

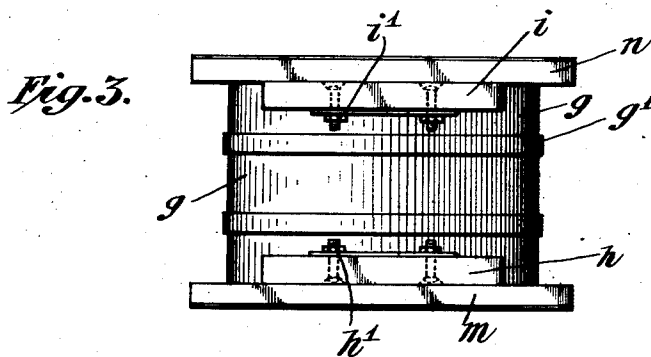
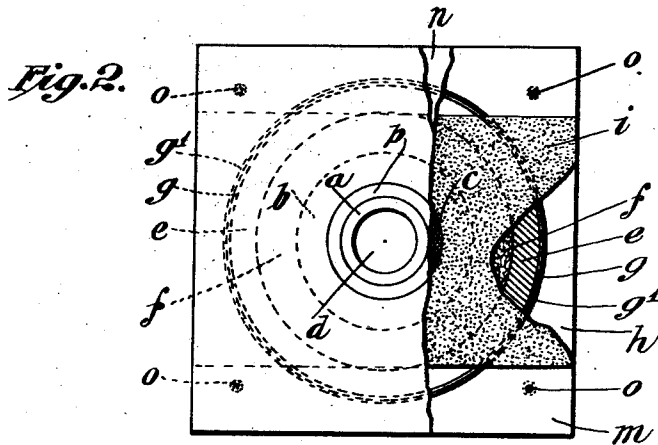
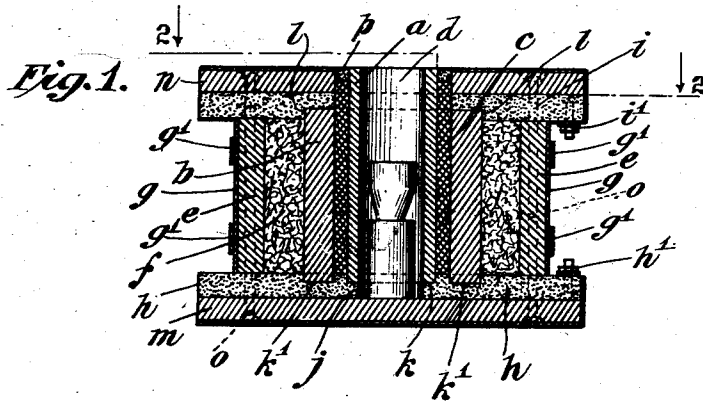
C. H. FULTON & W. A. COURSEN.

METALLURGICAL FURNACE.

APPLICATION FILED JULY 7, 1911.

1,048,144.

Patented Dec. 24, 1912.



Attest:

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UNITED STATES PATENT OFFICE.

CHARLES H. FULTON AND WILLIAM A. COURSEN, OF RAPID CITY, SOUTH DAKOTA.

METALLURGICAL FURNACE.

1,048,144.

Specification of Letters Patent. Patented Dec. 24, 1912.

Application filed July 7, 1911. Serial No. 637,274.

To all whom it may concern:

Be it known that we, CHARLES H. FULTON and WILLIAM A. COURSEN, both citizens of the United States, residing, respectively, at Rapid City, in the county of Pennington and State of South Dakota, have invented certain new and useful Improvements in Metallurgical Furnaces, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

Our invention relates to furnaces, and more particularly to electric resistance furnaces.

The main object of the invention is to provide an electric resistance furnace which will develop uniform heat conditions throughout the heated chamber.

A further object is to provide a furnace of this character wherein the resistance material is so arranged and the current is so applied thereto as to secure equal capacity of the resistance material at every point thereof thereby securing uniform development of heat units by the said resistance material at every point about the chamber inclosed by same.

A still further object is to provide a furnace of this character wherein the heated chamber is provided with a refractory wall, having high electrical resistance and having therein a continuous chamber for the resistance material, the said furnace wall being so constructed and arranged as to avoid its racking or becoming loose when heated, or from continued use.

A still further object is to provide a furnace of this character wherein the oxygen will be excluded from the resistance material while permitting the convenient addition of such material from time to time as required.

A still further object is to provide in a furnace of this character, a compact unitary structure wherein the wall of the furnace will contain a plurality of concentric cylinders so constructed and arranged as to contain the resistance material adjacent to the heated chamber; to apply the current to said material at every point about said heated chamber; to insulate the furnace as to the electric current, at all points except through said material; to resist the effect of the heat upon the furnace; and to prevent heat radiation at all points about the heated chamber. And a still further object is to provide a

furnace of this character wherein all parts will be so combined and associated as to insure rigidity and permanency in the structure.

