July 31, 1928. 1,678,875

W. ROHN

ELECTRIC BRIGHT ANNEALING FURNACE

Filed Oct. 23, 1925 2 Sheets-Sheet 1

Fig. 1.

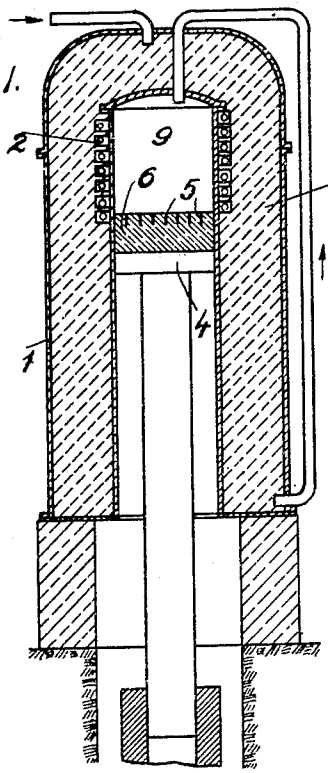
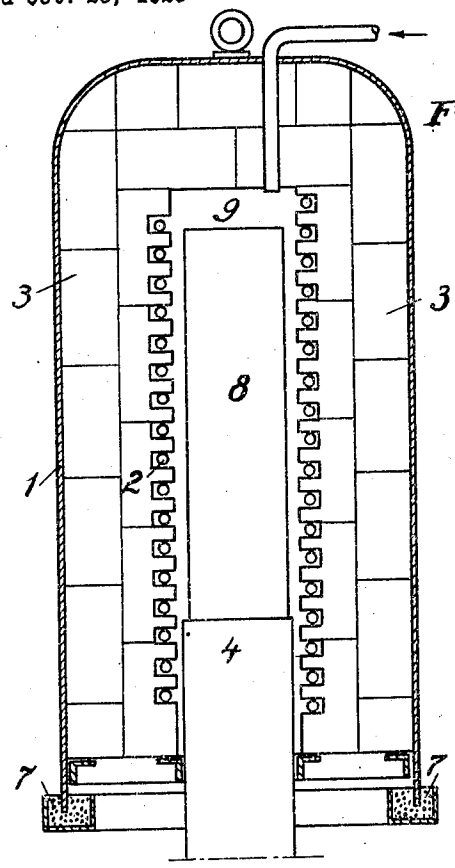


Fig. 3



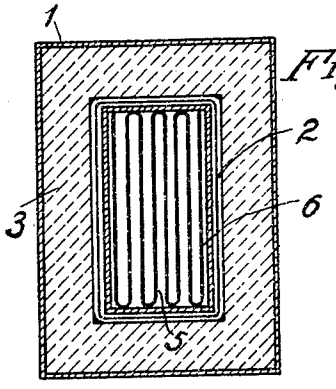


Fig. 2

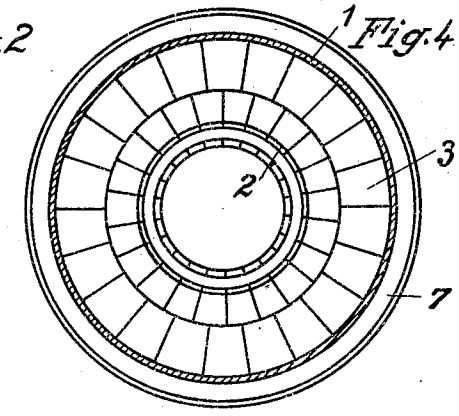


Fig. 4

INVENTOR
Wilhelm Rohn

BY
Wesley G. Carr
ATTORNEY

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W. ROHN

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Filed Oct. 23, 1925 2 Sheets-Sheet 2

Fig.5.

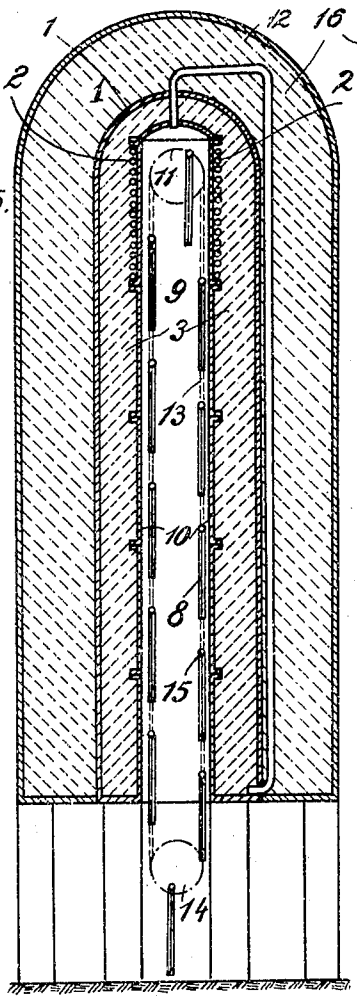


Fig.6.

