

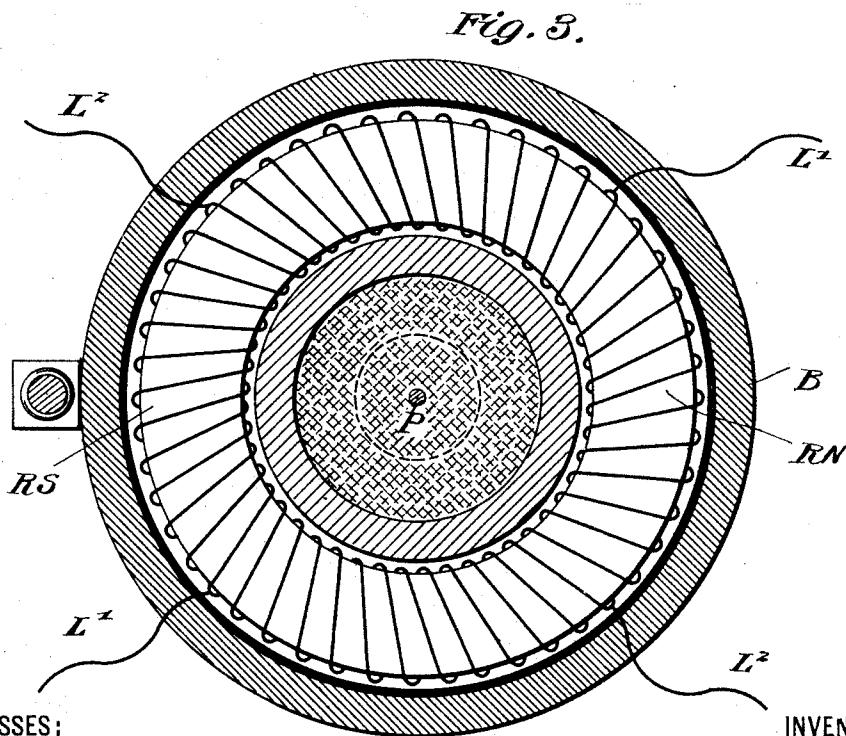
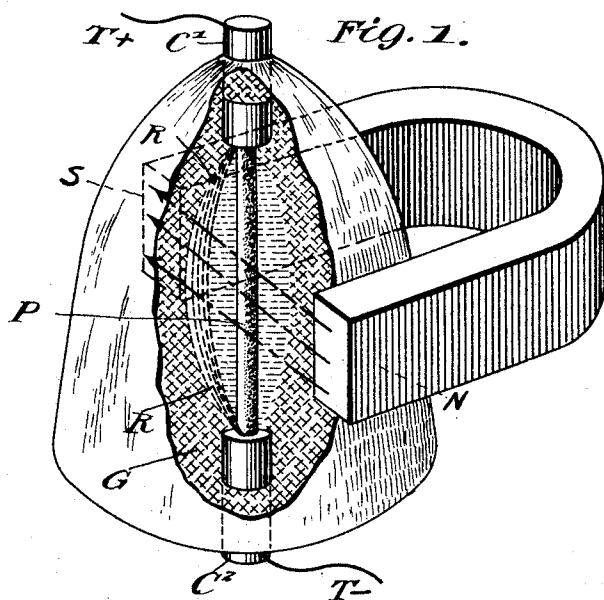
(No Model.)

2 Sheets—Sheet 1.

F. J. PATTEN.
ELECTRIC FURNACE.

No. 586,824.

Patented July 20, 1897.



WITNESSES:

Frank S. Ober.
Chas. M. ...

