Feb. 3, 1942. C. I. HJELMGREN 2,271,977

ELECTRIC HEATER

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Fig.1.

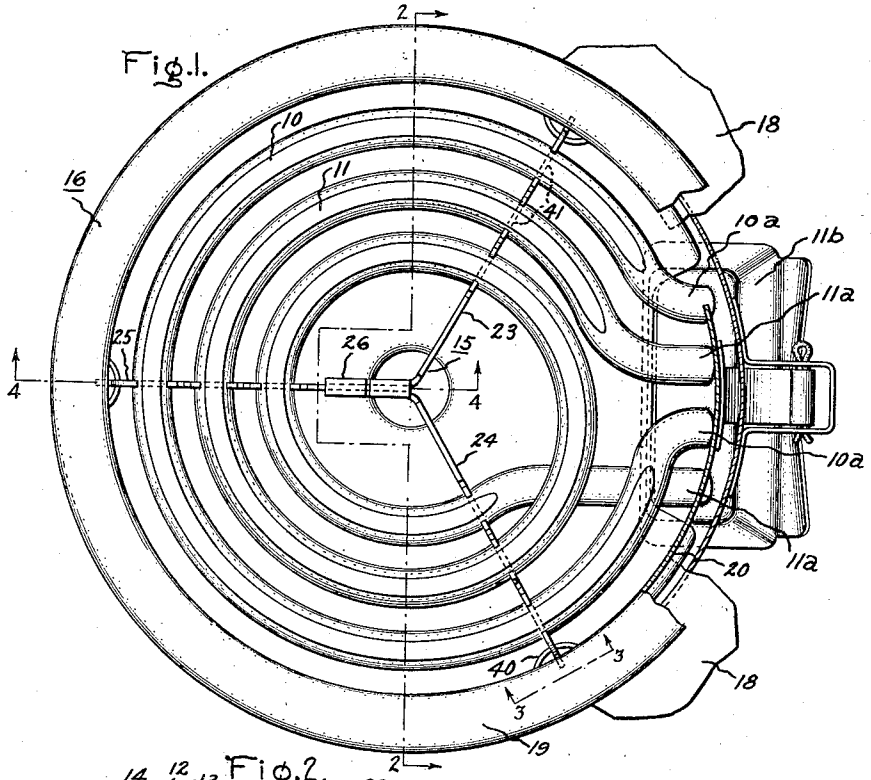


Fig.2.

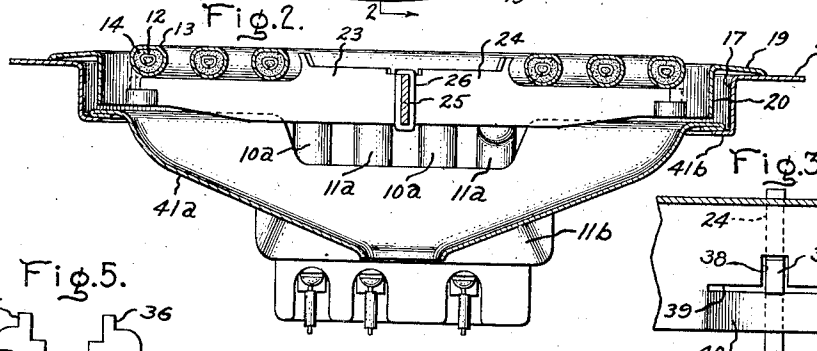


Fig.3.

Fig.5.

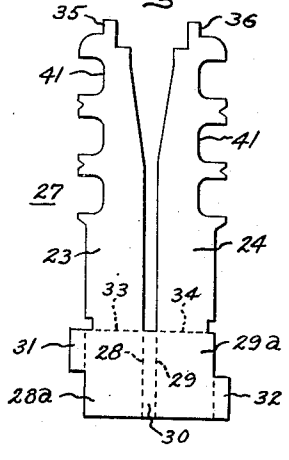


Fig.6.

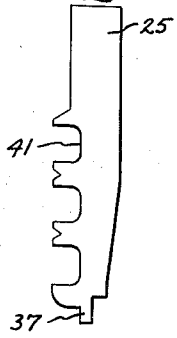
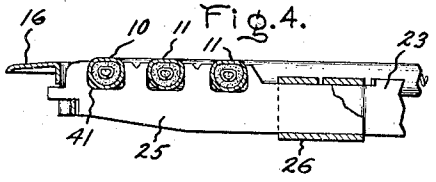


Fig.4.



