Aug. 8, 1961 A. L. RANKIN, JR 2,995,645

ELECTRIC SPACE HEATER

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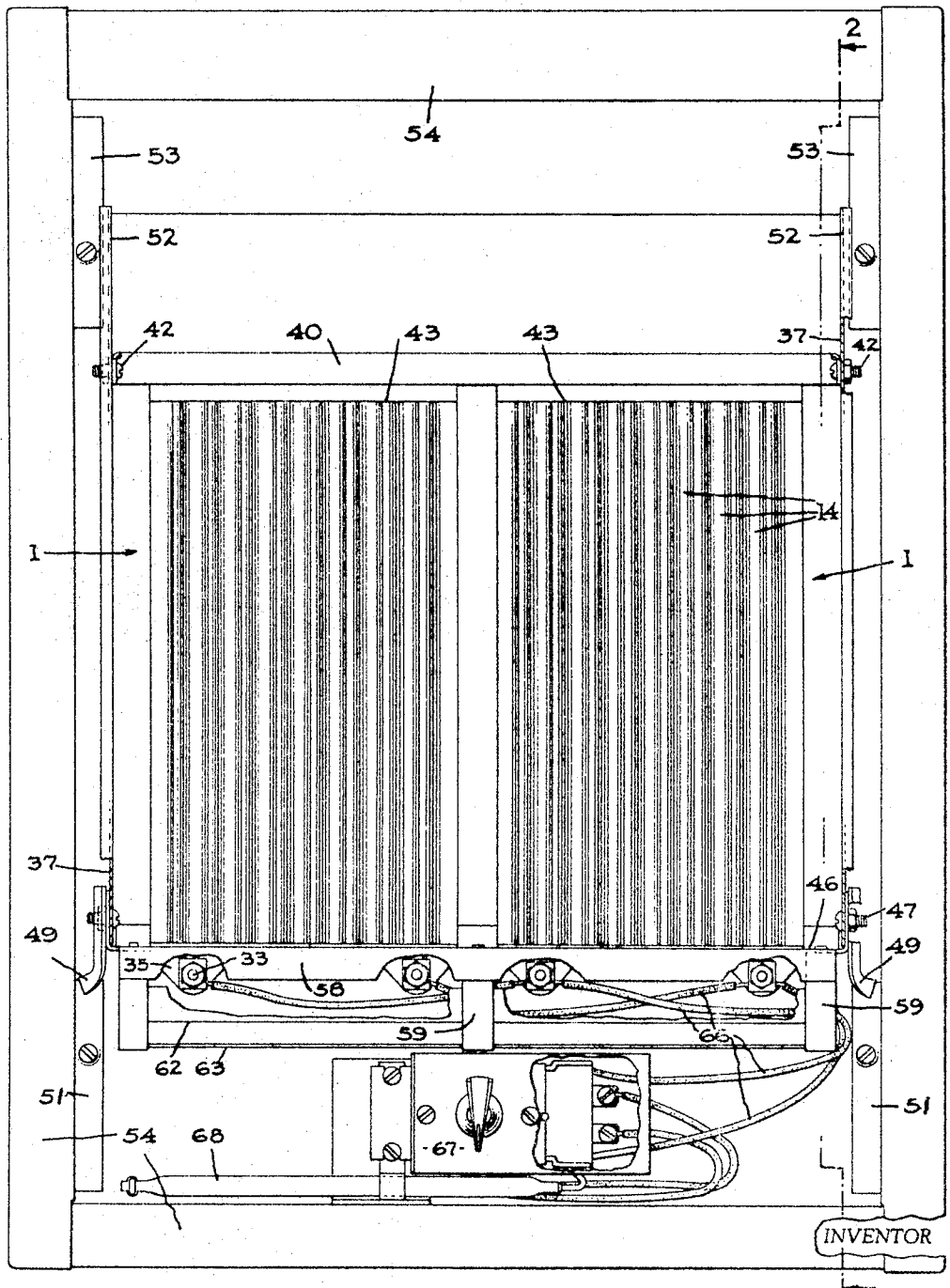


FIG. 1.

