Jan. 1, 1935. E. L. WIEGAND 1,985,965

ELECTRIC RESISTANCE HEATING ELEMENT

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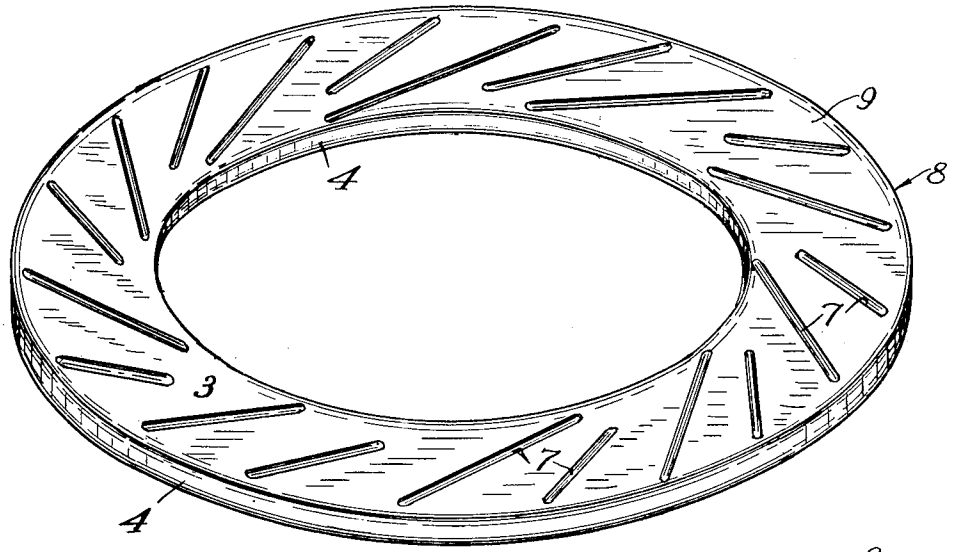


Fig. 1

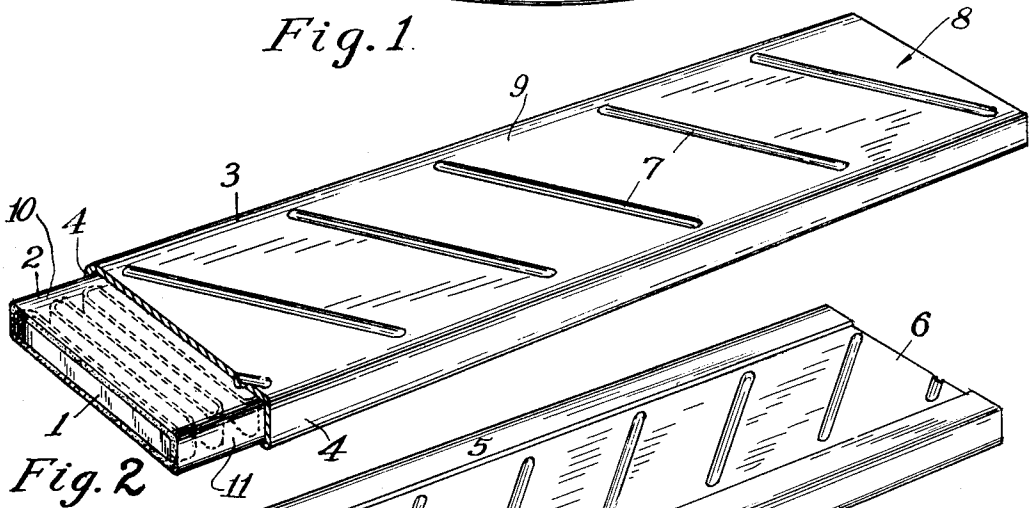
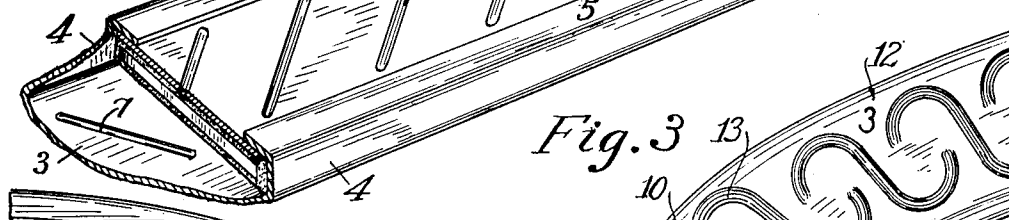


