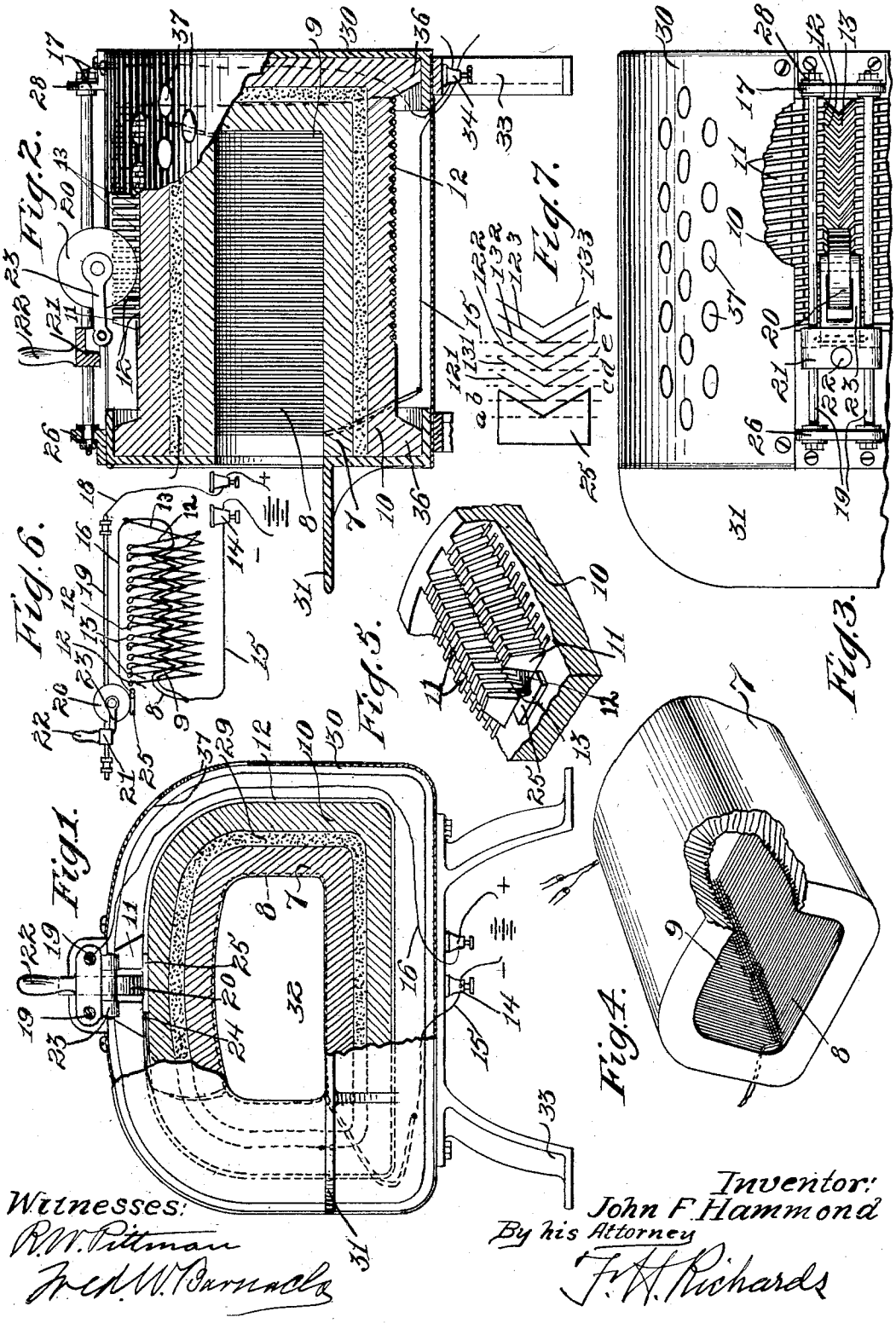
No. 817,767. PATENTED APR. 17, 1906.

J. F. HAMMOND.

ELECTRIC FURNACE.

APPLICATION FILED APR. 13, 1905.



Witnesses:
R. W. Pittman
Fred. W. Barnacle

Inventor:
John F. Hammond
By his Attorney
F. A. Richards

UNITED STATES PATENT OFFICE.

