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3,310,652

HEATING APPARATUS

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2 Sheets-Sheet 1

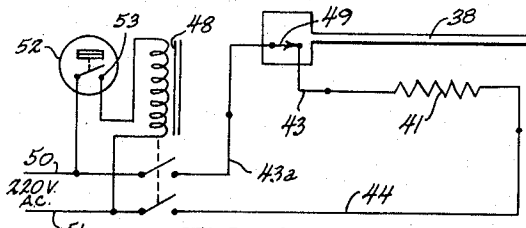


FIG. 6

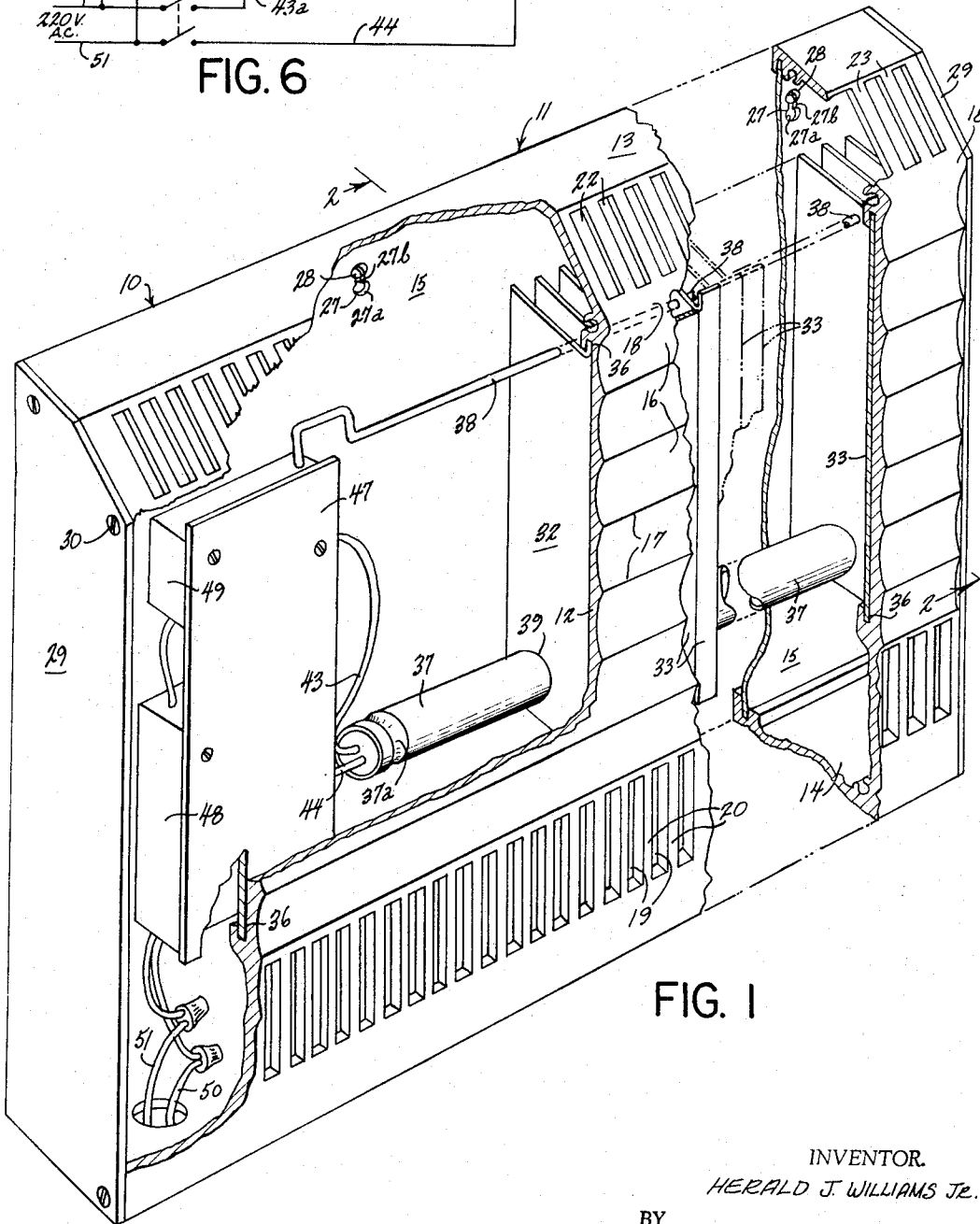


FIG. 1

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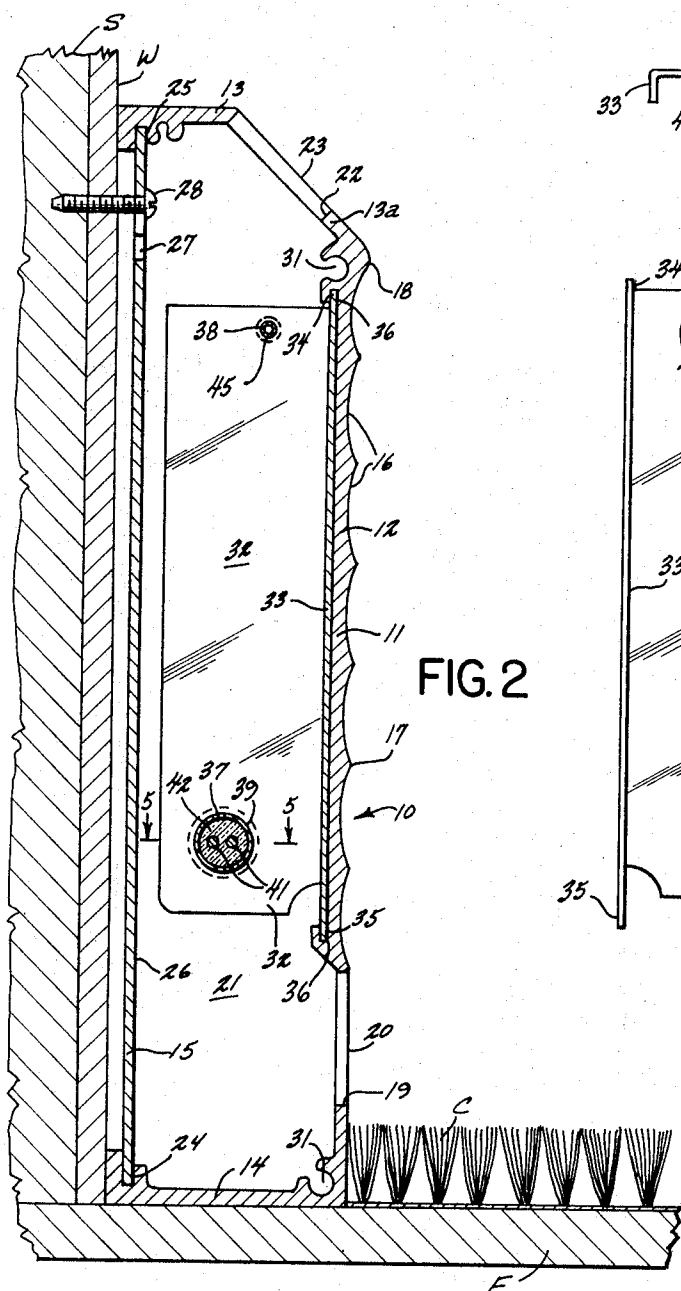


FIG. 2

