July 31, 1928. 1,678,876

W. ROHN

ELECTRIC BRIGHT ANNEALING FURNACE FOR CONTINUOUSLY BRIGHT ANNEALING

Filed Oct. 23, 1925 3 Sheets-Sheet 1

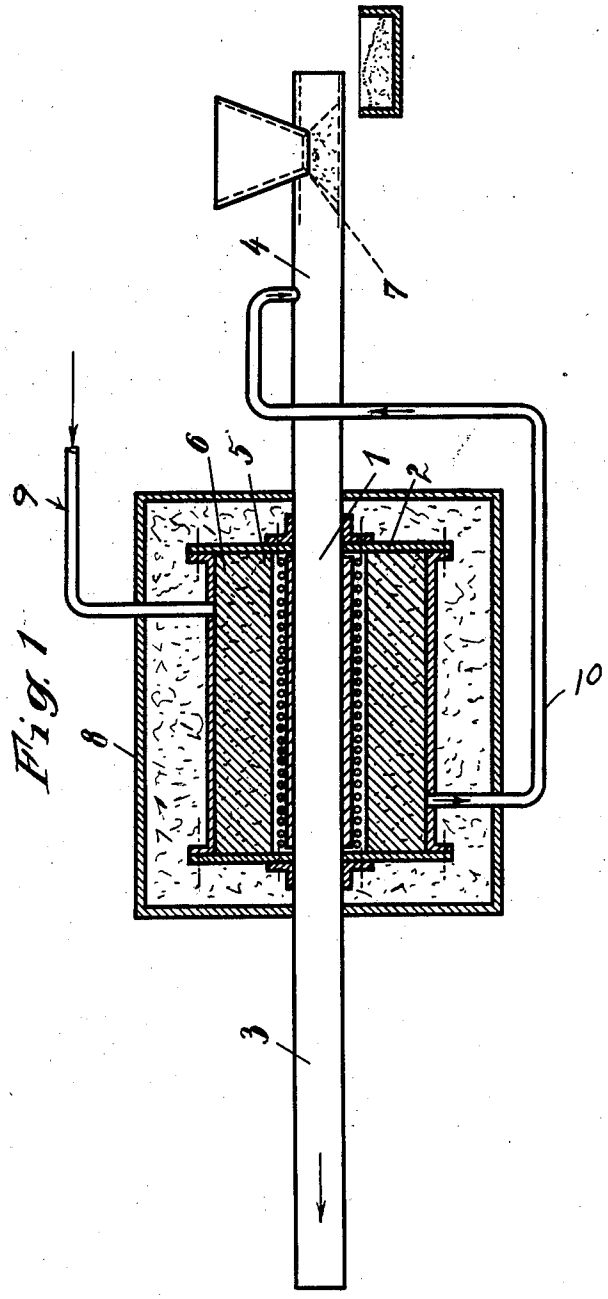


Fig. 1

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Filed Oct. 23, 1925 3 Sheets-Sheet 2

