ABSTRACT: A combined supporting and electrical grounding structure is incorporated in a baseboard electric heater. The tube of a fin-and-tube elongated heating element is supported on a bracket. The tube is anchored firmly to the bracket by an inverted-U locking plate that has a pair of legs with offset portions extending across an edge of the support bracket. Adjacent to that edge of the bracket there is a slot into which a screwdriver can be inserted and twisted for deforming the bracket, to tighten the locking plate firmly.
COMBINED SUPPORT AND GROUND CLIP FOR HEATER ELEMENTS

This invention relates to comfort space heaters and the like and more particularly to means for mounting the heating element in such apparatus.

So-called comfort space heaters are widely used for heating rooms in offices, homes, and so on. A popular type of comfort space heater has an elongated heat-exchange element in an elongated enclosure. The heater has a low profile so that it may be used along a wall in lieu of the normal baseboard molding. Such "baseboard heaters" are particularly popular. Electric baseboard heaters require provision for the expansion and contraction of the heating element which occurs during its cycles of heating when energized and cooling when deenergized. The expansion and contraction of the heating element is a source of difficulty in the case of electric heaters since the National Electric Code requires the heating element to be connected to an electrical ground. It is an object of this invention to provide improved, economical means for fixing the heating element of a space heater in position in its enclosure. It is yet another object of this invention to provide improved means for electrically grounding the electric element of a baseboard heater.

The heating element may be fabricated in at least two versions. One version has a single tubular resistor and another has dual tubular resistors. In the dual-tube form, a series of heat-dissipating fins are secured to two longitudinally extending parallel sheathed resistance heating elements. The resistance wire is encased in a metal tube that is filled with a compacted granular insulation such as magnesium oxide. Rotation of the dual-tube heating element about its longitudinal axis is easily prevented by the mounting brackets. However, a problem arose where the single tube was employed, in that there is a tendency of the heating element to rotate about its longitudinal axis during shipping and installation and even when in use over long periods of time. Rotation of the element can cause the fins to touch the enclosure. Fins touching the enclosure cause noisy operation of the heater during the expansion and contraction of the heating element as the fins drag across the backwall or front cover of the enclosure. An object of this invention resides in providing an improved means for electrical grounding means to prevent such rotation of the heating element.

The foregoing objects and advantages are achieved in the illustrated embodiment of the invention described in detail below and shown in the accompanying drawings. In that embodiment, a heat-exchange unit comprises an elongated electric heating element bearing transverse fins. The mounting means for the heating element has a pair of brackets for the element and a securing plate cooperating with the brackets for preventing relative movement between the bracket and the heating element. The bracket has a notch whose sides constitute legs portions spaced apart to receive the heating element. The securing plate also includes a pair of spaced legs connected together by a bridging portion, forming an inverted generally U-shaped member. The heating element is trapped and fixed in position in the notch of the bracket and the oppositely directed U-shaped securing plate. Formations on the bracket and the securing plate cooperate with each other to develop a tight grip on the heating element. A pair of sharp corners in the gripping edges provide secure grounding and prevent rotation of the heating element.

For a better understanding of the invention in its various aspects, reference is made to the following description of the illustrated embodiment, and to the accompanying drawings showing a presently preferred embodiment of the invention. In those drawings:

FIG. 1 is a front elevation of an electric baseboard heater with the front cover removed for purposes of illustration;
FIGS. 2, 3 and 4 are fragmentary front views of portions of the baseboard space heater of FIG. 1, identified by the circled areas of FIG. 1, on a greatly enlarged scale;
FIG. 5 is a cross section at the line 5--5 of FIG. 3, omitting the enclosure and showing the front cover in phantom lines;
FIG. 6 is a lateral view of a securing plate or clip shown in the assembly of FIG. 5;
FIG. 7 is an endwise view of the securing plate or clip of FIG. 6;
FIG. 8 is a fragmentary top view partly in cross section along line 8--8 of FIG. 3; and
FIG. 9 is a fragmentary cross-sectional view along the line 9--9 of FIG. 4.

