulation back to the air conditioner cabinet and thus providing a positive controlled lower rate of air delivery across a resistance heater within the air casing and to the room space.

5 Claims, 3 Drawing Figures



2 Sheets-Sheet 1

FIG. 1



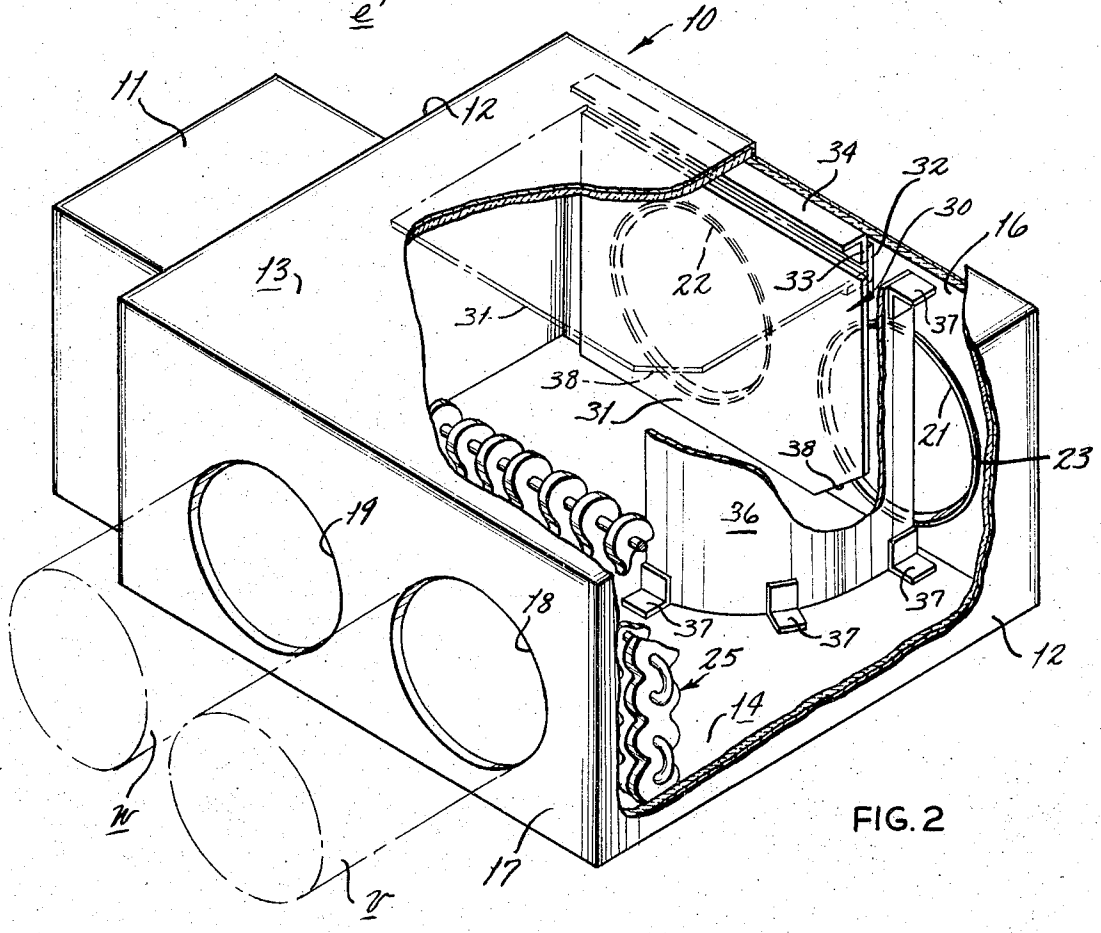


FIG. 2

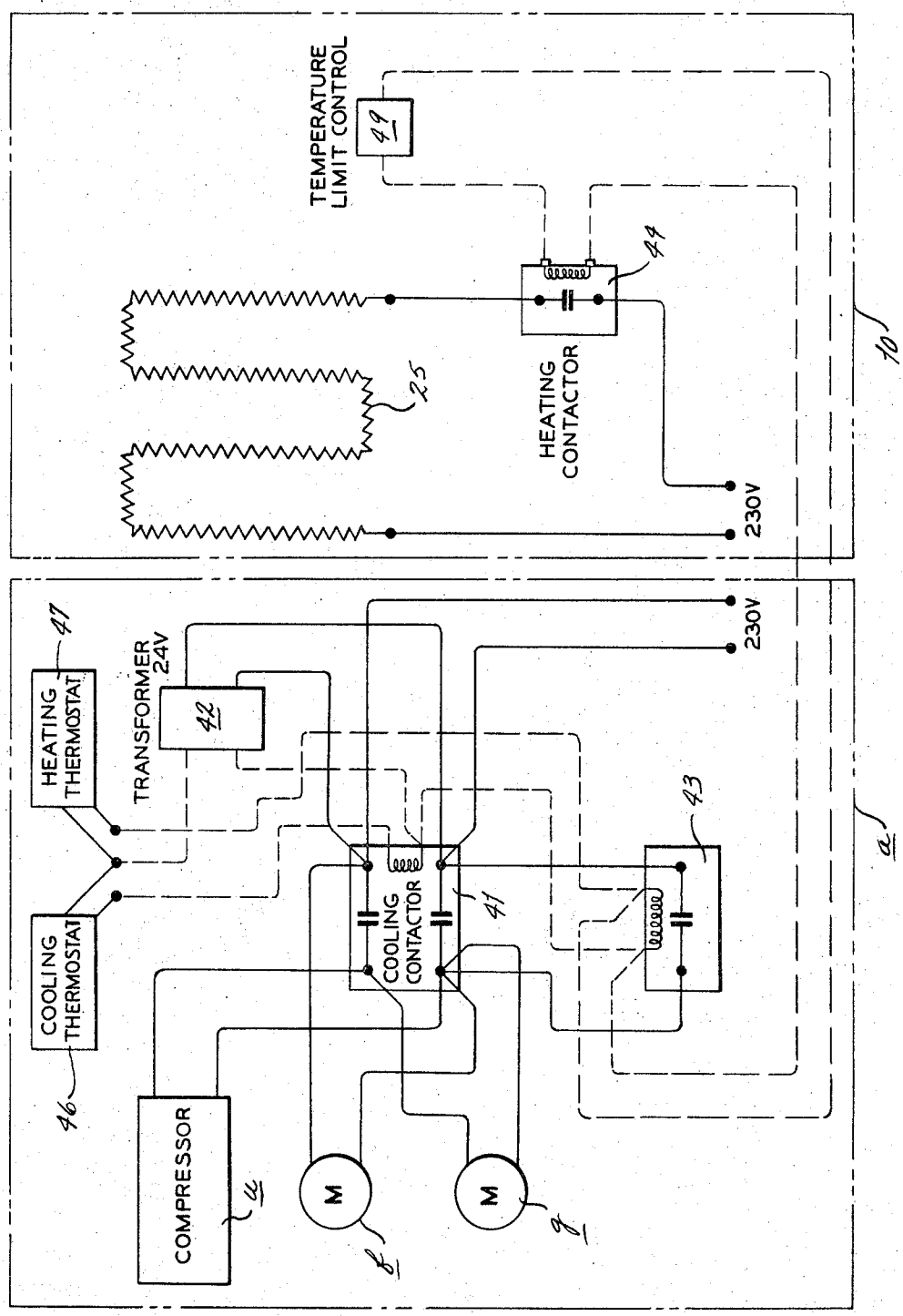

TEMPERATURE LIMIT CONTROL
49
44
HEATING CONTACTOR
25
230V
10
230V
47
HEATING THERMOSTAT
TRANSFORMER 24V
42
43
COOLING CONTACTOR
41
COOLING THERMOSTAT
46
COMPRESSOR
45
M
M
a

FIG. 3

SUPPLEMENTAL HEATER UNIT FOR AIR CONDITIONER OF THE DUAL BLOWER TYPE

BACKGROUND OF THE INVENTION

Certain small air conditioning units, for example, window units, have been equipped with heater coils, which may be switched on when the compressor is switched off. They utilize the air conditioner's air delivery system to deliver heated air.

Air conditioning units may be located remotely from the room space to be air conditioned and connected thereto by ducts. Such an air conditioner unit, of a type especially suited for mobile homes, is shown in U.S. Pat. No. 3,566,614 to Imral. In it, air from the room space passes from a return duct into a remotely located air conditioner cabinet, and is cooled in a space open to two separate blowers, each leading to its own air delivery outlet. Flexible air delivery ducts connected to these outlets deliver the cooled air to spaced-apart portions of a mobile home.

