Oct. 19, 1948. M. R. DALLIN 2,451,926

ELECTRIC AIR HEATER

Filed Jan. 30, 1946 2 Sheets-Sheet 1

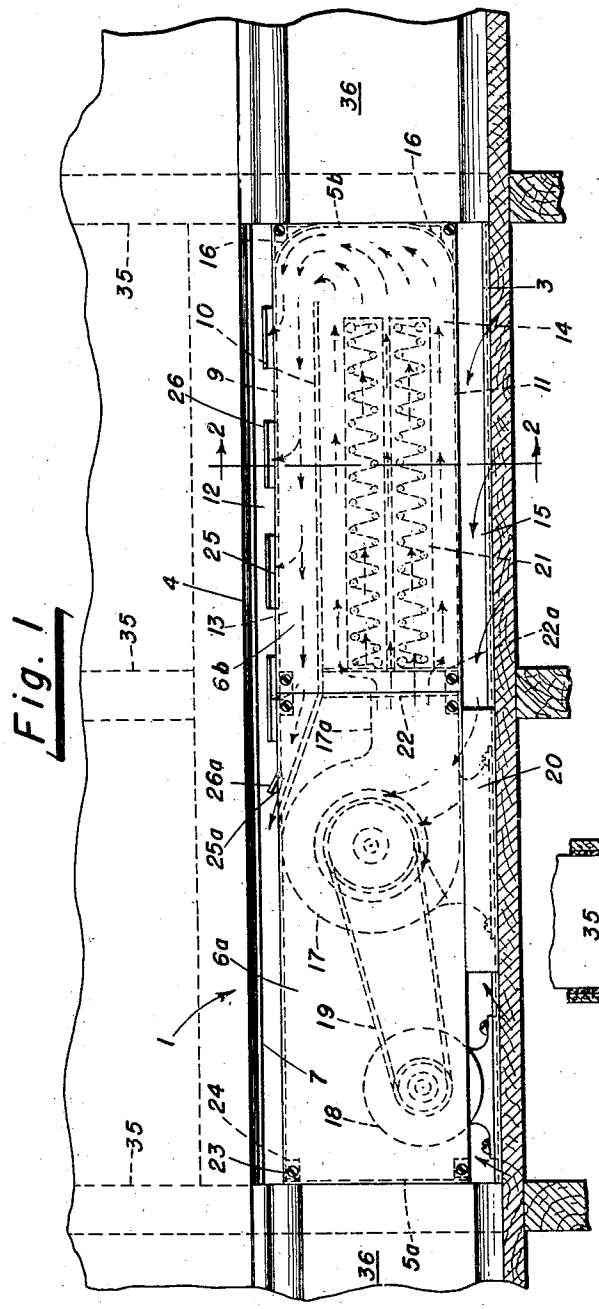


Fig. 1

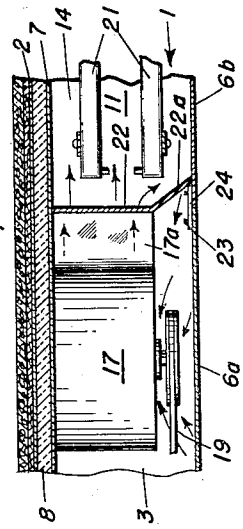


Fig. 3

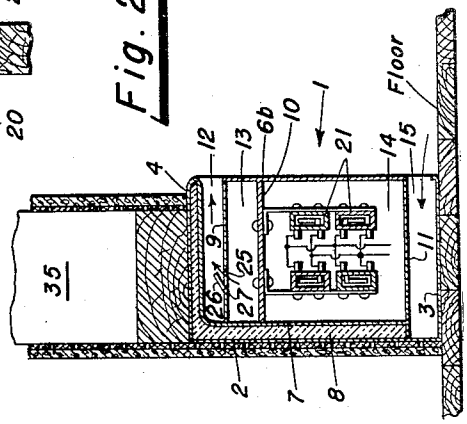


Fig. 2

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ELECTRIC AIR HEATER

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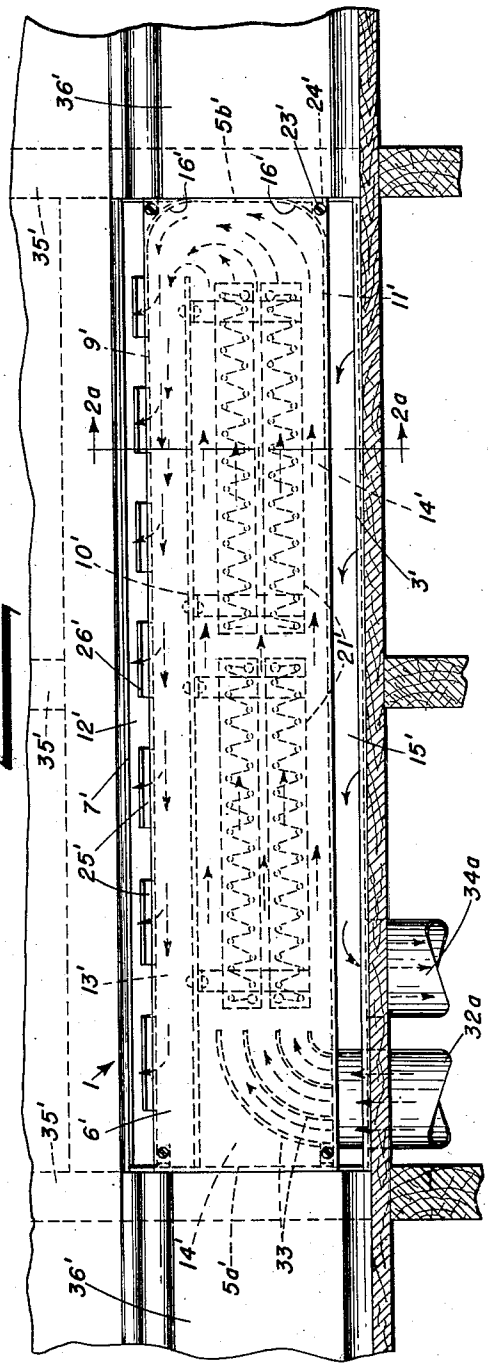


Fig. 5

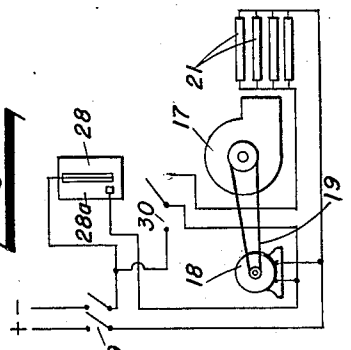


Fig. 4

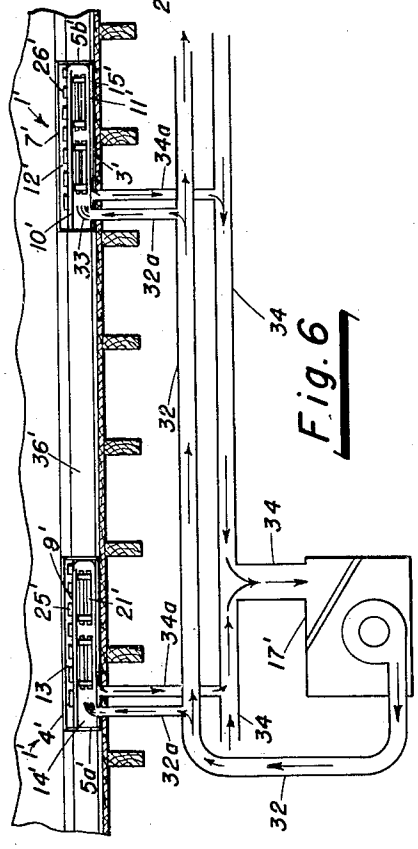


Fig. 6

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UNITED STATES PATENT OFFICE

2,451,926

ELECTRIC AIR HEATER

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11 Claims. (Cl. 219—39)

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This invention relates to an improved construction for an electric air heater of the type which includes a motor-driven blower that forces air though the heater casing in heat exchange relation with the electric heating elements. In accordance with this invention, heaters may be constructed as portable units but are particularly well suited for permanent installation within the wall of a room at baseboard level.

One object of the invention is to provide a heater of the type described in which the component parts are arranged in a novel and improved manner to produce a heater unit that is relatively long, low and of shallow depth.

Another object is to provide a heater unit having an improved arrangement of internal air ducts whereby a near-maximum amount of heat is transferred to the air as it is passed through the heater.