JOHN F. HAMMOND, OF BREWSTER, NEW YORK.

ELECTRIC FURNACE.

No. 817,767. Specification of Letters Patent. Patented April 17, 1906.

Application filed April 13, 1905. Serial No. 255,263.

To all whom it may concern:

Be it known that I, JOHN F. HAMMOND, a citizen of the United States, residing in Brewster, in the county of Putnam and State of New York, have invented certain new and useful Improvements in Electric Furnaces, of which the following is a specification.

This invention relates to the class of electric furnaces which receive their heat by passing a current of electricity through suitable conductors located in proximity to or embedded in a suitable muffle.

It is an object of the invention to provide a simple, economic, and efficient arrangement whereby the furnace may be heated and also means whereby the amount of heat may be regulated and its admission to the muffle readily controlled.

It is also comprehended in the invention to provide means whereby objectionable sparking will be practically eliminated when the current-changing device moves from one contact to another to control the course of the current.

In the accompanying drawings, forming a part of this specification, is shown one of the embodiments of my invention, whereon—

Figure 1 is a front elevation, partly broken away. Fig. 2 shows a side elevation, also partly in section. Fig. 3 is a fragmentary top or plan view. Fig. 4 is a perspective view of the muffle, partly broken away. Fig. 5 is a perspective view of a portion of the current-changing device. Fig. 6 shows diagrammatically the current-changing device in connection with the system of wiring used in the present case, and Fig. 7 shows a detail of the terminals that are connected by the roller-switch.

The furnace may be of any suitable type according to its intended application and in the present instance is shown as a ceramic furnace specially adapted for use in connection with the manufacture of jewelry and dental articles.

In the accompanying drawings the reference-numeral 7 indicates the muffle (shown separately in Fig. 4)—that is, shown as having two separated windings 8 and 9—preferably of platinum wire, arranged on the surface of its inner wall or embedded a slight distance therein. Upon the current being passed through these coils the muffle will be heated to a degree dependent upon the amount of current flowing therethrough. The muffle may have an outer casing 10, and between it and the muffle proper a suitable refractory material is placed, such as fire-brick or fire-clay. The casing 10 is inclosed in a suitable frame 30, mounted on a pedestal 33, whereby the whole is supported. The casing 10 is offset from the muffle, except at the ends, by means of annular ring portions 36, thereby providing a space around the convex portion of the casing 10. The top of the outer casing 30 may have suitable apertures 37 for ventilation of such space.

At the top of the casing 10 are arranged two series or rows of separate blocks or projections 11 of insulating material. A resistance-coil 12, made of suitable material, such as nickel wire, is wound around the outside of the casing 10 from end to end, and as each winding passes over the top it is placed between the alternate projections 11 of each series. A similar coil 13 is wound on the casing 10, each winding being intermediate of the windings of said coil, and at the top passing between the alternate projections 11 of each row. Where these two coils pass from one set of projections to the other, they are bent substantially **V**-shaped, as shown in Figs. 3 and 7; but each is separated from the other and rests on the top of the casing 10, that is made of insulating material.

The extremities of the heating-coils 8 and 9, embedded in the muffle, at one end connect with a terminal 14 by a lead 15. The other end of the heating-coil 8 connects with one end of the resistance-coil 13, while the other end of the inner coil 9 connects with one end of the resistance-coil 12. The said other end of the coil 8 also connects by a wire 16 with a terminal plate 25. The device for controlling the portions of such resistance-coils 12 and 13, that are included in series with the heating-coils 8 and 9, comprises a roller-contact 20, supported on an arm 23, secured to a head 21. The latter is slidable on two parallel rods 19, secured at their ends by brackets 17 and 26 to the top of the furnace. A handle 22 serves to advance the head, and thereby cause the wheel 20 to pass between the two sets of projections 11 and have a rolling engagement with the **V**-shaped portions of the two resistance-coils 12 and 13. The other lead 18 from the source of current is connected with the extremity of one of the rods 19, thereby placing the wheel 20 in circuit between said terminal and the **V**-bends.

