E. L. SMALLEY.

ELECTRIC OVEN.

APPLICATION FILED MAY 10, 1917.

1,234,499.

Patented July 24, 1917.

4 SHEETS—SHEET 1.

Fig. 1.

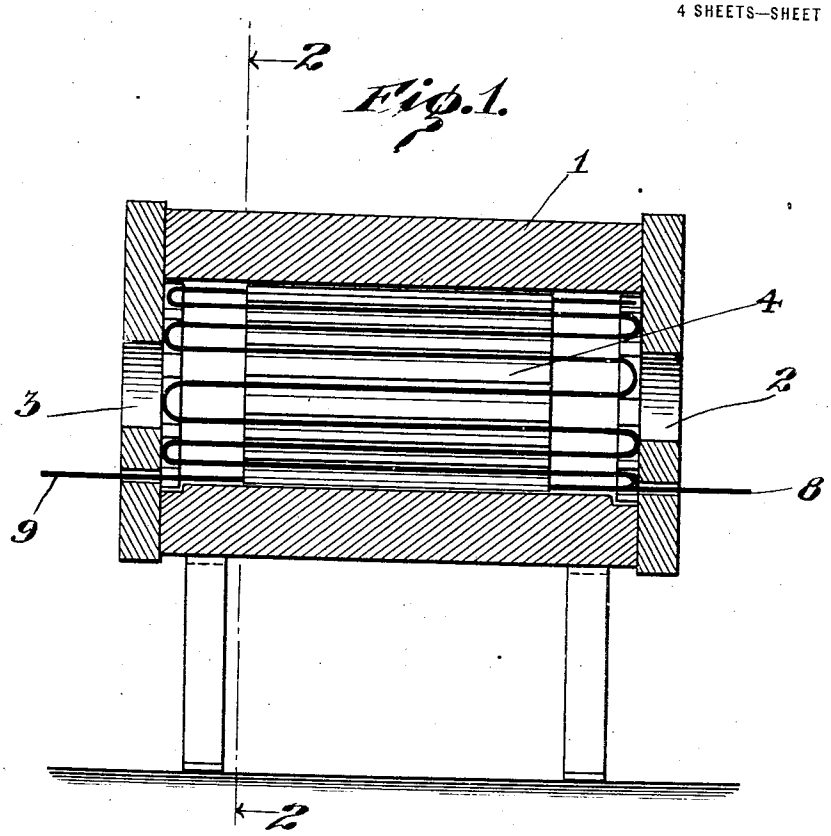
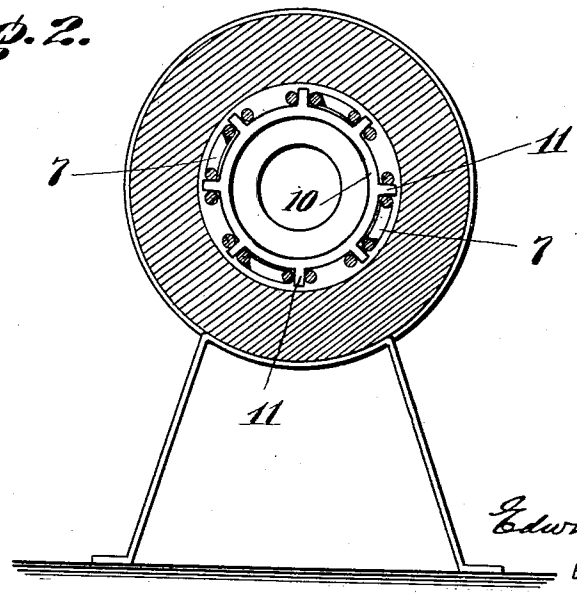


Fig. 2.



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4 SHEETS—SHEET 2.

Fig. 3.