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Fig.7.

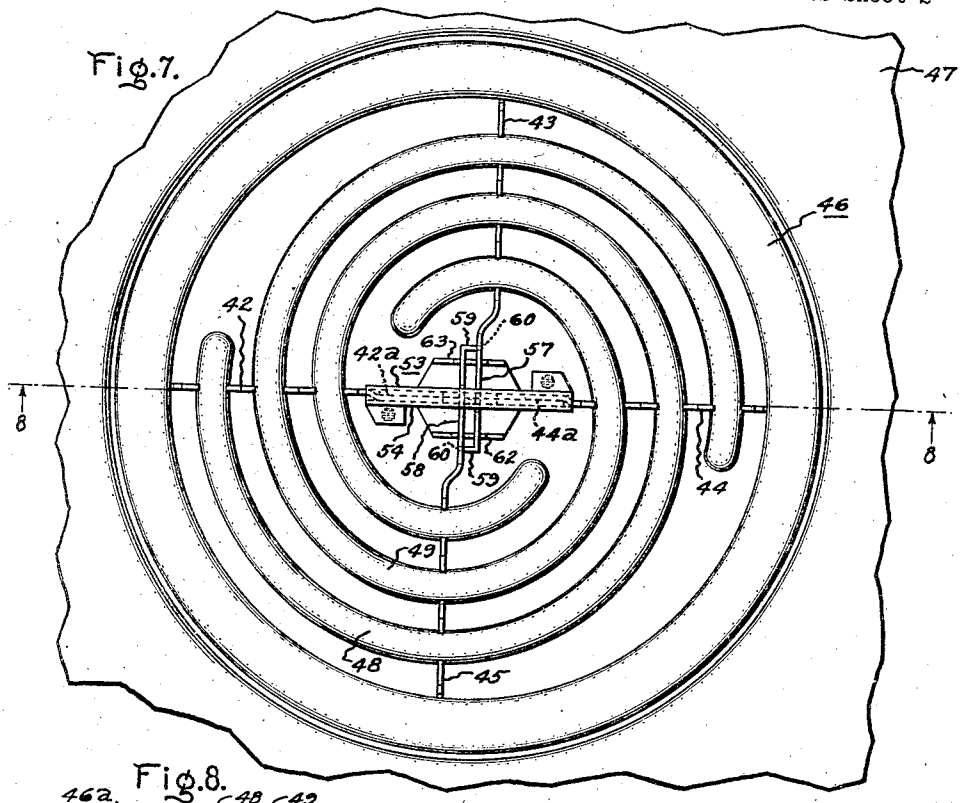


Fig.8.

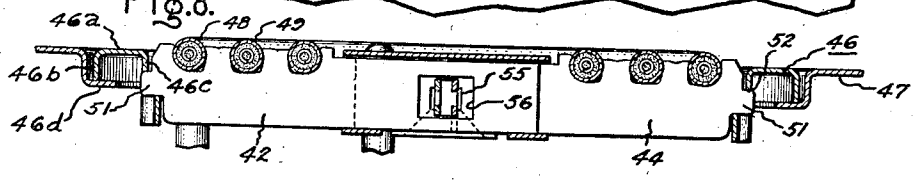


Fig.9.

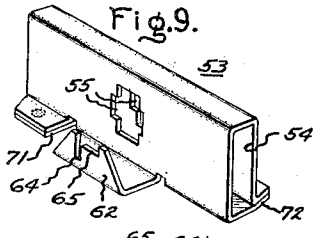


Fig.10.

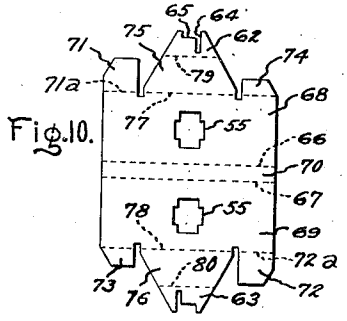


Fig.11.