Fig. 2



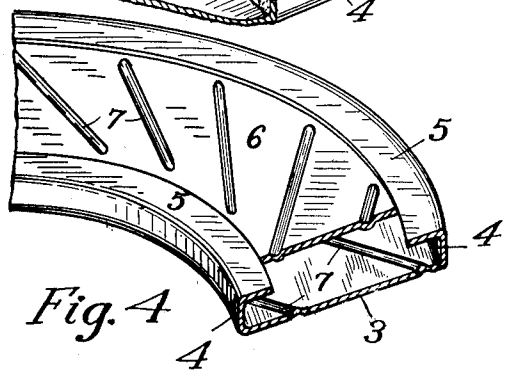


Fig. 4

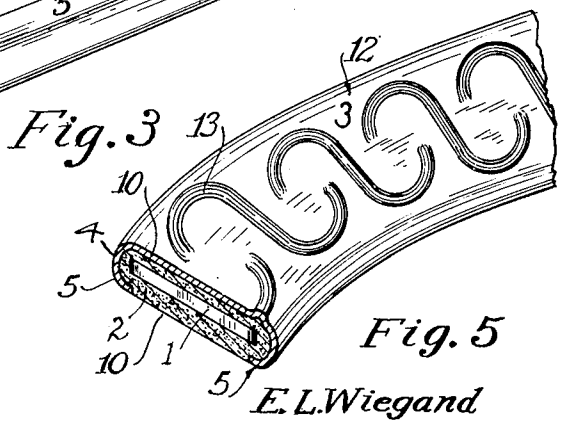


Fig. 3

Fig. 5

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1,985,965

ELECTRIC RESISTANCE HEATING ELEMENT

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Application January 8, 1932, Serial No. 585,493

19 Claims. (Cl. 201—67)

This invention relates to sheathed electric heating elements, and the principal object of the invention is the provision of sheathed electric heating elements having increased rigidity and resistance to warping or other deformation. The invention is applicable whether the sheath encloses entirely or only partly, and is particularly applicable to sheathed electric heating elements of the type disclosed in my United States Patents 1,613,426, 1,614,330, 1,614,331, and 1,614,938, that is, to sheathed electric heating elements comprising a resistor enclosed in a body of electrically-insulating heat-conducting material wholly or partly enclosed by a metal sheath supporting and protecting the body and acting as a heat-transfer surface for the element, and in this application I have illustrated my invention embodied in heating elements of that type.

In the drawing accompanying this specification and forming a part of this application:

Figure 1 is a view in perspective, showing a ring element of that type and embodying my invention,

Figure 2 is a similar view, but showing a strip element,

Figure 3 is a second view of the element of Figure 2, showing the element the other side up,

Figure 4 is a view similar to Figure 3, but showing a curved element, and may be taken as a fragmentary view of a portion of the element of Figure 1, showing the element the other side up, and—

Figure 5 is a view in perspective, illustrating the application of the invention to an element wherein the sheath only partially encloses.

Each of the heating elements herein shown comprises a resistor 1, a body 2 of cementitious electrically-insulating heat-conducting material embedding the resistor 1, and a sheath wholly or partly enclosing the body 2, and in each instance the resistor 1 is in the form of a ribbon, disposed sinuously in the body 2.

In the elements of Figures 1 through 4 the sheath 8 is two-part, entirely surrounding the body 2, and consists of a channel member 9 and a cooperating companion member 6, and in each of these elements the companion member 6 is merely a wide flat metal strip overlying one face 10 of the body 2, and the channel member 9 is a metal member having a wide flat portion 3 overlying the other face 10 of the body 2, having edge portions 4 rising from the edges of the flat portion 3 and overlying the sides 11 of the body 2, and having also lips 5 inturned from the free edges of the edge portions 4 and overlying the edges of the companion member 6 to secure the sheath in position surrounding the body 2.

In the element of Figure 5 the companion member 6 is omitted, and the lips 5 engage directly with the one face 10 of the body 2, and the sheath 12 overlies only one face 10 of the body 2, and the other face 10 of the body 2 is exposed, between the lips 5.

In each of the elements of Figures 1 through 4 the sheath 8 is provided on each of its face portions 3 and 6 with impressed corrugations 7, and in the element of Figure 5 the sheath 12 is provided with impressed corrugations 13 over its single face 3; in each of the elements of Figures 1 through 4 the corrugations 7 are straight, and depressed inwardly, as shown, and in the element of Figure 5 the corrugations 13 are hooked, and raised outwardly.

I prefer, however, that the corrugations be straight, and also, that the corrugations be depressed inwardly, in order not substantially to impair the contact between the surface of the sheath and a cooking vessel or other article to be heated, or air or other fluid flowing across the surface.

In each element the corrugations are at an angle to the length of the element (in the ring unit, to the circumference), to strengthen and stiffen the face of the sheath, and to allow for expansion in the direction of the length, and in the elements of Figures 1 through 4 the corrugations of the two faces 3 and 6 are inclined relatively oppositely, to secure even greater rigidity.

From the foregoing it will be apparent that the elements herein shown are of greater rigidity and resistance to deformation, and accordingly, that my invention does accomplish at least its principal purpose. However, it is to be understood that the invention is not limited to the particular heating elements or type of heating elements herein shown, or to the particular forms herein shown, but may be otherwise embodied, and has other uses and advantages, and accordingly the disclosure herein is to be regarded as illustrative only, and the invention is not limited thereto.

Having thus described my invention what I claim is:

1. An electrical resistance heating element comprising a resistor of flat formation arranged to present heating areas of considerable expanse, a metal sheath adjacent said resistor and spaced therefrom, substantially co-extensive with said heating areas and continuously subject to the

influence of said resistor, and a compact mass of refractory, electrically non-conducting material filling the space between said resistor and sheath, said sheath having reinforcing corrugations embossed therein and projecting into said non-conducting material.