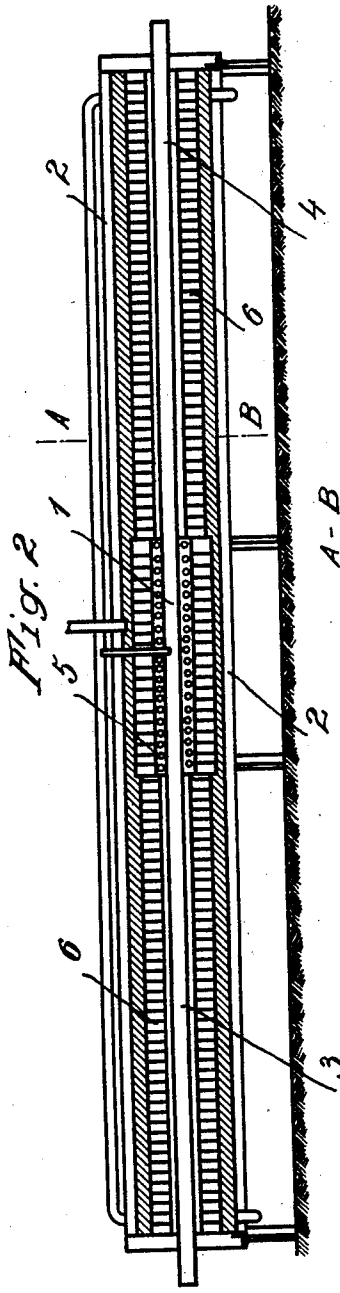


Fig. 2

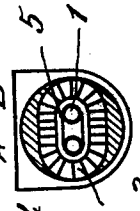


Fig. 4

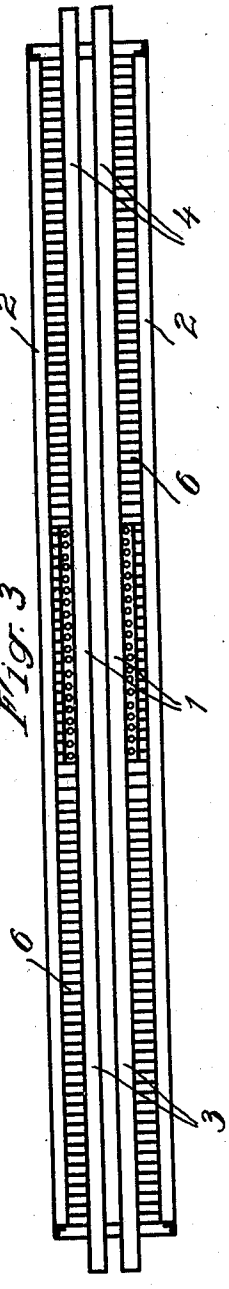


Fig. 3

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Filed Oct. 23, 1925 3 Sheets-Sheet 3

Fig. 5

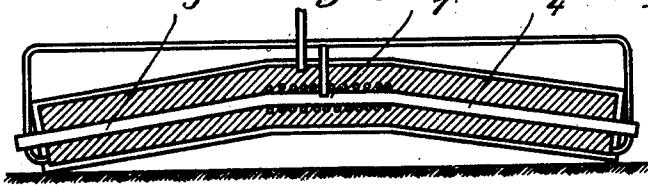


Fig. 7



Fig. 6



Fig. 8

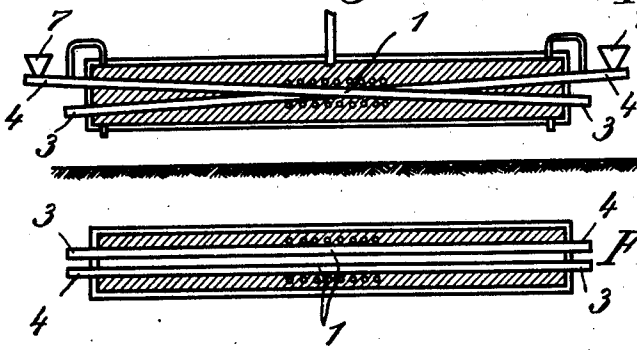


Fig. 10

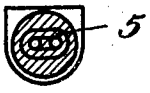


Fig. 9

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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 FOR CONTINUOUSLY BRIGHT ANNEALING.

Application filed October 23, 1925, Serial No. 64,351, and in Germany November 1, 1924.

My invention relates to an electric bright annealing furnace for continuously bright annealing.

Electric bright annealing furances are known which are adaptable to charges of any dimensions. These furnaces operate in such a manner that after the annealing chamber has been charged with articles the furnace casing is closed and then charged with a protective gas. The annealing process is then carried through and only after complete cooling the casing is opened again. The material to be annealed is thus introduced and removed in individual charges. In many cases, for instance if rods or small articles have to be annealed such a service is not convenient.

My invention relates to an electric bright annealing furnace in which the annealing chamber proper is formed by a metal container enclosed by an airtight furnace shell. The electric heating or resistor member is located in a space between said metal container and the furnace shell and the protective gas traverses the space between the metal container and the furnace shell and the interior of the metal container.

In the drawing, Figure 1 is a view, in vertical longitudinal section, of a furnace embodying my invention.

Fig. 2 is a view, in vertical longitudinal section, of a furnace embodying my invention, in a modified form.

Fig. 3 is a longitudinal horizontal section of the furnace shown in Fig. 2.

Fig. 4 is a section taken on the line A—B of Fig. 2.

