No. 741,333. PATENTED OCT. 13, 1903.

F. E. J. HATCH.

ELECTRIC FURNACE.

APPLICATION FILED DEC. 4, 1902.

NO MODEL.

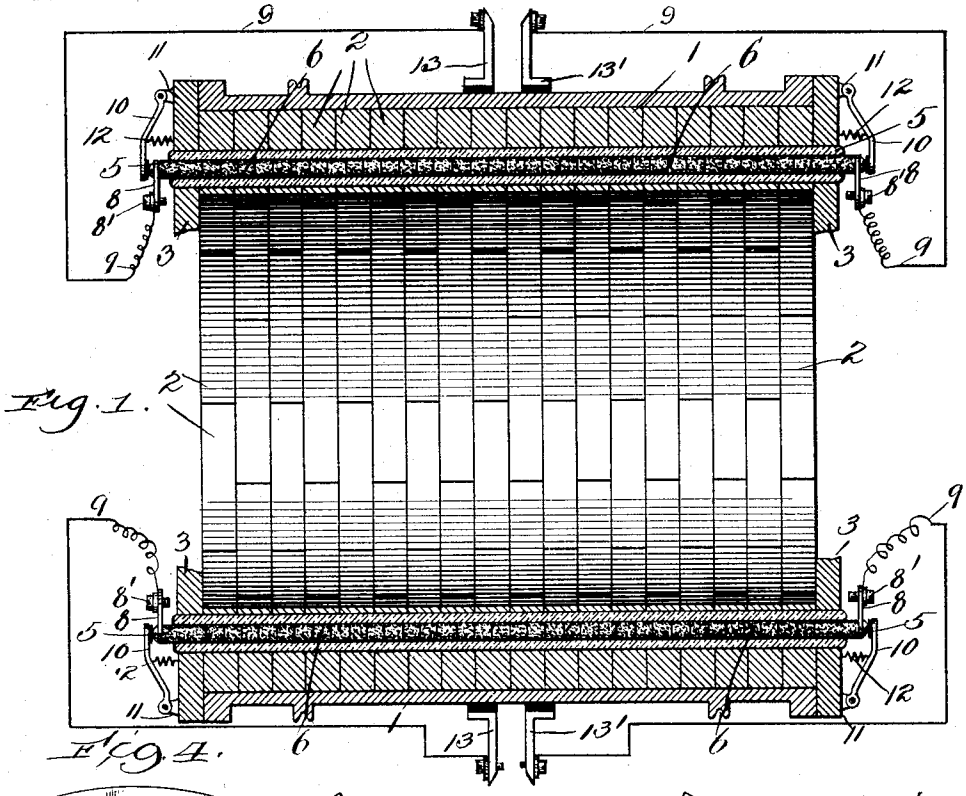
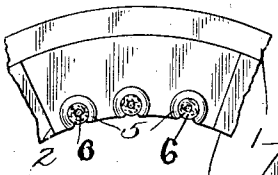


Fig. 1.

Fig. 4.



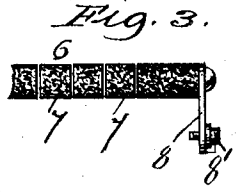


Fig. 3.

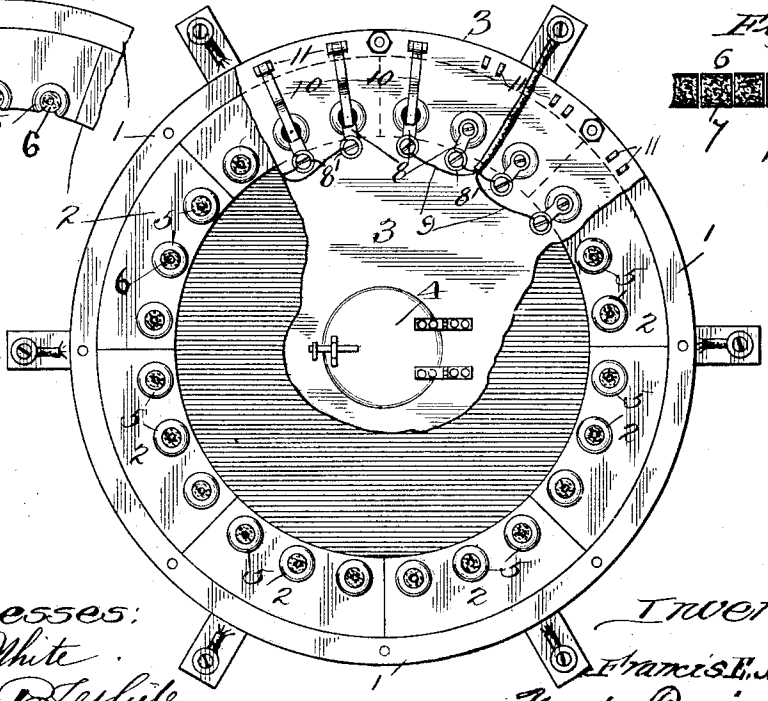


Fig. 2.