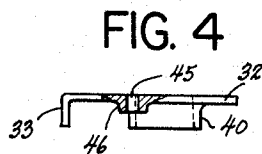


FIG. 4

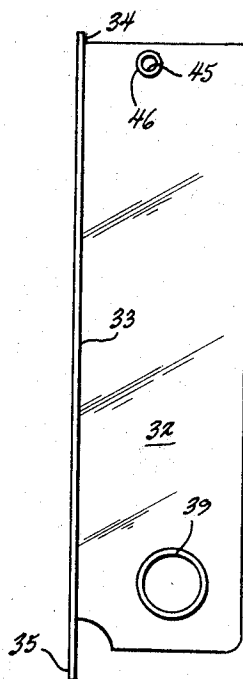


FIG. 3

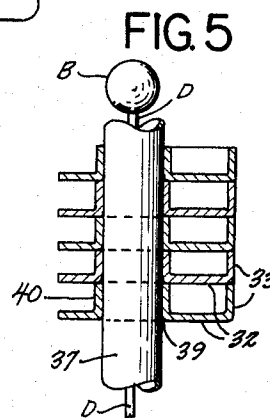


FIG. 5

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HEATING APPARATUS

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5 Claims. (Cl. 219-365)

This invention relates to an electric baseboard heating unit.