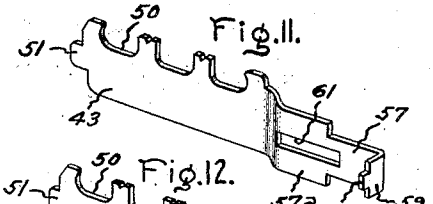
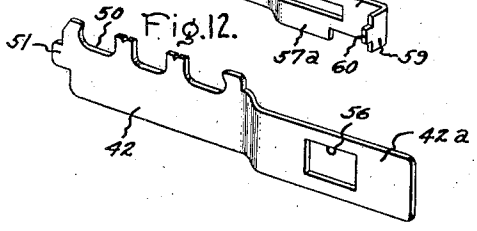


Fig.12.



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UNITED STATES PATENT OFFICE

2,271,977

ELECTRIC HEATER

Charles I. Hjelmgren, Chicago, Ill., assignor to Edison General Electric Appliance Company, Inc., a corporation of New York

Application October 10, 1939, Serial No. 298,819

6 Claims. (Cl. 219—37)

This invention relates to electric heaters, more particularly to electric heaters of the hotplate type, such as used with electric ranges, and it has for its object the provision of an improved device of this character.

This invention has particular application to electric hotplates having sheath wire heating elements arranged in the form of flat loops or coils. Certain sheath wire heating elements have a resistance conductor housed in a metallic sheath and embedded in and supported in spaced relation with the sheath by a compacted layer of heat conducting, electrically insulating material, such as powdered magnesium oxide. One heating unit of this type is described in the U. S. patent to C. C. Abbott, No. 1,367,341, dated February 1, 1921.

In a particular electric range hotplate employing a sheath wire element of this type, the turns of the element are supported by metallic strips formed into a grid-like spider, the turns being rigidly secured to the strips. The ends of the strips are mounted in a supporting ring which functions to hold the spider and the heating element mounted on it in the top opening of the range.

As there is considerable expansion and contraction in the turns of the heating element as its temperature is elevated and reduced, and as they are secured to the strips, strains are set up in the strips which may result in buckling of the heating element so that it is no longer flat, or in bending of the outer ends of the strips, whereby the outer turns of the element are loosened.

This invention contemplates an improved electric heater wherein the holding strips for the various convolutions of the heating elements, instead of being rigidly fixed to each other, are relatively movable, thereby relieving the strains in the strips and heating elements during expansion and contraction of the elements.

This invention further contemplates an improved connection between the strips which provides for the relative movement between them, and also which has considerable mechanical strength so that the strips will support the turns of the heating element in their normal plane even when heavily loaded by a cooking appliance.

For a more complete understanding of this invention, reference should be had to the accompanying drawings in which Fig. 1 is a plan view of an electric hotplate having a pair of heating elements, and provided with holding means for the heating elements arranged in accordance with this invention; Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows; Fig. 3 is an enlarged fragmentary sectional view taken through the line 3—3 of Fig. 1 and looking in the direction of the arrows; Fig. 4 is a sectional view taken through the line 4—4 of Fig. 1 and looking in the direction of the arrows; Figs. 5 and 6 are elements used to make the electric hotplate shown in Figs. 1, 2, 3 and 4; Fig. 7 is a plan view of an electric hotplate of modified form arranged in accordance with this invention; Fig. 8 is a sectional view taken through the line 8—8 of Fig. 7 and looking in the direction of the arrows; and Figs. 9, 10, 11 and 12 illustrate certain elements used in making the hotplate of Figs. 7 and 8, Figs. 9, 11 and 12 being perspective views of the elements of these figures, and Fig. 10 being a development of the element shown in Fig. 9.

