(No Model.) 3 Sheets—Sheet 1.

G. D. BURTON & E. E. ANGELL.

METHOD OF AND APPARATUS FOR ELECTRIC METAL HEATING.

No. 537,009. Patented Apr. 9, 1895.

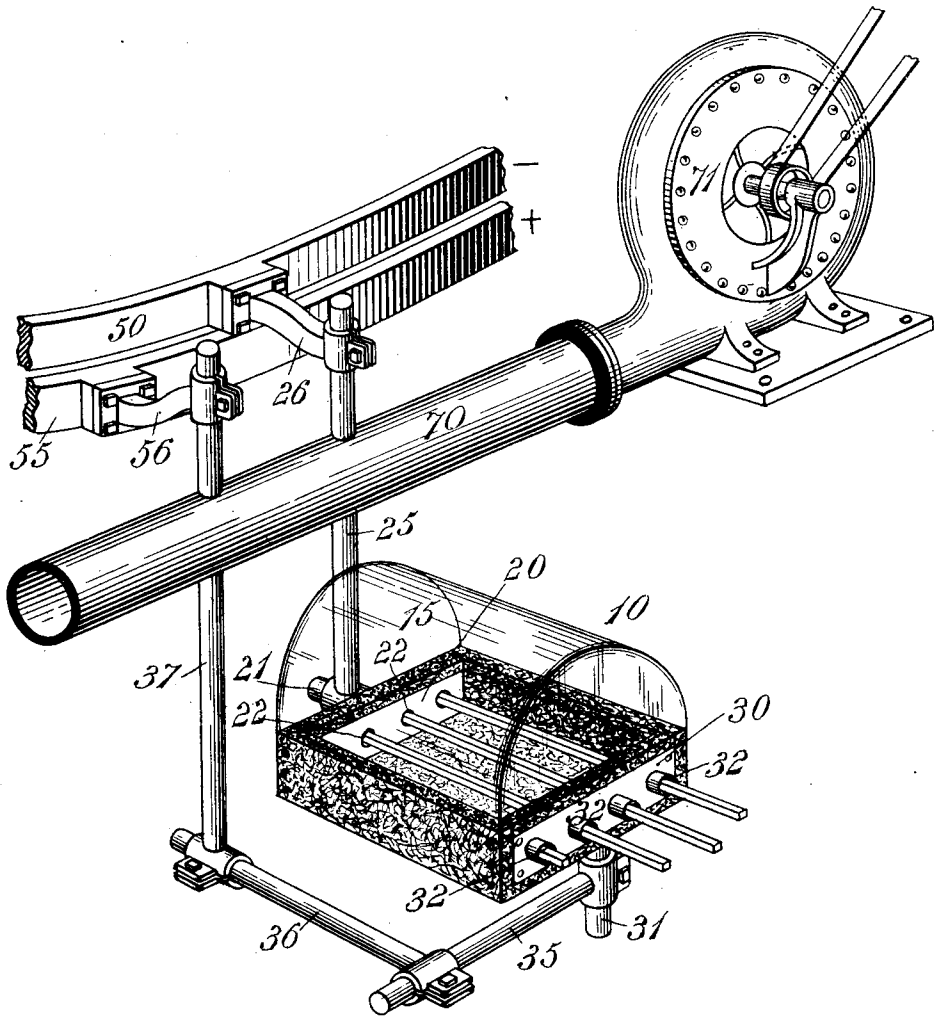

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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No. 537,009. Patented Apr. 9, 1895.

