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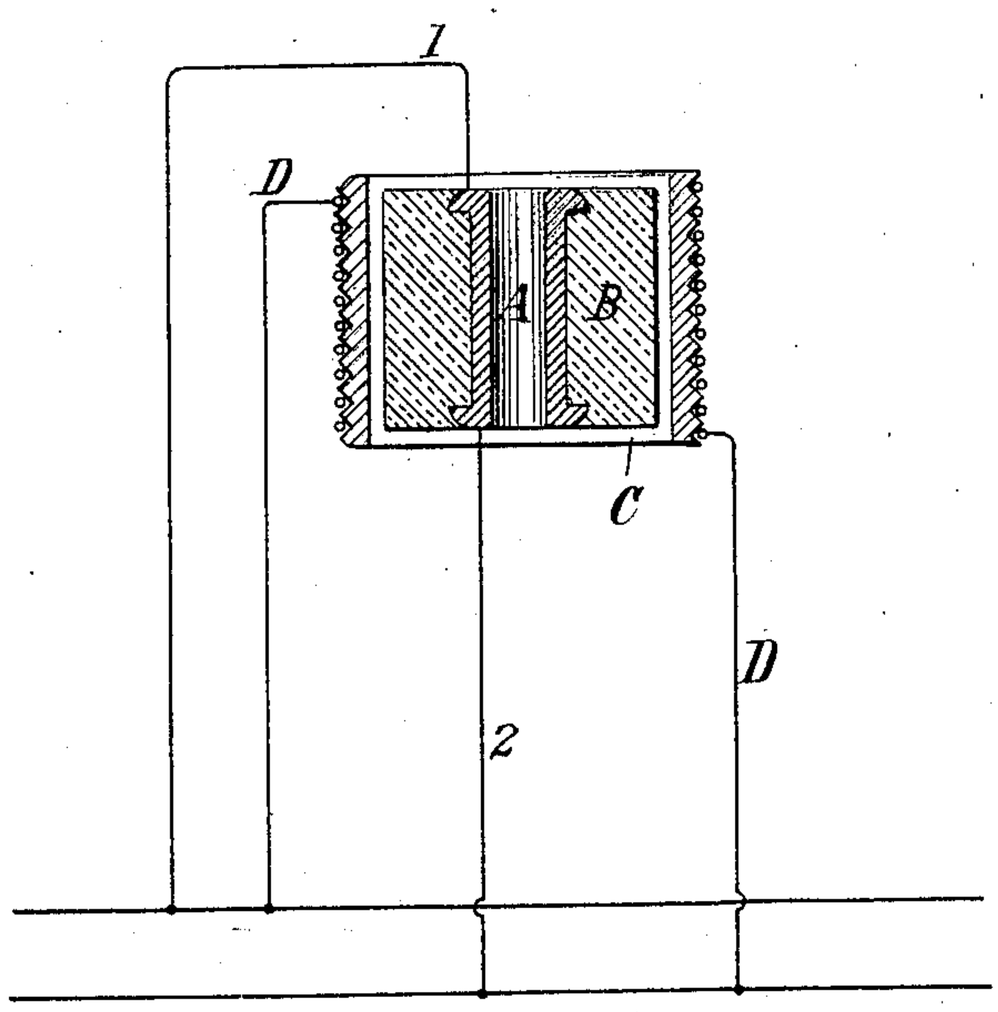
H. N. POTTER.

ELECTRIC FURNACE.

(Application filed Sept. 15, 1899.)

(No Model.)



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UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF GÖTTINGEN, GERMANY, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 652,640, dated June 26, 1900.

Application filed September 15, 1899. Serial No. 730,546. (No model.)

To all whom it may concern:

Be it known that I, HENRY NOEL POTTER, a citizen of the United States, and a resident of Göttingen, Germany, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

My invention relates to the class of devices employed for producing high temperature by means of electric current.

The object of the invention is to provide means for securing a constant even high temperature in such a manner as to render it possible to apply to any desired object intense heat free from foreign substances, such as are liable to be encountered, for instance, in the electric arc.

The invention is peculiarly adapted for use in forming certain classes of glowers, such as are used in the so-called "Nernst" lamps, but is also applicable to various other purposes.

The invention will be described more particularly in connection with the process of forming a Nernst glower.

The furnace consists generally of a tube composed of materials which will withstand a high temperature and conduct electric currents when in a heated condition—such, for instance, as the rare earths. This is protected by an outer covering of suitable material, and means are provided for heating the tube to render it conductive. The objects to be heated are placed within the tube.

The accompanying drawing shows a section of the furnace.