Referring more particularly to Figs. 1–6 inclusive, this invention has been shown as applied to an electric range hotplate of the type described and claimed in the copending application of John C. Sharp, Serial No. 311,147, filed December 27, 1939, and assigned to the same assignee as this invention. As there described, this hotplate comprises a pair of heating elements 10 and 11 which are of the sheathed type such as described and claimed in the above-mentioned Abbott Patent No. 1,367,341. Each of these elements comprises a coiled resistance conductor 12 mounted in a metallic sheath 13 and embedded in and supported in spaced relation with reference to the sheath by a highly compacted layer 14 of heat conducting and electrically insulating material; any suitable electrically insulating material may be used, such as powdered magnesium oxide. The oxide may be compacted in any suitable manner as by reducing the sheath. The sheath may be reduced in any suitable way as by rolling, swaging or drawing. The heating element 10, as shown, is formed into a partial circle, while the element 11 is formed into a spiral positioned inside of the element 10. The terminal ends 10*a* and 11*a* of the two elements are adjacent each other at one side of the hotplate and are secured to a terminal shield 11*b*.

In accordance with the invention, the heating elements 10 and 11 are supported upon a suitable spider-like grid 15 which in turn is supported in a supporting member 16 which is adapted to fit within the opening 17 of the top plate 18 of an electric range. The supporting member 16, as shown, is provided with an annular surface 19 that rests directly upon the top plate 18. De-

pending from the inner edge of the surface 19 is a circular wall 20. This wall 20 is utilized to support the grid 15.

The grid 15 is formed of three diverging strip-like members 23, 24 and 25 arranged generally radially within the circular supporting wall 20. These strips are positioned vertically within the ring, as shown in Figs. 1 and 2, and preferably they will be aranged at angles of substantially 120° to each other.

The two legs 23 and 24 span the terminal ends of the heater elements, and they are provided with a socket 26 which is rigidly secured to them, and which is adapted to receive the inner end of the leg 25 with a close sliding fit.

While the legs 23 and 24 and the socket 26 may be formed as separate members and secured together in any suitable manner, I prefer to form them from a single piece of metal. For this purpose, a blank of metal 27 as shown in Fig. 5 is used. The blank is folded along the two dotted lines designated 28 and 29 to bring the two legs 23 and 24 into substantially parallel arrangement. This will also bring the walls 28a and 29a on opposite sides of the lines 28 and 29 into substantially parallel arrangement. The area 30 between the lines 28 and 29 defines the bottom wall of the socket 26, while the walls 28a and 29a define the side walls of the socket. The top of the socket is closed by two tabs 31 and 32 which are folded over in the manner indicated in Fig. 2. After the socket 26 has thus been formed the legs 23 and 24 are bent outwardly along the lines 33 and 34 to the required angle between them, as shown in Fig. 1.

The outer ends of the two legs 23 and 24 are provided with tongues 35 and 36, and the outer end of the leg 25 is provided with a similar tongue 37 which are adapted to be received in openings 38 provided for them in the vertical wall 20. As shown, the openings 38 are vertically positioned in the wall and these openings at the bottom merge into elongated horizontal openings 39. The tongues 35, 36 and 37 are supported within the openings 38 by means of sections 40 of the wall 20 pressed inwardly from the plane of the wall under the elongated openings 39, as clearly shown in Figs. 1, 2 and 3.

It will be observed, therefore, that the grid 15 is defined by two legs 23 and 24 rigidly secured together, and by a third leg 25 having its inner end received in a socket 26 rigidly secured to the legs 23 and 24. A sufficient length of the end portion of the leg 25 is inserted in the socket 26 to provide a rigid, mechanically strong grid at the center which prevents any sagging of the grid.

The turns of the heating elements 10 and 11, as shown, are mounted in recesses or indentations 41 provided in the upper edges of the arms 23, 24 and 25. The upper edges of the opposite side walls of the recesses are peened over so as to hold the units rigidly to the strips, as shown in Fig. 4. It will be understood that by reason of the sliding connection between the strip 25 and the strips 23 and 24, it can move relatively to these strips to provide for expansion and contraction of the heating elements 10 and 11 as they are heated and cooled. Inasmuch as only one loop of the heating element 11 lies between the strips 23 and 24 on the terminal side of the hotplate very little stress is set up at this side of the plate, and it is not necessary to provide for relative movement between the strips 23 and 24. However, as shown, there are a number of loops of the two elements 10 and 11 lying within the 240° space between the strips 23 and 24 on the opposite side of the hotplate, and, therefore, substantially all expansion and contraction takes place here. The strip 25 is free to move relative to the strips 23 and 24 and prevents the setting up of strains in the heating elements, and thereby obviates permanent distortion of the heating elements and breakage of the supporting strips.