Referring to the drawing, an illustrative embodiment of the invention as shown is an electric baseboard heater 20. Sheet metal enclosure 22 of the baseboard heater has a pair wall 24 and end walls 26 and 28. A front cover 30 (shown in phantom lines in FIG. 5) extends from one end wall to the other in front of heater element 32 and the end terminal boxes 34, 36. The terminal boxes contain the connections between the internal wiring (not shown) of the heater and the external power circuit wiring. For an illustration of such wiring reference may be made to pending Zabayekvich application Ser. No. 647,976, assigned to the assignee of the present invention.

The heat-exchange element 32 includes a diagrammatically shown central resistance wire 38 which is surrounded by compacted granular insulation 40 within a tube 42. Advantageously, the resistance wire 38 is Nichrome, the granular insulation is magnesium oxide and the tube is aluminum. A plurality of fins 44 are mounted on the tube. Each fin has an extended neck 46 that tightly fits the tube, and laterally extending fin portions 48 that have formed ends 50. The fins are stacked at 52 to the tube at diametrically opposed points to prevent relative lengthwise and rotational movement on the tube.

The heat-exchange element 32 is supported and positioned within the enclosure 22 by a pair of end brackets 52, 56 and a center bracket 58. The end brackets 54, 56 form part of the respective end terminal boxes 34, 36. The element 32 is fixed in place in the enclosure by the center bracket 58, as will be explained in detail below. The ends of the element 32 are free to move longitudinally relative to the brackets 54, 56 as it expands and contracts in use due to heating and cooling. The end portions 32a, 32b are restrained against undue lateral movement by retainers 60 (FIGS. 2, 4 and 9) having a loose fit or a sliding fit on tube 42. Bracket portions 61 support retainers 60.

Referring to FIGS. 3 and 5 to 8, the center bracket 58 of sheet metal includes a base portion 58c secured to the rear wall 24 of the enclosure. Upper and lower arms 58b, 58e are spaced apart, and they extend perpendicularly outwardly from base 58c. Lower arm 58b has a plate portion that is notched at 62 to define a pair of upwardly extending legs 58d, 58e, connected by a bridge 58f. The legs 58d, 58e flarely flank opposite sides of the heat-exchange element between an adjacent pair of fins. In FIG. 5 the legs engage the extruded portion 46 of one of the fins 44 that overlies the tube 42. If desired, the legs can be made to engage the tube 42 directly, by shortening the neck 46 of one of the fins. The heater element is held in position by securing means in the form of a generally flat locking plate or clip 62 that has a deep notch so as to have a pair of legs 62a, 62b connected together at a right 62c. Plate 62 is an inverted generally U-shaped part. Each leg 62a, 62b has a transverse or offset end portion 62d, 62e having a detent portion 62f, 62g that is bent upward for locking engagement with the lower edge 58g of bracket arm 58c. The height portion 62h has a pair of spaced sharp projections 62i which forcible engage and penetrate into the surface of the heater element 32. Bracket arm 58c has a slot 58i formed adjacent to and generally parallel to edge portion 58g to provide a deformable part 58j for purposes described below. Lateral edges 58k at the ends of edge portion 58g guard against any tendency of the legs 62a, 62b to spread.