At the initial position when the current is first caused to flow through the leads the

wheel 20 will be located on the contact-plate 25, but will not connect with any of the resistance-wires, as indicated diagrammatically in Fig. 7. The broken lines *a*, *b*, *c*, *d*, *e*, and *f* indicate the line of contact with the wheel, and the lines 121 122 123 and 131 132 133 indicate, respectively, the portions of the coils 12 and 13 engaged by the wheel. In this initial position the current will pass first into the rod 19 and wheel 20, thence by plate 25 through wire 16 to one end of the heating-coil 8. After traversing this coil the current will be led out by the lead 15. This will cause the whole of the current to pass through one only of the two heating-coils, which will have the effect of slightly warming the muffle. Upon advancing the wheel 20 to the position *b* from Fig. 7 it will be observed that one extremity of the resistance-coil 12 will now be in circuit with the positive lead and that a branch of the circuit will be established throughout the length of this coil, the current thence traversing the other heating-coil 9 and passing out by lead 15. This will give a parallel circuit through the two heating-coils; but one of them will have the entire length of the resistance-coil 12 in circuit with it. This will at once reduce the current flowing through the coil 8 and prevent overtaxing this coil before it has sufficiently increased its temperature to offer an increased resistance to the current. On the next advance of the wheel to the position *c* it will be observed from Fig. 7 that by reason of the **V** shape of the terminals or portions of the circuit engaged by the wheel that the wheel is still in contact, but about leaving the plate 25, that it is also still in contact with the portion of the coil 12, but that it has now just made contact with the extremity of the other resistance-coil 13. This will establish another branch in parallel with the parallel circuits of the latter position *b*, the third branch being through the entire length of the resistance-coil 13 and thence through the coil 8; but the latter being connected by the wire 16 with the coil 13 the wire 16 will form a shunt around the coil 13, practically cutting it out of operation until a slight advance from this position will cause the wheel to leave the plate 25 and be in engagement with the wires 121 and 131. The circuit will now be in a parallel of two branches, one branch being through the resistance 12 and thence through the coil 9 and the other branch, including the resistance 13, in series with the coil 8. The next succeeding position *d* will bring the wheel to connect the two portions 131 and 122 of the coils 12 and 13. This will establish a parallel circuit of two branches, one branch including the entire resistance-coil 13 in series with its corresponding heating-coil 8, while the other branch will include the other heating-coil 9 in series with a portion of the resistance-coil 12, having one convolution or winding less in circuit than in the latter position, which convolution connected the portion 121 with the portion 122. In other words, the resistance is reduced for the current passing through the coil 8. The next succeeding position *e* will bring the wheel to leave the wire 131 and now connect the wires 122 and 132. This will produce a parallel circuit of two branches, one branch including the coil 8 in series with the reduced portion of the coil 13 and the other branch including the other heating-coil 9 now in series with the resistance-coil 12, reduced by one convolution, and each succeeding stage or position of the wheel by which one of the wires is cut out and a new one cut in will reduce one of the resistances 12 or 13 by one convolution, until at the final position the resistance has been entirely cut out and the coils 8 and 9 are in parallel circuit directly connected between the leads, thereby admitting the greatest amount of current to them and producing the maximum heating effect; but it will be observed that in each instance the wheel contacts with the apex of the **V**-shaped terminals, as they might be considered, before it leaves the extremities of such **V**-shaped portion of the same wire, thereby in each instance making a shunt around the convolution before cutting it out of circuit.

Having thus described my invention, I claim—

1. In a furnace, the combination with a muffle whose interior is wound with a heat-generating wire, of a casing for said muffle and whose exterior is wound with a resistance-wire, both of said wires being connected, and means for traveling from one to another of the convolutions of the resistance-coil for varying the resistance.

2. In a furnace, the combination with a muffle whose interior is wound with platinum wire, of a casing for said muffle, and whose exterior is wound with nickel wire, both of said wires being connected, the convolutions of said nickel wire being so bent, at portions parallel to each other, that the bend of one wire will lie within the bend of another wire, and a device for traveling along said bends for varying the resistance.

3. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor, and which is externally wound with a resistance-wire, each convolution of the resistance-wire being bent so as to lie in the bends of the other convolutions, a member for riding over said bends, means to support and actuate said member, and means for supporting said actuating means.

4. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor, and which is externally wound with a resistance-wire, each convolution of the resistance-wire being bent

so as to lie in the bends of the other convolutions, a rotatably-mounted member for riding over said bends, and which will contact with one bend before it breaks contact with another, means to support and actuate said member, and means for supporting said actuating means, one of the wires being connected with said supporting means.

