

(No Model.)

H. G. O'NEILL.

METHOD OF MANUFACTURING ELECTRIC HEATERS.

No. 498,078.

Patented May 23, 1893.

Fig. 1.

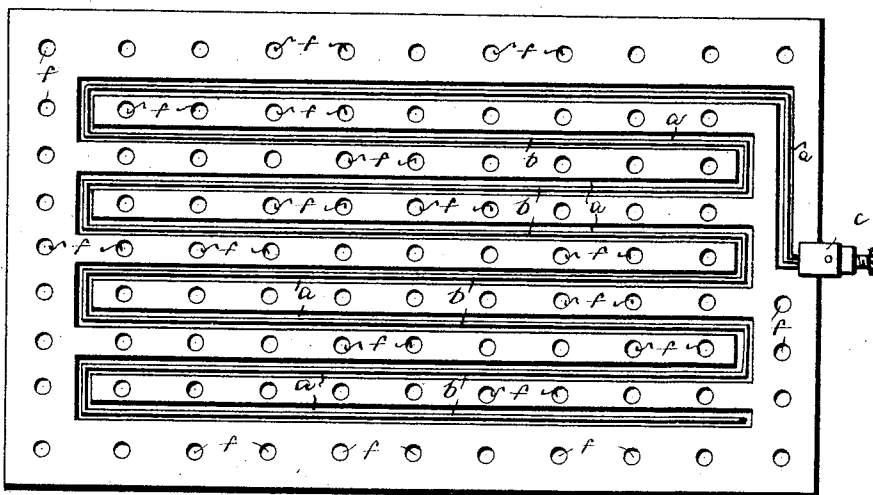


Fig. 2.

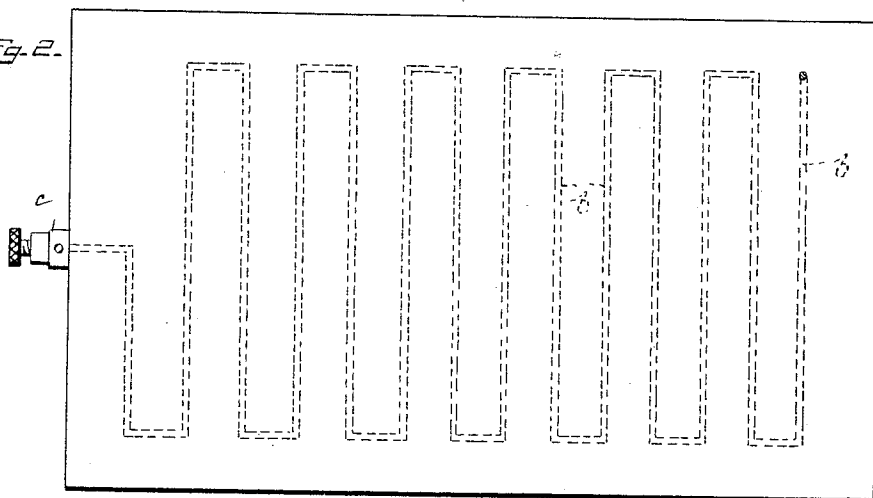


Fig. 3.

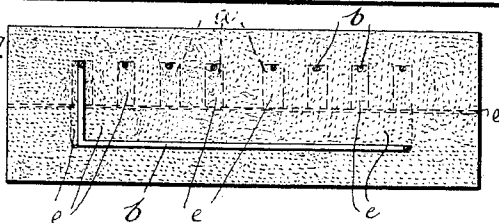
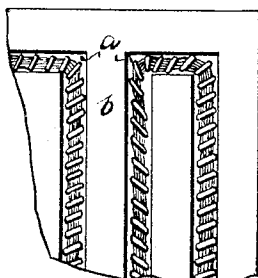


Fig. 4.



Fig. 5.



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UNITED STATES PATENT OFFICE.

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METHOD OF MANUFACTURING ELECTRIC HEATERS.

SPECIFICATION forming part of Letters Patent No. 498,078, dated May 23, 1893.

Application filed August 20, 1892, Serial No. 443,610. (No model.)

To all whom it may concern:

Be it known that I, HENRY G. O'NEILL, a subject of the Queen of Great Britain, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Methods of Manufacturing Electrical Heaters; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

Figure 1 is a bottom plan view of the upper section of the heater body, before baking and carbonizing and before covering the resistance conductors with cement. Fig. 2 is a plan view of the lower section of the heater body, with the conductor shown in dotted lines. Fig. 3 is a transverse vertical section through the completed body. Fig. 4 is a modified form of the filament. Fig. 5 is a partial plan view of a heater body provided with the modified form of filament illustrated in Fig. 4.