In manufacturing the heater 20, the enclosure 22 is substantially completed before the heat-exchange element 32 is installed. At that time, the end brackets 54, 56 and center bracket 58 have been secured to the rear wall 24 of the enclosure. The heat-exchange element 32 is shifted laterally into the space between the upper and lower legs 58b, 58c of the
center bracket and then lowered into position between legs 58d, 58e. The legs enter the space between two successive fins. The tube rests against the bight 58f. Locking plate or clip 62 is next slid into place between the fins, and then it is moved laterally against bracket 58. The transverse or offset portions of the legs are small enough to enter the space between two adjacent fins even when the bracket 58 is already in that space. The clip 62 has an elongated shape and comes to rest with the bight projections 62f, 62g engaging the heat-exchange element 32. The leg ends 62d, 62e are then snapped over the bracket edge 58g which snaps past detents 62f, 62g. At this point the heater element 32 is trapped. However, it may still be rotated about its longitudinal axis for final adjustment. In order to lock the heater element securely in position a tool such as a blade 0 of a screw driver is inserted in the slot 58i, and twisted. The twisting action deforms portion 58j to move from its dotted position of FIG. 5 to the solid line position. The deformation of bracket portion 58j causes the sharp corners 62h of the bight portion of the clip to drive into the heater element 32. Advantageously, the clip and bracket are made of galvanized steel so that forceful engagement may be maintained between the assembled parts. The heat-exchange element is tightly gripped between the bights 62c and 62h of the locking plate 62 and the supporting portion of bracket arm 58c, so that bights 58c and 62c, h are gripping portions. A tight grip is established by cooperation of portions 58j of the bracket and its "cooperating" portion(s) 62j, 62k, there is an intermediate portion, and likewise locking plate 62 has an intermediate portion between its gripping portion 62h and its "cooperating" portion(s) 62f, 62g; and these two intermediate portions are face-to-face and generally parallel to the fins between which the bracket ex tends. These intermediate portions provide separation between the heater-gripping portions located between the fins and the cooperating portions of the locking plate and the bracket located cleat of the fins (see FIG. 5) so that slot 58i and the leg ends 62d and 62e are in a position of clearance for easy handling. Sharp corners 62h indent the engaged neck 46 of the fins and they indent tube 42. Where the neck 46 is soft and thin, corners 62h can even penetrate the neck 46 and thus make direct contact to tube 42. Furthermore, offset parts 62f and 62e make secure metal-to-metal contact to lower arm 58k of bracket 58 which, in turn, has fastening that provides mechanical and electrical connection to the enclosure wall 24. The end retainers 60 are next secured to parts 61 of the respective end brackets 54, 56, and electrical connections are made to the ends of the resistance wire 38.

The foregoing construction provides an excellent, dependable intermetallic connection between the heat-exchange element 32 and the bracket 58 to assure proper electrical grounding, and the same construction fixes the heating element against rotation. The heat-exchange element is free to expand and contract, but it is captive against rotation about its longitudinal axis. The location of slot 58i below the level of the fins makes for easy access to that point for a tool to deform strip 58j downward in tightening the grip of the locking plate and the supporting plate against the heating element 32.

While only one embodiment of the invention has been shown and described in detail it will be recognized by those skilled in the art that various changes and modifications may be made herein without departing from the spirit and scope of the invention.

What is claimed is:

1. A space heater including a heat-exchange unit comprising an elongated heating element including an elongated heating tube bearing a series of transverse heat-exchange fins, an enclosure for said heat-exchange unit, and means for supporting said heat-exchange unit in said enclosure, said supporting means including a bracket secured to said enclosure and having a plate portion extending between two of said fins, and a locking plate having an intermediate portion in face-to-face confrontation with said plate portion, and essentially parallel to said fins, said bracket and said locking plate having respective portions gripping opposite sides of said elongated tube and having mutually cooperating means for gripping portions of said locking plate between said cooperating portions of said elongated tube for causing said gripping portions to grip said elongated tube, and said plate portion of said bracket extending between and interconnecting said gripping portion and said cooperating means of the bracket, and said intermediate portion of said locking plate extending between and interconnecting said gripping portion and said cooperating means of the locking plate, fordisposed said cooperating means at a location spaced substantially from said elongated heater tube.

2. A space heater in accordance with claim 1 wherein at least one of said gripping portions is part of a formation that includes a pair of legs closely straddling said elongated tube.

3. A space heater in accordance with claim 1 wherein at least one of said gripping portions is part of a formation that includes a pair of legs straddling said elongated heating tube.

4. A space heater in accordance with claim 1 wherein said elongated heating tube contains an insulated electric resistance wire, and wherein at least one of said gripping portions includes at least one sharp projection of metal forced into electrical contact with said elongated heating element by said cooperating means.

5. A space heater including a heat-exchange unit comprising an elongated heating element including an elongated heating tube bearing a series of transverse heat-exchange fins, an enclosure for said heat-exchange unit, and means for supporting said heat-exchange unit in said enclosure, said supporting means including a bracket secured to said enclosure and having a plate portion extending between said elongated tube, and said locking plate having respective portions gripping opposite sides of said elongated heating tube and having cooperating portions at the side of said elongated heating tube remote from the gripping portion of said locking plate for causing said gripping portions of said locking plate to grip said elongated heating tube, said locking plate including at least one leg having a laterally offset part extending across an edge portion of said bracket, said bracket having an elongated opening formed therein adjacent to and generally parallel to said edge portion so as to define a strip, said strip and said offset portion constituting said cooperating portions, and said strip being deformed for causing said gripping portions to grip said elongated heating tube as aforesaid.

