Dec. 18, 1928. 1,695,860

W. ROHN

ELECTRIC ANNEALING OR HEATING FURNACE

Filed Oct. 23, 1925 3 Sheets-Sheet 1

Fig. 1

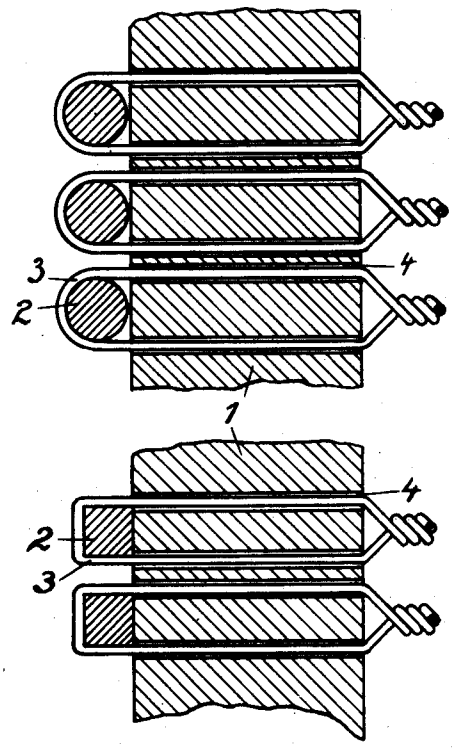
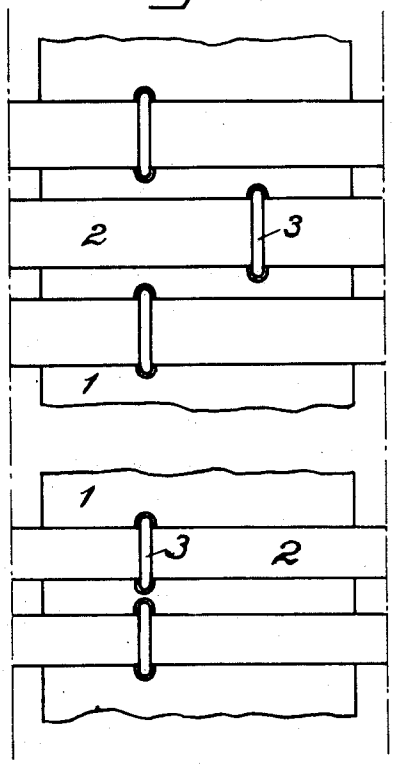