An object of my invention is to provide a new and improved electric baseboard heating unit of simple and inexpensive construction and operation.

Another object of my invention is to provide a novel extruded aluminum electric baseboard heating unit producing substantial radiation and convection of heat to effect very desirable even heating of a room or space.

Still another object of my invention is to provide a new and novel electric baseboard resistance heater utilizing a light weight shell or housing of extruded aluminum to which heat is efficiently supplied by conduction without noise of expansion of the parts as to produce heat radiation in multiple horizontal and obliquely upward and downward directions.

A further object of my invention is to provide an improved electric baseboard resistance heater which may be readily and easily installed which operates at safe temperatures to prevent injury or damage to persons or objects by heat.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a perspective view broken away and shown in section for clarity of detail.

FIG. 2 is a transverse section view of the invention taken at 2-2 of FIG. 1 and shown installed against the wall of the building, as at 2-2 in FIG. 1.

FIG. 3 is an elevation view of one of the fins employed in the present invention.

FIG. 4 is a top plane view of the fin of FIG. 3.

FIG. 5 is a detail section view taken approximately at 5-5 in FIG. 2 and showing the apparatus in partial assembly and also illustrating diagrammatically one mode of tightly securing the heater tube to the fins by expansion of the heater tube after assembly.

FIG. 6 is a circuit diagram, typical of the circuits that may be employed in connection with the present invention.

One form of the invention is illustrated in the drawings and is described herein. The space heating unit is indicated in general by numeral 10 and includes an extruded aluminum housing 11 which includes an upright front wall 12, a top 13 and a bottom 14. A back panel 15 is formed separately from the extrusion and is assembled therewith.

It will be noted that the front wall 12 has a plurality of shallow rounded grooves 16 in the front face thereof, giving the front face of the wall 12 a fluted appearance. The peaks 17 of the ridges extending along the grooves or flutes 16 lie substantially in a common upright plane, but it will be noted that the uppermost ridge 18 projects

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forwardly beyond the common plane of the ridge peaks 17 so as to act as a bumper to prevent furniture and other objects from engaging and defacing the front face at peaks 17 and in the grooves 16.

The front wall 12 also has a plurality of elongate of slot-shaped air inlet ports 19 spaced above the bottom 14 of the housing a substantial distance so as to be well above the uppermost portions of any carpeting on a floor F which also supports the space heater 10. The air inlet ports 19 are separated from each other by narrow bridging portions 20 across which air sweeps as it enters the interior 21 of the housing to cool these bridging portions and effectively minimize conduction of heat from the front wall 12 to the bottom 14 in rear portions of the housing.

An inclined front portion 13a of the top is also provided with a plurality of slot-like air outlet ports 22 through which the convection currents of heated air escape from the hollow interior 21 of the housing. The outlet ports 22 are separated from each other by narrow bridging portions 23 across which the air sweeps as it passes through the outlet ports 22 so as to effectively remove a substantial portion of any heat being conducted along the bridging portions 23 from the front wall 12 and thereby minimize transfer of heat by conduction through the top 13 to the rear portion of the housing.

The back panel 15 extends throughout the entire length of the housing 11 and has its edges confined in grooves 24 and 25 in the extruded bottom and top 13 and 14. The back panel 15 is constructed of aluminum and has a smooth mirror-like heat reflective inner surface 26 acting to minimize heating of the back panel 15, and thereby cooperates with the slot at top 13 of the housing and the lower portion of the front wall 12 in maintaining minimum temperatures at the wall W against which the space heater 10 is mounted. Furthermore it will be noted that the back panel 15 is spaced from the surface of wall W.