INVENTOR

Francis Jarvis Patten

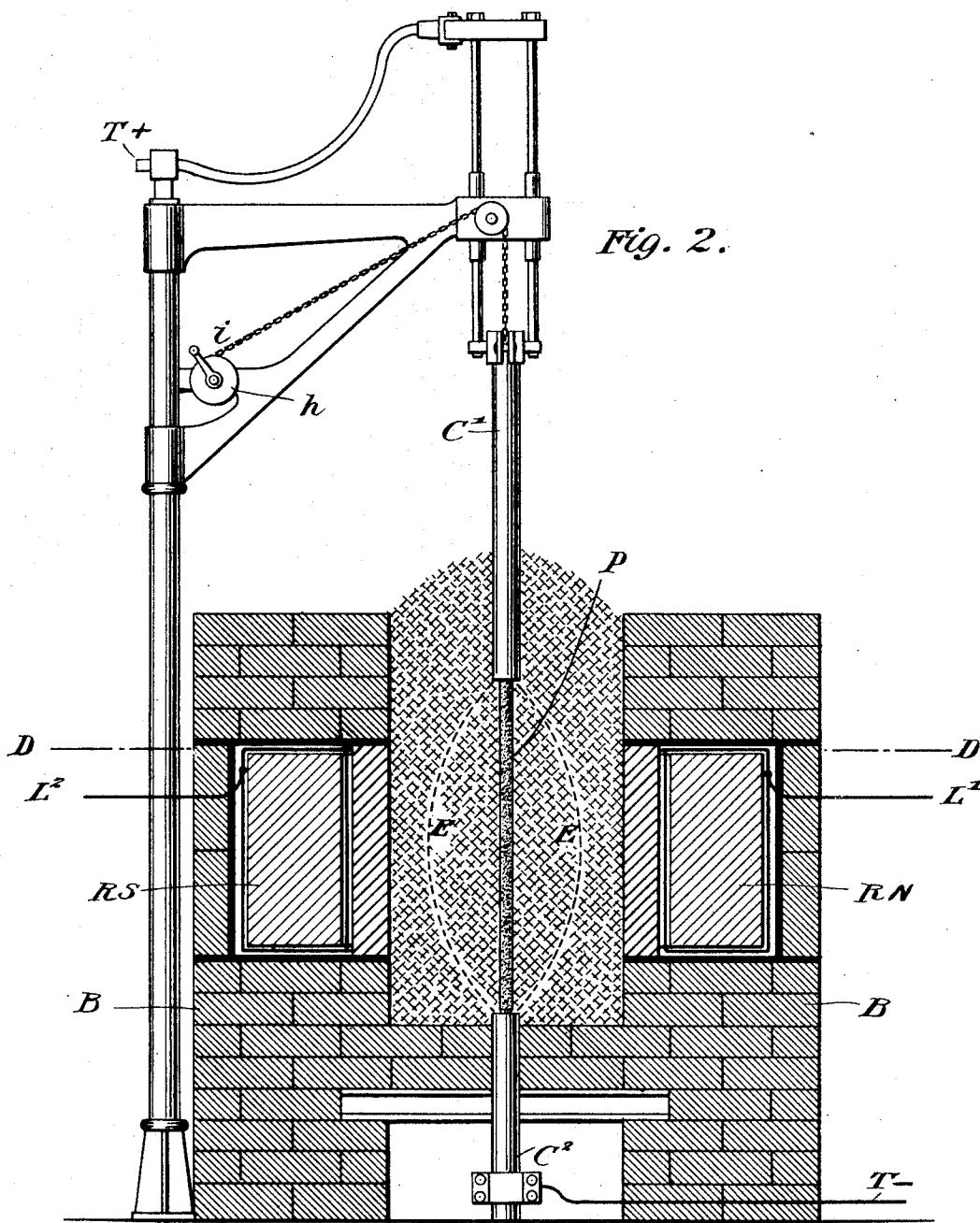
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UNITED STATES PATENT OFFICE.

FRANCIS JARVIS PATTEN, OF NEW YORK, N. Y.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 586,824, dated July 20, 1897.

Application filed January 30, 1897. Serial No. 621,317. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS JARVIS PATTEN, a citizen of the United States, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Processes of and Apparatus for Electrical Heating, of which the following is a clear description.

My invention relates to that class of electric furnaces in which a carbon pencil is embedded in a mass of material to be fused, the pencil being brought to incandescence by sending an electric current of sufficient volume through it. This style or type of furnace may be referred to as the "incandescent type" in contradistinction to the arc type, in which the heat is that of an electric arc between carbons.

My system will be understood from an examination of the accompanying drawings, in which—

Figure 1 is illustrative of the principle applied. Fig. 2 is a sectional view of the furnace in elevation, and Fig. 3 a horizontal sectional view.

The principle applied is a novel one and has not, I think, been heretofore used in the electric arts.

It will be understood from a study of Fig. 1, in which C' and C² are carbon rods connected to a source of direct current. The carbons are represented as separated by a considerable distance at their ends—that is to say, by a distance so great that under the voltage used the current cannot possibly arc across the space from one carbon to the other, and there would be no current in the circuit were not provision of some kind made to bridge it across the gap between the carbons. For illustration, then, let it be supposed that originally a comparatively slender carbon pencil or wire connected the two carbon rods or electrodes, and that this pencil or wire on passing the normal current became incandescent and that the resulting temperature operated to fuse some portion of the lime and coke mixture G G, (represented as surrounding and embedding the pencil connecting the carbons before the current is turned on.)