As shown, a reflector 41a is provided which is mounted on a flange 41b formed on the wall 20.

In the form of my invention shown in Figs. 7–12 inclusive the hotplate is provided with four supporting strips 42, 43, 44 and 45 positioned substantially at right angles to each other and extending radially from the center of the hotplate outwardly to the supporting member 46. The supporting member 46 is provided with an annular surface 46a from the edges of which two circular walls 46b and 46c depend. The wall 46b rests upon a flange 46d formed in the range top so as to support the hotplate. The two heating elements 48 and 49 are formed into spirals nested one within the other, as shown. These heating elements are rigidly mounted in the strips 42—45 inclusive in the same way as in the first form by means of indentations 50 formed in the upper edges of the strips. Moreover, the strips are provided at their outer ends with tongues 51 which are supported in apertures 52 provided in the wall 46c in the same manner that the outer ends of the strips 23, 24 and 25 are supported by the member 16.

The strips 42—45, however, of this form are secured together in a somewhat different fashion than in the first form disclosed, but are secured for relative movement and also are secured to prevent sagging at the center of the unit, as are the strips of the first form.

In the case of the hotplate shown in Figs. 7–12, a suitable interlocking member 53 is provided to mechanically interlock the ends of the strips 43—45 together. The member 53 is provided with walls defining an elongated socket 54 into which the inner ends 42a and 44a of the strips 42 and 44 are received. The ends 42a and 44a are received in overlapping relation in the socket 54, as shown in Fig. 7, and preferably they will be slightly offset, as shown in this figure and in Fig. 12, so that the bodies of the strips 42 and 44 will be in substantial alignment.

The side walls of the socket 54 are provided with cross-shaped openings 55 and the inner ends 42a and 44a of the strips 42 and 44 are provided with elongated openings 56 which register with the openings 55 and which preferably are somewhat longer than these openings. The openings 55 in the socket and the openings 56 in the strips 42 and 44 receive the inner ends 57 and 58 of the strips 43 and 45, which, as shown in Figs. 7 and 8, are directed through these openings. The two ends 57 and 58 of the strips 42 and 44 are arranged in overlapped parallel relation, but are spaced somewhat from each other by end sections 59 on the two members arranged at right angles to the ends 57 and 58 and directed towards each other, as clearly shown in Fig. 7. These angular extensions 59 terminate in tongues 60 which are received in elongated apertures 61 provided for them in the strips.

The extreme end portions 57 and 58 of the strips 43 and 45 preferably will have a lesser width than the remainder of the strips, as shown

in Fig. 11; that is, the portions of the ends of the strips which protrude from the opposite sides of the socket will be reduced in width.

To reenforce and stabilize the inner end sections 57 and 58 of the strips 43 and 44, seats 62 and 63 are provided on opposite sides of the socket 54 in spaced relation with reference to it, as clearly shown in Figs. 7 and 9. These seats each having a relatively deep recess 64 in which the relatively wide inner portion 57a of one of the strips is received before it enters the openings 55 and 56 and with a relatively shallow recess or seat 65 which receives the protruding end section 57 of the other strip.

The socket 54 and the seats 62 and 63 may be formed as separate members secured together in any suitable manner, but I prefer to form them from a single piece of material. They may be made from a single piece of material which is blanked out as shown in Fig. 10. This sheet of material is bent along the lines indicated 66 and 67 to bring the two pieces of material 68 and 69 into substantially parallel relation. The areas of the sections 68 and 69 define the side walls of the socket, while the area 70 of the material between the lines 66 and 67 defines the top wall of the socket. The bottom wall is defined by tabs 71 and 72 which are bent inwardly at right angles to the wall areas 68 and 69 respectively along the lines 71a and 72a, and are secured to tabs 73 and 74 respectively which are bent outwardly at right angles to the wall sections 68 and 69, as shown in Fig. 9. The tabs 71 and 72 are secured to the tabs 73 and 74 in any suitable manner, as by welding. The seats 62 and 63 are defined by bending roughly triangular-shaped pieces 75 and 76 outwardly along dotted lines indicated 77 and 78 so as to lie at right angles to the walls 68 and 69 respectively, as shown in Fig. 9. Then the end sections in which the seats 62 and 63 are included are bent upwardly along the dotted lines 79 and 80 to the positions shown in Fig. 9. Preferably, the openings 55 and the slots 64 and 65 will be formed in the blank shown in Fig. 10 before it is formed into the supporting member 53.