The back panel 15 is provided with a plurality of keyhole shaped apertures 27 aligned at upper portion of the panel and receiving screws 28 secured to the studs S of the wall W. The keyhole slots 27, which have enlarged screw head receiving lower portions 27a and reduced screw shank receiving upper portions 27b, are spaced from each other all along the back panel 15 by spacings of approximately one inch so that regardless of the location of the studs S in the wall, the entire space heating unit 10 may be placed in the precisely desired position on the wall. It will be noted that the keyhole slots 27 are disposed opposite the ports 22 through which screw driven access may be had to the screws 28 for tightening after the space heating unit is hung on the screws.

It will further be noted that endwalls 29 are attached to the housing 11 as by self-tapping screws 30 extending into extruded recesses 31 of the housing.

It is well to note that the extrusions may be cut off in substantially any length, according to the size of heating unit desired for heating the space or room of the building defined by the walls and floor. There is essentially no modification of the structure except as for length in order to change from one size of heating unit to another.

Means are provided for supplying heat to the front wall

12 of the housing and for heating the air within the interior 21 of the housing as to produce convection currents of heated air passing outwardly at ports 22. It should be noted that as the front wall 12 is heated, radiant heat is emitted from the front surface of wall 12. Because the front of the surface of the wall is provided with a plurality of flutes or grooves 16, the radiation of heat is in multiple horizontal and upwardly and downwardly inclined directions so as to assure distribution of the radiant heat through a range of elevation substantially greater than the width of the radiating front surface of the housing. The floor and objects thereon, and objects disposed off the floor are effectively heated by the multi-directional radiant heat rays emitted from the front wall 12. The means supplying heat to the front wall 12 and to the air within the interior 21 includes a plurality of sheet aluminum fins 32 in spaced and confronting relation with each other and lying substantially normal to the front wall 12. The front edge portion of each of the fins 32 defines an integral flange 33 lying flush against the inner surface of front wall 12 and having upwardly and downwardly projecting terminal ends 34 and 35 within cooperating grooves 36 integrally formed in the extruded front wall 12. The flange 33 of each of the fins 32 extends transversely along the front wall 12 into engagement with the next adjacent fin 32 so as to engage the front wall under a maximum of area, thereby conducting a maximum of heat to the front wall. It is important to note that the fins 32 are assembled with each other and with the heater tube 37 and with the temperature sensing probe 38 prior to assembly with the housing 11. The fins 32 are maintained in predetermined relation with each other by the aluminum heater tube 37 which extends through the aligned openings 39 of the fins. It is important to note that each of the fins 32 is also provided with an integrally formed boss or collar 40 around the periphery of opening 39 and projecting transversely from the fin along the heater tube 37 in tightly gripping relation therewith and into engagement with the next adjacent fin 32. The height of each of the bosses or collars 40 is equal to the width of the flanges 33, and it will therefore be seen that the fins 32 with their integral bosses or collars 40 engage the heater tube 37 over its entire heating length.

In order to assure maximum conduction of heat from tube 37 to each of the fins 32, the openings 39 and collars 40 are formed as closely to the size of the tube 37 as is possible in a drawing operation; and after the preliminary assembly of fins 32 on the tube 37 is effected in the manner illustrated in FIG. 5, the tube 37 is physically and permanently expanded to a larger size to effect a pressure in the engagement between the tube 37 and each of the collars 40 and thereby cause maximum heat conduction from the tube to the fins. In one form as illustrated diagrammatically in FIG. 5, a hardened ball B having a size slightly in excess of the interior of the tube 37 is drawn by means of a cable through the interior of the tube after the preliminary assembly of fins 32 thereon. Expansion of the tube 37 into intimately pressurized engagement with the fins is thereby effected. It will be understood that subsequent to the preliminary assembly of the fins and heater tube 37 the fins may then be moved into the cooperating mounting channels 36 of the housing so that the flanges 33 lie flush against the front wall 12.