It is a well-known fact that in furnaces of this general description in which a mixture G G of lime and coke is fused to make cal-

cium carbid a carbon pencil, placed as indicated, on being brought to incandescence by the current sent through it, acts as a nucleus of fusion of the lime and coke mixture in its immediate vicinity along its entire length, thus creating in the mass of the mixture a central core of fused material of an approximately ellipsoidal form. The mixture itself of lime and coke is a very poor conductor of electricity, whereas the fused mass of lime and coke between the carbon electrodes, produced by heating the carbon pencil to incandescence, is a comparatively good one and at once takes the place of the carbon pencil when the latter has wasted away and united with the fused part of the surrounding mixture. In this way a central portion of the mixture is fused and the desired product, calcium carbid, is formed, the nugget or central core gradually increasing in size as more and more material becomes fused. Finally the nugget is withdrawn and the process is repeated. Evidently as the nugget of molten material becomes larger and larger in diameter its cross-section and conductivity rapidly increases, and when the cross-section of conducting material becomes large enough to convey many times the fusing-current an artificial resistance has to be introduced to prevent short-circuiting the source of current. Now it is my purpose to confine the current between the electrodes to a definite portion of the molten or conducting nugget and also to direct the current around the outer surface of the fused central core or nugget, so that it will get at new material that has not been attacked by the current. Fig. 1 illustrates how this is accomplished, and it depends upon the principle that an electric current having a choice of several paths of about equal resistance, some of which pass through a magnetic field and some of which do not, will select the path farthest removed from the magnetic field. Thus in Fig. 1 is represented a mass of molten material of ellipsoidal form K, which I will suppose has been fused from the surrounding mixture G G, filling the space between the carbon electrode C' C². The molten core K is highly conducting, and if it be of greater cross-section than the current, requires for its transit a small linear element of the core would convey all the current, and under or-

dinary circumstances the current would be confined to a central pencil of the core extending from one main carbon to the other. If, however, we place the core in a magnetic field, as shown, in Fig. 1, with lines of force N S, as shown, transverse to the current direction, the current between electrodes will no longer take the direct path through the central axis of the molten material from one carbon to the other, but will be pushed off to one side, taking the course R R, as shown. In other words, the current will take the longer-curved path in order to avoid traversing the magnetic field, this of course only providing there is not very great difference of resistance between the longer and the shorter path. In this way we are enabled by the use of a strong magnetic field to drive the fusing-current away from the central portion already fused to the surface of the nugget or unfused portions of the mixture, thus attacking new material.

One other step is essential to a complete application of the principle. Evidently if the magnet in Fig. 1 be revolved about the axis of the carbons as a center the field magnetism will turn with the magnet, and the current-path R R in its endeavor to avoid traversing the field will revolve around the surface of the nugget, attacking fresh or unfused material on all sides. Thus the current can in this way be forced to take a revolving electric path that continually spins around the outer surface of the molten mass, describing an ellipsoid of revolution in space. In applying this principle to practice, however, I create a revolving magnetic field electrically by energizing an iron ring by biphasé alternating currents in a well-known way. In a previous application I have shown this principle applied to furnaces of the arc type, wherein the arc is thus controlled and made to remain fixed or travel in a similar way. In this application I describe the adaptation of the same principle to furnaces of the carbon-pencil or incandescent type. Figs. 2 and 3 show such a furnace. Fig. 2 is a sectional elevation, and Fig. 3 is a horizontal section on the line D D of Fig. 2. B B is an inclosing wall of brick-work; C' C², the upper and lower carbon

electrodes; P, the connecting carbon pencil, which is brought to incandescence early in the operation and eventually fused. T T are electric terminals, and a chain and wheel permit of raising and lowering the upper carbon C'. E E represents the nugget of molten matter after the carbon has been fused and melting of the mixture G G has progressed somewhat. R^s R^s is a section of the magnetic ring which surrounds the mass to be fused and the shifting magnetism of which causes the current to assume a curved path that revolves around the surface of the molten nugget or path. In this way I produce in effect a revolving electric current that gets at the surface of the molten mass at every point and so attacks new unmolten material in a more effective manner than it could do by taking a direct path between electrodes. L' L² are the terminals of the ring-winding through which the biphasé currents are introduced.

Having thus described my invention, what I desire to secure by Letters Patent is the following:

1. The herein-described process of electrically heating a homogeneous mass of material of low and approximately uniform conductivity, which consists in passing an electric current through such a mass, establishing around such mass a magnetic field, having its lines of force transverse to the line of current flow through the mass, and causing said field to rotate about said line of current flow.

2. In an electric furnace the combination of two or more terminal electrodes connected with each other by a carbon pencil of relatively small cross-section, said pencil being inclosed in a rotating magnetic field the lines of force of which are substantially transverse to said pencil; together with means for establishing a rotating magnetic field around said pencil.

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

FRANCIS JARVIS PATTEN.

Witnesses:

O. J. MORA,
I. NORRIS.