Oct. 19, 1937. J. J. GOUGH 2,096,582

ELECTRIC HEATING UNIT FOR SANDWICH TOASTERS

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Fig. 1

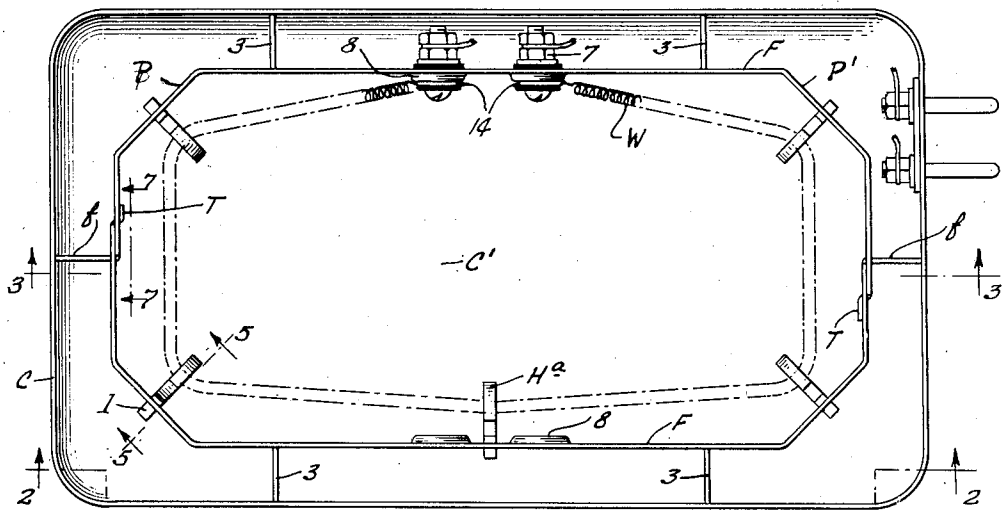


Fig. 2

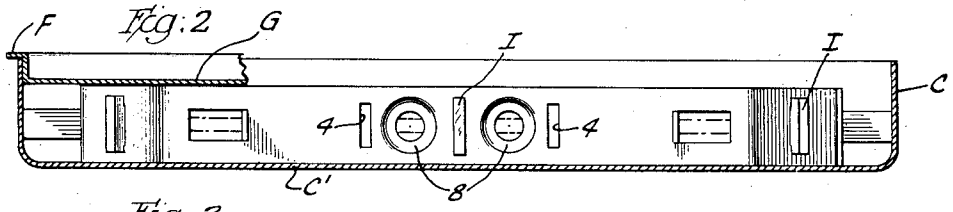


Fig. 3

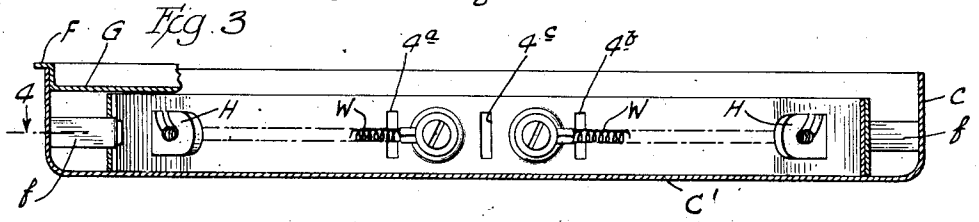


Fig. 4

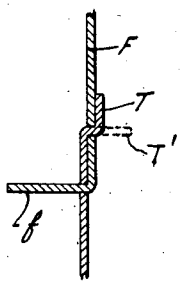


Fig. 5

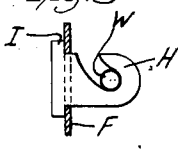


Fig. 6

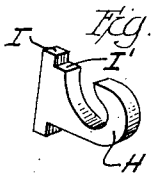
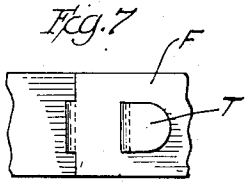