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FIG. 2.

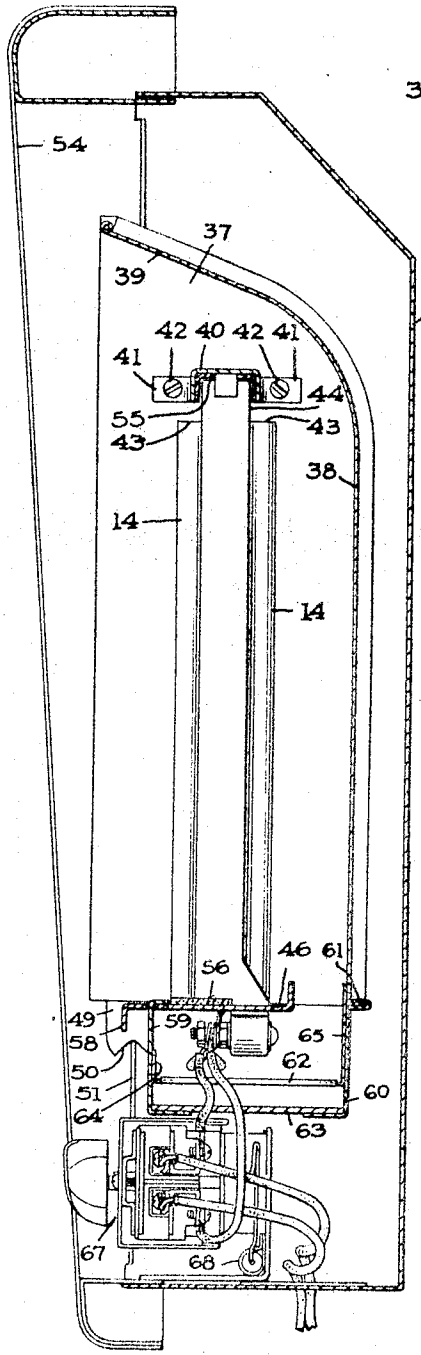


FIG. 8.

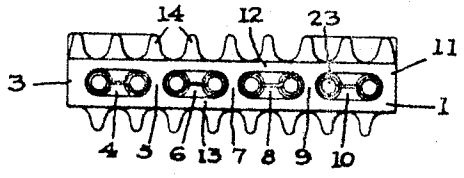


FIG. 6.

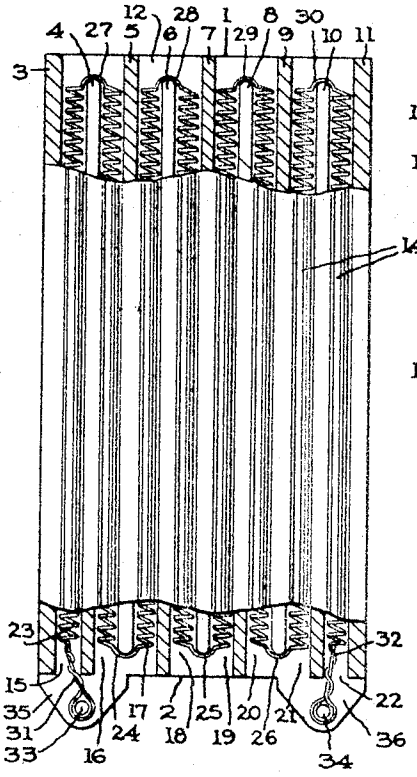


FIG. 7.

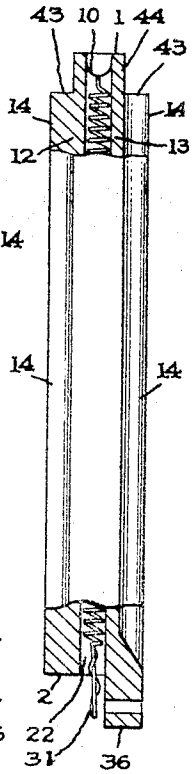


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FIG. 3.