The invention consists primarily in an electric resistance furnace embodying therein a refractory wall forming a heating chamber, a channel in said wall, completely surrounding said chamber, a granular resistance in said channel, and contact plates adjacent the opposite ends of said wall and in electrical connection with said body of resistance material at all points about said chamber; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings:—Figure 1 is a vertical section of a furnace embodying my invention; Fig. 2 is a plan view thereof with sections thereof broken away upon different planes indicated by the line 2—2 of Fig. 1; and Fig. 3 is a side elevation of the furnace.

Like letters refer to like parts throughout the several views.

In the accompanying drawings, we have shown a form of the invention which in practice we have found to give highly satisfactory results. It comprises an inner tubular section *a* forming the inner wall of the furnace, said section and all other parts of the furnace wall being preferably circular in cross section. Surrounding the section *a* is a second tubular section *b* concentric therewith and of a diameter sufficient to form between these two sections a channel adapted to receive granular resistance material. These sections in addition to being composed of refractory material are made of material also offering high resistance to an electric current. In practice we have found the material which possesses these two characteristics in a degree to be best adapted for this use to be magnesia, and we preferably make these two sections of this material. The channel between the sections *a* and *b* is filled with a mass of granular resistance material *c* such as cryptol, crushed graphite or carbon, or any other suitable material which may be compacted slightly so as to present a substantially uniform volume of this material at all points about the section *a*, the space within which section constitutes the heated chamber and is indicated by the reference letter *d*.

About the section *b* is a third tubular section *e* preferably of fire clay or other heat insulating material, the diameter of which section is sufficiently great to form a chamber *f* between the sections *b* and *e* relatively wider than the channel containing the resistance material *c*. This chamber we fill with powdered magnesia and by this means secure a highly effective heat insulating jacket about the resistance material. The magnesia has the twofold function of offering high resistance to the electrical current in a manner to act substantially as an electrical insulator, and also to prevent heat radiation to the outside of the furnace. These various rings are inclosed by a circular jacket *g* and metallic bands *g'* about the outer tubular section *e*.

The electrical current is conducted to the resistance material by means of the plates *h* and *i*, which plates are of electrically conductive material and provided respectively with suitable binding posts *h'* and *i'*. These plates are preferably composed of carbon and are rectangular in contour. In addition to performing their function as conductors of the electrical current, we utilize these plates to establish a definite relation of the rings *a*, *b*, and *e*. The lower plate *h* is provided with a central opening at *j*, coinciding with the bore of the tubular section *a*, the edge of this opening being rabbeted at *k* to form a seat for the said section *a* and to hold the lower end of said section. The said plate *h* is also channeled away as at *h'* to receive the lower edge of the tubular section *b* and space it away from the section *a* sufficiently to form the channel for the resistance material *c*. This arrangement also raises the bottom of the said channel above the horizontal joint between the said plate and the said tube, and forms the bottom of said channel of the electrical conducting material of said plate. The upper and lower edges *b* and *e* are cut away to accommodate the plates *h* and *i* so as to bring these plates flush with the top of said sections. This construction prevents a rotative movement of the said sections which might tend to rack or loosen up the various parts constituting the furnace wall. The upper plate *i* has a central opening therein of a diameter approximating the bore of the section *b* and the edge thereof is rabbeted as at *l* to accommodate the top edge of said section. This construction brings the inner surface of the central opening in said plate flush with the inner surface of the section *b* and exposed within the channel between the sections *a* and *b* in a manner to bring it into intimate electrical contact with the resistance material *c* at every point about the heated chamber *d* when the granular resistance material is packed within said channel. This arrangement also per-

mits the resistance material to be introduced to the channel between the sections *a* and *b* at any time, and at the same time permits the contact between this material and the plate *i* to be made at a point below the top of this channel where a more uniform condition of the resistance material will be found to exist.

Above the plate *i* and below the plate *h* are caps *n* and *m* of fire clay or other suitable material, which caps are united by the stay rods *o* in a manner to secure all of these parts in the position above described. The lower cap *m* is imperforate and forms a base for the entire furnace while the upper cap *n* has a central opening therein coinciding with the opening in the plate *i* thus causing the edge of said opening to form a part of the channel containing the resistance material.

To prevent the burning of the resistance material *c* through the contact of air therewith, we provide an annular plug *p* of carbon or other suitable material adapted to fit snugly between the section *a* and the cap *n*, a construction which not only excludes air from the chamber containing the resistance material, but at the same time permits said channel to be opened at will in order to renew or replenish the supply of such material therein.

The particular construction of the sections *a* and *b* results in that condition wherein the volume of the resistance material at any point about the section *a* is substantially the same as at any other point, thereby offering a substantially uniform resistance to the flow of the electrical current therethrough at all points, or equalizing the capacity of this resistance in a manner to develop uniform heat conditions at every point about said section. Furthermore, the plates *h* and *i* present continuous contact surfaces of uniform area throughout, about the entire periphery of the section *a*, thus distributing the current in a manner to contribute toward such uniform development of heat.