Referring to the figure, A represents a tube composed of a mixture of dry electrolytes—such, for instance, as magnesia and yttria or zirconia and yttria in such proportions as are usually employed in glowers in electric lamps of the Nernst type. These materials or other analogous ones are ground and mixed together with a binder—such as paste, tragacanth, starch, &c.—and moisture to make a dough, which is formed into a tube. About this tube, either before or after baking the same, is pressed a jacket B, composed of one of the constituents of the tube without admixture with the other or others—as, for instance, a magnesia-yttria tube could be jacketed in either pure magnesia or pure yttria. This jacketed tube I bake into one solid piece by submitting it to the intense heat of a porcelain kiln or other furnace giving a very high temperature. When the composite block is baked, I either wind about it a heating-conductor or I place it inside a tube C of some insulating material, as talcite, on which the heating-conductor D is wound, or else I arrange to have the whole highly heated by some other source of heat—as, for instance, a gas-furnace or a Bunsen flame. About the ends of the inner tube, usually underneath the jacketing material, I attach terminal wires 1 and 2, of platinum or other suitable material, in any manner capable of giving a good electrical connection to the inner tube. Having prepared my composite tube I heat it in any suitable way to such a temperature that the inner tube becomes an electrical conductor. I then apply a sufficient electrical voltage to the ends of the inner tube to cause a sufficient current to pass therethrough to bring the inner tube to such a temperature as I may desire to use. Usually the immediate result of this heating by the electric current is to cause a more or less violent contraction of the tube and the surrounding jacket, so that cracks are formed in both tube and jacket, and electric arcs play across these cracks, melting the materials and causing the cracks to widen. After the first short electrical baking I interrupt the current, allow the furnace to get cold, and cement the cracks thoroughly full—the cracks in the tube with the mixture of which it is composed and the cracks in the jacket with a paste composed of its material. After drying and rebaking in the kiln I submit the furnace to a second electrical burning, or else I burn it again electrically without first baking it in the kiln. The cracks resulting from the second electrical burning are usually much smaller than those produced by the first burning, so that often a third burning after repatching is sufficient to give a furnace which can be used for hours without further patching. In general I watch the furnace-walls during the service of the furnace and repair any cracks that form as soon as they are detected.

The object of using the peculiarly-constructed jacket is threefold—first, to furnish a support for the various fragments into which

the inner tube cracks which shall hold each fragment in its proper relation to the others until the gaps can be stopped; second, to furnish a support for the inner tube which cannot flux it at the high temperature reached, and, third, to furnish the inner tube with a support which shall have an extremely-small electrical conductivity even at the high temperatures at which the tube is a very good conductor, the conductivity of a mixture at any given high temperature being in general enormously better than that of the pure substances of which it is composed. The first condition would be filled by any refractory support, the second by any support containing no constituents not found in the tube, the third by a pure refractory substance, and all three by a pure substance forming one of the constituents of the tube. The jacket serves also to minimize the loss of heat by radiation and connection, so that it is possible to maintain the inner tube at a temperature at which a glower might operate with a much smaller supply of energy than would be required by the glower.

In certain cases the jacket may be made of a material not found in the inner tube—as, for instance, a zirconia-yttria tube might be bedded in thoria. In such cases the jacketing material is either chemically indifferent to the materials of the tube or its entrance into the tube is without deleterious effect.

This furnace is particularly adapted for use in forming glowers for Nernst lamps and affords a ready means for solidifying and shrinking them, and it possesses the important advantage that it gives a clean heat. The glowers may be supported in the tube A in any manner. The furnace is also useful for producing a very high temperature where it is desired to treat any materials which may be inserted within the tube A.

This furnace is especially useful for forming tubular glowers, inasmuch as it is extremely difficult, if not impracticable, to bake tubular glowers of any considerable size in an electrical arc or in an oxyhydrogen flame, or any other source of heat, both because of the liability of the glower to become unsymmetrical in shape and to be unevenly baked and to crack.

Instead of giving the preliminary heat to the tube A and its surrounding jacket B by means of an electric current through the conductor D the necessary preliminary temperature may be given by other means—such, for instance, as an alcohol or gas flame or by placing it in a suitable heating-furnace.

The invention claimed is—

1. An electric furnace consisting of a tube composed of a mixture of dry electrolytes, an electric circuit including the said tube, a closely-surrounding jacket composed of one of the constituents of the tube, a heating-conductor surrounding the jacket, and a support therefor, substantially as described.

2. An electric furnace consisting of a tube composed of a mixture of dry electrolytes, an electric circuit including the said tube, a surrounding jacket composed of one of the constituents of the tube, a heating-conductor surrounding the jacket, a support therefor, and means for charging the said electric circuit.

3. An electric furnace consisting of a tube composed of a mixture of dry electrolytes, a heating-conductor for giving an initial temperature to said tube, an inclosing jacket for the tube composed of one of the constituents of the tube, and means for causing an electric current to traverse the tube when heated.

4. An electric furnace consisting of a tube composed of a mixture of dry electrolytes, an electric circuit including the said tube, an inclosing jacket consisting of one of the constituents of the tube, a surrounding cylinder of talcite, and a conductor disposed upon or carried by the cylinder of talcite, substantially as described.

5. An electric furnace consisting of a tube of material which is a non-conductor when cold but becomes a conductor when heated, an electric circuit including the said tube, the tube being supported by a jacket of a material which does not become a conductor at the temperature at which the furnace is to operate.

6. An electric furnace consisting of a tube composed of a mixture of dry electrolytes embedded in a jacket composed of one of the constituents of the tube.

7. An electric furnace consisting of a tube composed of a mixture of dry electrolytes, the said tube being provided with terminals, and embedded in a jacketing mass composed of a single constituent of the said tube.

8. An electric furnace consisting of a tube of material which is a non-conductor when cold but becomes a conductor at a red heat, surrounded by a jacket of a material which remains practically non-conducting even at the operating temperature of the furnace, and which contains nothing which can flux the inner tube.

9. An electric furnace consisting of a tube of a material which is a non-conductor when cold but becomes a conductor at a red heat, a non-conducting inert supporting-jacket therefor, terminals for said tube, and means for causing an electric current to traverse the tube when heated.

Signed at Berlin, Germany, this 4th day of September, A. D. 1899.

HENRY NOEL POTTER.

Witnesses:

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