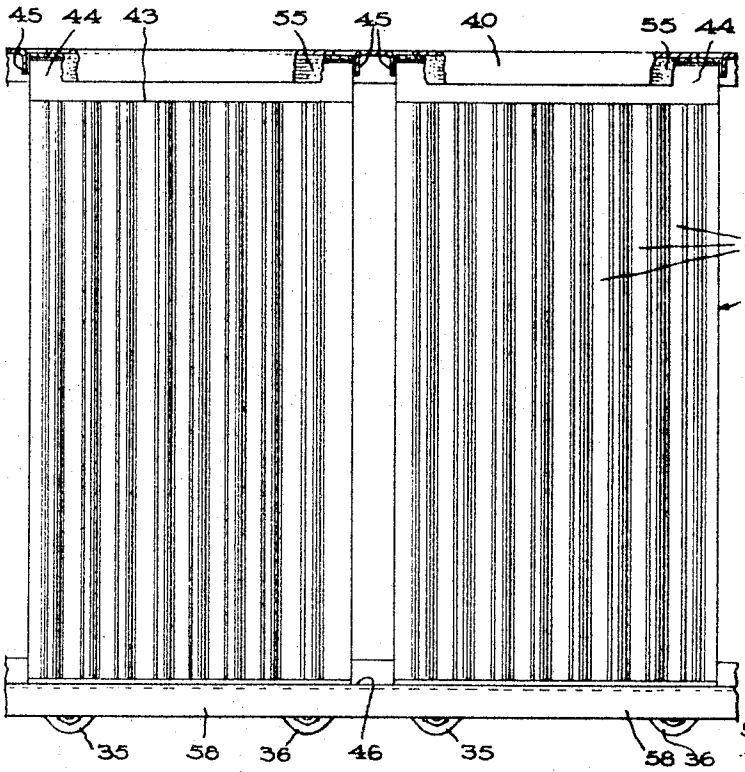
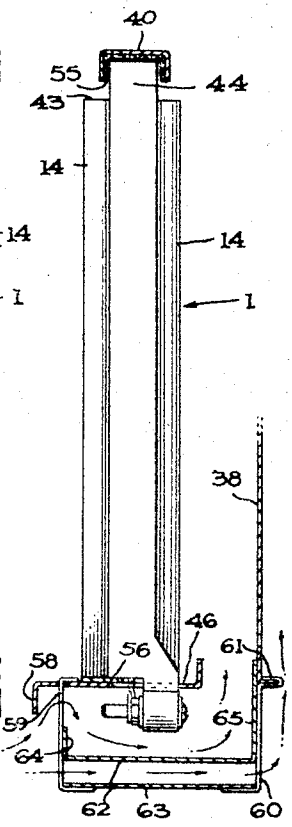



FIG. 5.



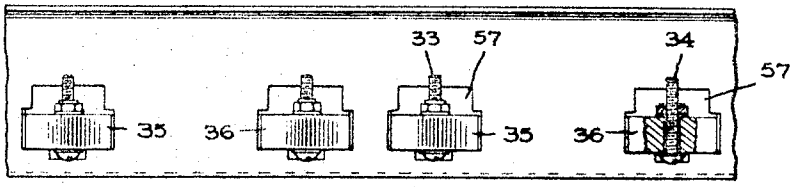




FIG. 4.

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United States Patent Office 2,995,645 Patented Aug. 8, 1961



2,995,645

# ELECTRIC SPACE HEATER

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Filed Sept. 30, 1959, Ser. No. 843,490
9 Claims. (Cl. 219—34)

This invention relates to electric heaters and more particularly to space heaters of the type in which electric resistance wire is combined with a supporting element or elements of refractory ceramic material so as to provide a radiant heating device.