Fig. 2



INVENTOR
Wilhelm Rohn
BY
Wesley G. Carr
ATTORNEY

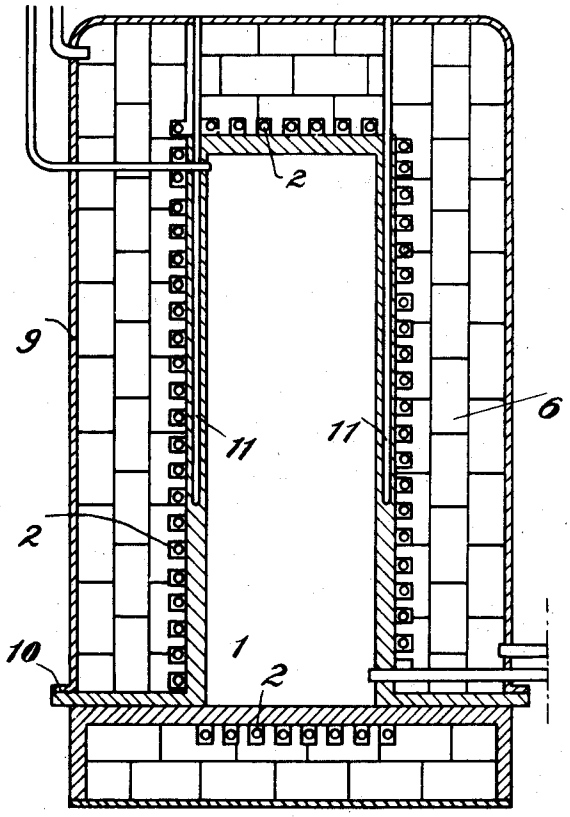
Dec. 18, 1928. 1,695,860

W. ROHN

ELECTRIC ANNEALING OR HEATING FURNACE

Filed Oct. 23, 1925 3 Sheets-Sheet 2

Fig. 3



INVENTOR
Wilhelm Rohn
BY
Weskey G. Carr
ATTORNEY

Dec. 18, 1928. 1,695,860

W. ROHN

ELECTRIC ANNEALING OR HEATING FURNACE

Filed Oct. 23, 1925 3 Sheets-Sheet 3

Fig. 4

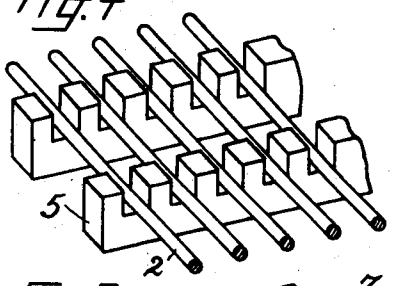


Fig. 6

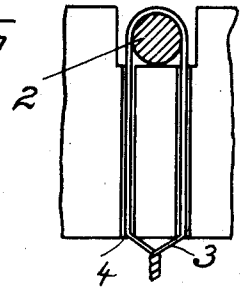


Fig. 5

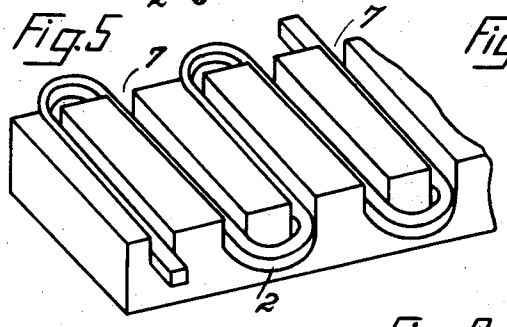


Fig. 7

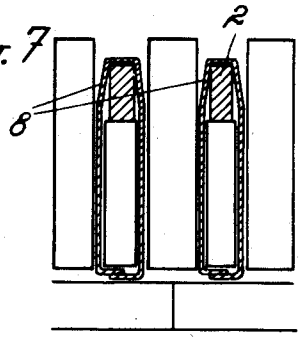
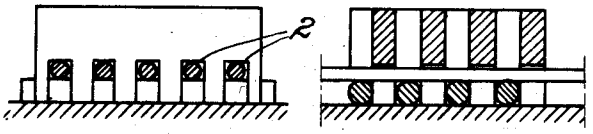


Fig. 8



INVENTOR
Wilhelm Rohn
BY
Wesley G. Carr
ATTORNEY

Patented Dec. 18, 1928. 1,695,860

UNITED STATES PATENT OFFICE.

WILHELM ROHN, OF HANAU-ON-THE-MAIN, GERMANY, ASSIGNOR TO SIEMENS-SCHUCKERTWERKE GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, OF SIEMENSSTADT, NEAR BERLIN, A CORPORATION OF GERMANY.

ELECTRIC ANNEALING OR HEATING FURNACE.

Application filed October 23, 1925, Serial No. 64,350, and in Germany December 15, 1924.

My invention relates to electric annealing or heating furnaces. It is the usual practice to construct electric annealing or heating furnaces in such a manner that the furnace structure itself is built up of refractory brickwork at the inner surface facing the furnace chamber, the heating or resistor members being supported by placing them either into recesses within the brickwork or suspending them from or stretching them between supporting members or hanger blocks. In such furnaces it has hitherto been impossible to attain temperatures which are sufficient for all purposes because the fusing and scaling temperature of the heating members is limited.

My invention relates to an electric annealing or heating furnace in which, with a definite heating member material, a very high temperature and a long life of the furnace may be attained.