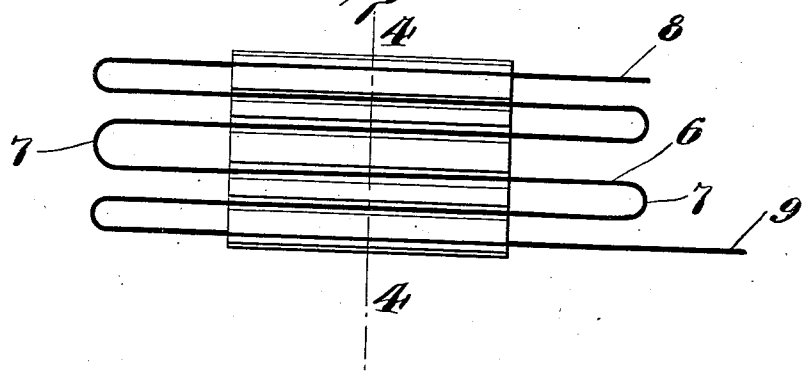


Fig. 4.

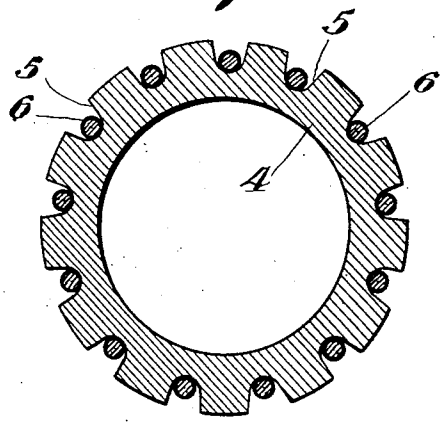
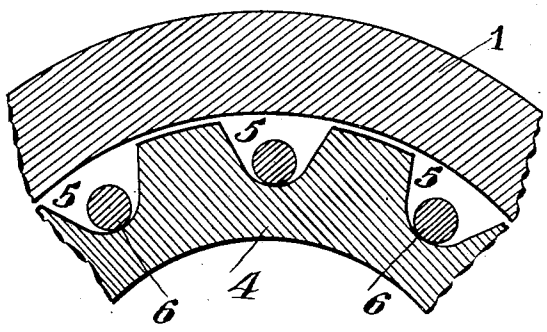


Fig. 5.



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4 SHEETS—SHEET 3.

Fig. 6.

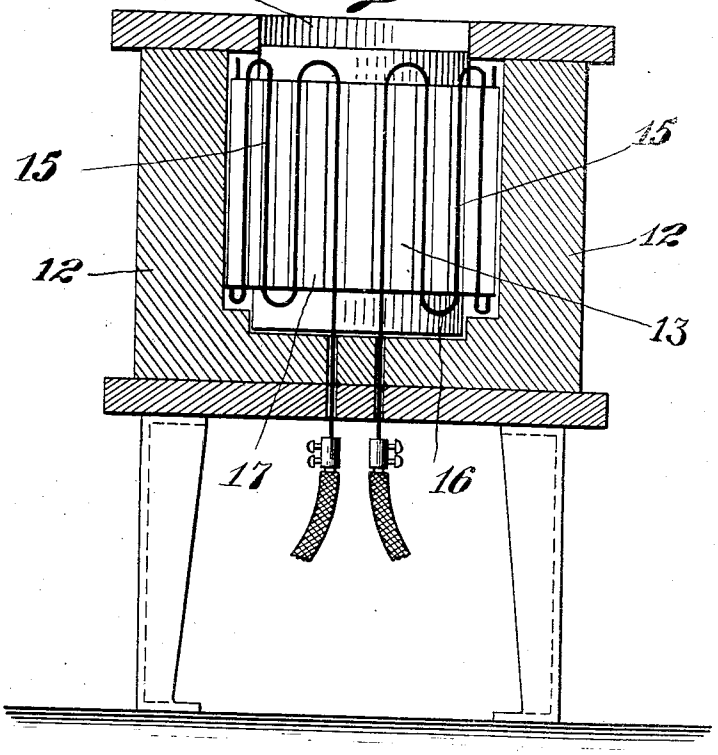
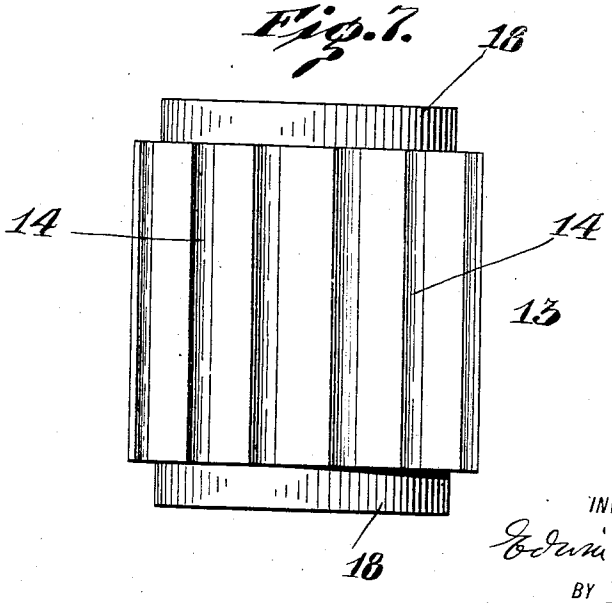