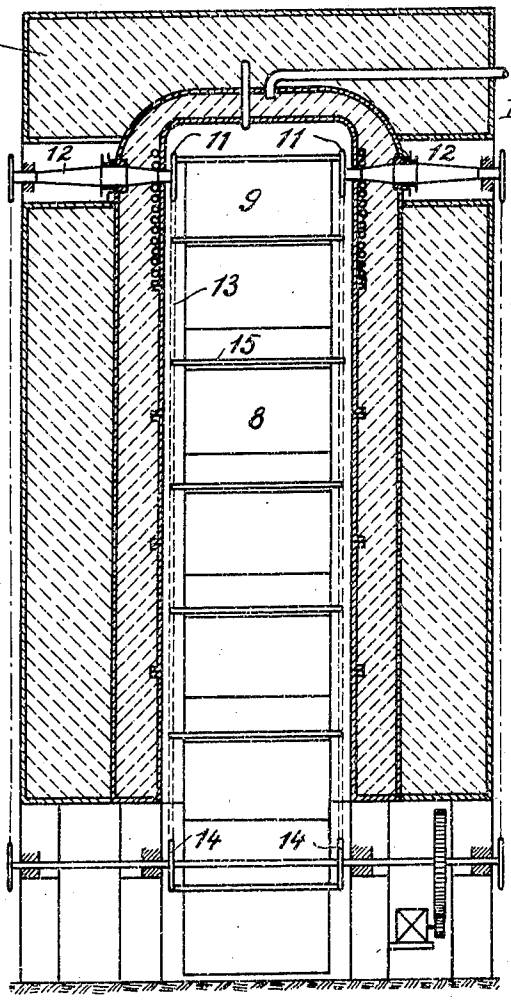
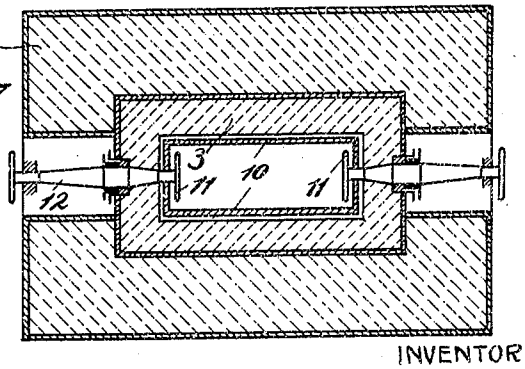


Fig.7



INVENTOR
Wilhelm Rohn
BY
Wesley G. Carr
ATTORNEY

Patented July 31, 1928. 1,678,875

UNITED STATES PATENT OFFICE.

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

ELECTRIC BRIGHT ANNEALING FURNACE.

Application filed October 23, 1925, Serial No. 64,349, and in Germany December 15, 1924.

My invention relates to an electric bright annealing furnace.

Electric bright annealing furnaces are known in which the goods to be annealed are protected against oxidation by a protective atmosphere. Such furnaces have shown excellent results in practice. In certain cases the following two objections have been raised, however, a part of the electrical energy supplied to the furnace must be expended for heating the refractory brickwork of the furnace. Since the goods can only be removed from the furnace after the furnace and the goods have well cooled down, this part of the energy consumed in heating the furnace structure is lost. Since, furthermore, the heat insulation of the furnace must be efficient in order to save current, the cooling down of the furnace requires a considerable time so that such furnaces are not utilized to their full extent.

My invention relates to an electric bright annealing furnace in which the above mentioned drawbacks are efficiently eliminated. My invention consists essentially in constructing the furnace shell which during the operation is filled with protective gas so that it is closed airtight at the top and is open at the bottom, provided the protective gas is lighter than air. If on the other hand the gases or vapors employed as protective or inert atmosphere are heavier than air the furnace shell is closed airtight at the bottom and left open at the top.

In the following specification and the accompanying illustrations it is assumed that the protective gas employed is lighter than air.

In the drawing,

Figure 1 is a view, in vertical section, of an annealing furnace embodying my invention,

Fig. 2 is a view, in horizontal section, of the furnace shown in Figure 1,

Fig. 3 is a view, in vertical section, of a modified form of annealing furnace embodying my invention,

Fig. 4 is a view, in horizontal section, of the furnace shown in Fig. 3,

Figs. 5 and 6 are views, in vertical section, of a further modification of my invention, and

Fig. 7 is a view, in horizontal section, of the furnace shown in Fig. 6.