Figs. 5 and 6 are vertical and horizontal longitudinal sections, respectively, of a modified form of furnace.

Fig. 7 is a lateral section of the furnace shown in Fig. 5.

Figs. 8 and 9 are vertical and horizontal longitudinal sections, respectively, of a further modification of my invention.

Fig. 10 is a lateral section through the furnace shown in Fig. 8.

Referring in particular to Fig. 1 of the drawings, it will be seen that the annealing chamber proper is formed by an iron tube or a similar metal container 1 which fits airtight into an outer furnace shell 2. The metal container forming the annealing chamber projects from the furnace shell at one or both sides to such an extent that one or two forechambers 3 and 4 are formed. The heating or resistor member 5 is wound around the metal container in the interior of the furnace shell and the remaining space between the heating member and the shell of the furnace is filled up with a heat insulation 6. The protective gas is introduced into the interior of the furnace shell 2 by the pipe 9, passes through the space between the metal container and the furnace shell and thus protects the resistor member as well as the outside of the metal container 1 forming the annealing chamber against oxidation. After the escape of the protective gas from the furnace shell 2 through the pipe 10, the gas is conducted to the one forechamber 4 of the annealing chamber, traverses the annealing chamber proper 1 and issues at the end of the second forechamber 3. In this manner the metal container forming the annealing chamber is also protected by the gas on its inner side as well as the articles contained in the annealing chamber. When the charge is sufficiently annealed, it is drawn out into the forechamber 4 so that it can cool down still within the range of protection of the protective gas. During this time fresh material may be pushed into the annealing chamber 1 from the other forechamber 3 which can then be filled up again. In furnaces with a single forechamber the material annealed is forced from the annealing chamber back into the forechamber and the annealing chamber charged again. The discharge of the annealed and cooled material may take place through a sand seal 7 of any kind.

The expansion of the metal shell enclosing the annealing chamber may be utilized for the automatic control of the heating current whereby the furnace may automatically be maintained at a constant temperature.

As the heat conductivity of the insulating layer between the resistor member 5 and the shell 2 of the furnace is generally comparatively high owing to the protective gas which traverses this insulating layer the economy of such an annealing furnace may be still further increased by surrounding the shell of the furnace at the outside with a heat insulating protection 8 of infusorial earth, asbestos or the like.

Since the protective gas is generally light-

er than air it will frequently be advisable to place the main axis of the furnace obliquely upwards so that the protective gas is introduced into the interior at the end closed by the sand seal 7 of the forechamber 4 located at the higher level. The lower end of the furnace of the forechamber 3 can remain open without the entry of air into the interior of the furnace having to be feared. The closure of the higher end takes place preferably by a sand seal through which the annealed and again cooled material can be removed.

For large capacities furnaces of this kind may be so designed that they operate with internal heat recovery whereby a considerable saving of current can be effected. There are two ways of solving this task.

In the Figures 2 and 4 an annealing furnace is illustrated which is formed by a metal container 1 enclosed by a further airtight shell 2. The two forechambers 3 and 4 adjoining the annealing chamber 1 proper are substantially of equal capacity and similar design and arranged symmetrically to the annealing chamber proper. The material or the articles to be annealed are not merely introduced from one end of the one forechamber 3, transversing the annealing chamber 1, passing through the second forechamber 4 and being discharged at the end of this chamber, but material is simultaneously introduced from the opposite end at the end of the other forechamber 4 so that two rows of material traverse the furnace in opposite directions. Each of the two forechambers serves therefore as entrance for a stream of material to be annealed. Hereby the result is attained that the material issuing from the annealing chamber proper of one stream meets the cold stream of the other row and runs along it so that the heat carried along by the first row is transmitted to the material of the second row running in the opposite direction. The latter is therefore already highly preheated when entering the annealing chamber proper. In this manner the contents of heat of the material leaving the annealing chamber is not wasted or utilized by a complicated system of waste heat recovery but the heat contents of the material issuing from the annealing chamber is made useful during the annealing process itself. Hereby an extraordinary saving of electric energy is obtained so that so to say only the radiation and discharge losses of the total furnace area need be covered by the supply of electric energy. In this arrangement it is obviously advisable to provide the two forechambers also with a good heat insulator 6 while in the arrangement according to Figure 1 it is advantageous to keep the heat transmission to the forechamber as high as possible in order not to let the length of the cooling path of the goods issuing from the annealing chamber 1 to become too long. Since in this way the two forechambers, particularly in the immediate vicinity of the annealing chamber possesses a rather high temperature, it may be advisable to surround these forechambers also with an airtight jacket or to include them into the airtight shell or jacket 2 of the annealing chamber so that the forechambers are also swept on the outside by the protective gas.