A further object is to provide a heater unit which includes an air distribution duct disposed directly over the duct in which the heating elements are placed whereby the air after being primarily heated by the heater elements is subjected to secondary heating in the distribution duct before it is discharged into the room.

Still another object is to provide a heater unit which includes a plurality of adjustable warm air outlets so that the air may be discharged at predetermined and adjustable velocities and quantities for ultimate delivery into the room at a substantially unform velocity throughout the entire useful length of the opening.

Yet another object is to provide an improved heater unit of the type described in which the utilization of heat produced by the unit approaches a near optimum.

A further object is to provide an electric heater unit operating at a high efficiency factor and which transfers heat to the room by convection, conduction and radiation.

A still further object is to provide a heater of the general type described having an improved arrangement for utilizing cold air which is returned to the unit from the room to cool the motor which drives the air blower.

These and other objects of the invention will become apparent from the following description when considered with the accompanying drawings that illustrate preferred embodiments of the invention.

Referring now to the drawings, in which like parts are indicated by similar reference characters in the several views, Fig. 1 is a front elevation showing one embodiment of a heater incorporating the invention wherein the motor driven blower constitutes an integral part of the unit, and which is particularly well suited for installation in a wall at baseboard level; Fig. 2 is a transverse section taken on lines 2—2 of Fig. 1; Fig. 3 is a partial plan view showing the arrangement of heater parts at the outlet of the blower; Fig. 4 is a circuit diagram illustrating one way in which operation of the heater may be controlled; Fig. 5 is a front elevation of a modified form of a built-in wall type heater in accordance with this invention; and Fig. 6 is a diagrammatic view showing a heating system which utilizes a plurality of heaters of the type shown in Fig. 5 in conjunction with a single air blower-filter unit that forces air through the several units to be heated, the air after circulation through the room or rooms then being returned to the blower for recirculation and reheating in each unit.

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Referring now to the construction shown in Figs. 1–3, the heater comprises a substantially rectangular and elongated casing 1 preferably made from relatively thin sheet steel and set into a wall of a room preferably at the floor level or incorporated in the baseboard member. The casing includes a back wall 2, bottom wall 3, top wall 4, end walls 5*a*, 5*b* and a pair of front panel walls 6*a*, 6*b*. A partition 7, also of sheet steel extends substantially parallel with and is spaced from the back and top walls 2 and 4. The space between these walls and partition 7 is filled with insulation material 8.

One section of the interior of casing 1 is divided longitudinally by three horizontally arranged partitions 9, 10 and 11 into four ducts. From the top down, and in order, these may be designated as the warm air discharge duct 12, the warm air distribution duct 13, a heater element duct 14 and a cold air inlet duct 15. At the right end of the casing, curved panels 16 may be installed to streamline the air flow between ducts 14 and 13.

The other section of casing 1 houses a blower 17, preferably a centrifugal type of conventional construction, which is coupled to a motor 18 by belt drive 19. Blower 17 and motor 18 are preferably located in line along the longitudinal axis of casing 1 so as to take up a minimum amount of space in depth.

So that motor 18 will be assured of receiving an adequate amount of air circulating around it for cooling, a portion of the cold air duct 15 may be blocked off at the room side by a panel 20. Thus with the blower running, air will be drawn

into its inlet from the cold air inlet duct 15 from the left as well as the right side of panel 20.

Blower 17 has its outlet 17a arranged so as to blow air into the left end of duct 14 which contains one or more paralleled and longitudinally extending electric heater elements 21. In the illustrated embodiment, heater elements 21 are of the enclosed bar type but it is to be understood that other types of heater elements may be utilized.

As shown in Figs. 1 and 3, a vertical partition having a straight portion 22 and a bent portion 22a extends across the interior of casing 1 at the end of the blower outlet 17a from partition 7 to the interior surface of the front panel 6b. In a vertical direction, the bent portion 22a extends between horizontal partitions 10 and 11, and the straight portion 22 from the top of the blower outlet 17a to partition 10. Thus all the air delivered from the blower outlet 17a is directed into the left end of duct 14 to be heated.