Witnesses:
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Harry Leslie.

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By Foster Bain & Ely.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 741,333. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

FRANCIS E. J. HATCH, OF GREENBAY, WISCONSIN, ASSIGNOR OF ONE-FOURTH TO EDWARD L. GRAHAM, OF SAGOLA, MICHIGAN.

ELECTRIC FURNACE.

SPECIFICATION forming part of Letters Patent No. 741,333, dated October 13, 1903.

Application filed December 4, 1902. Serial No. 133,851. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS E. J. HATCH, of Greenbay, in the county of Brown and State of Wisconsin, have invented certain new and useful Improvements in Electric Furnaces; and I hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to electric furnaces, and more particularly to electric furnaces of the type employing incandescent refractory conductors as the heating media.

The object of my invention is to provide a novel arrangement of the refractory conductors whereby a high thermic efficiency and an even distribution of heat are attained.

A further object of my invention is to provide a simple and improved construction of the refractory conductors and an arrangement thereof whereby the conductors are protected from contact with the material to be treated and whereby they are rendered readily accessible for renewal and inspection.

A further object is to provide means for constantly maintaining the conductors in condition to render most effective service.

With these and other objects in view, which will become apparent to those skilled in the art from the following description, my invention consists in the features and details of construction and arrangement hereinafter fully described, and specified in the claims.

In the drawings I have illustrated my invention as applied to a furnace of the type disclosed in my prior patent of the United States, No. 640,283, dated January 2, 1900, wherein is described a rotary electric furnace comprising a non-conducting cylinder internally provided with a series of refractory conductors arranged to be brought successively into an electric circuit to be heated to a high state of incandescence by the passage of a current therethrough and subsequently to their removal from said circuit introduced into the material within the furnace to be treated to disseminate their heat through such material.

In the drawings, Figure 1 represents a central vertical section of a cylinder adapted for use in a furnace of the character described equipped with my invention. Fig. 2 is an end elevation of the same with part of the exterior casing broken away to show the arrangement of the conductors. Fig. 3 is a detail of a portion of a conductor. Fig. 4 is a detail of a fragment of the cylinder, illustrating a slightly-different method of applying my invention thereto from that illustrated in Figs. 1 and 2.

1 represents a cylinder, of metal or other suitable material, having an interior lining 2, of fire-brick or other suitable refractory material. 3 3 indicate cylinder-heads inclosing the ends of said cylinder and provided with suitable doors or manholes, as indicated at 4, for the introduction of material into the interior of the cylinder 1.

5 5 indicate straight tubes, of porcelain or other suitable material of a highly-refractory nature, traversing the cylinder-lining and cylinder-heads in parallelism to the axis of the cylinder and in close proximity to the interior surface of the cylinder-lining. Said tubes 5 are open-ended to afford an axially-unobstructed passage therethrough. They may be provided in any suitable numbers and placed at such intervals apart as may be found best adapted for practical operation.

6 6 indicate a series of refractory conductors, of carbon or other similar material, adapted to become incandescent when submitted to the action of an electric current of suitable strength. Each of the carbon conductors 6 is composed of a series of small cylindrical blocks 7 of such diameter as to snugly fit within the bore of the tube 5. The blocks 7 are arranged to completely fill the tubes 5 from end to end, and the end blocks 7′, which are preferably longer than the intermediate blocks 7, are arranged to project a suitable distance beyond the open ends of said tubes.

8 8 indicate metallic terminal pieces suitably secured to the blocks 7′ and each provided with a binding-screw 8′, adapted for connection to suitable wires 9, forming part of an electric circuit.

10 10 indicate small lever-arms pivoted at one end in suitable lugs 11, projecting from the face of the cylinder-heads 3 and each at its free end bearing upon the extremity of one of the projecting blocks 7′, forming part

of the conductors 6. Said arms are suitably insulated from the carbon blocks, as shown.

12 12 indicate springs secured to the arms 10 and the face of the cylinder-head and tending to draw the arms 10 toward the cylinder, whereby the carbon conductors 6 are maintained under continuous pressure in a longitudinal direction. A pressure device of the character described is provided to operate upon each conductor, at each end thereof.

13 and 13′ indicate commutator sections or plates secured upon the exterior of the cylinder-casing 1 and forming the terminals of wires 9, forming part of the circuit including the carbon conductors 6. Such commutator-plates are adapted to be brought into circuit with a suitable source of electric supply at intervals in the manner described in my aforesaid patent. Any suitable number of commutator-plates may be employed, or other devices might be substituted therefor, the only requirements for the successful operation of my device being that a circuit be established through the wires 9 and the carbon conductors 6 at suitable intervals.