Fig. 7



Inventor:
James J. Gough
by Albert Scheible
Attorney

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ELECTRIC HEATING UNIT FOR SANDWICH TOASTERS

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Fig. 8

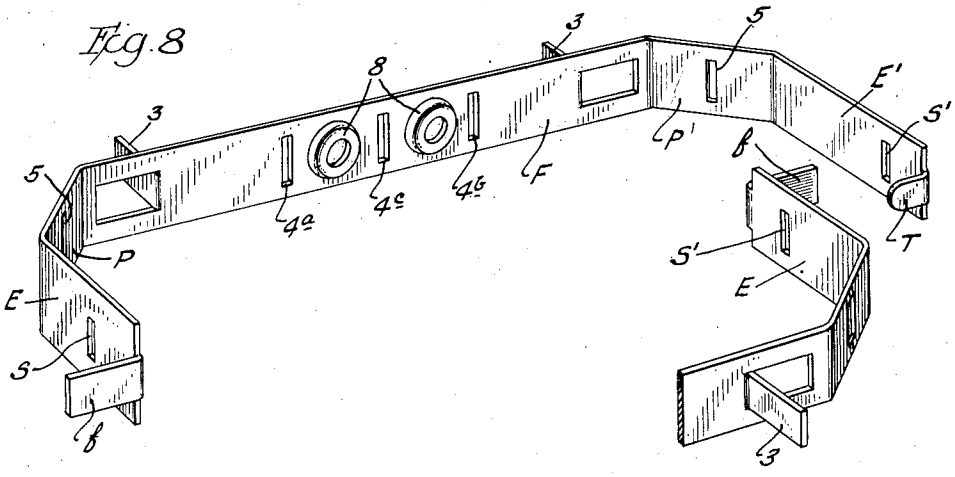


Fig. 9

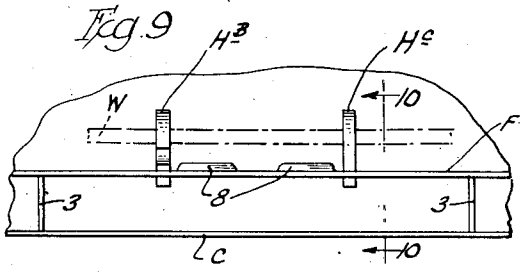


Fig. 10

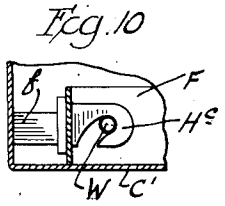


Fig. 12

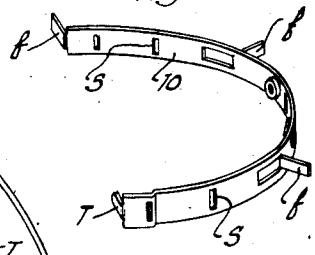
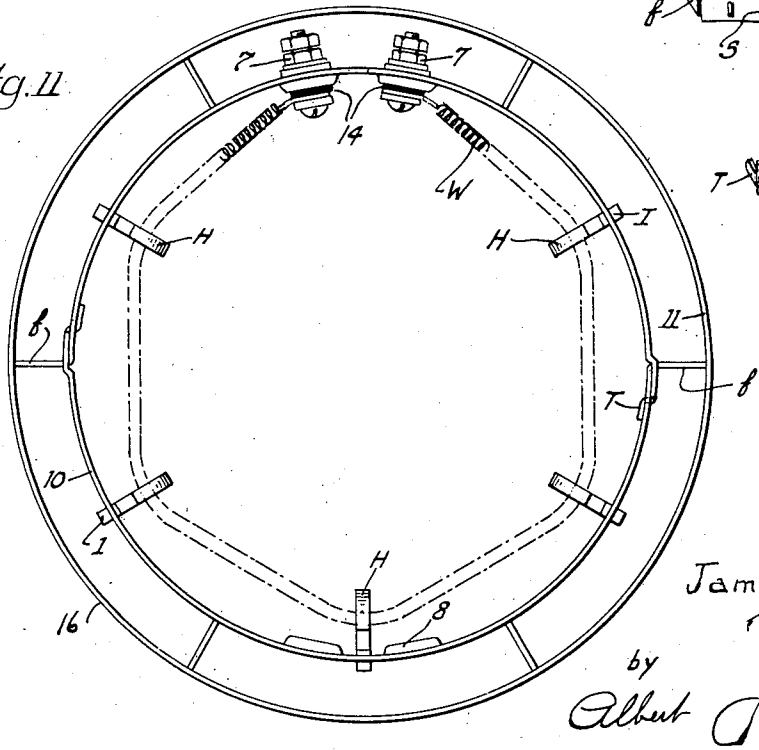


