

H. E. VAN DOREN.  
ELECTRIC HEATING ELEMENT.  
APPLICATION FILED MAR. 7, 1914.

1,166,095.

Patented Dec. 28, 1915.  
2 SHEETS—SHEET 1.

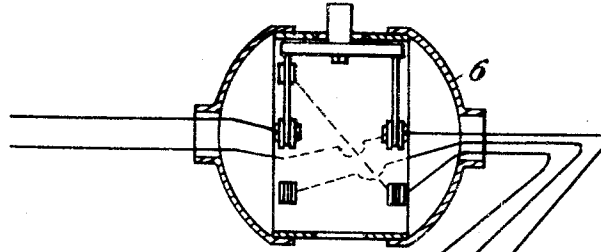


Fig. 1.

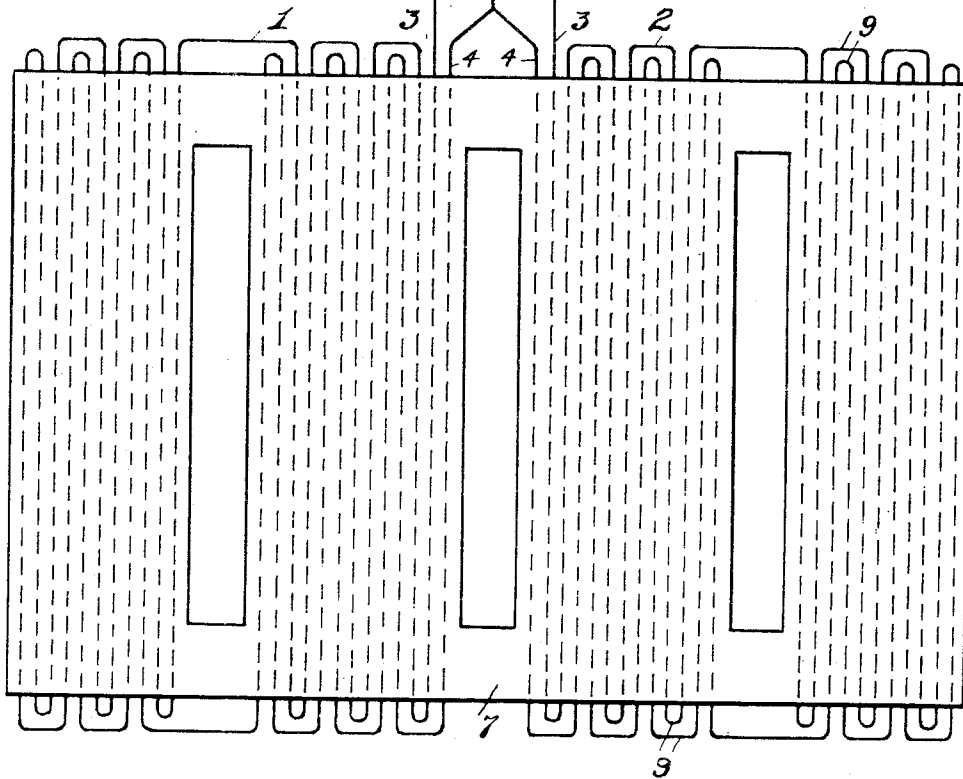


Fig. 2.



Witnesses:  
J. B. Caines  
Lila W. Cook.

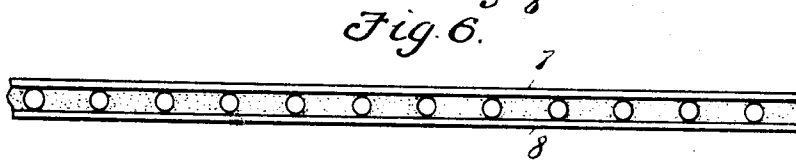
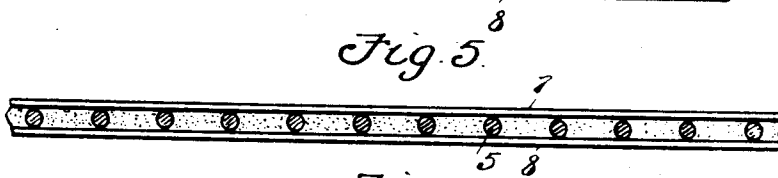
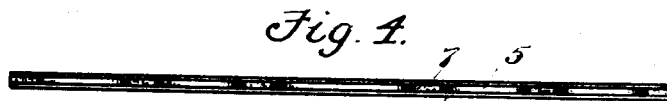
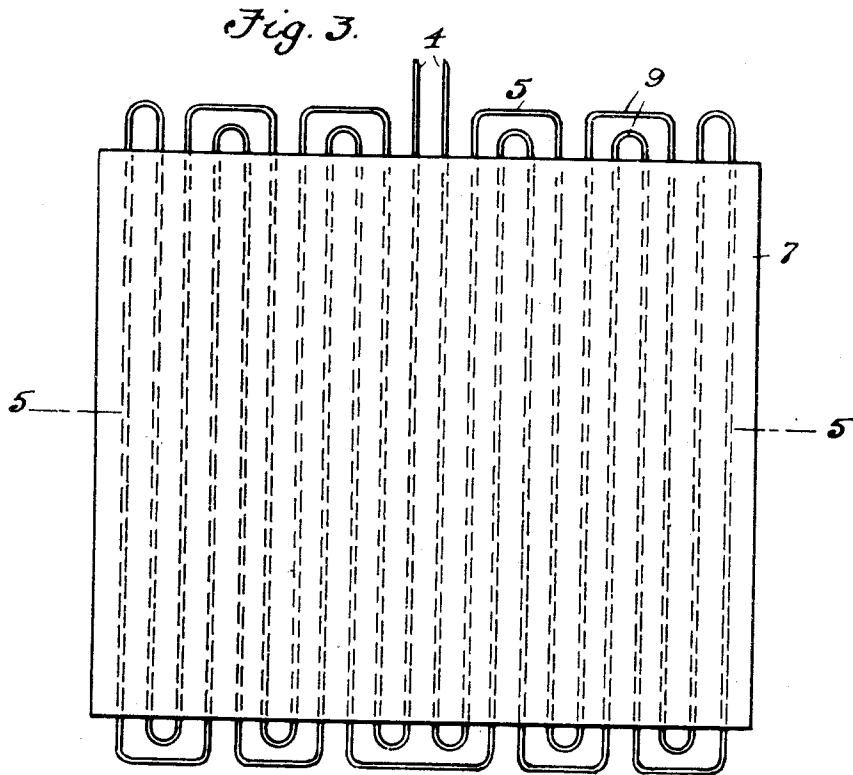
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By George J. Oltoch.  
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2 SHEETS--SHEET 2.