The purpose of the present invention is to provide a supplemental heater unit for such a remote, dual blower type air conditioner, to operate at a reduced air delivery rate. The rapid rate at which cooled air may be circulated through a room space is not well suited for heating; persons feel more comfortable when heated air is introduced at relatively slow velocity. While a manually operated damper might be used to reduce the rate of air delivery, its use would be inconvenient; and an electrically operated damper would add expense.

SUMMARY OF THE INVENTION

In the present invention a supplemental heater unit incorporates a simple damper of the atmospheric type, to reduce the rate of air delivery while a resistance heater is energized. The damper is closed by a pressure differential which results from powering one of the two blowers of the air conditioner while the other blower is unpowered. The damper prevents recirculation of the air from the heater's air casing back to the air conditioner cabinet; this assures positive delivery of air at the reduced rate. When the heater is switched off and the air conditioner operated for cooling, using both blowers, the pressure differential ceases and the damper opens automatically.

Summarized briefly, the present heater unit includes a walled air casing with first and second air inlets, to be connected to the first and second blower outlets of such an air conditioner. An electrical resistance heater is positioned within the air casing between the inlets and a pair of outlets; ducts to the room space are connected to these instead of to the air conditioner itself. A flat damper plate, hingedly supported above the inlet from the second blower of the air conditioner, is closed when this blower is de-energized and the first blower is operated. The damper plate positively prevents flow back from the heater air casing to the air conditioner cabinet. The inlets of both blowers in such an air conditioner are open to the same space within the air conditioner cabinet; powering the first blower to drive air into the air casing exerts a suction which is communicated through the outlet of the unpowered second blower to the other side of the damper. Thus, a simple damper of the atmospheric type will serve, with this type of dual blower air conditioner, to provide positive flow of heated air to the room space at a fixed reduced rate, and prevent re-circulation from the air casing back to the air conditioner cabinet.

The suction which closes the damper is so great that it may be broadened to partially block the flow from the powered blower, thus to effect an even greater reduction in air delivery.

The rate of air flow, measured in cubic feet per minute, does not vary directly with the blower power supplied. Restrictions in the flow path, such as registers in the system and the size of the return duct, result in a disproportionately high air delivery at reduced blower capacity. Thus even with the present invention, it is normally not possible to cut the rate of air delivery in half. However, by reducing the rate of air delivery by 25 percent, for example, the effective temperature rise, over room temperature, may be increased from 27° to 36°. This difference is important to body comfort; for a 27° rise over ordinary room temperature might result in delivery of air at below body temperature, whereas a 36° rise would assure delivery of air at above body temperature.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic plan view of a supplemental heater unit embodying the present invention, attached to a dual blower air conditioner unit of the type heretofore referred to. Arrows show flow of heated and return air.

FIG. 2 is an enlarged perspective view of the heater unit of FIG. 1, with the walls partially broken away. Phantom lines show the damper in open position during normal air conditioning operation.

FIG. 3 is an electrical diagram showing the heater unit wired into the air conditioner unit of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A dual blower air conditioner, of the type suitable for use with the present invention, is shown at the left side of FIG. 1. This type of air conditioner, described in detail in U.S. Pat. No. 3,566,614, is especially suited for use with mobile homes; its low overall height permits it to be positioned beneath a mobile home; its dual outlets permit delivery of cooled air to the opposite ends of the mobile home; and the use of flexible air delivery and return ducts permits the unit to be easily installed and serviced.

The arrangement of the components of this type of dual blower air conditioner is shown schematically in FIG. 1. A rectangular cabinet *a* is separated by an S-shaped vertical separator wall *b* into an air handling side *c* and a condenser side *d*, the latter containing a condenser coil *e*, two motors *f* and *g* and their condenser cooling fans *h*. Shafts from the motors *f* and *g* opposite to the fans *h* extend through the vertical separator wall *b* to mount centrifugal blowers *j*, *k* whose respective air delivery ducts *m*, *n* lead side by side to first and second adjacent circular air outlets *p*, *q*in the forward wall *r*. An air return inlet *s* permits return air to flow into the air handling side *c* of the cabinet, through an evaporator coil *t*, and thus into the air space which supplies both blowers *j*, *k*. A compressor *u* is positioned as shown; and the components described are operably connected with other conventional air conditioning components. When the compressor *u* is energized, both

motors *f*, *g* are powered; and air will be delivered by the blowers *j*, *k* through their respective delivery ducts *m*, *n* at equal delivery rates.

The supplemental heating unit of the present invention is interposed at the air conditioner outlets *p*, *q* in such manner as not to interfere with the normal air conditioning mode of operation; yet the combination will supply heated air at a lesser, predetermined delivery rate, to assure an adequate temperature rise.