Fig. 7.



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4 SHEETS—SHEET 4.

Fig. 8.

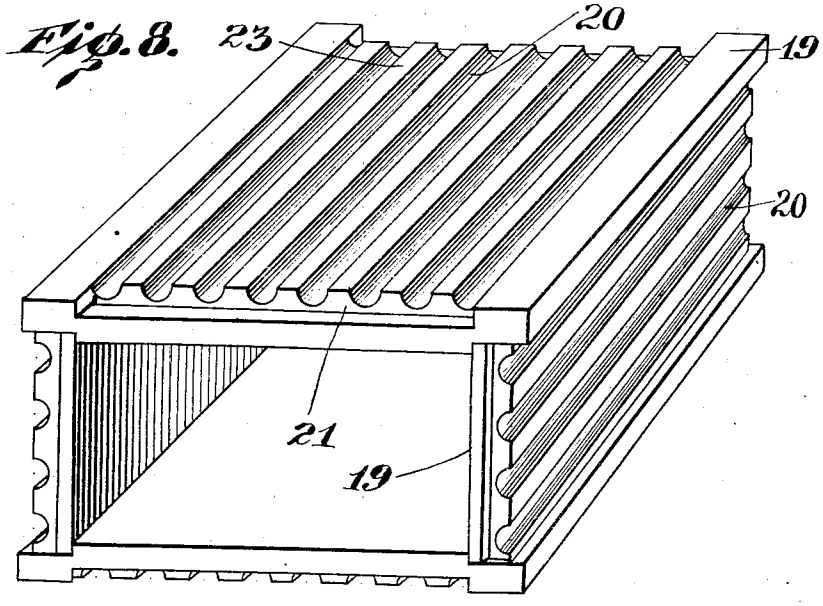


Fig. 9.

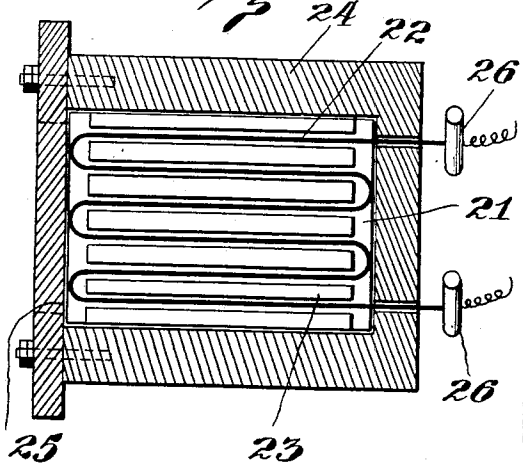
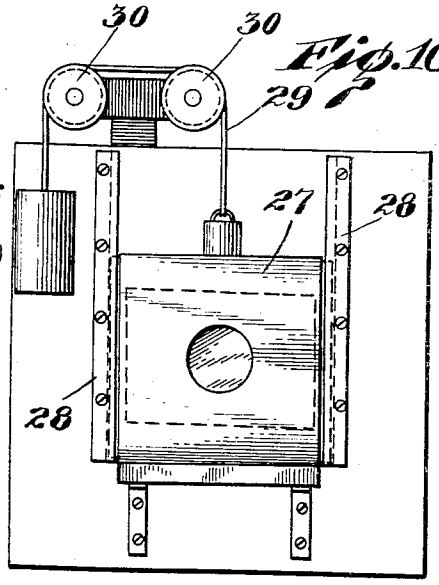


Fig. 10.