In Figs. 1 and 2 I have illustrated the tube 5 as being peripherally closed and entirely embedded within the fire-brick lining of the furnace in very close proximity to the interior surface of the said lining. It may, however, be found desirable to bring the carbon conductors into more intimate proximity to the material to be treated within the furnace than is possible with such a construction should very intense heat be required in the reduction of the material undergoing treatment. In such instance a construction such as that indicated in Fig. 4 might be employed, wherein the tubes 5 are arranged to come flush with the surface of the fire-brick lining and are cut away or slotted in longitudinal lines to expose a portion of the inclosed carbon conductors to the interior of the furnace.

By the employment of a construction such as that herein described the carbon conductors are efficiently protected from being wholly or partly destroyed by abrasive contact with the material within the furnace, and at the same time they are arranged to disseminate their heat at practically the interior surface of the lining of the furnace. The formation of the carbon conductor in short longitudinally-separated blocks, as shown, results in a peculiarly-advantageous action. Though continually held in contact with each other by the action of the pressure devices upon the opposite ends thereof, the short sections of the carbon conductors never form a completely-closed circuit throughout the entire sectional area of a block, and consequently incipient electric arcs are formed between adjoining blocks forming sections of the conductor. The heating effect of such arcs is rapidly manifested, and the blocks between which such incipient arcs are formed become heated at their adjacent ends. By properly proportioning the blocks forming the sectional conductors they may be brought to intense incandescence from end to end while under the influence of the electric current, so that practically the entire conductor is brought to an intense heat. Further, it will be noted that the pressure of the springs upon the ends of the divided conductors constantly tends to take up the wear due to the formation of the arcs therebetween and to maintain the short sections in proper contacting relation. It will also be noted that the character of the tubes 5 is such as to permit the ready removal of the carbons, which may be pushed out through the cylinder-heads by the use of a straight rod or poker.

An additional advantage incident to the construction illustrated in Figs. 1 and 2 is that the carbon conductors are positively insulated from each other, so that the furnace is not liable to be short-circuited through the material contained therein, as is possible when the carbons are directly brought into contact with the material under treatment.

It is obvious that the carbon could be embedded directly in the brick lining and the porcelain tubes omitted in either construction.

I have above described in detail the preferred structure of carbon conductor employed in the practice of my invention; but I also contemplate the use of powdered or comminuted carbon in place of the carbon blocks. The latter form of divided conductor may be found advantageous for some purposes, and its action is similar to that of the block form of carbon.

While I have herein described my present invention as embodied in a furnace of the character typified by my former patent, I do not desire to be understood as limiting myself to its use in such connection, as it is obvious that the novel features of the present invention might advantageously be employed in connection with furnaces differing widely from that herein illustrated for the purpose of full disclosure of my invention.

Having described my invention, what I claim as new and useful, and desire to secure by Letters Patent of the United States, is—

1. In an electric furnace, a refractory heating-wall and a sectional electrical conductor embedded in said wall.

2. In an electric furnace, a refractory heating-wall and an electrical conductor composed of a series of contacting sections embedded in said wall.

3. In an electric furnace, a refractory heating-wall, an electrical conductor composed of a series of sections arranged for contact embedded in the wall, and means for forcing said sections into contact.

4. In an electric furnace, a refractory wall provided with straight, open-ended channels therein, and sectional electrical conductors arranged in said channels.

5. In an electric furnace, a refractory wall, a conductor therein composed of a series of

longitudinally-separated sections, and pressure devices arranged to exert a continual pressure upon said conductor in a longitudinal direction.

6. In an electric furnace, a refractory wall, and a refractory conductor embedded therein having its constituent particles arranged in varying conditions of electrical contact, whereby incipient arcs are formed in said conductor when a suitable electric current is passed therethrough.

7. In an electric furnace, a cylinder having refractory walls, a series of open-ended tubes embedded in said walls parallel to the axis of the cylinder, a series of electrical conductors within said tubes, a series of commutator-plates on the exterior of the cylinder, and electrical connections between said plates and the said conductors.

8. In an electric furnace, a divided conductor, and an enveloping tube of refractory material, forming part of a furnace-wall.

9. In an electric furnace, a series of divided conductors, tubes of refractory material wholly or partially surrounding said conductors, and supports for said tubes constituting the furnace-wall.

10. In an electric furnace, a refractory wall, and a conductor partially embedded in said wall and partially exposed to the interior of the furnace.

11. In an electric furnace, a refractory wall, a series of tubes embedded in said wall, to interrupt the interior surface thereof, a series of refractory conductors traversing said tubes, and slots in said tubes exposing portions of the conductors to the interior of the furnace.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

FRANCIS E. J. HATCH.

In presence of—
HOWARD H. BEEBE,
GEO. W. CAVERLY.