May 3, 1955 E. A. FARR ET AL 2,707,745

HEATER

Filed Aug. 18, 1952 2 Sheets-Sheet 1

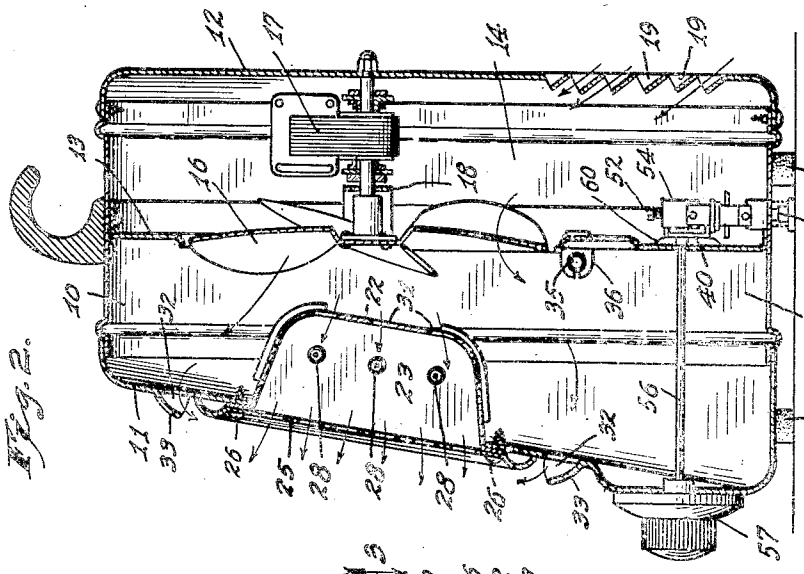


Fig. 2.

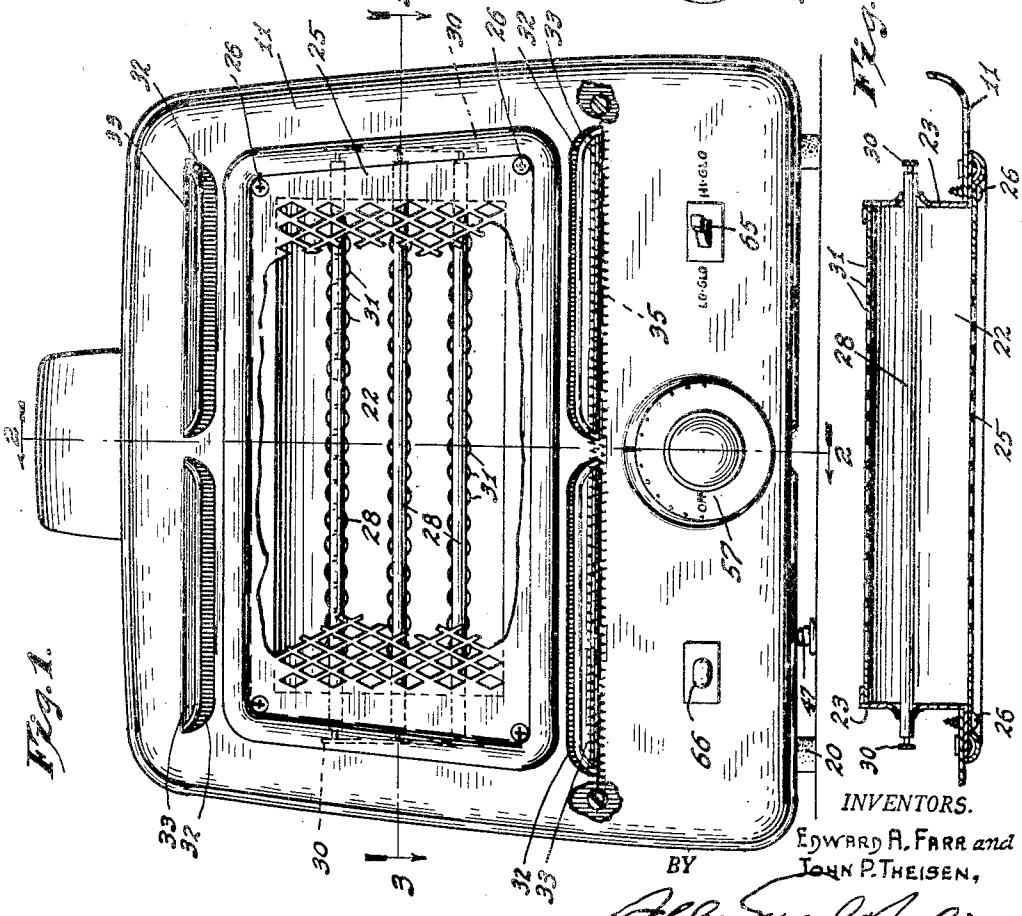


Fig. 1.

