No. 715,508. Patented Dec. 9, 1902.

H. N. POTTER.

ELECTRIC FURNACE.

(Application filed Mar. 27, 1902.)

(No Model.)

Fig. 1

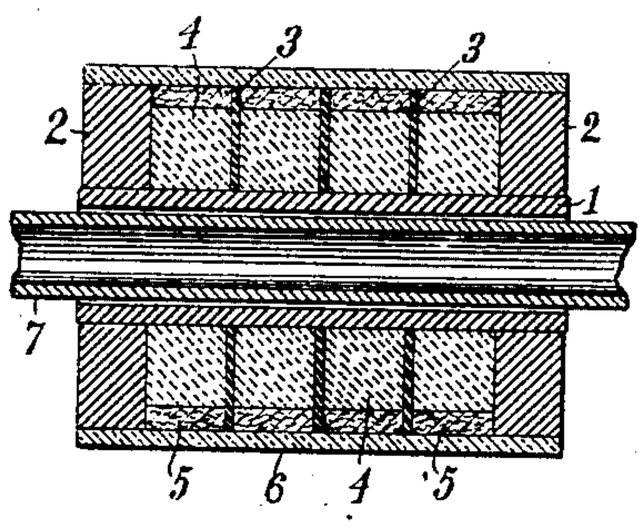


Fig. 2

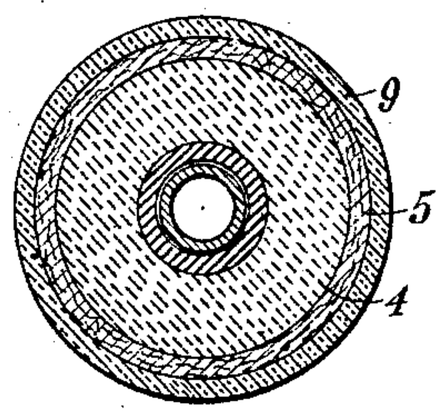


Fig. 3

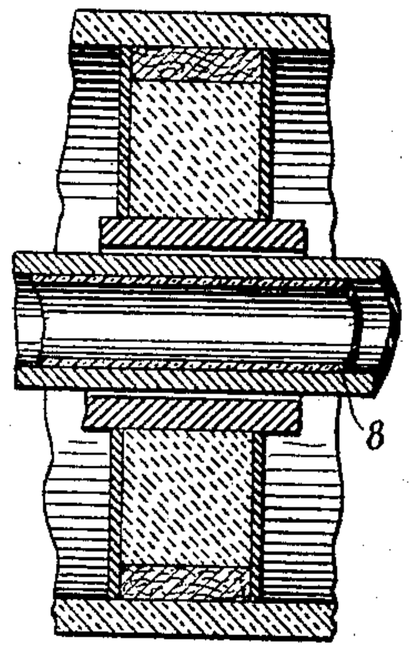


Fig. 4

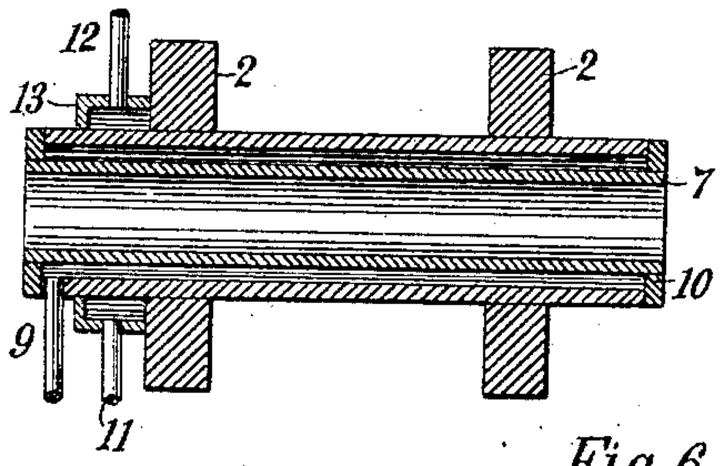


Fig. 5

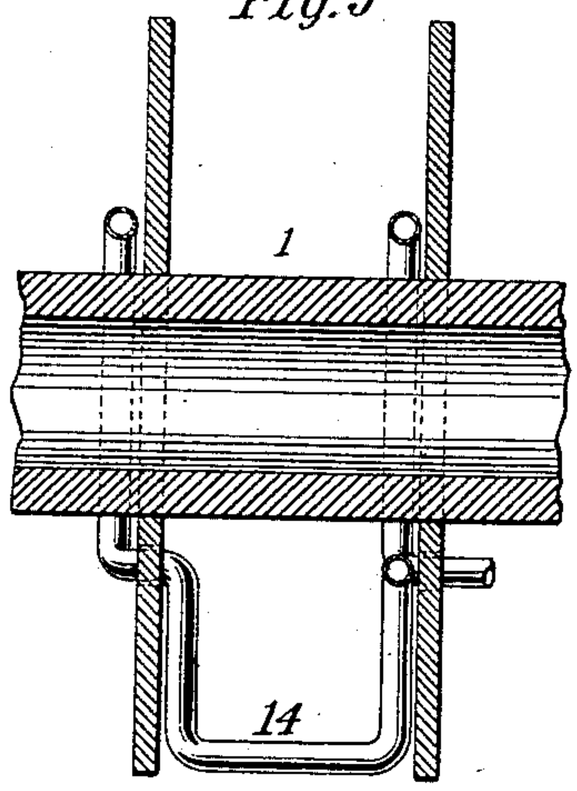
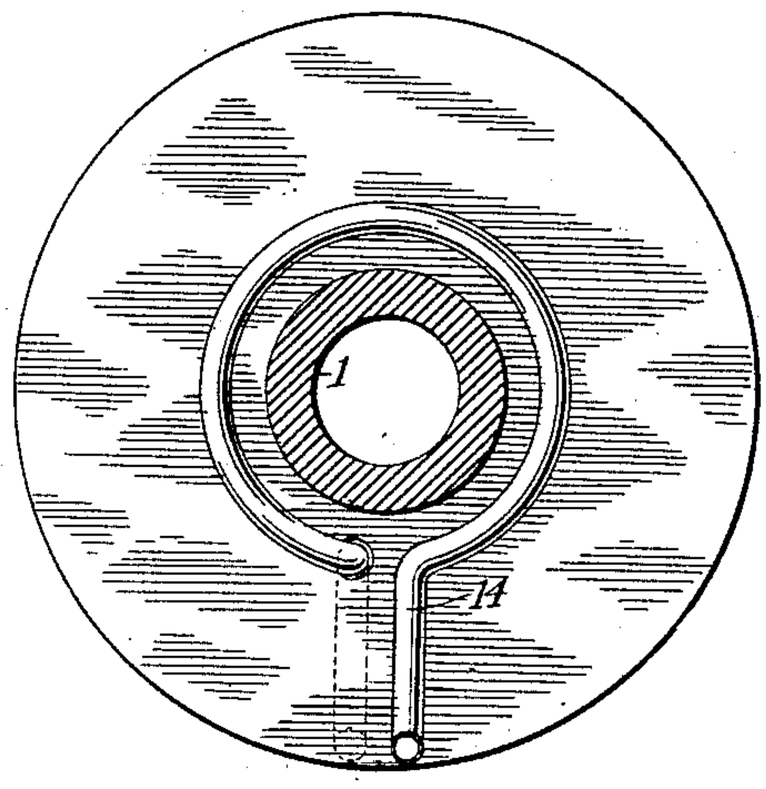


Fig. 6



Witnesses:
Wm. H. Capel.
George H. Stockbridge

Inventor
Harry Noel Potter

by Charles A. Terry Atty

UNITED STATES PATENT OFFICE.

HENRY NOEL POTTER, OF NEW ROCHELLE, NEW YORK, ASSIGNOR TO GEORGE WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 715,508, dated December 9, 1902.

Application filed March 27, 1902. Serial No. 100,161. (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 New Rochelle, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Electric Tube-Furnaces, of which the following is a specification.

In an application filed by me on the 21st day of November, 1901, Serial No. 83,078, I show and describe a lined carbon furnace-tube in which the tube rotates about its axis in order that the melted lining material may flow evenly over the inner surface of the carbon tube, while that invention also contemplates the rotation of the furnace-tube for other purposes, as when metallic chromium is produced by a continuous operation and the material is worked steadily through the furnace partly by the effects of the rotation of the tube.

The present invention contemplates making the furnace of a double tube, an outer and an inner tube, the outer being an electrical conductor provided with terminals in any suitable manner and the inner being a comparatively thin walled tube of such diameter as to permit its rotation within the outer tube. By rotating the inner tube upon its axis many of the effects produced by rotating the entire furnace are secured and some additional advantages are obtained. Thus when the furnace is made according to my present invention the inner tube or the part of the furnace most subject to wear can be easily renewed. Moreover, since the furnace itself is not rotated the terminals will also be stationary, and their construction can be modified so as to allow them to be water-cooled. The annular space between the inner and the outer tubes may be filled with an inert gas, though in practice the oxygen of the air in the limited space between the tubes would soon be taken up and would in most cases do little or no injury. If a special gas is used, however, it would usually be hydrogen, though for certain purposes nitrogen might be used.

The stationary tube will generally be of carbon, and the inner tube may be either of carbon, lined or unlined, or of a material such as magnesia, zirconia, or the like.