Electric heaters of the above type are of two general categories, i.e., portable space heaters that can be carried by hand from place to place, and wall heaters that are permanently installed in the wall or walls of a room to be heated, usually in recesses so as to be flush with the wall surface. In construction and operation, these two types of heaters are essentially the same. They generally involve a reflector housing which is open at the front (except for the usual protective grill or the like) and contains suitable radiating elements heated by electrical resistance wire. Radiant heat is emitted directly out through the grill from these elements, and it is also reflected out through the grill from the reflector housing. Provision is usually made for circulating secondary air around the back of the reflector and out the top of the heater for the dual purpose of cooling the device and at the same time delivering additional heat by convection air currents.

Even in the cleanest households, the accumulation of dust from the atmosphere in the interior of such heaters necessitates fairly frequent cleaning. For this purpose the grill may be removable so as to expose the heating elements and other parts for dusting by hand. In some cases, as disclosed for example in U.S. Patent No. 2,662,963, the reflector assembly including the heating elements is tiltably mounted so as to be swingable partially out through the front of the heater, the grill having first been removed, thus facilitating dusting behind the reflector in the secondary air passage, etc. But often it is desirable to maintain continuous heating, and at other times one may forget to turn off the current, so that there is the danger of contact with the hot wire or other electrically alive part of the device with resultant burns, shocks, and other serious injuries.

A principal object of the invention is to provide an improved ceramic brick or tile for use in heaters of the above types, together with improved heater construction for mounting one or more of said bricks, the combination thereof making it possible to enclose the electric circuit substantially completely and thus to prevent accidental contact therewith during handling, cleaning and like normal usage of the heaters.

Another object is to provide an improved electric heater of the type characterized in the preceding paragraph which embodies novel and improved heat baffle means for protecting the thermostatic control from the effects of radiant heat.

Other objects are to provide an improved heater of the class described which is efficient in operation, easily as well as safely cleaned, and relatively simple in construction and inexpensive to manufacture.

One embodiment of the invention has been illustrated in the accompanying drawings, which by way of example show a heater of the wall insert type, but it is to be understood that the invention can be embodied in other types of heaters as already set forth and also that the drawings are for purposes of illustration only and are not to be taken as a definition of the limits of the invention, reference being had to the appended claims for this purpose.



In the drawings,

FIG. 1 is a front view of a heater embodying the invention;

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

FIG. 3 is a front view showing the improved ceramic elements described above, together with part of the means for mounting the same;

FIG. 4 is a view of FIG. 3 from the bottom;

FIG. 5 is an end view of FIG. 3, with a sectional showing of additional parts of the heat baffle means; and

FIGS. 6, 7 and 8 are respectively a partially sectioned front view, a partially sectioned end view, and a top view of one of the ceramic elements.

For convenience, reference will be made first to FIGS. 6, 7 and 8 showing a preferred form of radiant heating element. It comprises first a refractory tile or brick of suitable ceramic material. As shown in these figures, the brick has substantially flat top and bottom surfaces 1 and 2 respectively that are interconnected by a series of vertical partition walls numbered successively from 3 to 11 inclusive, and by side walls 12 and 13 integral with the partition walls 3–11. If desired, the side walls 12, 13 can be suitably ribbed as indicated at 14 to increase the radiating and conducting surface.

The partition walls 3–11 and the integral side walls 12, 13 enclose a series of successive parallel passages 15–22 inclusive through which a suitable electrical resistance wire 23, preferably in coil form, is laced back and forth to form a continuous heating circuit. Preferably the brick is formed so that the cross-over connections between adjacent passages are not exposed, and since these cross-overs take place alternately at opposite ends of the brick, the partition walls 3–11 are arranged so that the successive walls terminate alternately short of the top and short of the bottom surfaces of the brick whereby the end surfaces 1 and 2 can be recessed to house said cross-over connections. Referring particularly to FIG. 6, the end walls 3 and 11 extend the full height of the brick between its top and bottom surfaces. The intermediate odd-numbered partition walls 5, 7, and 9 begin at the level or plane of the top surface 1 of the ceramic element, but terminate short of the level or plane of the bottom surface 2 of said element. Thus the cross-over connections 24, 25 and 26 between the pairs of adjacent passages 16—17, 18—19, and 20—21, pass over these shortened ends of the partition walls 5, 7 and 9 and are thus recessed into the bottom surface 2 of the element.