Fig. 3.

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Filed Aug. 18, 1952 2 Sheets-Sheet 2

Fig. 4.

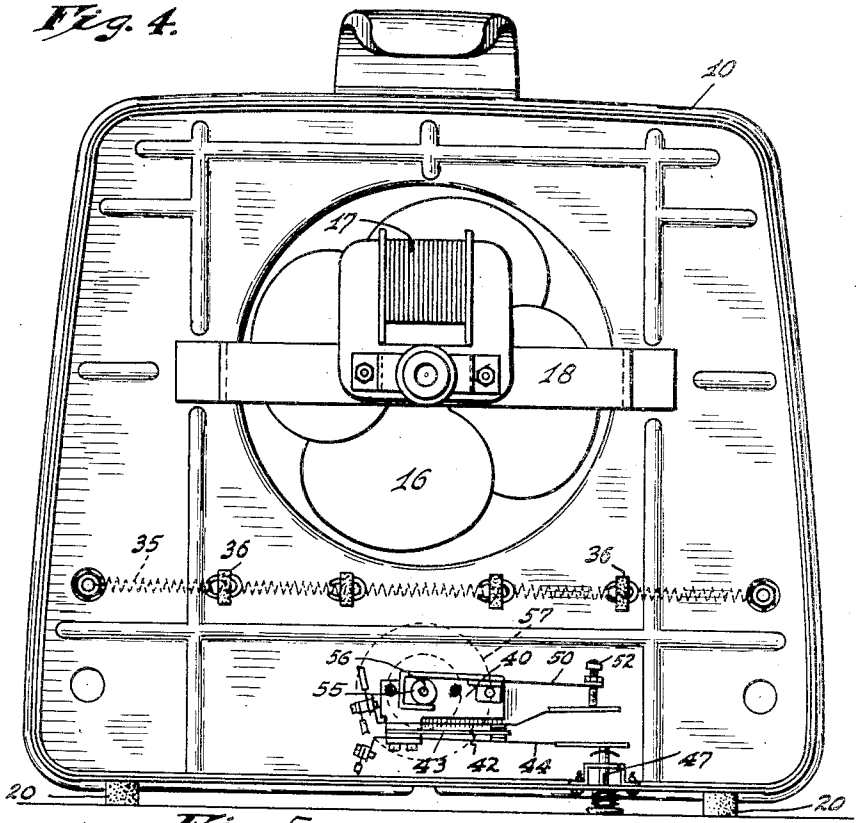


Fig. 5.

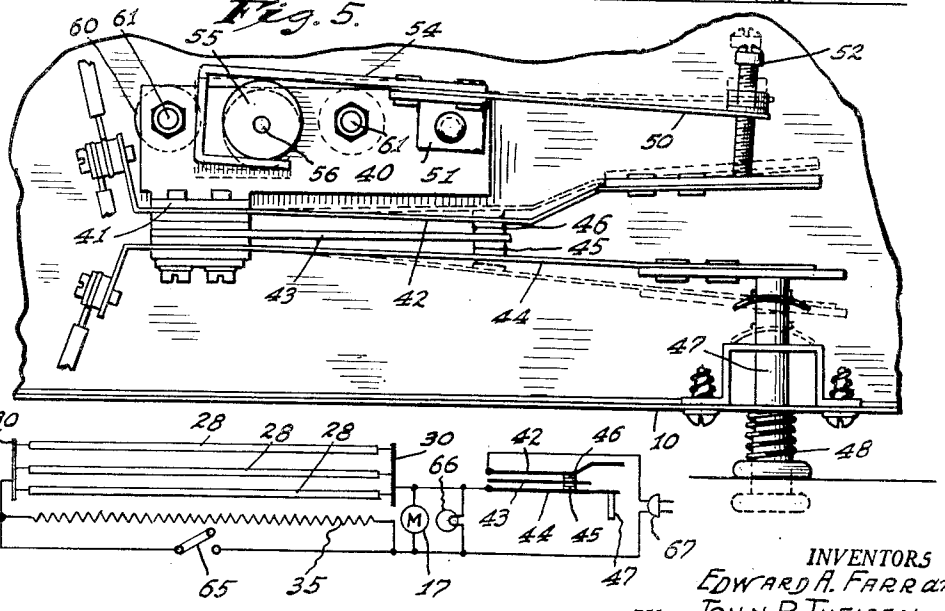


Fig. 6.