Fig. 11



Inventor:
James J. Gough
by
Albert Scheible
Attorney

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UNITED STATES PATENT OFFICE

2,096,582

ELECTRIC HEATING UNIT FOR SANDWICH TOASTERS

James J. Gough, Chicago, Ill., assignor to Chicago Electric Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application February 20, 1937, Serial No. 126,910

12 Claims. (Cl. 219—19)

My invention relates to an electric heating unit particularly adapted for radiating heat toward an adjacent flat surface, as for example to a grid of an electric sandwich toaster or an electric waffle iron; and more particularly to an electric heating unit of this general class in which a heat-radiating high resistance wire is looped over insulators mounted on a supporting member, and in which the looping of the wire over the insulators also retains the insulators in their proper supported positions.

In its general objects my invention aims to provide an unusually simple, speedily assembled and inexpensive heating unit of the above recited type, and one which will be so positioned by its mere insertion in the corresponding portion of an appliance as to dispose the heating wire for radiating its heat fairly uniformly toward the grid or other surface which is to utilize the heat.

More particularly, my invention aims to provide a light and simple heating unit including a simple resilient loop of high resistance wire supported within a frame of considerably smaller area (in the general plane of the frame) than the compartment of the appliance housing the unit, and including insulators over which the said loop is hooked, the insulators being slidably attached to the frame and held in their operative positions by the tension of the said loop.

In addition, my invention aims to provide an electric unit of the above recited characteristics, in which adjacent insulators of counterpart size and shape can readily be supported either in counterpart positions for facilitating the interlocking of the insulators with a heating wire which is to be used at a moderate temperature, or in relatively inverted positions when the heating wire is to be raised to so much higher temperature that the expansion of this wire might bulge it out of interlocking relation to an insulator.

With household electric appliances such as waffle irons or toasters having horizontal grids, the cost of the needed heating units heretofore has been undesirably high, for the following reasons:

(1) Because of the quite rigid structure required for the supporting member on which the insulators are mounted, and the undesirably high cost of manufacturing this member. For example, if the wire is zigzagged over insulators mounted on cross-bars spanning two side rails, the construction of a rigid side rail and cross-bar assembly for this purpose has required a rather thick metal punching, usually made from a blank corresponding substantially in area to the interior cross-section of the casing section of the appliance in which the heating unit is disposed. In addition, such a single-piece structure requires correspondingly large and expensive dies for both the blanking and the forming operations.

With the cross-bars formed separately from the side rails, the cost and weight of the needed metal is reduced, but the firm attaching of the said bars to the rails adds considerably to the manufacturing expense, and the same occurs when the cross-bars span a complete frame.

In a third type of supporting members, the insulators have been supported in relatively staggered disposition on opposite side bars of a frame. But in this case the frame likewise has to be heavy and rigid to prevent the tensioning of the wire, when looped in zigzag formation over insulators alternately mounted on one and the other of the said bars, from bowing these bars toward each other so that loops of the wire may snap off one or more of the insulators when the wire elongates during its rise in temperature.

(2) Because of the frequently considerable cost of mounting the insulators on the supporting member.

(3) Because the undesirably increased weight of an entire unit of the above recited three types adds to the shipping weight and transportation cost of the appliance equipped with such a unit, since the manufacturer commonly pays the transportation to the larger distribution points for his products.