This invention has relation to the production of apparatus, wherein the energy of electricity is designed to be converted into heat, and its object is to provide a practical mode or method of manufacturing electric heaters with an interior carbon filament of considerable length but extremely small cross-section, without failure of the continuity of said filament. It is designed by this invention therefore to secure, in the carbon filament, positive continuity, necessary to conduction, while nevertheless its length may be considerable, and its sectional area of extremely limited character, a result involving in any ordinary mode of manufacture, on account of the fragile character of an extremely thin carbon filament, difficulties of attainment, which may be regarded, as practically insuperable. Important features are therefore it is believed presented, referring not alone to the great advantage in such a heater of the thin or filamentous high resistance conductor in the action of conversion, but also, to the obvious practicability and economy in the mode of manufacture.

In carrying out this invention I prefer to

make the body of the heater of silicate of magnesia, or fire clay, although analogous substances, which are conductors of heat and at the same time electrical insulators, may be employed. The material is designed to be reduced to powdered form, and is then mixed with any suitable non-conducting cement, such as may be composed of the silicate of soda mingled with the powdered substance of which the body is made and sufficient water to form a plastic mass. This is designed to be pressed in the desired form, which may be either plain or ornamental, flat or curved, or it may be in the shape of a hollow vessel for cooking purposes, or of a heating instrument. When plain or flat, it may be made in sections, which may have their inner faces formed with slight grooves or depressions, as at *a*, to receive carbonizable material *b*.

The carbonizable material may consist of a filament of silk or flax, cotton thread, an extremely thin strip of straw, bamboo, cane, or other suitable substance, which when the mass is baked, will be carbonized by the heat to which it is subjected. The filament or strip is laid in the groove of the plate running back and forth or cross-wise in a continuous but zig-zag manner, and at its ends metallic terminals *c* are attached and the whole covered in with powdered material of the same character as that composing the heater body, and hermetically sealed, pressure being employed to insure a compact and solid condition. The plate or body provided with the carbonizable material is then thoroughly dried and afterward placed in a furnace and subjected to sufficient heat to carbonize the filament or strip, and at the same time to harden or bake the inclosing body.

For ordinary heaters for warming purposes, it is preferred to make the body in two plain sections, whereof the grooves or depressions of one section should extend widthwise, while those of the other extend lengthwise, so that the carbonizable strips of one plate will lie in a plane parallel to that of the carbonizable strips of the other section, but will nevertheless extend in a crossing direction as indicated in the drawings. In this manner, the carbonizable material may be made of considerable length, that of one section being

joined to that of the other section at its end, as at *d*, and at all other points, separated therefrom by a layer of non-conducting cement *e*, which also serves to attach the two sections together.

Instead of using a single extended filament or strip of carbonizable material, I may wind it around a supporting core of some non-conducting substance, such as asbestos. The core with its covering is embedded in the heater, and the filament carbonized. Such covered filament is laid in the plastic body in the manner hereinbefore described and hermetically sealed therein by the non-conducting cement, and the terminals being applied, the whole is baked in a furnace, converting the carbonizable strip or filament into a conductor of high resistance of proper character to develop the maximum degree of heat from a given outlay of electrical energy.

The terminals or end connections for the carbon conductor, to which the feed wires are to be attached, should be of some metal of sufficiently high melting point to withstand the temperature necessary for the carbonization of the interior filament, and it is preferred to use phosphor bronze or silicon bronze, although any metal having a sufficiently high fusion point will answer. These terminals must have projections extending within the body portion, and to these projections the ends of the strip or filament may be made to adhere by means of some carbonizable cement, such as thick molasses, or a composition of sugar and white of egg.

While not absolutely essential, it is better to form perforations in series as at *f*, between

the lines of the filament, in order to furnish points of egress for the gases of decomposition during the process of carbonization, as well as for vapor or moisture. After being removed from the furnace and slowly cooled, these perforations are filled with the cement hereinbefore referred to. These perforations will also assist in the drying of the plastic body, which should be slowly and thoroughly effected before it is placed in the furnace, so that when subjected to the necessary heat, it will not crack.

This heater, of whatever form, when properly baked in the furnace, will be hard and durable, and will contain within it, a continuous filamentous carbon conductor of minimum cross-section, such as it would be impracticable to provide in any manner which contemplates the manipulation of such a carbon filament or strip, because of its extremely fragile character.

Having described this invention, what I claim, and desire to secure by Letters Patent, is—

The method of forming electrical heaters, which consists in molding a carbonizable filament inside a heater body composed of plastic material, and in subsequently heating the body and filament to bake the former and carbonize the latter, substantially as specified.

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

HENRY G. O'NEILL.

Witnesses:

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