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HEATER

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Application August 18, 1952, Serial No. 304,873

4 Claims. (Cl. 219—39)

This invention relates to a portable room heater of the type embodying one or more electrical resistance heating elements and a fan or blower for discharging into a room air heated by the heating elements.

It is an object of the invention to produce a heater which will operate automatically to maintain a substantially constant temperature in the room within which the heater is located. A further object of the invention is to produce a heater which will disseminate both radiant heat and a heated air stream. Still another object of the invention is to produce an automatically controlled heater which can be simply and economically constructed, which will be conveniently portable, and which will prove durable and effective in use.

In carrying out the invention in its preferred form, we provide a casing, conveniently of metal, having interiorly a vertical partition dividing it into inlet and outlet chambers provided respectively with air-inlet and air-outlet openings. Associated with the outlet chamber is a forwardly presented reflector within which one or more electrical resistance heating elements is located. The outlet openings in the discharge chamber include one or more in such reflector, the arrangement being such that at least some of the air forced from the inlet chamber to the outlet chamber by a fan or other appropriate air-mover may escape from the outlet chamber through the holes in the reflector, passing in contact with the heating elements en route. Desirably, the outlet chamber is provided with auxiliary openings above and below the reflector and arranged to discharge obliquely across the open front of the reflector.

Within the inlet chamber, we provide a temperature-responsive element adapted to be responsive to the temperature of air drawn into the inlet chamber when the fan is operated. This temperature-responsive element, which is preferably adjustable, automatically operates a switch controlling the supply of current to the heating elements and the motor.

The accompanying drawings illustrate the invention:

Fig. 1 is a front elevation of a preferred form of heater;

Fig. 2 is a vertical section on the line 2—2 of Fig. 1;

Fig. 3 is a fragmental horizontal section on the line 3—3 of Fig. 1;

Fig. 4 is a rear elevation of the heater with the rear wall or cover removed;

Fig. 5 is a fragmental view similar to Fig. 4 but on an enlarged scale, indicating a preferred construction for the temperature-responsive element and the switch which operates it; and

Fig. 6 is a wiring diagram.

The heater shown in the drawing embodies a hollow casing 10 conveniently formed of sheet metal provided at its front with a front wall 11 and at its back with a rear wall 12, the latter being removable. A vertically extending partition located intermediately of the casing 10 between the front and rear walls divides the interior of the casing into an inlet chamber 14 and an outlet chamber 15 communicating with each other through a

large opening adapted to receive a rotatable fan 16. The fan 16 is mounted on one end of the shaft of an electric motor 17 supported from the partition 13 through a suitable bracket 18. The rear wall 12, desirably in its lower portion, is provided with a series of air-admitting openings 19. Feet 20 support the casing above the floor or other supporting surface.

Opposite the fan 16 the front wall 11 of the housing is provided with an opening adapted to receive a reflector 22, preferably formed as a stamping of bright-surfaced sheet-metal in an elongated trough-like shape and provided with end walls 23. Conveniently, the longitudinal edges of the reflector 22 and the edges of the end walls 23 are bent outwardly to form flanges lying against the front face of the front wall 11. Such flanges and the open front of the reflector are desirably covered by a foraminous grill 25, which may be secured to the front wall 11 by screws 26 passing through the aforesaid flanges.

Within the reflector and extending longitudinally thereof is an electrical resistance heater shown as comprising three elements 28 of the sheathed type. As will be seen from Fig. 3, the elements 28 may be held in place by forcing them through holes provided in the end walls 23. Beyond the end walls 23, the conductors of the heating elements are interconnected in parallel by metal-strip connectors 30.

The inner or rear wall of the reflector 22 is provided with a multiplicity of perforations 31 so located that air forced forwardly by the fan 16 will pass through such perforations, in contact with the heating elements 28, and out through the foraminous grill 25. Desirably, the front wall of the heater 11 is provided with auxiliary outlet openings 32 defined by louvers 33 disposed to direct the air emerging from the openings 32 obliquely across the grill 25.

For a reason which will hereinafter become apparent, the heater in the drawing is shown as provided with an auxiliary heating element 35 in the form of an open coil of resistance wire supported in front of the partition 13 through insulators 36.