Similarly the even-numbered intermediate walls, 4, 6, 8 and 10 begin at the level or plane of the bottom surface 2 of the ceramic element, but terminate short of the level or plane of the top surface 1 of said element. Thus the cross-over connections 27, 28, 29 and 30 between the pairs of adjacent passages 15—16, 17—18, 19—20, and 21—22 pass over the shortened ends of the walls 4, 6, 8 and 10 and are in effect recessed into the top surface 1 of the ceramic element as shown in FIGS. 6–8.

Except for the recesses in the end surfaces 1 and 2, which are covered as hereinafter described, the entire heating circuit thus far described is completely enclosed in and protected by the ceramic element. The ends 31 and 32 of this circuit extend out of the lower ends of the end passages 15 and 22 respectively and are connected to suitable heating circuit terminals 33 and 34. For reasons to be pointed out, each of these terminals is mounted in an ear or lug 35 or 36 which form downwardly extending projections at the ends of the ceramic element.

One or more of the ceramic bricks with its heating circuit as described above is mounted in a suitable framework forming part of the heater construction and arranged to accomplish the dual result o covering the end recesses so as to protect the otherwise exposed cross-over connections 24–30, and preferably of permitting the heating unit to swing through a limited arc at least large enough to facilitate cleaning the device. It will be understood, however, that is will not always be necessary to provide both of these features in combination.

In the forms shown, the ceramic element is mounted in a suitable reflector unit, preferably formed of heat-reflective sheet metal. The sides 37 and the back 38 of the reflector are integrally connected and form a reflector open to the front of the heater, the back 38 curving forwardly and upwardly at the top as shown at 39. One or more of the ceramic elements described above are mounted in this reflector, being held at the top by an inverted channel-shaped retaining member 40 the ends of which are secured to the sides 37 of the reflector in any suitable manner as by tabs 41 and screws 42 (FIG. 1). FIGS. 1–4 show two ceramic elements mounted side-by-side in a correspondingly shaped and sized reflector, the top retaining member 40 being common to both elements. Preferably the ribs 14 of the ceramic elements terminate short of the top surfaces 1 thereof, forming shoulders 43 (FIG. 7), and the flanges of the channel-shaped retaining member 40 fit over the top central part 44 of the ceramic element which projects above the shoulders 43. Endwise movement of the ceramic elements may suitably be restrained by tabs 45 bent down from the web of the retaining channel 40.

The ceramic elements rest on a horizontal supporting plate 46 the ends of which are flanged upwardly around and are suitably connected as by bolts 47 to the lower ends of the side walls 37 of the reflector. This reflector assembly is mounted for pivotal movement in a main casing 48, preferably by means of arms 49 suitably secured to the end flanges of the plate 46 and notched as shown at 50 in FIG. 2 to rest on and pivot about knife edges 51 rigid with the casing 48. The arrangement is preferably such that the assembly of reflector and supporting plates tends to swing inwardly in the casing 48, its motion being limited in any suitable manner as by engagement of flanges 52 of the reflector with stop plates 53 rigid with the main casing 48. The entire unit may be surrounded by a decorative frame 54, which usually carries a suitable removable protective grill (not shown).

As shown, the top and bottom surfaces of the ceramic element are padded by means of sheets of asbestos 55, 56 or the like, one interposed between the top of the ceramic element and the retaining member 40 and the other interposed between its bottom and the supporting plate 46.