My present invention aims to overcome all of the above recited shortcomings of the now commercial heating units of the above recited general class by using a simple metal frame as the member which supports the needed insulators; by constructing this frame of a metal strip bent flatwise; by providing this frame with integral fingers extending outwardly from the frame and disposed for engaging the walls of the casing section in which the heating unit is disposed, thereby centering the frame within a casing of much larger interior area than the area of the frame, so as to reduce the weight and cost of the frame; by forming the frame so that the insulators are merely slidably attached to it, and looping the heating wire over the insulators so that the tensioning of this wire holds insulators rigidly positioned on the frame; and by disposing the said wire so that its tensioning will not bow any frame side inwardly, thereby permitting the frame to be made from a rather thin strip of metal.

Moreover, my invention aims to provide an in-

sulator-supporting frame of the just recited characteristics which can readily be constructed of frame parts which are consecutively fastened to each other without requiring any rivets or welding operations, and which frame parts also have integral projecting portions designed for spacing the frame from the riser wall of the compartment in which the heating unit is to be disposed.

Illustrative of the manner in which I accomplish the objects of my invention,

Fig. 1 is a plan view of an electric heating unit embodying my invention, showing this as it appears when disposed in the rectangular lower casing section of a sandwich toaster.

Fig. 2 is a vertical section taken along the line 2—2 of Fig. 1 and including a part of a pan-shaped grid supported by and within the mouth portion of the illustrated casing section.

Fig. 3 is a vertical section taken along the line 3—3 of Fig. 1.

Fig. 4 is an enlarged and fragmentary horizontal section taken along the line 4—4 of Fig. 3, showing the interlocking of adjacent end portions of the two frame halves.

Fig. 5 is a similarly enlarged vertical section taken along the line 5—5 of Fig. 1 through one of the oblique corner portions of the frame.

Fig. 6 is a perspective view of one of the wire-loop supporting hooks, drawn on the same scale as Fig. 5.

Fig. 7 is an enlarged and fragmentary elevation, looking from the line 7—7 of Fig. 1.

Fig. 8 is an enlarged perspective view of one of the two counterpart halves of the frame of the heating unit of Fig. 1, before this is attached to the other frame half, the figure also including an end portion of the relatively reversed other frame half as the latter appears when about to be interlocked with the first named frame half.

Fig. 9 is a fragmentary plan view allied to the midlength portion of the lower part of Fig. 1, but showing the use of two relatively inverted hooks in place of the single one shown in the corresponding part of Fig. 1.

Fig. 10 is a fragmentary vertical section taken along the line 10—10 of Fig. 9.

Fig. 11 is a plan view of a circular casing section, such as the lower section of a waffle iron, and of a circular-framed two-part heating unit disposed in the said section.

Fig. 12 is a reduced perspective view of one of the counterpart halves of the frame of the heating unit of Fig. 11, taken before that half was interlocked with the companion frame half.

In the drawings, Figs. 1 to 3 show a generally rectangular and pan-like lower casing section C of a sandwich toaster, and Fig. 2 as well as Fig. 3 includes an end portion of a shallow pan-like grid G which spans the mouth portion of this casing section, and which grid has a peripheral flange F seated on the mouth end of that section.

To heat the bottom C^1 of the said casing section I provide a heating unit including a generally rectangular frame considerably shorter and narrower than the said section. This frame consists of two relatively interlocked frame halves, each such frame half being a strip of steel bent flatwise to a generally semi-rectangular shape presenting a long frame side part F having its ends connected respectively to two shorter frame ends E and E^1 by connecting portions P and P^1, each of which extends at an oblique angle to the frame parts which it connects.

Each such frame half, in its separate preliminary shape of Fig. 8, has a finger *f* projecting from the tip of its end part E and extending both parallel to the main frame side part F and in a direction away from the other end part E^1, and each such end part E^1 has a vertical slot S through which the finger *f* on the companion frame half can be slidably inserted.