The heat supplying resistance wires 41 are mounted in suitable ceramic or lava insulators 42 and are then slipped into the heater tube 37, one end of which is closed upon an insulator as by crimping as indicated at 37a in FIG. 1. After a quantity of powdered insulating material such as magnesium oxide, is poured into the tube to fill all the voids, as between the wires and the insulation, the other end of heater tube 37 is similarly closed or pinched shut. Conductors 43 and 44 connect to the

resistance wires 41 within the heater tube 37 adjacent the first fin of the series.

The temperature sensing probe 38 comprises, in the form shown, a tube which extends through aligned apertures 45 at the upper portions of the fins 32. The fins 32 are provided with collars 46 around the peripheries of apertures 45 which engage the probe or tube 35 in intimate heat conducting relation. It will be noted in FIG. 4 that the collars 46 are relatively short as compared to the height of boss or collar 40 and therefore the probe or tube 38 is exposed to the air between each of the fins.

It is to be noted that all of the components including the extruded housing 11, fins 32, heater tube 37 and tube 38 are all aluminum or aluminum alloys having similar expansion and contraction characteristics under heating and cooling. As a result, heating and cooling is accomplished quietly and without the noise or cracking usually experienced in a heating unit. Because of the same expansion and contraction characteristics, relative movement between components is eliminated when heating occurs.

The heating unit 10 also includes a mounting plate 47 also mounted in the channels 36 of the front wall 12 of the housing. Panel 47 mounts the controls for the heating resistance 41, which controls include the relay 48 and the high temperature cut out switch 49 which is connected to the probe 38 and responds to the temperature sensed thereby to open the switch 49 in the event that the temperature sense exceeds a predetermined maximum. In the form shown the temperature sensing probe 38 comprises a capillary tube containing a gas which, by pressure operates the switch 49 when a certain temperature is sensed.

Power lines or conductors 50 and 51 are provided at the heating unit 10 in a conventional manner and suitable knockout may be provided in the bottom 14 to accommodate mounting the end of the conductor through which the power conductors are supplied. The heating resistor 41 is connected through conductor 43, a high temperature cut out switch 49 and conductor 43a is connected to one set of contacts of relay 48 which are connected to power line 50. The other side of heating resistor 41 is connected by conductor 44 directly to the other set of contacts of relay 48 which is connected to the other power line 51. In the form shown a thermostat 52 incorporates a control switch 53 through which one side of the coil of relay 48 is connectable to power line 50. The other side of the coil of relay 48 is connected directly to power line 51. It will be understood that if a high voltage thermostat 52 is employed in the disclosed form, a low voltage thermostat and relay could be employed by interposing a suitable transformer. Preferably, the thermostat 52 provides a high rate of cycling so as to prevent wide swinging of the temperature variation in the space to be heated.

It should be particularly noted that the extruded housing provides a substantial heat mass, but it has been experienced that the heating unit is extremely light, approximately two and one-half pounds per lineal foot of length. The temperature at the front surface of the front wall 12 does not exceed 190° F. and is therefore safe to be touched and will not damage or injure objects or persons. In normal operation, the removal of heat from the fins 32 by convection air currents and the normal modulation of temperature by the controls maintains the temperature at the front face of wall 12 at approximately 140° F. When the temperature sensing probe 38, which extends through all of the fins 32 and in engagement with all of the fins 32, senses a temperature in excess of 190° F. the circuit to the resistor heater 41 is opened to thereby reduce additional heating. It has been experienced that of the heat supplied by the resistor heater 41, fifty percent of the heat is transmitted into the space by radiant rays emitted from the front face of wall 12; and fifty percent

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of the heat is transmitted into the space by convection currents. It will be understood that this ratio of radiant heating to convection heating is very nearly ideal, substantially when combined with a high rate of cycling as is employed in the present unit. The fluted front wall 12 directs radiant heat throughout a normal comfort zone which includes the area within four feet above the floor. Heating throughout this zone is accomplished by the diversification of radiant rays emitted from the fluted front surface.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

I claim:

1. A space heating unit applicable against a building wall, comprising an elongate housing to be mounted substantially horizontally along the building wall, said housing having an open interior and air inlet and outlet ports permitting convection currents to pass therethrough, said housing having an upright front wall to face the space to be heated and to radiate heat therefrom, a plurality of upright fins within the housing and lying transversely of said front wall and in confronting and spaced relation with each other, said fins having upper and lower portions and also having upright front portions in heat conducting engagement with said front wall, heating means applying heat to the lower portions of said fins, said fins having aligned apertures in the upper portions thereof, a temperature sensing probe extending through the aligned apertures in said fins and engaging said fins in heat conducting relation, and said probe being exposed to the air between said fins, and means connected with said heating means and responding to a high limit temperature sensed by the probe to reduce the heat applied by said heating means, whereby to limit the temperature of said fins and front wall of the housing.
2. The space heating unit of claim 1 wherein said probe extends substantially the entire length of the housing and through all of the fins to sense temperature of each of the fins and of the air therebetween and thereby limit temperatures throughout the housing.
3. The space heating unit of claim 1 wherein said probe includes a round tube extending through each of the fins and engaging the fin around the entire periphery of the aperture therein.
4. A space heating unit applicable against a building wall, comprising an elongate housing to be mounted substantially horizontally along the wall, said housing having an open interior and air inlet and outlet ports permitting convection currents to pass therethrough, said housing having an upright front wall to face the space being heated and to radiate heat therefrom, a plurality of fins in spaced and confronting relation with each other within the housing and lying transversely of the front wall, said fins having upper and lower portions and also having upright transversely extending flanges lying flush against said front wall in heat conducting relation, the flange of each fin extending into close proximity with the next adjacent fin, said fins also having aligned probe-receiving apertures in the upper portions thereof and also having aligned heater tube-receiving openings in the lower portions thereof, each of said fins also having an annular boss around the periphery of said opening and extending transversely of the fin into engagement with the next adjacent fin, a heat conductive tube extending substantially through-

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- out the length of the housing and through said tube receiving openings in the fins and in tight fitting heat conductive relation with said bosses,
- an electric resistance heating element extending through said tube and producing heating of the tube and fins and front wall,
- a temperature sensing probe extending through the aligned apertures and engaging the fins in heat conduction relation and also being exposed to the air between the fins,
- and means connected with said electric resistance heat element and with said probe and responding to a high limit temperature sensed by the probe to de-energize said heating element whereby to limit the temperatures of said fins and front wall of the housing under all circumstances.
5. A space heating unit applicable against a wall of a building floor therein, comprising an elongate extruded aluminum shell having a bottom wall and a front wall and a top, said shell also having opposite ends, said front wall having a lower edge and also having air inlet slots spaced upwardly from said lower edge, said top having a plurality of air outlet slots therein through which heated air convection currents may pass, the top also having narrow bridging portions between said outlet slots minimizing heat conduction through said top from the front wall, said front wall having an outer surface with horizontally oriented elongate and shallow rounded grooves therein to emit radiant heat rays in diverse horizontal and inclined directions, said front wall also having cooperating upwardly and downwardly facing channels adjacent the open interior and extending throughout the length of the shell, the top and bottom wall of the shell having rear edges with cooperating upwardly and downwardly facing channels extending along the entire length thereof, a back panel adjacent the rear edge of said top and bottom wall mounted in the cooperating channels thereof, end panels mounted on the opposite ends of said shell, a plurality of aluminum fins in spaced and confronting relation with each other and in upright position within said open interior, said fins having front edge portions having flanges lying flush against the front wall of the shell, said flanges having upper and lower ends extending into and mounted in the channels of the front wall, the flange of each fin extending along the front wall into close proximity with the next adjacent fin, each of said fins having upper and lower portions and said fins having aligned openings in said lower portions with bosses encompassing said openings, each of said bosses extending into engagement with the next adjacent fin, said upper portions having aligned apertures therein, an aluminum heater tube extending through the openings and bosses of each of said fins and peripherally engaging each of said bosses in tight fitting and heat conducting relation, a resistance heater having insulating mounting means and extending through said heating tube, a temperature sensing probe extending through said apertures of the fins in heat conducting relation therewith and being exposed to the air between the fins, and control means within the interior of said shell and connected with said resistance heater and with said temperature sensing probe to control the energization of said resistance heater and limit the maximum temperature produced at said fins, said control means also including a mounting plate in said channels of the front wall.

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