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UNITED STATES PATENT OFFICE.

EDWIN L. SMALLEY, OF MONTCLAIR, NEW JERSEY.

ELECTRIC OVEN.

1,234,499. Specification of Letters Patent. Patented July 24, 1917.

Application filed May 10, 1917. Serial No. 167,695.

To all whom it may concern:

Be it known that I, EDWIN L. SMALLEY, a citizen of the United States of America, residing at #2 Harvard St., Montclair, New Jersey, have invented a new and useful Improvement in Electric Ovens, of which the following is a specification.

This invention relates to electric furnaces or heaters, and my improvements are fundamentally directed to means whereby the resistor element employed, and the muffle, which serves as a support therefor, are associated in relation whereby the resistor most efficiently exercises its function as a heating element, without disturbing or injuring the support, which latter, being of refractory, non-conducting material, is of more or less frangible character; and whereby said support may retain the resistor element in its desired operative position to permit complete diffusion of the heat generated by said resistor.

Heater plates to carry a resistor element of wire have hitherto been used, wherein the wire resistor has been threaded through orifices in such plate, strands of the resistor lying in grooves for heat dispersion; but, where the resistor element, as in the present instance, is composed of stout, heavy duty wire, which is not susceptible of bending easily, it is not possible to thread this material to and fro through orifices in the plate, because to do so would, in creating the bends, impose pressure against edges of the supporting plate, which would rupture the latter.

The heavy duty conductor employed as a resistor in my improved furnace, being of a stout, relatively non-pliable nature, is capable of retaining in service the shape into which it is formed, and is lodged within open recesses provided in a surface of a supporting plate, to prevent short circuiting of its strands, and to enable the attainment of the highest efficiency possible from the correlation between the resistor and its refractory support.

The stiff, relatively unbending character of the resistor element, which thus enables it to retain in service the form to which it has been shaped in manufacture, has led me to so shape said resistor into parallel strands with bent ends, in the form of a grid, that it may, in this form, be laid within a series of parallel grooves in a supporting plate of material which is both refractory and non-conductive of electricity, to thereby comprise an efficient heater unit for heavy duty.

The said heater unit may be arranged variously to suit the different types of furnaces or heaters with which it is to be used, all as will be more particularly pointed out in the following description, wherein other features and advantages of my invention will be presented.

In the drawing:—

Figure 1 is a side sectional elevation of a tube furnace embodying my improvement.

Fig. 2 is a section on the line 2—2 of Fig. 1.

Fig. 3 is a detail, in side elevation of a muffle, carrying the resistor element.

Fig. 4 is an enlarged section on the line 4—4 of Fig. 3.

Fig. 5 is a further enlarged partial view, showing the relation between muffle, resistor, and furnace housing.

Fig. 6 is a vertical, sectional view of a crucible furnace.

Fig. 7 is an elevation of a muffle for use with the crucible furnace.

Fig. 8 is a perspective view of a muffle composed of multiple units.

Fig. 9 is a top sectional view of a furnace housing, showing the upper heater unit, and

Fig. 10 is a front view of a furnace, with sliding door equipment.

In Figs. 1 to 5 inclusive, my improved resistor element is illustrated as applied to a tube furnace, wherein 1 indicates the brick housing, which is cylindrical in form, and non-conductive of heat, with front wall 2 and rear wall 3 of corresponding material. Fitting within said housing is a heater tube or tubular lining 4, which is of refractory material that is a non-conductor of electricity, said heater tube being of less length than the housing, and disposed centrally therein. On its outer surface the heater tube is provided with a series of longitudinal, parallel grooves or depressions 5, to receive a resistor or resistance conductor, as

6, which latter, composed of a stout wire, has been manufactured in the form of a cylindrical grid, with return bends 7 and a series of parallel strands, suitably spaced apart to enable them to register with and lodge in the grooves 5. The opposite terminals 8, 9, may extend outside the furnace, as through orifices in the walls 2 and 3, to be included in an electrical circuit (not shown).