It will be evident that the ears or lugs 35, 36 extend downwardly below the support 46 and carry the terminals 33, 34 therebelow. As shown in FIG. 4, the plate 46 has suitable openings 57 through which the lugs pass and which serve to anchor the lower end of the ceramic element or elements against lateral displacement. Preferably, however, the fit of the ears 35, 36 in these openings is somewhat loose so as to allow a small amount of freedom of movement to the ceramic elements. Of course, where more than one ceramic element is used, the support 46 is provided with the appropriate number of openings 57, two ceramic elements and four openings 57 being shown in FIG. 4.

Thus there are no open or exposed wires or electrical connections above the plate 46, and there is no risk of accidental shock by a live wire above plate 46, whether the reflector assembly is in normal position or tilted forwardly for cleaning. It is desirable, however, to provide additional security by shielding the terminals 33, 34 beneath the plate 46, and this shielding can advantageously be coordinated with heat baffle means that prevents radiation from the heating units directly on to the thermostatic control means in the bottom of casing 48. Ventilation around the terminals 33, 34 and the supply leads thereto underneath the plate 46 is also important not only to prevent overheating of these electrical parts but also to cool the heat baffles which protect the thermostatic means.

The present invention accomplishes the foregoing objectives simply and inexpensively, yet effectively, by means now to be described. Referring to FIGS. 3 and 5, the plate 46 extends forwardly from the heating elements and has a down-turned flange 58 along its outer edge. Inwardly of this flange, a suitable number of front hanger straps 59 are mounted in any desired manner, as for example by inserting their upper ends through slots in the plate 46 and bending them over. Behind the heating elements a corresponding series of rear hanger straps 60 is mounted in any suitable way as by crimping their upper ends over the bottom flange of the reflector 38 as shown at 61.

The aforesaid hanger straps 59 and 60 provide means for mounting a pair of horizontal, vertically spaced plates 62 and 63 below the supporting plate 46. The space between plates 62 and 63 being open at its sides, ventilating air can pass freely between the two plates for effective cooling as indicated by the arrows in FIG. 5, and thence upwardly between the back reflector 38 and the back of the casing 48 to prevent overheating the latter. The upper plate 62 has a front flange 64 which is turned upwardly inside the flange 58 on the plate 46, as seen in FIGS. 2 and 5. In this way accidental contact with the terminal and their supply leads from the front of the device is prevented, while at the same time cooling air can enter between flanges 58 and 64 and flow around the terminals. Preferably such cooling air is directed upwardly inside the reflector 38 by means such as an upturned flange 65 on the rear edge of the plate 62. The plate 62 is suitably secured to the straps 59, 60 to mount it in the position shown.

Thus not only the terminals 33, 34 but also the supply leads indicated generally at 66 are housed in a wireway between the plates 46 and 62 wherein they are protected against contact from the outside and at the same time cooled by circulating air to avoid overheating. At the same time the spaced plates 62, 63 act as heat baffles and, together with the circulation of air between them, serve to shield the thermostatic switch device indicated generally at 67 and its sensitive bulb 68 from the heat.

For cleaning, the grill (not shown) being removed, the entire assemblage of elements carried by the supporting plate 46 can be swung outwardly in a counterclockwise direction (FIG. 2) on the knife edges 51. This facilitates access to the various parts inside the reflector walls 37, 38 and also to the inside of the casing 48 and the back of the reflector 38, all without interfering in any way with the effectiveness of the security measures described above.

It will be understood that the invention is not restricted to the particular embodiment shown in the drawings and described with particularity above, and that various changes can be made by those skilled in the art without departing from its spirit. Reference should therefore be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. Electric heater construction comprising at least one radiant heating member of ceramic material having a plurality of substantially parallel vertical passages formed therein, the successive walls between said passages terminating alternately short of the top of said member and short of the bottom of said member, thereby forming recesses in the top and bottom surfaces of said member with each recess connecting the ends of two adjacent passages and being surrounded by co-planar portions of said surfaces, electric resistance wiring laced back and forth

in said passages with the crossover connections between adjacent passages passing over the shortened ends of said walls and housed in said recesses, a id heater structure including a shelf-like support for the bottom of said ceramic member and a cap-like support for the top of said ceramic member, said supports fitting against said coplanar portions of said bottom and top surfaces respectively to cover said recesses and the cross-over connections therein and to close the otherwise open ends of said passages, said ceramic member having lugs projecting downwardly below said bottom surface, one adjacent each outermost passage and extending through an opening in said shelf-like support, said lugs each carrying a terminal below said support to which the wire in one of said outermost passages is connected.