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# UNITED STATES PATENT OFFICE.

HORATIO E. VAN DOREN, OF SOUTH BEND, INDIANA.

## ELECTRIC HEATING ELEMENT.

1,166,095.

Specification of Letters Patent.

Patented Dec. 28, 1915.

Application filed March 7, 1914. Serial No. 823,251.

*To all whom it may concern:*

Be it known that I, HORATIO E. VAN DOREN, a citizen of the United States, residing at South Bend, in the county of St. Joseph and State of Indiana, have invented certain new and useful Improvements in Electric Heating Elements, of which the following is a specification.

The invention relates to an improved method of constructing the heating element of electric heaters, the method being devised particularly with a view to the utilization of high resistance elements in such heater, and in providing for a proper holding of said elements without restriction as to their movements in expansion and contraction under the developed heat.

In constructing the improved heating section, I provide a means, through the use of a single binder, of securing the respective insulating plates together, properly positioning the resistance elements between them and holding said elements against displacement while permitting their relative necessary movement under contraction and expansion.

To illustrate the improved method, I have shown more or less in detail the contemplated heating member in the accompanying drawings, in which:—

Figure 1 is a plan of the preferred form of heater, showing the control switch therefor. Fig. 2 is a longitudinal section of the same. Fig. 3 is a plan of a slightly modified form of heater. Fig. 4 is an edge view. Fig. 5 is an enlarged section on the line 5—5 of Fig. 3. Fig. 6 is a view similar to Fig. 5 with the resistance elements removed.

In the preferred form of heater, the resistance elements are arranged in the form of coil sections 1 and 2, each comprising conductors 3 and 4 of high resistance qualities which are maintained in spaced parallel relation throughout and together bent into flat coil form of rectangular outline. In this form the respective wires 3 and 4 are intermediate the length of the section, spaced a greater distance apart throughout one projection, to permit the formation of openings in the insulating sheets for the application of the heater in one use thereof.

In the form shown in Fig. 3, the heater is practically identical with that shown in the preferred form, except that in this instance the conductors are arranged in double coil as 5.

In connection with the preferred form, I have shown the conductors 3 and 4 connected through a switch 6 to the service conductors, the switch being of peculiar construction to provide for connecting the separate coils in parallel or series, as may be desired to vary the heating effect in a well understood manner.

The improved heating element proper comprises the wire conductors arranged in the manner described, and held between insulating sheets 7 and 8 preferably of mica or the like, whereby to provide a comparatively thin high capacity heater, adapted for many and varied uses. In the construction of the heater, it will be obvious that means must be provided for insulating the resistance elements one from another within the heater, for holding them against casual displacement, and at the same time permitting their expansion and contraction in use. It is with a view to providing for these results that the improved method has been devised, and in the carrying out of this method the wire resistance elements arranged in the form or forms shown, or in other appropriate forms, are laid upon one of the mica sheets and a heavy coat of shellac or the like is spread over the sheet and wire resistance elements. The remaining sheet of mica is placed upon the shellac coat and the whole subjected to pressure.

In the hardening of the shellac combined with the applied pressure, there is formed in the shellac a groove or channel for each resistance element, and in the initial heating of the elements by applying the current, the shellac immediately adjacent or surrounding the respective elements is baked, with the effect to cause said shellac to shrink or contract to a slight degree, so as to in effect free the wires to permit their longitudinal movement in contraction and expansion.

A desirable and essential point in the method is arranging the wires of greater length than the similar dimension of the mica plates, so that the return bend 9 in both forms are arranged beyond the edges of the plates so that with the improved means for securing the resistance elements in place, there is absolutely no restriction to the free expansion and contraction of the elements.

I have found shellac to be admirably adapted for the purpose, though it is to be

understood that I contemplate the use of other materials in this connection, so long as such materials embody the essential characteristic of the method, which is that of  
5 providing a semi-fluid connector which will unite the resistance elements and insulating plates, which will harden under pressure to provide channels, and which in the initial  
10 application of the current will, through the heat developed by resistance, undergo such change as will cause a slight shrinkage to form the element channels of slightly greater diameter than the elements, to provide for free expansion and contraction of the latter.

5 What is claimed is:—

The herein described method of forming plate like electric heaters consisting in ar-

ranging the resistance element in spaced parallel relation upon an insulating sheet, applying a cementing material to said sheet  
20 and element, applying a second sheet on said material, pressing the heater thus formed to harden and form the material, and applying electric current to the resistance element to cause a slight shrinkage of  
25 the material uniformly away from said element, whereby the element is free to expand within the cementing material.

In testimony whereof I affix my signature in presence of two witnesses.

HORATIO E. VAN DOREN.

Witnesses:

L. W. COOK,  
GEORGE OLTSCHE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."