Referring to FIG. 2 the present supplemental heater unit includes a walled air casing, generally designed **10**, formed like a rectangular metal box, lined with conventional thermal insulation material, and with an added circuit box **11** on one of its vertical side walls **12**. The side walls **12**, together with top and bottom walls **13**, **14**, provide a conduit for the passage of air from a vertical inlet wall **16** to a vertical outlet wall **17**. Air delivery ducts *v*, *w*, shown in phantom lines in FIG. 2, are attached to outlets **18**, **19** in the outlet wall **17** instead of to the air conditioner outlets *p*, *q*.

In the inlet wall **16**, at the same spacing as that of the air conditioner outlets *p*, *q*, first and second air inlets **21**, **22** are provided, having means, such as a simple edge flange **23**, to make sealed connections to the air conditioner outlets *p*, *q*. Interposed between the inlets **21**, **22** to the heater casing **10** and its outlets **18**, **19** (preferably immediately in advance of the outlets **18**, **19**) is an electrical heater generally designated **25**. This is shown as a simple lattice-like resistance heater, which occupies the greater part of the interior area across the air casing **10** and which permits the flow of air therethrough without substantial interruption. This result follows, in the embodiment shown, because the cross-section of the air casing **10** is amply larger than the combined cross-sections of the air outlets **18**, **19**; the air passing through it may slow, to take up heat from the resistance heater **25**, and then again resume its original flow rate as its passes into the delivery ducts *v*, *w*.

At first consideration, it might be thought that a positive cut in the rate of air delivery could be achieved merely by cutting off one of the blowers *j*, *k*. This does not follow; if only the first blower *j* were powered, the drop in air pressure within the air handling side *c* of the air conditioner cabinet *a* would be communicated to the air casing **10** through the duct of the second blower *k*, to suck back to the air handling side *c* part of the air delivered by the first blower *j*. Without some means to close off the second air inlet **22** or the duct *n* leading to it, the air delivery from the first blower *j* alone would drop to some unpredictable rate and heated air might enter the air conditioner cabinet *a*. The remote location of the air conditioning and heating units precludes use of a mechanical damper; and to provide an electrically controlled damper would add expense and mechanical complications.

To sole this problem I provide damper means of the atmospheric type, generally designated **30**. The embodiment illustrated in FIG. 2 includes a metal damper plate **31** larger than the second air inlet **22**. It is hinged, as hereinafter described, to blow upward when the second blower *k* is powered and to be drawn sealedly against the inlet opening **22** when there is a pressure drop in the air delivery duct *n* leading to it, compared with the pressure in the air casing **10**.

In the simple embodiment illustrated, the damper plate **31** has adhered along its upper edge the lower margin of a horizontal strip of flexible rubber **32**. The upper margin of rubber strip **32** is adhered to the downward projecting leg **33** of an angle **34** mounted beneath the top wall **13** of the air casing **10** immediately inward of the inlet wall **16**. The width of the flexible rubber strip **32** between its upper and lower margins so adhered, serves as substantially frictionless hinge means to permit the damper plate **31** to blow open from its closed position, as shown in FIG. 2 in solid lines, to its open position shown in phantom lines.

The damper plate **31** may be made of such width as to close only the second air inlet **22**. In the embodiment illustrated the plate **31** is made somewhat broader, to extend over 15 percent to 20 percent of the area of the first air inlet **21**, thus to reduce the air delivery rate to roughly 75 percent of its rate for air conditioning and to effect an increase in temperature rise, as hereinabove explained. While it is not feasible to use a hinged plate **31** to close off as much as half of the first air inlet **21**, the pressure differential exerted across the second air inlet **22** is great enough to hold the damper plate **31** firmly closed across a substantial but minor portion of the first air inlet **21**, despite the flow of air past the projecting edge **35** of the plate **31**.

To direct the air flow to both the casing outlets **18**, **19** when only the first inlet **21** is open, a vane **36**, curved in plan form, is optionally provided to extend from the center of the inlet **21** aft and curvedly a short distance toward the second air outlet **19**. In the embodiment illustrated, the vane **36** is supported by several angles **37**. A corner **38** of the damper plate **31** is cut off roundedly, as shown in FIG. 2, to provide clearance from the vane **36** when the damper plate **31** raises to open position.