Within the inlet chamber 14, and conveniently near the bottom thereof adjacent the inlet openings 19, we provide automtaic temperature-responsive mechanism for controlling the current to the heating elements and to the motor. A preferred form of such mechanism is shown in Fig. 5. It comprises a base 40 secured to the rear face of the partition 13 having, near its bottom, an outturned ear 41 to which are secured in insulated relationship an upper contact arm 42, an intermediate contact arm 43, and a lower contact arm 44. The lower contact arm 44 and intermediate arm 43 have cooperating controls 45, while the intermediate and upper arms have cooperating contacts 46; the arrangement being such that current will flow between the upper and lower contact arms only when both the contacts 45 and contacts 46 interengage.

The lower contact arm 44, which is desirably of spring metal, is biased downwardly, but is adapted to be forced upwardly to cause interengagement of the contacts 45 by a plunger 47 vertically slidable in the lower wall of the casing 10. A spring 48 urges the plunger 47 downwardly to permit the contacts 45 to separate; but the plunger is so arranged that engagement of its lower end with the floor will force it upwardly in the casing to elevate the arm 44 and close the contacts 45.

The upper contact arm 42, like the lower contact 44, is desirably of spring metal and is biased upwardly. To force the arm 42 downwardly and cause interengagement of the contacts 46, we employ a temperature-responsive element shown as in the form of a bi-metal strip 50 secured to a bracket 51 pivotally supported on a horizontal axis from the base 40. The strip 50, which flexes up-

wardly upon increases of temperature, is provided at its outer end with an adjustable screw 52 adapted to bear on the outer end of the contact member 42.

It will be obvious that the temperature at which the bimetal strip 50 operates to cause an interengagement of the contacts 46 will depend upon the position of the bracket 51 about its axis of pivotal connection to the base 40. To control adjustment of the bracket, there is secured to it a rigid adjusting member 54 having its remote end bent into a U-shape to embrace a substantially circular cam 55 eccentrically mounted on an adjusting shaft 56. The shaft 56 (Fig. 2) extends through the partition 13 and front wall 11, being provided in advance of the front wall with a graduated adjusting knob 57. By rotating the knob 57 the cam 55 may be rotated to rock the bracket 51 about its axis and thus control the temperature at which the bimetal strip 50 acts to cause engagement of the contacts 46.

We have found that the temperature-responsive switch mechanism above described may be used to exercise an effective automatic control over room temperature if adequate precautions are taken to reduce the transmission of heat within the casing 10 from the elements 28 and 35 to the temperature-responsive element 50. The partition 13 serves to reduce such direct heat transmission, since it serves as a reflector reflecting forwardly heat emanating from the heating elements. Locating the temperature-responsive switch mechanism in a separate chamber from that containing the heating elements, adjacent the bottom of that separate chamber, and near the opening through which air enters tends further to render the temperature-responsive element more accurately responsive to the temperature of the air entering through the inlet openings 19. To reduce direct heat transmission from the partition 13 to the temperature-responsive element, the partition may be provided with rearwardly offset bosses 60 on which the base 40 is supported by bolts 61, the bosses serving to hold the base 40 in spaced relation to the partition, thus permitting some of the air entering the inlet chamber 14 to flow upwardly between the partition and the base 40.

In addition to the parts above described, the heater includes a switch 65 and a pilot lamp 66.

As will be clear from the wiring diagram constituting Fig. 6, the heating elements 28 are connected in parallel with each other and in series with the heating element 35 and the double switch 45, 46 to the terminals of a connector plug 67 by which the heater may be connected to a current-source. The motor 17 and pilot lamp 66 are connected across the heating elements so as to be controlled jointly with the heating elements by the switch 45, 46. The switch 65 is connected across the auxiliary heating element 35 and serves, when closed, to render that heating element effectively inoperative.

With the heater resting in vertical position upon the floor or other supporting surface, the plunger 47 will be elevated, thus forcing the contact arm 44 upwardly and closing the switch 45. If the plug 67 is connected to a suitable source of current, energization of the heating elements and the motor 17 will depend upon the condition of the contacts 46. If the room in which the heater is located is at a temperature below that for which the control knob 57 is adjusted, the bimetal strip 50 will be depressed to force the contact arm 42 downwardly and close the contacts 46, thus causing current to be supplied to the heating elements and the motor 17. Operation of the motor causes air to be drawn into the inlet chamber 14 through the openings 19 and to be forced by the fan 16 through the openings 31 and 32. Some of the heat emanating from the heating elements 28 will be given up to the air which passes through the openings 31 and over the surfaces of the heating elements. Desirably, the heating elements 28 operate at a temperature sufficient to cause them to glow; and as a result, a considerable amount of radiant heat will be emanated. The reflector 22 serves

to reflect forwardly the radiant heat not emitted through the grill 25. Air escaping through the openings 32 is warmed by heat which escapes by conduction from the heating elements through the reflector.