In order to prevent mutual friction or a mixing up of the two counter streams of material to be annealed instead of the single annealing chamber with two forechambers which constitutes a substantially tubular structure of any desired cross section, two of such systems may be located side by side, in one of which the material to be annealed travels from the front to the back and in the other of which it moves from the back to the front, as illustrated in Figs. 2 and 3. The two annealing chambers may be provided with an electric heating system common to both or each may have a separate one. It is advisable to arrange the two annealing chambers with continuations as closely together as possible so that the heat exchange between them is as perfect as possible while both combined must be provided on the outside with a good lagging so that a radiation of heat into the atmosphere is prevented to the greatest possible extent. The further airtight furnace shell which encloses the annealing chamber and the forechambers is preferably made common to both courses.

The transport of the materials or goods through the furnace may be facilitated by a conveyor band or chain.

In certain cases it may be advisable to keep the annealing chamber substantially horizontal but to give the two forechambers 3 and 4 adjoining the annealing chamber 1 a certain inclination downwards, as shown in Fig. 5, in order to keep the protective atmosphere well together. In a system with two courses the two courses may, as shown in Fig. 8, be disposed with a certain opposite inclination, the goods then being supplied to the lower chambers 3 and 3 and the ends of the chambers 4 and 4 being closed by a sand seal 7 through which the annealing goods leave the furnace. The supply of the protective gases should take place at the highest points of the entire chamber system if the protective gas is lighter than air. If a protective gas or steam is employed which is heavier than air the supply must be introduced at the lowest points of the system and the inclinations must be reversed.

Various modifications may be made in the furnace embodying my invention without departing from the spirit and scope thereof

and all such modifications are intended to be covered by the appended claims.

What I claim is:—

1. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space betwen said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process.

2. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite direction following a common course consisting of an annealing chamber and a forechamber adjoining on each end of said annealing chamber.

3. In a electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite direction following a common course consisting of an annealing chamber and a forechamber adjoining on each end of said annealing chamber, said annealing chamber being located substantially horizontal while said forechambers are inclined in the vertical plane.

4. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite directions being each conducted through a separate tube line, each consisting of an annealing chamber with adjoining forechamber on each end.

5. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite directions being each conducted through a separate tube line, each consisting of an annealing chamber with adjoining forechamber on each end, the two tube lines being oppositely inclined.

6. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite directions being each conducted through a separate tube line, each consisting of an annealing chamber with adjoining forechamber on each end, the two tube lines being oppositely inclined, said forechamber being likewise enclosed by an airtight shell traversed by a protective gas.

7. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent sys-

tems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite directions being each conducted through a separate tube line, each consisting of an annealing chamber with adjoining forechamber on each end, the two tube lines being oppositely inclined, said forechambers being likewise enclosed by an airtight shell traversed by a protective gas, the shells of annealing chamber and forechambers being combined to form a single unit.

8. In an electric bright annealing furnace, the combination of a metal container forming the annealing chamber proper, an airtight shell surrounding said chamber, electric resistor members located in the space between said container and said shell and means for supplying a protective gas to the space between said container and said shell and to the interior of said container, a plurality of such systems being located side by side and the goods traversing adjacent systems in opposite direction, for the purpose of effecting a heat recovery during the annealing and cooling process, the streams of goods traversing the furnace in opposite directions being each conducted through a separate tube line, each consisting of an annealing chamber with adjoining forechamber on each end, the two tube lines being oppositely inclined, said forechambers being likewise enclosed by an airtight shell traversed by a protective gas, the shells of annealing chamber and forechambers being combined to form a single unit, the conveyance of the goods through said furnace being facilitated by the provision of conveyor members.

In testimony whereof I affix my signature.

WILHELM ROHN.