2. An electrical resistance heating element, comprising: a resistor; a sheath at least partly embracing said resistor; and electrically non-conductive material insulating said sheath from said resistor; said sheath having an operative surface provided with spaced corrugations depressed inwardly thereof, providing said operative surface with flat surfaces of substantial area between said corrugations, whereby the flat surfaces are adapted to contact the article to be heated.

3. An electrical resistance heating element, comprising: a resistor; a sheath at least partly embracing said resistor; and electrically non-conductive material insulating said sheath from said resistor; said sheath having a plurality of operative surfaces provided with spaced corrugations depressed inwardly thereof, providing said operative surfaces with flat surfaces of substantial area between said corrugations, whereby the flat surfaces of any one of said operative surfaces are adapted to contact the article to be heated.

4. An electrical resistance heating element, comprising: a resistor; a sheath at least partly embracing said resistor; and electrically non-conductive material insulating said sheath from said resistor; said sheath having an operative surface provided with spaced corrugations depressed therein, projecting into said non-conductive material, providing said operative surface with flat surfaces of substantial area between said corrugations, whereby the flat surfaces are adapted to contact the article to be heated.

5. An electrical resistance heating element, comprising: a resistor; a sheath at least partly embracing said resistor; and electrically non-conductive material insulating said sheath from said resistor; said sheath having a pair of oppositely disposed operative surfaces provided with biased spaced corrugations depressed inwardly thereof, and the corrugations of the opposite operative surfaces inclined in opposed diagonal directions, said corrugations being arranged to provide said operative surfaces with flat surfaces of substantial area therebetween, whereby the flat surfaces of any one of said operative surfaces are adapted to contact the article to be heated.

6. An electrical resistance heating element, comprising: a resistor; and a sheath at least partially embracing said resistor; said sheath being provided with a plurality of corrugations, disposed at a substantial angle to the length thereof effective both to strengthen said sheath transversely and to take up longitudinal expansion.

7. An electrical resistance heating element, comprising: a resistor; and a sheath at least partially embracing said resistor; said sheath being provided with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and effective both to strengthen said sheath both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

8. A relatively flat electrical resistance heating element, comprising: a resistor; and a sheath embracing said resistor on at least one of the two flat sides of the element; said sheath being provided in its flat face with a plurality of corrugations, disposed at a substantial angle to the length thereof effective both to strengthen said face transversely and to take up longitudinal expansion.

9. A relatively flat electrical resistance heating element, comprising: a resistor; and a sheath embracing said resistor on at least one of the two flat sides of the element; said sheath being provided in its flat face with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and effective both to strengthen said face both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

10. A relatively flat electrical resistance heating element, comprising: a resistor, and a sheath embracing said resistor on both of the flat sides of the element; said sheath being provided in each of its flat faces with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and inclined oppositely to the corrugations in the other face and effective both to strengthen said faces both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

11. An electrical resistance heating element, comprising: a resistor; and a sheath at least partially embracing said resistor; said sheath being provided with inwardly depressed spaced corrugations, leaving therebetween contact surfaces of considerable area, adapted to be engaged by an article to be heated.

12. A relatively flat electrical resistance heating element, comprising: a resistor; and a sheath embracing said resistor on at least one of the two flat sides of the element; said sheath being provided with inwardly depressed spaced corrugations, leaving therebetween flat contact surfaces of considerable area, adapted to be engaged by an article to be heated.

13. An electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a metal sheath at least partially enclosing said body; said sheath being provided with a plurality of corrugations, disposed at a substantial angle to the length thereof effective both to strengthen said sheath transversely and to take up longitudinal expansion.

14. An electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath at least partially enclosing said body; said sheath being provided with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and effective both to strengthen said sheath both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

15. A relatively flat electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath enclosing said body on at least one of the two flat sides of the element; said sheath being provided in its flat face with a plurality of corrugations, disposed at a substantial angle to the length

thereof effective both to strengthen said face transversely and to take up longitudinal expansion.

16. A relatively flat electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath enclosing said body on at least one of the two flat sides of the element; said sheath being provided in its flat face with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and effective both to strengthen said face both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

17. A relatively flat electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath enclosing said resistor on both of the flat sides of the element; said sheath being provided in each of its flat faces with a plurality of corrugations, disposed at a substantial angle to the length thereof substantially less than a right angle and inclined oppositely to the corrugations in the other face and effective both to strengthen said faces both transversely and longitudinally and also to take up both transverse and longitudinal expansion.

18. An electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath at least partially enclosing said body; said sheath being provided with inwardly depressed spaced corrugations extending into said body, said corrugations leaving therebetween contact surfaces of considerable area, adapted to be engaged by an article to be heated.

19. A relatively flat electrical resistance heating element, comprising: a resistor; a body of electrically-insulating heat-conducting material embedding said resistor; and a sheath enclosing said body on at least one of the two flat sides of the element; said sheath being provided with inwardly depressed spaced corrugations extending into said body, said corrugations leaving therebetween flat contact surfaces of considerable area, adapted to be engaged by an article to be heated.

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