As the heater continues to operate, the room in which it is located will be warmed, and the temperature of the air entering through the openings 19 will increase. In response to the increased temperature of the air entering the inlet chamber 14, the temperature-responsive element 50 will flex upwardly; and when the room becomes heated to the temperature for which the control knob 57 has been set, upward flexing of the temperature-responsive element 50 will permit the contacts 46 to open, thus interrupting the supply of current to the heating elements and motor.

The pilot lamp 66 is desirably mounted, as indicated in Fig. 1, so as to be visible from in front of the heater. It serves to indicate whether or not the heating elements and motor are being supplied with current.

It will be noted from Fig. 2 that the front wall 11 of the heater is disposed at an inclination, sloping generally upwardly and rearwardly from its lower edge. This constitutes a safety feature, lessening the chance that the heater will be placed against a wall or an article of furniture in such a way that air-outlet openings would be occluded and prevent dissemination of heat from the heater. Another safety feature resides in the louvres 33 and their effect in directing air obliquely across the open front of the reflector, thus militating against overheating by radiant heat of any object too near the open front of the reflector. The switch-closing plunger 47 is likewise a safety feature; for, since the switch 45 will be closed only when the plunger is forced upwardly by contact with a support, the heater cannot be operated while lying face-down on the floor with the air-outlet openings occluded. This latter feature forms the subject-matter of our prior Patent No. 2,590,600, granted March 25, 1952.

We claim as our invention:

1. A heater, comprising a casing having a front wall, said casing also having air-inlet and air-discharge openings, the latter being in said front wall, electrical resistance heating means disposed in the casing in alignment with the air-discharge opening, a reflector for reflecting forwardly heat emitted from said heating means, said reflector having air-passing openings in rear of said heating means, means within said casing for drawing air inwardly through said inlet opening and forcing it forwardly through the reflector-openings, said reflector-openings and said heating means being located in line with the discharge from said air-forcing means whereby air entering the reflector will flow directly over and in heat-receiving contact with said heating means, and out said discharge opening, the front wall of said casing having an auxiliary air-outlet opening at one side of said air-discharge opening, and means for directing air emerging from said auxiliary opening obliquely across said air-discharge opening.

2. A heater, comprising a casing, a vertically extending partition dividing said casing interiorly into inlet and outlet chambers, said inlet chamber having one or more air-admission openings near its lower end, said partition having at its upper portion and wholly above said air-admission openings an opening for the pasasge of air from the inlet to the outlet chamber whereby air entering said air-admission opening will flow generally upwardly to said first named opening, means in said casing for drawing air inwardly through said air-admission openings and discharging it through said outlet chamber and air-discharge openings, electrical resistance heating means in said outlet chamber for heating the air passing therethrough, and temperature-responsive means for controlling said heating means, said temperature-responsive means being located in the lower portion of said inlet chamber adjacent the path of air entering through said air-admission openings.

3. A heater, comprising a casing, a vertically extending partition dividing said casing interiorly into inlet and outlet chambers, said inlet chamber having one or more air-admission openings near its lower end, said partition having at its upper portion and wholly above said air-admission openings an opening for the passage of air from the inlet to the outlet chamber whereby air entering said air-admission opening will flow generally upwardly to said first named opening, means including a rotatable, axial-delivery fan located in said first named opening in said casing for drawing air inwardly through said air-admission openings and discharging it through said outlet chamber and air-discharge openings, electrical resistance heating means in said outlet chamber for heating the air passing therethrough, and temperature-responsive means for controlling said heating means, said temperature-responsive means being located in the lower portion of said inlet chamber adjacent the path of air entering through said air-admission openings.

4. A heater as set forth in claim 1 with the addition that there are two auxiliary air-outlet openings in said front wall, one of said openings being located above and the other below said air-discharge opening, said air-directing means directing downwardly air emerging from the upper auxiliary opening and directing forwardly air emerging from the lower auxiliary opening.

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