It will be noted that the resistor bends extend beyond the heater tube 4, at opposite ends thereof, whereby the resistor strands are unsupported by said heater tube for portions of their length. Therefore I mount upon the inner surfaces of the walls 2 and 3, end supports 10, which may be of the same material as the heater tube. Said end supports 10 may be in concentric alinement with the heater tube, and provided with radial spurs 11, to receive, and lodge between them, separate bends of the resistor element, whereby said end bends are prevented from sagging under the influence of high temperatures.

The end supports 10 may be secured to the walls 2, 3, as by molding them thereon; although, obviously, I am not limited to that mode of connection.

Thus by the means described, the resistor element is secured at its bends in near contact with the housing brick of the furnace. The resistor may be conveniently fitted upon the heater tube by expanding it slightly to pass thereover.

In the vertical type or crucible furnace, with top opening, shown in Figs. 6 and 7, the cylindrical brick housing 12 contains the cylindrical lining 13 of refractory, insulating material, having grooves 14, to receive a formed resistor grid 15, whose bends 16 are disposed about the ends of the ribs 17 separating said grooves.

The refractory lining has end collar portions 18 which extend beyond the bends of the resistor.

In Figs. 8 and 9, wherein a rectangular furnace is shown as composed of multiple units, these may consist of refractory plates 19, having grooves 20, and recessed end portions 21. The resistor element 22 is here shown as a flat grid, whose strands lie within the grooves, and whose bends fit around the ends of the groove walls 23, within the compass of the end portions 21. The housing brick is shown at 24, with front wall 25, and the terminals of the resistor extend through the housing, outside which they may carry the binding posts 26.

I have also illustrated, in Fig. 10, a sliding door 27, movable in guides 28, and conveniently operable by means of a weighted connector 29, running over pulleys 30.

Obviously, while I have shown a single continuous resistor element in the various forms of furnace with which it may be applied, I am not limited thereby but may employ double or multiple resistor elements, so that in case one circuit should burn out, the furnace would still be operable. Also instead of having the resistor element composed of straight lengths with opposite bends, said resistor element may take any other desirable conformation in the lengths provided between the bends. In the instance of the tube furnace, a resistor element may, if desired, have its return bends so provided that it lies only over a segment of the peripheral extent of the heater tube.

By the terms "tube" and "tubular" as applied to the furnace and its lining; and "cylindrical" as applied to the form of resistor grid, I mean to imply tubes and cylinders of any desirable cross-sectional contour.

Variations may be resorted to within the spirit and scope of my said invention, and parts thereof used without others.

I claim:—

1. The combination, with a heating member for electric furnaces, comprising a support of refractory, non-conductive material, having spaced reception grooves therein, of a preformed resistance conductor, of relatively unyielding material, and comprising a series of strands respectively engaging with the grooves in said support, whereby said strands are insulated from each other.

2. The combination, with a heating member for electric furnaces, comprising a support of refractory, non-conductive material, having spaced, open ended grooves therein, of a preformed resistance conductor, of relatively unyielding material, and comprising a series of strands, with connecting bends, said strands respectively engaging with the grooves in said support, whereby said strands are insulated from each other.

3. In an electric furnace, the combination with a tubular housing, and a tubular lining of refractory material, non-conductive of electricity, therein, said lining having a series of longitudinal grooves in its surface opposed to the housing, of a preformed resistance conductor of relatively unyielding material, permanently shaped with return bends as a cylindrical grid, the strands of said grid lying respectively within said grooves, and its bends extending beyond the ends of said lining.

4. In an electric furnace, the combination with a tubular housing, having end walls, and a tubular lining of refractory material, non-conductive of electricity, therein, said lining having a series of longitudinal grooves in its surface opposed to the housing, of a preformed resistance conductor of relatively unyielding material, permanently shaped with return bends as a cylindrical grid, the strands of said grid lying respec-

tively within said grooves, and its bends extending beyond the ends of said lining, together with concentric mounts upon the end walls, having recesses for lodgment of said bends.

In testimony whereof I, the said EDWIN L. SMALLEY, have signed my name to this specification, in the presence of two subscribing witnesses, this 30th day of April, 1917.

EDWIN L. SMALLEY.

Witnesses:
AUGUST O. EIMER,
IRVING H. BALL.