5. In a furnace, the combination with a casing provided with grooves, of rows of separators registering with said grooves, a resistance-wire convoluted in said grooves and passing between said separators; that portion of each convolution which lies between the rows of separators being so bent that one bend will lie within the bend of another, a muffle internally wound with a heat-generating wire, and which is connected with said resistance-wire, a shoe for traveling along the bends of said resistance-wire, and means for guiding said shoe.

6. In a furnace, the combination with a muffle of a heat-generating coil on the interior of said muffle, a resistance-coil on the exterior of said muffle, and which is connected with the heat-generating coil, and means for varying the amount of resistance.

7. In a furnace, the combination with a muffle whose interior is wound with platinum wire, of a casing for said muffle whose exterior is wound with nickel wire, both of said wires being connected, the convolutions of said nickel wire being so bent at portions parallel to each other that the bend of one wire will lie within the bend of another, and a device for traveling along said bends for varying the resistance.

8. In a furnace, the combination with a muffle whose interior is wound with platinum wire, of a casing for said muffle, and whose exterior is wound with nickel wire, both of said wires being connected, the convolutions of said nickel wire being so bent at portions parallel to each other that the bend of one wire will lie within the bend of another wire, and a rotating device for traveling along said bends for varying the resistance, and said resistance device being adapted to contact with one convolution before it leaves the other.

9. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor, and which is externally wound with a resistance-wire, each convolution of the resistance-wire being bent so as to lie in the bends of the other convolutions, a rotating member for riding over said bends, a sliding head to support said rotating member, and rods for supporting said head.

10. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor having grooves therein which is wound with a resistance-wire, each convolution of the resistance-wire being bent so as to lie in the bends of the other convolutions, a wheel for riding over said bends, means to support and actuate said wheel, and guides for supporting said actuating means, one of the wires being connected to said guides.

11. In a furnace, the combination with a casing provided with external grooves of two parallel rows of separators registering with said grooves, a resistance-wire convoluted in said grooves and passing between said separators, and which are bent to suitable form between said rows, a muffle internally wound with heat-generating wire, and which is connected with said resistance, a rotary shoe for traveling along the bends of said resistance-wire, and means for guiding said shoe.

12. In a furnace, the combination with a ceramic muffle, of a platinum coil on the interior of said muffle, a casing, a resistance-coil on the exterior of said casing, and means for varying the amount of resistance.

13. In a furnace, the combination with a muffle whose interior is wound with platinum wire, of a casing for said muffle, and whose exterior is wound with nickel wire, both of said wires being connected, the convolutions of said nickel wire being so bent at portions parallel to each other that the bends will be V-shaped and will lie within each other, and a device for traveling along said bends for varying the resistance.

14. In a furnace, the combination with a muffle whose interior is wound with platinum wire, of a casing for said muffle, and whose exterior is wound with nickel wire, both of said wires being connected, the convolutions of said nickel wire being so bent at portions parallel to each other that the bend of one wire will lie within the bend of another wire, a device for traveling along said bends for parting the resistance, and said resistance device being adapted to contact with one convolution befores it leaves the other, and an outer finishing-casing.

15. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor, which is externally wound with a resistance-wire, each convolution of the resistance-wire being bent so as to lie in the bends of the other convolutions, a rotating member for riding over said bends, a sliding head for carrying said member, a handle for operating said head member, and means for supporting said head.

16. In a furnace, the combination with a muffle internally wound with a heat-generating wire, of a casing therefor, and which is externally wound with a resistance-wire, each convolution of the resistance-wire being bent so as to lie in the bends of the other convolutions, a rotatably-mounted member for riding over said bends, a sliding head for supporting said member, means for actuating said head, a support for said head, one of the wires being connected to said support.

17. In a furnace, the combination with a casing provided with grooves, of rows of separators registering with said grooves, a resistance-wire convoluted in said grooves and passing between said separators, and which are bent to suitable form between said rows, a muffle internally wound with heat-generating wire and which is connected with said resistance-wire and a rotary shoe for traveling along the bends of said resistance-wire and means for guiding said shoe.

18. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a connector member, a pair of feed-wires, and terminals connected with said wires and arranged to be engaged by such connector, said terminals being arranged to cooperate with the connector, whereby the connector will first connect the first translating-coil with the feed-wires, thereupon the advance of the connector, a parallel circuit of two branches will be established across the leads, in which one branch includes said first translating-coil and the other branch includes the second translating-coil arranged in series with the first resistance-coil; upon a further advance of the connector a shunt will be established in the branch including the first translating-coil, which shunt includes the second resistance-coil; upon a still further advance of the connector the second resistance-coil will be established in series with the first translating-coil on one branch of the aforesaid parallel circuit; and at a further advanced position of the connector the two said resistance-coils will be cut out, leaving the two translating-coils in parallel across the leads.

19. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a connector member, a pair of feed-wires, and terminals connected with said wires and arranged to be engaged by such connector, said terminals being arranged to coöperate with the connector, whereby the connector will establish a parallel circuit of two branches, in which one branch includes the first translating-coil connected in series with the first resistance-coil, and the other branch includes the second translating-coil in series with the second resistance-coil; at a further advance of the connector the same parallel series arrangement will be effected, but with one convolution of each said resistance-coils being cut out, thereby reducing the amount of resistance in circuit with each translating-coil; upon further advance of the connector the convolutions of the resistance-coils will be successively cut out, until at the final position the resistances will be entirely cut out and the translating-coils will be connected in parallel across the leads.

20. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a connector member, a pair of feed-wires, and terminals connected with said wires and arranged to be engaged by such connector, said terminals being arranged to coöperate with the connector, whereby the connector will establish a parallel circuit of two branches in which one branch includes the first translating-coil in series with the first resistance-coil, and the other branch includes the second translating-coil in series with the second resistance-coil; at a further advanced position of the connector the first resistance-coil will have a shunt established around one of its convolutions, and upon a further advance the said convolution will be cut out of circuit; at a still further advance the second resistance-coil will have a shunt established around one of its convolutions, and upon a still further advance the said latter convolution will be cut out; and the succeeding position of the connector will cause alternately a reduction of the number of convolutions in the two resistance-coils, until at the final position the two translating-coils will be connected in parallel across the leads.

21. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a pair of leads, one of such leads being connected with the front end of each of the translating-coils, the other lead being connected with a movable switch member and arranged to remain in connection therewith throughout its range of movement, a contact-plate connected with the other extremity of said first translating-coil and also connected with the rear end of said second resistance-coil, the rear end of said first resistance-coil being connected with the rear end of the first translating-coil, said switch member being movably supported to first engage with said contact-plate and thereupon engage alternately with the convolutions of the two resistance-coils successively from their front end to their said rear end.

22. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a pair of leads, one of such leads being connected with the front end of each of the translating-coils, the other lead being connected with a movable switch member and arranged to remain in connection therewith throughout its range of movement, a contact-plate connected with the other extremity of said first translating-coil and also connected with the rear end of said second resistance-coil, the rear end of said first resistance-coil being connected with the rear end of the first translating-coil, said switch member being movably supported to first engage with said contact-plate and thereupon engage alternately with the convolutions of the two resistance-coils successively from

their front end to their said rear end, the engaging portions of said convolutions of the resistance-coils being arranged whereby the switch member will constantly remain in engagement with two portions not in the same coil.

23. In an electric translating device, the combination of a translating-coil, a second translating-coil, a resistance-coil, a second resistance-coil, a pair of leads, one of such leads being connected with the front end of each of the translating-coils, the other lead being connected with a movable switch member and arranged to remain in connection therewith throughout its range of movement, a contact-plate connected with the other extremity of said first translating-coil and also connected with the rear end of said second resistance-coil, the rear end of said first resistance-coil being connected with the rear end of the first translating-coil, said switch member being movably supported to first engage with said contact-plate and thereupon engage alternately with the convolutions of the two resistance-coils successively from their front end to their said rear end, said engaging portions of the convolutions comprising a series of V-shaped portions overlapping but insulated from each other, whereby the switch member will constantly engage two of such convolutions not in the same coil.

Signed at Nos. 9 to 15 Murray street, New York, N. Y., this 11th day of April, 1905.

JOHN F. HAMMOND.

Witnesses:
FRED W. BARNACLO,
JOHN O. SEIFERT.