Referring in particular to Figures 1 and 2 of the drawing, 1 is an airtight furnace shell closed at the top and open at the bottom. In the upper portion of the said shell is housed the heating or resistor member 2. The arrangement of the resistor member may be such that a resistor strip or band is inserted in the joints of the brickwork 3 facing the annealing chamber or by leading the resistor member in the form of a strip or of any other suitable section over suitable supports or fixing or suspending them from said supports. The resistor member may equally well be located in recesses on the inner face of the brickwork or which are formed by applying suitable shaped bricks or blocks to the inner side of the brickwork. The heating members 2 may consist of chrome-nickel or similar suitable resistance materials, but it may equally well be made of ordinary iron, nickel or the like since the inert atmosphere prevailing within the furnace not only protects the goods to be annealed against oxidation but also the resistor member. The portion of the furnace shell located below the heating zone may also be provided with protective brickwork. In many cases the heat insulation of this portion of the shell may be less than in the heated zone. Sometimes it may even be advisable to omit the heat insulation altogether in the portion of the shell located below the heated zone. The protective gas is generally introduced at the top of the furnace.

The goods to be treated in such a furnace are introduced from the bottom which may be effected in various ways. A table or plate 4 may for instance be provided below the open lower end of the furnace upon which the goods are placed prior to the charging of the furnace. This table is then raised by hydraulic means, for instance, until the goods reach the heated zone 9. It will be advisable to cover the table top with heat insulating refractory brickwork 6 so that the supporting plate itself is not heated. It is also possible to provide the plate upon which the goods rest with an electric heating device 5 in order to be able to heat the goods from below also after they have been brought into the heating zone. When the annealing process is finished the plate 4 on which the goods rest is slowly or intermit-

tently lowered whereby the goods gradually reach increasingly colder zones in which they can cool down still surrounded by the protective gas. After sufficient cooling the supporting plate only is lowered so far that the goods pass out of the range of the protective atmosphere and can be removed.

A second possibility is that the furnace shell with resistor member is made movable by suspending it from a suitable crane or winch device or providing it with a hydraulic piston. The goods are then placed upon a supporting plate and then the furnace shell with the resistor member is placed or lowered upon it so that the material to be annealed is brought into the heated zone. The further proceedings are generally understood and need not be described here.

In this manner the heat energy stored up in the heating zone remains permanently preserved within the furnace so that annealings may take place in much shorter time than with the hitherto employed furnaces so that on the one hand a considerable saving of electrical energy is effected and on the other hand the furnace is essentially better utilized. A further advantage of the improved furnace is that a part of the heat energy which the annealed articles contain when leaving the heating zone is transmitted to the lower parts of the furnace and is stored within it. When the next charge is introduced into the furnace a part of this heat stored in the lower zone of the furnace is transmitted to the cold charge so that it reaches the annealing zone in a preheated state. Hereby a further saving of energy is effected.

In this arrangement the contamination of the protective atmosphere with air is prevented merely by the difference between the specific weight of the protective atmosphere and the air. In cases in which this appears insufficient, the lower end of the furnace may dip into an oilcup or any other suitable sealing device through which the material to be inserted into the furnace is passed. Even in cases where a special closing device does not appear necessary, it will naturally be advisable to keep the lower opening of the furnace closed by a slide, damper, flap or the like which are opened automatically only when a charge is introduced or withdrawn.

Such a construction of furnace may also be applied in the following manner illustrated in the Figures 3 and 4.

It is well known that in ingot heating furnaces a considerable sealing of the charge takes place which may in certain cases amount to 2% and even more of the charged material. It is, however, as a matter of course also possible to discharge the annealed goods in a hot state from a furnace of the described kind. In this manner an oxidation and burning of the ingot 8 is prevented during the heating and the ingot only leaves the protective atmosphere at the moment when the heated ingot is to be inserted between the rolls and is thus exposed to oxidation and burning from that moment. With such a method of operation it is not necessary to provide below the heating zone, a non-heated zone of considerable extent as in this case the material to be heated should be withdrawn in the hot state. In order to keep the consumption of gas during the heating period as low as possible the arrangement may be such that the goods 8 to be heated are placed upon a support 4 located in the center of a dish 7 containing sand. When the furnace 1 with its brickwork 3 and the resistor member 2 is then slipped over the goods to be heated the lower edge of the shell is buried in the sand (or immersed in an oil-trough) and a perfect seal of the interior of the furnace relatively to the external air is obtained whereupon the supply of protective gas may be reduced to a minimum until the moment when the goods are to be removed again.

The construction illustrated in the Figures 5 to 7 can be carried out for very large quantities of heating material and works with internal heat recovery whereby a great saving in electric energy is effected so that the electric annealing or heating process is well able to compete with other annealing or heating processes even for inferior materials.