In this form of the invention, it will be observed that the two strips 42 and 44 can move relatively to each other in the plane of the grid, the openings 56 being sufficiently long to permit substantial relative movement between these members without interfering with the ends of the other two strips 43 and 45 which pass through them. Likewise, the strips 43 and 45 can move longitudinally in the plane of the grid, the elongated openings 61 providing for a substantially longitudinal movement of the tongues 60 which are received in them.

While I have shown particular embodiments of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An electric heater comprising a sheath wire heating element having a thermally expansible and contractible rigid sheath arranged into a substantially flat coil, a plurality of radially arranged diverging strips upon which said coil is mounted having their inner ends adjacent each other, means rigidly securing the turns of said coil to said strips, a supporting member for the outer ends of said strips, and connection means between said inner ends including a part on the inner end of one of said strips interfitting with a complementary part secured to the inner ends of the remaining strips so as to provide for free sliding movement between said parts, and said interfitting parts have interengaged surfaces of sufficient area to support said strips and heating element at the center so as to prevent sagging of the strips, and also of the turns of said heating element from the plane of said coil.

2. An electric heater comprising a sheath wire heating element having a metallic sheath arranged into a substantially flat coil, a supporting member for said coil having a continuous supporting wall with spaced apertures therein, means supporting said coil within said supporting member including at least a pair of strips to which the turns of said coil are secured, said strips having their outer ends received in said apertures and their inner ends adjacent each other, and means connecting said inner ends together comprising an elongated socket connected to the inner end of one of said strips and in which the inner end of another is closely fitted for free sliding movement so as to permit substantially free expansion and contraction of said turns, the socket receiving a sufficient length of said inner end of the other of said strips to prevent sagging of the inner ends of said strips.

3. An electric heater comprising a sheath wire heating element having a thermally expansible and contractible sheath arranged into a substantially flat coil, a supporting member for said coil having a continuous supporting wall, a plurality of strips to which the turns of said coil are secured diverging from each other at relatively wide angles and having their outer ends attached to said supporting wall, a socket rigidly attached to inner ends of certain of said strips and receiving the inner end of another in free sliding engagement, the socket receiving a sufficient length of said end to prevent sagging of the inner ends of said strips.

4. An electric heater comprising a sheath wire heating element having a metallic sheath arranged into a substantially flat coil, a supporting member for said coil having a continuous supporting wall, a plurality of strips to which the turns of said coil are secured diverging from each other at relatively wide angles, the outer ends of said strips being provided with tongues which are fitted into apertures provided for them in said supporting wall, and a socket rigidly attached to the inner ends of certain of said strips and receiving the inner end of another in free sliding engagement, the socket receiving a sufficient length of said end to prevent sagging of the inner ends of said strips.

5. An electric heater comprising a sheath wire heating element having a thermally expansible and contractible sheath arranged into a substantially flat coil, a supporting member for said coil, a strip folded upon itself to form a socket and two legs diverging from said socket at a relatively wide angle, a second strip having one end slidably received in said socket, means connecting the other end of said second strip and the ends of said diverging legs to said supporting member, and means securing the turns of said coil to said second strip and legs, the relative sliding movement between said second strip and said socket providing for the free expansion and contraction of said turns.

6. An electric hotplate comprising a sheathed

heating element having an expansible and contractible sheath formed into a partial circle, a second sheathed heating element having an expansible and contractible sheath formed into a flat spiral positioned within the first, the two terminal ends of the two heaters being adjacent each other at one side of the hotplate, a grid supporting said heating elements having a pair of strips rigidly secured together and arranged at a wide angle to each other and positioned to span the terminal ends of the heating elements, and said grid also having a third strip arranged at wide angles to the first two strips, means rigidly connecting the turns of said two sheaths to said strips, and connection means between said strips constructed and arranged to provide for relative movement between the third strip and the other two and also to prevent sagging of the grid where the strips are joined.

CHARLES I. HJELMGREN.