6. A space heater in accordance with claim 1 wherein said locking plate is an inverted generally U-shaped member including a pair of legs closely flanking said elongated heating tube and connected by a bridging portion constituting said gripping portion of said locking plate, the extremities of said legs being offset across an edge portion of said bracket, said offset portions of said legs and said edge portion of said bracket constituting said cooperating means for causing said gripping portions to grip said elongated heating tube.

7. A space heater including a heat-exchange unit comprising an elongated heating element including an elongated heating tube bearing a series of transverse heat-exchange fins, an enclosure for said heat-exchange unit, and means for supporting said heat-exchange unit in said enclosure, said supporting means including a bracket secured to said enclosure and having a plate portion extending between said fins, and a locking plate having respective portions gripping opposite sides of said elongated heating tube and having cooperating portions at the side of said elongated heating tube remote from the gripping portion of said locking plate for causing said gripping portions to grip said elongated heating tube, said gripping portion of said bracket being the bottom portion of a notch having lateral edges closely flanking said elongated heating tube, and said locking plate including a pair of legs offset said locking tube and extending downward from a gripping portion of said locking tube, said leg portions having offset extremities extending across an edge por-
tion of said bracket, said bracket having an elongated opening extending adjacent to and generally parallel to said edge portion so as to define a strip, said offset portions and said strip constitutes said cooperating portions of said bracket and said locking plate, and said strip being deformed for causing said gripping portions to grip said elongated heating tube as aforesaid.

8. A space heater in accordance with claim 7 wherein said edge portion includes lateral formations obstructing laterally outward spread of said legs at said offset portions and wherein said strip is bowed downward between said offset portions.

9. A space heater in accordance with claim 5, said strip having ends integral with the remainder of the bracket, said strip being deformed in the direction away from said elongated heating tube and against said offset portion so that said strip and said offset portion constitute said cooperating portions causing said gripping means to grip said elongated heating tube.

10. A space heater including a heat-exchange unit comprising an elongated heating element having a metal tube comprising an insulated resistance wire and transverse heat-exchange fins on said metal tube, an enclosure for said heat-exchange unit, and means for supporting and electrically grounding said heat-exchange unit, said supporting and grounding means including a pair of mutually confronting metal plates extending between a pair of said fins and having oppositely directed notched formations gripping said tube, one of said metal plates being secured to said enclosure, a first one of said metal plates having an offset portion extending across an edge portion of the second of said metal plates at the side of the gripped tube remote from said gripping formation of said first metal plate, said second metal plate having an elongated opening therein extending transverse to an imaginary line between the gripping portion and the offset portion of said first metal plate and said opening extending adjacent to and generally parallel to said edge portion thereby defining a strip whose ends extend integrally from said second plate and said strip bearing tightly against said overhanging portion for maintaining a tight grip of said gripping portion against said tube.

11. A space heater in accordance with claim 10 wherein at least one of said plates has at least one sharp projection at a gripping portion thereof embedded in said metal tube.

12. A space heater including a heat-exchange unit comprising an elongated heating element including an elongated electric heating tube bearing a series of transverse heat-exchange fins, an enclosure for said heat-exchange unit, and means for electrically grounding and for supporting said heat-exchange unit in said enclosure, said supporting means including a metal bracket member secured to said enclosure and having a portion extending into the space between two successive fins of said series of fins, and a locking member extending into said space, said members having respective portions gripping opposite sides of said elongated heating element and having cooperating portions outside said space between said two successive fins causing forcible grip of said elongated heating tube by said gripping portions, one of said members having an offset part against an edge portion of the other of said members and one of said members having a slot adjacent said edge portion, the material of the latter member between said slot and said offset part being deformed against said offset part, the deformed part and the offset part constituting said cooperating portions.