2. Heater construction as defined in claim 1, said supporting plate having a downwardly extending flange along one edge thereof which substantially masks said terminals.

3. Electric heater construction as defined in claim 1, said top support comprising an inverted channel member fitting over the top of said element with stops for the ends of said element, said bottom support comprising a substantially flat plate on which said element rests by gravity, said lugs projecting downwardly through said openings and having limited freedom of movement therein.

4. Electric heater construction comprising at least one radiant heating element of ceramic material having a plurality of substantially parallel vertical passages therethrough, the top and bottom surfaces of said element having recesses connecting the ends of adjacent passages, electric resistance wire laced back and forth through said passages with the cross-over connections housed in said recesses and forming a heating circuit, heater structure comprising a housing open on one side to expose said element and having a reflecting surface on the other side of said element, a cover for the top of said element secured to said heater structure, a bottom supporting plate secured to said heater structure and carrying said heating element, said cover and bottom plate fitting against the portions of said top and bottom surfaces around said recesses to cover said recesses and to close the otherwise open ends of said passages, said plate having openings and said heating element having terminal lugs projecting downwardly through said openings, heating circuit terminals mounted in said lugs below said plate, laterally spaced supporting elements depending from said plate, and baffle plate means carried by said supporting elements below and in spaced relation to said supporting plate to provide for air circulation between said plates and around said terminals.

5. Electric heater construction as defined in claim 4, including supply circuit connections to said terminals which are disposed in a wireway formed between said spaced plates.

6. Electric heater construction comprising at least one radiant heating element of ceramic material having a plurality of substantially parallel vertical passages therethrough, electric resistance wire laced back and forth through said passages and forming a heating circuit, heater



structure comprising a housing open on one side to expose said element and having a reflecting surface on the other side of said element, a cover for the top of said element secured to said heater structure, a bottom supporting plate secured to said heating structure and carrying said heating element, said plate having openings and said heating element having terminal lugs projecting downwardly through said openings, heating circuit terminals mounted in said lugs below said plate, laterally spaced supporting elements depending from said plate, baffle plate means carried by said supporting elements below and in spaced relation to said supporting plate to provide for air circulation between said plates and around said terminals, and supply circuit connections to said terminals which are disposed in a wireway formed between said spaced plates, said bottom supporting plate having hinge means at its ends and carrying said housing and reflector for pivotally mounting the assembly of said housing, said radiant element and cover and supporting plate therefor, and said baffle plate means.

7. Electric heater construction as defined in claim 6, said supporting plate having a downturned flange along one edge and said baffle plate means having an upturned flange along a corresponding edge and said flanges substantially masking the wireway space between said plates along one side thereof, one of said flanges being located outwardly beyond the other to permit the entry of air into said space.

8. Electric heater construction as defined in claim 6, said baffle plate means comprising two horizontal vertically spaced baffle plates, and means extending vertically between said supporting plate and the upper baffle plate along one side and substantially masking the space therebetween in which said terminals are housed, said masking means having a passageway for entry of air into said terminal housing space and the sides of the space between said baffle plates being open for free circulation of air therebetween.

9. Electric heater construction as defined in claim 6, said baffle plate means including a pair of horizontal vertically spaced baffle plates, supply circuit connections to said terminals which are disposed in a wireway formed between said supporting plate and the upper baffle plate, the space between said two baffle plates being open at its sides for free circulation of air therebetween, said heater construction including thermostat means for said heating circuit which is disposed beneath said lower baffle plate and shielded thereby against heat from said element.

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