Each frame half also has a tab T projecting from the tip of its said other end part E^1 and extending parallel to the main frame side part F toward the other end part E. In addition, each such other end part E^1 has an upright slot S^1 through which the tab T of the other frame half can be slidably inserted, the said slots S and S^1 being each spaced by the same distance from the adjacent end of the full-width portion of the same frame half.

When the two separately formed frame halves are set down on a flat surface, with their ends relatively disposed as shown for one end of each in the right-hand portion of Fig. 8, the fragmentarily illustrated frame part can readily be slid toward the right for simultaneously causing the finger *f* of one frame half to extend through and outwardly beyond the slot S^1 in the companion frame half, and sliding the tag T of the said companion frame half through the slot S^1 of the said one frame half.

Each tab T is then clinched against the inner face of the frame portion E through which it extends, so that this clinching cooperates with the slidable interfitting of each tab T with a slot S^1 in rigidly connecting the two frame halves. In addition, the fingers *f*, when each of a length only slightly less than half the difference between the length of the complete frame and the interior length of the casing section C, space the frame ends equally from the ends of the said casing section. To space the frame also to an equal extent from each longitudinal riser side of the said casing section, I also form the main portion F of each frame half with auxiliary spacer fingers 3 projecting outwardly of the frame for a distance approaching half the difference between the transverse spread of the frame and the interior width of the said casing section.

To afford means for supporting wire-holding hooks, I provide each main frame-half part F near its mid-length with at least one upright slot 4, and desirably with three slots (4*a*, 4*c* and 4*d*) as shown in Figs. 2 and 8; and I also provide a similar slot 5 in each of the oblique frame corner parts P. These slots 4 and 5 preferably are all of counterpart size for receiving the shanks I^1 of lava counterpart mica insulators each of which includes both a back I (Fig. 6) longer than such a slot and a hook at H at the opposite end from the said shank.

To facilitate a suitable positioning of the terminals 7 to which the ends of the heating wire are to be fastened, I also desirably form the mid-length portion of the major side F of each frame part with two centrally perforated annular bosses 8 for centering insulators 14 through which the two wire terminals extend in the usual manner.

With the frame of my heating unit constructed in the heretofore recited manner, the two wire terminals 7 can be mounted on this frame before the ends of a suitable length of the resilient (and desirably coiled) heating wire are respectively fastened to these terminals. Four of the insulators shown in Fig. 6 are then slid inwardly of the frame respectively through the slots 5 in the oblique corner portions of the frame, and if the said wire is to be heated to only such a limited temperature as not to expand it unduly in

length, a single similar insulator is slid (inwardly of the frame) part way through a mid-length slot in the frame side opposite the wire terminals, this last named insulator being shown at the middle of Fig. 2.

When all of these insulators have thus been slidably applied to the frame with their hook openings facing upwards, the loop (to which the wire is bent when its ends are fastened to the two wire terminals) can readily be stretched to snap it over the hook portion of each insulator. While this is being done, the tensioning of the wire draws all of the hooks inwardly of the frame until the projecting upper and lower end portions of the hook backs I (Fig. 6) bear against peripheral portions of the frame, as shown in Figs. 1 and 5, and this tension thereafter also holds the wire interlocked with all of the hooks.

However, if the resistance of the wire is considerably lower (in proportion to the voltage of the current supply, as is needed when the grid bottom G is to be heated to a correspondingly higher temperature, the elongation of the wire when thus heated might snap the wire loop out of the hook H*a* of the insulator which is at the middle of a relatively long stretch of the wire. To avoid this when my heating unit is to operate at such a high temperature I then employ two insulators having their hooks H*b* and H*c* respectively extending through the slots 4*a* 4*b* which are adjacent to (but at opposite sides of) the mid-length slot 4, as shown in Fig. 10.

In doing this, I affix one insulator H*b* with its hook opening upward, and the other insulator H*c* with its hook opening downwards as shown in Fig. 6, so that these hooks will cooperate in preventing the longest stretch of the heating wire from being snapped off them either upwards or downwards.