Panels 6a, 6b may be fastened in position in a detachable manner, such as by bolts 23 which thread into ears 24 secured to the interior walls of casing 1, in order to permit the operating components of the heater to be serviced conveniently. Furthermore, panel 6b is located sufficiently close to heater elements 21 so that a substantial amount of heat will be transferred thereto. Spaced longitudinally along the partition 9 are a plurality of slotted apertures 25 through which warmed air is discharged into the warm air discharge duct and thence into the room. These apertures are of varying widths, with the most narrow one being located at the right end of casing 1. Further, a cover plate 26 mounted on hinge 27 is preferably associated with each of the apertures and these may be adjusted angularly. Angular adjustment of coverplates 26 serves to regulate the direction and velocity of the warmed air through the warm air discharge duct into the space to be heated. Such adjustment may be made either at the factory or at the place of installation so as to effect a substantially uniform distribution of warmed air throughout the entire portion of the warm air discharge duct which is provided with the apertures 25.

The left end portion of partition 10 slopes upwardly to meet the underside of partition 9 at blower 17, and adjacent the junction of these partitions, partitions 9 may also be provided with one or more slotted apertures 25a and hinge mounted cover plates 26a which extend transversely of the casing 1 so that some of the warm air will be distributed to that part of the warm air discharge duct 12 over the motor and blower and thence into the room.

Operation of the heater shown in Fig. 1 may be controlled by manually or automatically actuated switches of conventional construction and circuit arrangement. One suitable control is shown in Fig. 4 wherein the heater elements 21, connected in parallel, and motor 18 are supplied with current from a source identified by conventional symbols, through a circuit that also includes a thermostat switch 28 located in the room to be heated and manually operated switches 29 and 30. Switch 29 is a double pole single throw for controlling power supply to the unit while switch 30 is single pole double throw to provide operation of the unit as a heating device in winter and as an air circulating device only in summer. With switch 29 closed and switch 30 closed in the right hand position, motor 18 and heater elements 21 will become energized automatically whenever contacts 28a of thermostat switch 28 close.

It will be seen that motor 18 alone may also be energized over a circuit which includes double pole switch 29 and single pole double throw switch 30 closed to the left hand position. With switch 30 in this latter position, heating elements 21 remain deenergized. Motor 18 will then drive blower 17 to circuate air through casing 1 without heating it when air circulation alone is desired.

With the motor 18 and blower 17 running, and with heater elements 21 energized, air will be delivered from the blower outlet 17a to the left end of duct 14. As air passes longitudinally along this duct, it is heated by elements 21. When the air reaches the right end of casing 1 it is turned by the lower curved panel 16 and passes upwardly, it being noted that partition 10 terminates short of end wall 5b to constitute a passageway between ducts 14 and 13. Upon reaching duct 13, the air is turned again by upper curved panel 16 and flows along this duct in a direction opposite to air flow in duct 14 where it is further heated by passing over partition 10 which is heated because of the proximity of heating coils 21. The air is then discharged through openings 25, 25a into the warm air discharge duct 12 and enters the room.

Cold air at floor level enters all along duct 15, is preheated therein prior to delivery to the inlet of the blower 17 and is subsequently discharged into the heater duct 14 for reheating and recirculation.

In addition to the heating effect obtained by forcing air over the heater elements 21 and then discharging it into the room for circulation, the front panel 6b which receives an appreciable amount of heat from heater elements 21 becomes quite warm by conduction of heat therethrough and this also serves to heat the room by radiation from its heated roomside surface.

A heater unit constructed in accordance with this invention possesses a high factor of heating efficiency because substantially all of the heat produced by the heater elements 21 is conveyed directly to the room with minimum losses. The layer of insulation 8 at the back and top of the heater reduces the transfer of heat in these directions, and any heat transferred by conduction through horizontal partitions 10 and 11 is picked up by the warmed air passing through duct 13 and the cold air returning to the heater through duct 15 respectively.

Also since partition 10 thus serves as a secondary heating surface for the warmed air as it passes through distribution duct 13, and partition 11 a pre-heating surface for the cold air returning all along duct 15, a near-maximum amount of heat is transferred to the air from the heater elements before being discharged into the room.

A modified construction for a heater embodying this invention is shown in Fig. 5. A view in transverse section such as along line 2a—2a would be the same as that shown in Fig. 2. In this embodiment, however, it will be seen that the horizontal partitions 9', and 11', and apertures 25' extend for the full length of the casing 1' instead of part way as in Fig. 1. Pratition 10' extends for substantially the entire length of casing 1', it being terminated just short of end wall 5b' to provide a passageway between heater duct 14' and warm air distribution duct 13', The front panel is a single plate 6', and there are

an increased number of bar type heater elements 21'.