I prefer to let both the tubes project axially beyond the terminals to such a distance as shall allow them to become reasonably cool, so as to facilitate the attachment of metal or other tubes to convey the inert gas. Moreover, I propose to extend the idea of water-cooling to the projecting ends of the tubes and in certain cases to the supporting-collars which are fully described in my application referred to above and also in the present application.

Hitherto I have proposed the use of a cylindrical tube; but for certain purposes, particularly those where high temperatures are not necessary, a conical tube has advantages. For example, a tight fit between the conical lining and the tube can always be secured without the necessity of fusing the lining to the carbon tube by simply pushing the lining into the carbon tube when the lining shrinks. In such cases it is advantageous to make the tube of magnesia, zirconia, or the like, constituting the lining somewhat longer than the carbon furnace-tube. At the large end, however, the lining-tube should cease to be conical and become cylindrical, with an outer diameter equal to the largest bore of the carbon tube.

For operations such as tempering steel, firing enamel, and making alloys the advantages of having an inner rotating carbon tube can be secured without the use of the latter by merely having a rotating magnesia lining, the temperature not being sufficiently high to cause the lining to adhere to the carbon furnace-walls.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal section of my improved furnace with an inner carbon tube adapted to rotate within the main furnace-tube. Fig. 2 is a cross-section of the same furnace. Fig. 3 is a longitudinal section of a portion of a similar furnace, in which, however, the inner carbon tube is provided with a lining of magnesia or the like. Fig. 4 is a longitudinal section illustrating the means

for supplying an inert gas and for water-cooling the ends of the furnace-tube, and Figs. 5 and 6 are respectively a longitudinal and a cross section illustrating the mode of water-cooling the carbon collars.

Referring to the drawings, 1 is a tube of carbon supplied with carbon terminal rings 2 2 and having collars 3 3 of carbon arranged along its length at suitable distances apart for supporting and strengthening the tube when it is acted upon by the heat developed in operation. Between the collars 3 3 are packing-rings 4 4, of magnesia or the like, these rings being preferably surrounded by rings or collars 5 5 of asbestos. The whole is surrounded by an insulating-tube 6.

Within the tube 1 a smaller tube 7 is adapted to rotate on its axis, the diameter of the inner tube being small enough to admit of this. The materials to be treated in the furnace are inserted within this inner tube, which is accordingly subject to greater wear than the rest of the furnace. When this tube is destroyed, it can easily be renewed at small expense.

The structure illustrated in Fig. 3 is similar to that just described, except that the tube 7 has a lining 8 of magnesia or similar material.

As already stated, I generally prefer to let the tubes 1 and 7 project beyond the terminals 2 2 at either end for reasons given above. This structure is illustrated in Fig. 4, wherein the tube 9 represents the inlet for an inert gas, such as hydrogen, this inlet-tube leading to a space 10 between the tubes 1 and 7. The tube 11 represents the inlet, and 12 the outlet, for a flow of water intended to cool the end of the furnace. This structure will generally be duplicated at the opposite end of the furnace. The pipes 11 and 12 are both connected to a box 13, surrounding the tube 1 and bearing at its otherwise-open end against the carbon terminal 2.

In Figs. 5 and 6 a pipe 14 is shown running in proximity to two of the carbon collars 3 3 and adapted to carry water for keeping these collars from becoming plastic.

As to the structures shown in the earlier figures of the drawings, it may be said that the tube 7 may be either of carbon or a material such as magnesia, the latter material being well adapted for use when low temperatures only are to be developed in the furnace. In either case the inner tubes are easily replaceable when they are worn out or burned out in service.

I claim as my invention—

1. An electric tube-furnace having an inner tube adapted, when the furnace is in operation, to be freely rotated therein.

2. A carbon-tube furnace, consisting of a fixed tube and an inner tube adapted, when the furnace is in operation, to be freely rotated within the fixed tube.

3. A carbon-tube furnace, consisting of an inner and an outer tube separated by an air-space.

4. In an electric furnace, an inner and an outer tube having the space between them filled with a stationary inert gas.

5. In a carbon-tube furnace, a number of supporting-collars surrounding the tube, and water-cooling devices supplied to the said collars.

6. In a carbon-tube furnace, a suitable carbon tube, collars of carbon surrounding the same, and cooling devices for the collars.

7. The combination with a tubular electric furnace, of a main tube and an inner tube, the space between the tubes being filled with an inert gas, and cooling means applied to oppose distortion of the tube when hot.

8. A carbon-tube furnace having a main stationary tube and an inner rotatable tube of carbon provided with a lining of magnesia or the like, the inner tube being capable of free rotation within the main tube when the furnace is in operation.

Signed at New York, in the county of New York and State of New York, this 25th day of March, A. D. 1902.

HENRY NOEL POTTER.

Witnesses:

WM. H. CAPEL,

GEORGE H. STOCKBRIDGE.