Referring in particular to Fig. 5, 1 designates a furnace shell closed at the top and open at the bottom, lined with refractory brickwork 3 and provided at the inner side of its upper zone only with an electric heating or resistor member 2. The inner surface of the refractory brickwork with the resistor member may either directly face the heating or annealing chamber 9 proper or a second airtight metal casing 10 may be located in its interior and so surrounding the annealing chamber 9 that two separate airtight chambers 3 and 9 are formed, one of which encloses the refractory brick lining and the resistor member, while the other forms the annealing chamber. Both chambers may either separately or in series be traversed by the protective gas.

In the design of the furnace illustrated by way of example two or more sprocket wheels 11 are provided at the highest point of the heated zone which are either mounted on a common shaft or overhang on two steep shafts 12 supported in an airtight manner in the furnace. Around the said sprocket wheels are passed endless chains 13 which at the lower furnace opening are led around two or more additional sprocket wheels 14 and kept taut by them. The lower or all the sprocket wheels are slowly rotated in the

same direction so that the chains travel up on one side and down on the other. The chains may be provided with extended bolts or rods 15 over which the articles to be annealed can be suspended or the chains themselves may be provided with hooks, eyes and the like for engagement with the goods. As shown in the drawings packets of sheet iron plates 8 are suspended on rods 15 connecting individual sections 13 of the chain which gradually travel from the cool zone of the furnace into the heating zone 9 and hence return again into the cool zone. In the unheated zone the cold ascending and the hot descending parts of the articles to be annealed directly face each other so that the hot descending parts transmit their heat to the cold ascending parts. A part of the heat is also radiated to the adjacent portions of the furnace walls so that these are raised to a higher temperature and in their turn participate in the preheating of the ascending articles.

Since the gases or vapors used for protective purposes have as a rule a higher heat conducting capacity than air, it may be advisable to surround the outer shell 1 by a layer 16 of heat insulating material, such as infusorial earth or the like.

While in bright annealing furnaces which after charging, filling with protective gas and carrying out of the annealing process must be cooled down completely before the goods can be removed and a new charge introduced, about 300 to 400 kilowatt hours must be expended per ton of goods at an annealing temperature of 800° C., and in continuous bright annealing furnaces (in which the articles to be annealed traverse the furnace continuously in one direction so that the heat stored in the furnace itself is retained permanently but the heat carried along by the annealed articles is lost) about 200 to 250 kilowatt hours per ton of material at a temperature of 800° C. must be expended, in the herein described furnace an energy consumption per ton of goods for 800° C. annealing temperature of only about 100 to 120 kilowatt hours is attained and in carefully carried out furnaces in large units even less.

My above described embodiment is intended as an example of the way in which the principle of construction is to be applied. The design and the shape of the furnace depends as a matter of course on the kind of material to be annealed i. e. whether rods, tubes or sections of such, sheet iron or small parts are to be treated. In certain cases it may be advisable to abandon the vertical arrangement and to choose an oblique or approximately horizontal arrangement. In some cases the consumption of protective gas may be further reduced by not keeping the lower end of the furnace simply open but by allowing it to dip into an oil bath through which the material to be annealed is introduced. In all cases the lower open end is preferably closed by a slide or damper which open automatically, for instance, when the material to be annealed passes into the furnace and closes again as soon as this is accomplished.

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 bright annealing furnace, in combination, an elongated airtight furnace shell closed at the top and open at the bottom and filled with a protective gas during the annealing operation, a refractory lining within said shell, electric heating means in the upper portion only of said shell, and means for introducing the goods to be annealed into said shell from the bottom.

2. In an electric bright-annealing furnace, in combination, an elongated airtight furnace shell closed at the top and open at the bottom and filled with a protective gas during the annealing operation, a refractory heat-insulating lining within said shell, electric heating means in the upper portion only of said lining, the heat insulation of the zone below the heating zone of the furnace being less than that of the heating zone and means for introducing the goods to be annealed into said shell from the bottom.

3. In an electric bright annealing furnace, in combination, an elongated airtight furnace shell closed at the top and open at the bottom and filled with a protective gas during the annealing operation, a refractory lining within said shell, electric heating means in the upper portion only of said lining, and sealing means for sealing the lower end of said shell during the annealing period.

4. An electric bright annealing furnace for continuous bright annealing and internal heat recovery comprising in combination, an airtight furnace shell closed at the top and open at the bottom and filled with a protective gas during the operation of said furnace, and electrically heated zone at the closed end of said shell and a heat insulation upon the adjoining lower zones and endless chains for conveying the goods to be annealed into the heated zone of the furnace and out of it again.

In testimony whereof I affix my signature.

WILHELM ROHN.