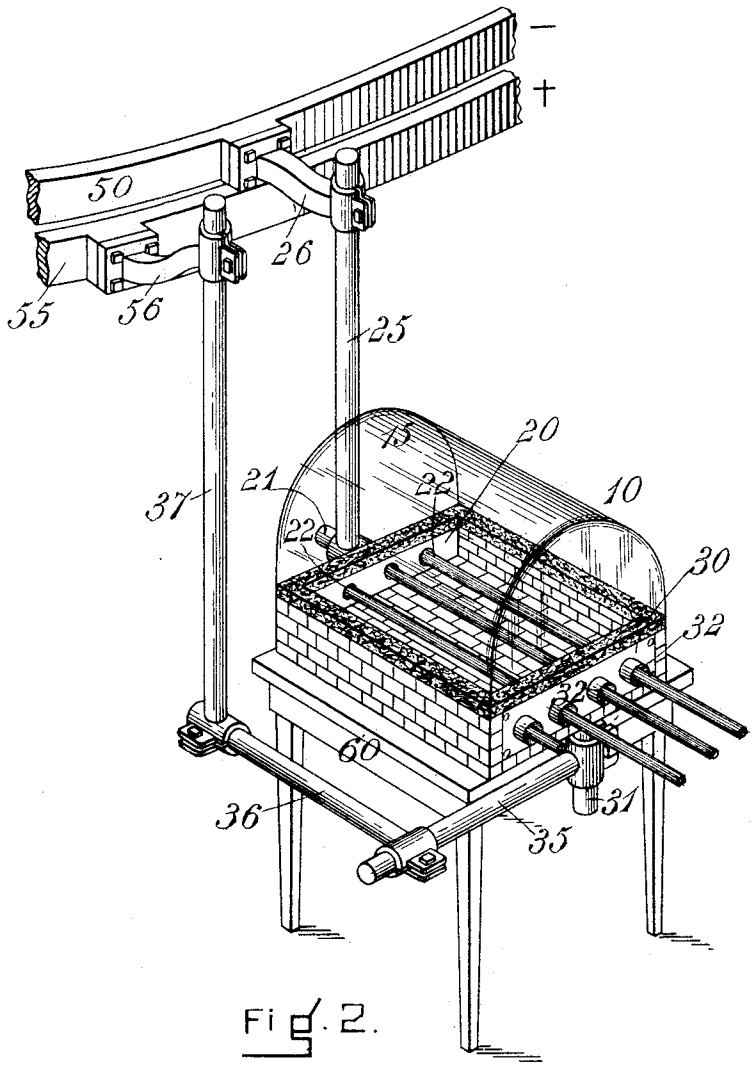

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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METHOD OF AND APPARATUS FOR ELECTRIC METAL HEATING.

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Fig 3.

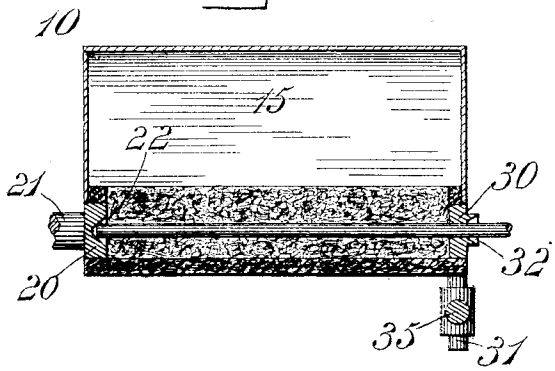


Fig 4.

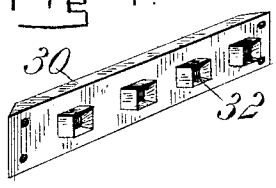


Fig 5.

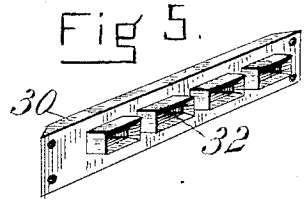


Fig 6.

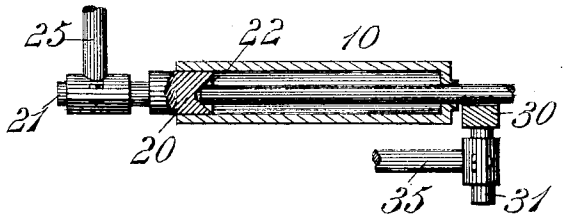
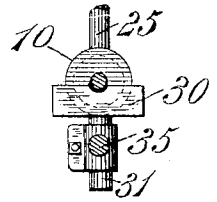


Fig 7.



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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR ELECTRIC METAL-HEATING.

SPECIFICATION forming part of Letters Patent No. 537,009, dated April 9, 1895.

Application filed August 30, 1892. Serial No. 444,538. (No model.)

To all whom it may concern:

Be it known that we, GEORGE DEXTER BURTON, residing at Boston, in the county of Suffolk, and EDWIN ELLIOTT ANGELL, residing at Somerville, in the county of Essex, in the State of Massachusetts, citizens of the United States of America, have invented certain new and useful Improvements in Apparatus for Electric Metal-Heating, of which the following is a specification.

This invention relates to a closed forge for heating metals for forging and tempering purposes, the inclosure of the bars or other forms of metal to be heated serving to decrease the time and economize the power required for heating.

The object of the invention is to provide an apparatus of this character in which the bars may be inserted and withdrawn with facility and quickly.

Figure 1 of the accompanying drawings represents a perspective view of this improved electric forge. Fig. 2 represents a perspective view of a similar closed electric forge, wherein the inclosing casing is shown as composed in part of fire brick. Fig. 3 represents a longitudinal vertical section of the closed electric forge. Fig. 4 represents a form of electrode for a closed electric forge adapted for heating square bars or pieces of metal. Fig. 5 represents a form of electrodes for a closed electric forge adapted to heat flat bars or plates of metal. Fig. 6 represents a side elevation of a device for inclosing a single bar during the heating operation. Fig. 7 represents a transverse section thereof.