When my completely assembled unit is inserted in the casing section C, the spacer fingers *f* and 3 co-operate with the effective lengths of the hooks for disposing the supported loop of high resistance wire at a considerable distance from the peripheral wall of the casing, so that the heat radiated from this wire is distributed over the grid bottom G with a sufficient uniformity for toasting purposes or the like. Moreover, when the frame of my unit is set on a substantially horizontal casing section bottom C^1 (from which it may be insulated by a customary—although not illustrated asbestos sheet overlying the said bottom), the frame also prevents a direct radiation of heat from the resistance wire to the riser wall of the casing section, thereby aiding me in obtaining an effective distribution of the heat over the grid above this frame.

Since each of the heretofore described frame halves can be cheaply formed by simple punch press operations from a simple strip of steel, only a single set of relatively small and inexpensive dies is required for producing both of these frame halves. Likewise, since the extending of one tab T and one finger *f* through slots adjacent to the overlapped end portions of the frame halves at each juncture of these halves latches these end portions against sliding with respect to each other, the simple bending of the two tabs T (from the position shown at T^1 to the full line position in Fig. 4), this operation alone completes the rigid assembly of the frame.

With the length of each lava insulator quite short in proportion to even half the width of the frame, I readily cause each stretch of the looped wire to extend at a short acute angle to the adjacent portion of the frame, so that the effect of the tension of the wire is directed almost longitudinally of each such frame portion. Consequently, the tensioning of the wire loop will not bow the frame sides toward each other even when the frame is formed from a rather thin strip, as for example a strip ¾ inch wide and $\frac{1}{32}$ inch thick. This lightness of the strip not only greatly reduces the cost and weight of the supporting member of my frame, but also (when the strip is of a moderately resilient steel) allows the frame to be digitally compressed so as to draw the spacer projections 3 and *f* somewhat toward each other. Such a momentary distortion of the frame is permitted all the more readily when the frame has the oblique corner portions P and P^1, instead of right angled corners, so that my frame can readily be flexed sufficiently for inserting it speedily.

However, while I have heretofore described my new electric heating unit in connection with an embodiment designed for use in a horizontally rectangular compartment, the shape of this unit can readily be varied to correspond to other sections of the compartment which is to house it. Thus, Fig. 11 shows a heating unit of generally similar construction, as disposed in the lower circular casing section 16 of an electric waffle iron, and Fig. 12 (on a reduced scale) shows one of the frame halves of this unit before it is attached to the companion frame half.

In each of the illustrated embodiments of my invention, the frame (which would function equally well, as far as the supporting of the insulators is concerned, if it did not have the radially projecting spacer fingers *f* and 3) requires less material than it would if of a size directly fitting the compartment housing it. Moreover, the extending of the finger *f* on each frame section through a slot of similar cross-section in the adjacent frame section co-operates with the disposition of the tab T for rigidly connecting these frame sections without requiring any firm fastening operation other than the clinching of the said tab as illustrated in Fig. 3. Moreover, it should be obvious that my heating unit can be of quite small height (transversely of the general plane of the frame) in proportion to the dimensions of the frame, thereby enabling it to be used in a correspondingly shallow compartment.

So also, while I have described my here presented heating unit as including many desirable details of construction and arrangement, these obviously might be varied in many respects without departing either from the spirit of my invention or from the appended claims.

I claim as my invention:

1. An electric heating unit comprising a frame formed of flatwise bent metal strip material, the frame having peripherally spaced slots extending at right angles to the general plane of the frame; insulators each including a hook part slidably inserted inwardly of the frame through one of the slots and also including a back part engaging the exterior of the frame; two circuit terminal members extending through and insulated from adjacent portions of the frame; and a resilient loop of high resistance wire having its ends connected respectively to the two terminals, the said wire extending consecutively through the hook parts of insulators which are consecutively disposed peripherally of the frame, and the backs of the said hooks being held against the exterior of the frame by the tensioning of the said wire.