FIG. 3 shows a wiring diagram in which the components of the heating unit **10** heretofore described are operably interrelated, by conventional means, with a dual blower air conditioner of the type heretofore described. The left side of the drawing shows the elements within the air conditioner cabinet *a*; the right side shows those within the heater unit circuit box **11**. Current from a 230 volt power source is supplied to a double pole relay-operated cooling contactor **41** and also to a 24 volt transformer **42**. One lead from the transformer is connected to the relay coil of the cooling contactor **41** and also to a similar relay coil in a relay **43** for the motor *f* to operate in the heating mode. An extension of this 24 volt circuit, shown in dashed lines, extends from the air conditioner cabinet *a* to connect to the relay coil of a heating contactor **44**, located in the circuit box **11** of the heater unit.

The other lead from the 24 volt transformer **42** is connected to a combination room space temperature control, including a cooling thermostat **46** and a heating thermostat **47**. The user selects which of the thermostats **46**, **47** is put into circuit. Assuming that the cooling mode is employed, the cooling contactor **41** will be closed on a temperature rise above the setting of the cooling thermostat **46**. Closing of its contacts will supply power from a 230 volt source through parallel connections to the motors *f* and *g* of the first and second blower *j*, *k*, respectively, and will also power the compressor *u*. On temperature drop, all these units will be de-energized.

When the system is operated in the heating mode, the user causes the thermostat **47** to be put into circuit. On temperature drop, current from the transformer **42** will be supplied to the coil of the relay **43** for the motor *f* and also, through the wiring sketched, to the heating contactor **44** in the air casing **10**. The relay coil in the heating contactor **44** is in series with a temperature control **49** of conventional construction. A separate 230 volt circuit leads through a heating contactor **44** and through the resistance heater **25**, which is in series circuit with it. Hence, when the room temperature is below the setting of the heating thermostat **47**, the 24 volt current actuates the relay in the heating contactor **44**, thereby to deliver the 230 volt current to the resistance heater **25**. Current through the heating thermostat **47** will also have actuated the relay **43**, causing the **230** circuit in the cabinet *a* to be made through the motor *f* only as illustrated. In this manner, power will be supplied to the blower *j* while the resistance heater **25** is energized.

It is to be understood that conventional elements such as fuses, junction boxes, etc. are employed in the usual manner; and that modifications in circuitry to meet conventional needs will be obvious to those skilled in the art.

I claim:

1. In an air conditioner of the type having a cabinet and first and second blowers operable simultaneously with or separately from each other and whose inlets are open to each other within the cabinet, such blowers having separate outlets, the improvement comprising

a heater unit including

a walled air casing having

first and second air inlets and means thereat to connect to such first and second blower outlets, respectively,

air casing outlet means, and

heating means within the air casing interposed between said first air inlet and the outlet means,

the heater unit being characterized in having

damper means inwardly adjacent to said second air inlet, to close said second air inlet responsive to suction external to said second air inlet created by said first blower,

whereby on powering such first air conditioner blower while the second is unpowered, a pressure drop within such air conditioner cabinet will close said damper means automatically and prevent recirculation to the cabinet of such air conditioner.

2. The improvement as defined in claim **1**, wherein

the heating means comprises an electrical resistance heater, together with

electrical switching and circuitry means to energize the said resistance heater and simultaneously to operate such first blower only if the air conditioner, without cooling.

3. The heater unit as defined in claim **1**, wherein

the said second air inlet is in a vertical wall of the air casing, and

the damper means comprises a flat damper plate closable against said inlet and supported by hinge means thereabove and closely adjacent to the inner surface of said vertical wall.

4. The heating unit as defined in claim **1**, wherein

said air inlets are positioned side by side in a vertical wall of the air casing, and

the damper means is a plate having upper edge hinge support means,

the plate being of such width and so positioned that when closed against said second air inlet it extends across a minor portion of said first air inlet.

5. For use with an air conditioner of the type having a cabinet and first and second blowers operable simultaneously with or separately from each other and whose inlets are open to each other within the cabinet, such blowers having separate side-by-side outlets,

a supplemental heater unit comprising

a walled air casing having a vertical wall penetrated by side-by-side first and second air inlets,

air casing outlet means, and

heating means within the air casing interposed between said first air inlet and the outlet means,

the heater unit being characterized in having

damper means inwardly adjacent to said second air inlet, to close said second air inlet responsive to suction external to said second air inlet created by said first blower,

the damper means being a plate having upper edge hinge support means,

the plate being of such width and so positioned that when closed against said second air inlet it extends across a minor portion of said first air inlet.

* * * * *