An annealing or heating furnace comprises as a rule four side walls and bottom and roof walls. In the known constructions all six surfaces are generally not covered by heating members. If, according to my invention, all six or at least five of these surfaces are utilized for carrying heating or resistor elements, either a considerably higher working temperature or a considerably longer life of the furnace thus constructed is attained. According to my invention the proportions of the heating elements are so chosen that their total surface is equal to the total inner surface area of the chamber to be heated, or even larger. The heating members are, furthermore, given a cross section as solid and compact as possible which, therefore, does not deviate too much from a round cross section. In the case of round wires which are arranged as far apart as they are thick, the total area of the heating members is already approximately one and a half times larger than the total area of the chamber to be heated. This ratio becomes still more favorable if strong strips, ribbons or tapes are disposed edgewise so that their narrow edges face the interior of the furnace, and by locating these ribbons or tapes so that their spacing is much narrower than their width. The construction of such furnaces may be simplified and made more substantial if the resistor members are not passed over or fixed upon any supports or hangers which, inasmuch as they must be constructed of electric-insulating ceramic material, are liable to destruction, but are tied to the walls.

In the drawing,

Fig. 1 is a view in lateral vertical section of a portion of a furnace wall embodying my invention;

Fig. 2 is a side elevation of the structure shown in Fig. 1;

Fig. 3 is a view, in vertical section, of a furnace embodying my invention;

Figs. 4, 5 and 6 are detail views of the means for supporting the resistor element;

Fig. 7 is a detail view of a modified resistor supporting means, and

Fig. 8 is a view partially in section, of portions of the furnace wall and the resistor operatively associated therewith.

Referring in particular to Figs. 1 and 2, 1 designates a part of the furnace wall, 2 a portion of the heating or resistor member and 3 a wire of the same material as the heating member which is passed through openings 4 in the furnace wall in U-shape, for instance, the outer ends being twisted together, or which is otherwise fixed to the wall.

According to my invention the furnace is so constructed that the furnace or the resistor members cannot be damaged even if very heavy articles are introduced into the furnace, and so that the arrangement of a reliable automatic temperature regulating device is rendered possible in a particularly simple manner.

It is, the ususal practice to dispose the resistor members in electric furnaces in such a manner that they rest quite free, or only slightly protected, upon the inner face of the furnace wall in order to permit a perfectly unobstructed radiation of the heat developed in the resistor members in the direction towards the interior of the furnace. In a furnace thus designed the brickwork and particularly the resistor elements are easily damaged when heavy or bulky articles are introduced into the furnace. Such a furnace furthermore does not at all, or only with the greatest difficulty permit the mounting of heating elements upon the bottom of the furnace, since this part is particularly liable to be damaged by the weight of heavy articles introduced. The bottom of the furnace should, however, be heated to bring about a quick and uniform heating

of the charge. To attain, with a definite material for the heating members, as high a temperature as possible in the furnace chamber, it is, furthermore, necessary to heat all the walls and even the door of the furnace electrically and to so choose the dimensions of the heating member that their total surface area is equal to or preferably larger than the internal surface area of the furnace.

Figure 3 illustrates an electric annealing or heating furnace in which 1^a designates a metal casing of the shape which the heating chamber of the furnace should possess. For heating temperatures up to 900° C., cast iron (such as refractory castings) may be used for this metal casing or shell. For still higher temperatures the metal casing may be constructed of chrome-iron, chrome-nickel, aluminium-iron or aluminium-nickel.

The heating or resistor member 2 should surround this metal casing on all sides if possible and should be arranged to permit the radiation of the heat developed to the outer wall of the furnace casing 1 in as unobstructed a manner as possible. There are various ways of bringing this about. As shown by way of example in Fig. 4, the resistor members 2 may be stretched across suitably shaped and arranged insulating rails 5 which may be provided with notches, and extend freely around the furnace casing. At a certain distance from the heating member is then arranged the heat-insulating brickwork 6. The refractory heat-insulating brickwork may, however, be directly applied to the outside of the metal casing. Notch-like recesses 7 must then be provided in the brickwork which form a substantially continuous channel into which the resistor elements 2 are inserted, as shown in Fig. 5 of the drawings.