It is not our intention to limit our invention to the precise details of construction shown in the accompanying drawings, it being apparent that such may be varied without departing from the spirit or scope of the invention.

Having described our invention, what we claim as new and desire to have protected by Letters Patent, is:—

1. An electrical resistance furnace embodying therein a refractory wall forming a heating chamber and having therein a channel completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance in said channel, and contact plates adjacent to the

opposite ends of said wall and in electrical connection with said body of resistance material at all points about said chamber.

2. An electrical resistance furnace embodying therein a refractory wall forming a heating chamber and having therein a channel of equal width and depth throughout, completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance in said channel, and contact plates adjacent the opposite ends of said wall and in electrical connection with said body of resistance material at all points about said chamber.

3. An electrical resistance furnace embodying therein a refractory wall forming heating chamber and having therein a channel completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance in said channel, and contact plates adjacent the opposite ends of said wall, each of said plates presenting continuous contact surfaces of uniform width and having electrical connection with said body of resistance material at all points about said chamber.

4. An electrical resistance furnace embodying therein a refractory wall forming a heating chamber and having therein a channel of equal width and depth throughout, completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance in said channel, and contact plates adjacent the opposite ends of said wall, each of said plates presenting continuous contact surfaces of uniform width and having electrical connection with said body of resistance material at all points about said chamber.

5. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance within said channel, and contact plates exposed within said channel adjacent the opposite ends thereof and in electrical connection with said body of resistance material at all points about said inner tube.

6. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters, whereby the smaller

of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a granular resistance within said channel, a lower contact plate having a central circular opening therein of substantially the diameter of said inner tube, a seat formed about said opening for said inner section, and a channel formed therein adapted to receive said outer tubular section, and an upper contact plate having an opening centrally thereof of substantially the same diameter as the tubular section having the greater diameter, and a seat formed about said opening adapted to receive the top of said section whereby said sections are held in a definite relation and said plates are placed in electrical connection with said body of resistance material at all points about said inner section.

7. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters, whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a granular resistance within said channel, a lower contact plate having a central circular opening therein of substantially the diameter of said inner tube, a seat formed about said opening for said inner section, and a channel formed therein adapted to receive said outer tubular section, an upper contact plate having an opening centrally thereof of substantially the same diameter as the tubular section having the greater diameter, and a seat formed about said opening adapted to receive the top of said section whereby said sections are held in a definite relation and said plates are placed in electrical connection with said body of resistance material at all points about said inner section, and an annular closure for the top of said channel between said sections.

8. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters, whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a granular resistance within said channel, a lower contact plate having a central circular opening therein of substantially the diameter of said inner tube, a seat formed about said opening for said inner section, and a channel formed therein adapted to receive said outer tubular section, an upper contact plate having an opening centrally thereof of substantially the same diameter as the tubular section having the greater diameter, and a seat formed about said opening adapted to receive the top of said section whereby said sections are held in a definite relation and said plates are placed in electrical connection

tion with said body of resistance material at all points about said inner section, an annular closure for the top of said channel between said sections, upper and lower caps, and means tying said caps together.

9. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance within said channel, contact plates exposed within said channel adjacent the opposite ends thereof and in electrical connection with said body of resistance material at all points about said inner tube, and an outer wall of material nonconductive of heat inclosing said tubular section.

10. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a removable plug fitting snugly within said channel and capable of movement therein, whereby the atmosphere is excluded from said channel, a granular resistance within said channel, contact plates exposed within said channel adjacent the opposite ends thereof and in electrical connection with said body of resistance material at all points about said inner tube, and an outer wall of material nonconductive to heat inclosing said tubular section, comprising a tubular section of substantially electrically nonconductive material, concentric with said other tubular sections and of a diameter sufficiently great to form a chamber between it and the next

smaller section, and powdered heat insulating material within said chamber.

11. An electrical resistance furnace embodying therein a plurality of substantially electrically nonconductive tubular sections of different diameters, whereby the smaller of said tubes forms a heating chamber and a channel is formed between said tubes completely surrounding said chamber, a granular resistance within said channel, a lower contact plate having a central circular opening therein of substantially the diameter of said inner tube, a seat formed about said opening for said inner section, and a channel formed therein adapted to receive said outer tubular section, an upper contact plate having an opening centrally thereof of substantially the same diameter as the tubular section having the greater diameter, and a seat formed about said opening adapted to receive the top of said section whereby said sections are held in a definite relation and said plates are placed in electrical connection with said body of resistance material at all points about said inner section, an annular closure for the top of said channel between said sections, and an outer wall of material nonconductive of heat inclosing said tubular section comprising a tubular section of substantially electrically nonconductive material, concentric with said other tubular sections and of a diameter sufficiently great to form a chamber between it and the next smaller section, and powdered heat insulating material within said chamber.

In witness whereof we have each affixed our signatures in the presence of two witnesses, this 22nd day of June, 1911.

CHARLES H. FULTON.
WILLIAM A. COURSEN.

Witnesses:

M. F. COOLBAUGH,
A. S. HALLEY.