The type of heater shown in Fig. 5 is intended for use in a heating system such as shown in Fig. 6 which comprises a central motor-driven blower-filter unit 17' conveniently located, as in a basement, which is provided to deliver air through a system of main and branch ducts 32, 32a, respectively, to a plurality of heaters 1'. Each branch duct 32a is fitted closely within an opening of approximately the same size in the left end of partition 11'. A plurality of curved vanes 33 supported at this end of duct 14' function to turn the air flowing from duct 32a into a horizontal direction for pasage along and within duct 14' to be heated by the electric heating units 21'. As air reaches the right end of casing 1' it rises into and is then passed back along duct 13' where it is discharged through openings 25' into the warm air discharge duct and thence into the room. Cold air from the room is drawn into casing 1' along duct 15' and passes downwardly through branch and main ducts 34a, 34 respectively, to the intake of the blower-filter unit 17' for filtering and redelivery to the casings 1'.

In the drawings the heater casings have been illustrated as being dimensioned to permit installation between three upright studs 35 of an internal wall of present conventional construction, the height of the casings being the same as that of the base board 36 to present a pleasing appearance. It is to be understood, however, that the dimensions of the casings and the capacity of the electric heater elements may be varied to suit any particular design requirement without departing from the basically novel and improved form of heater construction as defined in the appended claims.

I claim:

1. An electric heater comprising an elongated casing, a partition dividing said casing longitudinally into upper and lower ducts, an electric heater element disposed in said lower duct, a motor-driven blower, said blower having its outlet in communication with one end of said lower duct, means defining a passageway between said lower and upper ducts at the other end of said lower duct to reverse the direction of air flow upon reaching said upper duct, and outlet means disposed along an exterior wall of said upper duct for discharging warmed air.

2. A heater unit as defined in claim 1 wherein said blower is located within said casing.

3. A heater unit as defined in claim 1 wherein said blower is located exteriorly of said casing.

4. An electric heater comprising, an elongated casing, a partition dividing one section of said casing longitudinally into lower and upper ducts, a centrifugal blower and motor coupled thereto disposed longitudinally in an adjacent section of said casing, said blower having its outlet connected to one end of said lower duct and its inlet open to the space to be heated, heater element means disposed in said lower duct, means defining a passageway between said lower and upper ducts at the other end of said lower duct to reverse the direction of air flow upon reaching said upper duct, and outlet means disposed along an exterior wall of said upper duct for discharging warmed air into the space heated.

5. A heater as defined in claim 4 and further including means channeling at least a portion of the air returning to the inlet of said blower over said motor for cooling.

6. An electric heater comprising an elongated casing, a plurality of partitions extending longitudinally within and dividing said casing horizontally from top to bottom into a warm air discharge duct, a warm air distribution duct, an air heater duct and a cold air return duct, respectively, said air return and discharge ducts being open along the front of said casing, electric heater element means disposed in said heater duct, a motor driven blower, said blower having its outlet communicating with one end of said heater duct and its inlet in communication with said air return duct, means defining a passageway between said heater and distribution ducts at the other end of said heater duct to reverse the direction of air flow upon reaching said distribution duct, and air outlet means disposed along said topmost partition for the passage of warm air from said distribution duct into said discharge duct.

7. A heater as defined in claim 6 wherein said blower is of the centrifugal type and is located within said casing.

8. A heater as defined in claim 6 wherein said outlet means comprise a plurality of apertures increasing respectively in discharge area in the direction of air flow through said distribution duct, and a cover plate associated with each said aperture, said cover plates being adjustable angularly to give directional and velocity control of the air discharged into the space heated.

9. A heater as defined in claim 6 wherein said outlet means comprises a plurality of apertures increasing respectively in discharge area in the direction of air flow through said distribution duct.

10. A heater as defined in claim 6 wherein the partition common to said warm air distribution and air heater ducts terminates short of the end wall of said casing to constitute the said passageway between said ducts.

11. A heater as defined in claim 6 wherein said electric heater element means is located sufficiently close to the front wall of said casing to transfer a substantial amount of heat thereto, said wall thereby serving as a source of radiant heat.

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