To render the resistor member as freely movable as possible and, at the same time, to prevent dislocation thereof, spaced openings 4 through the brickwork may be provided, as shown in Fig. 6. Through these openings U-shaped wire or strip ties 3 are passed which consist of a material similar to the resistor member itself. These ties may be bent over or twisted together at the outside of the wall so that the resistor member 2 is securely held in place. The resistor member may equally well be attached to the wall in the manner illustrated in Fig. 7, in which wire or strip ties 8 are placed around the resistor member, which ties pass outside in the joint between two adjacent bricks or stones, and are there bent over. Obviously the two methods may be combined, as shown in Fig. 8. in which parts of the wall are treated respectively in the first or second mentioned manner.

The remaining portion of the refractory outer brickwork may be constructed in the ordinary manner. The brickwork may be either self-supporting or it may be reinforced by an iron framework. The brickwork 6 may also be enclosed by a continuous outer casing 9, (Fig. 3), which is connected with the casing 1 forming the inner furnace chamber, and enclosing it by suitable flanges 10 or the like, so that the resistor members and a portion of the refractory brickwork are entirely enclosed. By the just described construction the effect of air upon the heating elements is reduced to a minimum, and, therefore, the life of the heating elements considerably extended. In this construction it is furthermore possible to charge the space between the outer and the inner metallic wall with a protective gas which protects the resistor element against the detrimental influence of the air. It is therefore possible to construct the heating or resistor elements of ordinary iron.

If magnetic actions are to be avoided in regard to the charge to be introduced, or to the fact that the furnace walls consist of magnetic material, the resistor windings may be arranged in "bi-filar" relation.

The construction of the inner furnace walls of metal offers at the same time the advantage that their expansion under the action of heat may be utilized for the automatic control of the heating current by the aid of means well known in the art. For this purpose it may be of advantage to make the inner wall 1 of the furnace of sufficient thickness so that bores 11 may be provided therein into which rods of quartz or porcelain, or other material of a different coefficient of expansion than the material of the furnace wall, may be inserted. The difference in the expansion of the furnace wall and the rod under the action of the heat may then be utilized to automatically close or open a contact switch which in turn effects the control of the heating current. It is, however, obviously possible to design devices for this purpose in which the parts effecting the control of the circuit are placed out of the reach of the higher temperature.

A bore of the described kind may naturally be equally well employed to house a thermo-electric couple which indicate the temperature of the furnace wall, and which is effectively protected by the described construction. Such a thermo-couple may likewise be employed to control automatically the heating current, and thus the temperature of the furnace, by well-known means.

As an example of the application of such furnaces, it may be mentioned that such a furnace is particularly suitable for heating steel rolls which have to be annealed. The construction described is also suitable for charging the heating chamber proper with a protective gas, which differs from the protective gas introduced between the inner and outer shell of the furnace, so that tempering

and cementation processes may be carried out.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and all such modifications are intended to be covered by the appended claims.

I claim as my invention:—

1. In an electric annealing furnace, a heating element therein comprising a plurality of convolutions of electrical resistance material of such dimensions that the total surface area of the element is at least as great as the area of the furnace chamber walls, means for supporting said element in operative position within said furnace comprising wires of metallic refractory material looped over said heating element at spaced points and extending through the wall of said furnace and means for maintaining said wires in operative position.

2. In an electric annealing furnace, an inner furnace casing of cast metallic material defining a heating chamber, an outer casing of refractory brickwork in contact with the outer surface of said metallic casing, grooves formed in the inner face of said outer casing, an electrical resistance element disposed in said grooves and freely expansible therein, and means for maintaining said resistance element in operative position, comprising spaced loops of metallic refractory material looped over portions of said element and extending through said brickwork.

In testimony whereof I affix my signature.

WILHELM ROHN.