2. An electric heating unit as per claim 1, including spacer elements spaced circumferentially of the frame and extending outwardly away from

the periphery of the frame, the spacer elements having their outer ends disposed for engaging various portions of a casing bore of larger dimensions than the said frame.

3. An electric heating unit as per claim 1, in which the length of the part of each insulator which extends inwardly of the frame is so small a fraction of the spread of the frame, in the direction in which that insulator extends, that each stretch of the said wire disposed between consecutive insulators extends at a quite small acute angle to the frame portion adjacent to that wire stretch.

4. An electric heating unit as per claim 1, in which the frame comprises two parallel frame end parts, two parallel frame side parts extending at right angles to the said end parts, and frame-corner elements each connecting the end of a frame end part with the adjacent end of a frame side part; each of the said corner elements extending obliquely to both of the frame parts which it connects, and being provided with one of the slots through which the said insulators extend.

5. An electric heating unit as per claim 1, in which the frame is composed of consecutive frame sections, the adjacent ends of each two consecutive frame sections being fastened to each other; each frame section having spacer elements formed thereon, the said elements being spaced longitudinally of that section and extending outwardly away from the said frame.

6. An electric heating unit as per claim 1, in which the frame is composed of consecutive frame sections, the adjacent ends of each two consecutive frame sections being fastened to each other; each frame section having spacer elements fast thereon and spaced longitudinally of that section and extending outwardly of the frame; one of the spacer elements on each frame section serving also as part of the means which fasten that frame section to an adjacent frame section.

7. An electric heating unit as per claim 1, in which the frame is composed of consecutive frame sections, the adjacent ends of each two consecutive frame sections being fastened to each other; each frame section including spacer elements fast thereon spaced longitudinally of that section and extending outwardly of the frame; each frame section having an auxiliary slot disposed near one end of that section and extending at right angles to the general plane of the frame, through which slot a spacer element of the adjacent section extends.

8. In an electric heating unit, a frame formed of two flatwise bent strips extending consecutively in continuation of one another, the adjacent end portions of each two consecutive strips being overlapped; insulators supported by and spaced peripherally of the frame and each presenting a hook portion within the frame; two terminals mounted upon and insulated from the said frame; and a resilient high resistance wire connected at its ends respectively to the said terminals within the said frame, the said wire extending consecutively through the hook portions of the said insulators; each of the said frame-forming strips having a slot near each free end thereof and having a finger projecting from the tip of each strip end, the fingers at opposite ends of each strip extending substantially at right angles from the face of the adjacent face of the strip and respectively inward and outward of the frame, and the two fingers on each strip extending respectively through the said slots in the end portion of the other strip.

9. An electric heating unit as per claim 8, in which the free end portion of one of the inwardly extending fingers is clinched against a part of the strip having the slot through which that finger extends.

10. An electric heating unit as per claim 8, in which each strip also has at least one spacer finger formed from the strip and extending outwardly of the frame, the said spacer fingers being distributed peripherally of the frame and of such lengths as to dispose their tips substantially within an imaginary contour conforming in shape to, but larger in dimensions, than the periphery of the frame.

11. An electric heating unit as per claim 8, in which each strip also has at least one spacer finger formed from the strip and extending outwardly of the frame, the said spacer fingers being distributed peripherally of the frame and of such lengths that the tips of these spacer fingers and the tips of the first named outwardly projecting fingers are all in an imaginary contour conforming in shape to, but larger in dimensions, than the periphery of the frame.

12. An electric heating unit as per claim 8, in which each strip also has at least one spacer finger formed from the strip and extending outwardly of the frame, the said spacer fingers being distributed peripherally of the frame and the tips of these spacer fingers as well as the tips of the first recited outwardly extending fingers lie in a contour conforming in shape to, but larger in dimensions, than the periphery of the frame; the said strips being formed of sufficiently thin and resilient metal so that the frame can be manually flexed to dispose all of the said finger tips in a contour smaller than the aforesaid one.

JAMES J. GOUGH.