The same reference numbers indicate the same parts in all the figures.

In heating metals by electricity with this apparatus, the bar, ingot, or other piece of metal, or the portion thereof to be heated, is inclosed within a closed chamber whereby free access of air and radiation of heat are prevented. An electric heating current is then passed through the inclosed metal to be heated until the desired forging or other temperature is attained, and then said metal is removed from the inclosure and subjected to the desired forging, shaping or tempering operation.

A closed electric forge adapted for one or more bars or pieces of metal may be employed in carrying out this process. The closed forge represented in Fig. 1 of the accompanying drawings comprises a box 10 the sides and bottom of which are composed of asbestos boards or other suitable non-conductor of electricity and a top 15 preferably composed of mica, glass or other suitable transparent material, which will permit the inspection of the metal being heated during the heating operation.

Electrodes 20 and 30 composed of copper or other suitable conductive material are disposed in and may constitute the opposite ends of the box 10. These electrodes are in the form of rectangular plates and are preferably of less breadth than the height of the box, non-conductive strips being disposed above them and forming a flush surface with the upper edges of the sides of the box.

The electrode 20 is provided with a tang 21 which projects outward for connection with the electric source, and on its inner face said electrode is provided with sockets 22 which may be round, square, angular, conical or other shape, for receiving the inner ends of the bars or other pieces of metal to be heated. The electrode 30 is provided with a depending tang 31 which extends through the non-conductive bottom of the box for connection with the other terminal of the electric source. This electrode is provided with a number of eyes 32 corresponding in shape to the bars to be heated and disposed opposite the sockets 22 of the electrode 20.

The top 15, which is shown in the form of a transparent dome is cemented to the upper edges of the box 10, or otherwise fastened to said box.

The electrodes are detachable from the box, the edges thereof being preferably beveled so as to be readily adjusted in the ends of the box.

Several sets of electrodes may be provided for each closed forge, the different sets having holes and sockets of different sizes and shapes to suit the different sizes and shapes of the bars. This interchangeability of the electrodes avoids dismantling the forge when bars of different sizes or shapes are to be heated.

The electrodes are connected with any suitable source of a heating current by any suitable conductors. As shown in Figs. 1 and 2 the electrode 20 is connected by a vertical rod 25 and a bracket 26 with a ring 50 which constitutes one pole of an electric current converter similar to that shown in the patent of the United States, No. 475,232, granted to the Electrical Forging Company on the invention of Burton, Eddy and Briggs, dated May 17, 1892. The electrode 30 is connected by means of conductors 35, 36 and 37 with a bracket 56 connected with a ring 55 constituting the other pole of said converter.

The box 10 of the closed forge shown in Fig. 2 is constructed of fire brick and a table 60 having a refractory or non-conductive surface serves as a support for the closed forge.

A cooling pipe 70 constructed of non-conductive material such as fiber board or rubber through which the conducting rods 25 and 37 pass, is shown in Fig. 1. A blower or force pump 71 is connected with said pipe 70 and serves to force a cooling fluid, as air, into contact with said conductors whereby overheating thereof is prevented, and the conduction of heat to the converter is avoided.

Instead of the converter shown a dynamo or storage battery adapted to supply a heating current of large volume and low voltage may be used.

In the use of the closed forge shown in Figs. 1 and 2 the bar to be heated is thrust through an eye 32 of the electrode 30 into the closed box 10 until its inner end rests in one of the sockets 22 of the electrode 20. The contact of the bar with both electrodes closes the circuit between them, and the heavy heating current passes through that portion of the bar which extends between the electrodes within the inclosure. As many bars may be inserted as there are eyes and sockets. When the entire capacity of the forge is not used, the remaining eyes may be closed by plugs to prevent access of air. The metal attains a red heat in a few seconds and the oxygen contained in the box is consumed and the heating will then be conducted in a partial vacuum.

The closed forge shown in Figs. 6 and 7 may be in the form of a tube composed of metal or preferably of a transparent non-conductive substance provided with non-conductive ends having openings for the passage of the bar to be heated. This closed forge can be applied to a single bar, and the electrodes may be connected with the bar outside the ends of the tube, if desired.

We find that in the process of heating where the heat of the bar is confined within an inclosure, that rapid heating of the conductors is avoided and that the heating of the material is accomplished with from ten to fifteen per cent. less power than where the heating is done by the electric current in the open air. In this process of heating, the bar is heated from its interior, the heat being conducted outward and there is very little scaling at the surface of the metal. In the ordinary heating of bars by coal, gas or oil fires, a loss by scaling amounting to nine per cent. occurs, whereas our experiments show that the loss by scale in our process varies from 1.56 to 2.1 per cent., whereby a large saving is effected.

While we show the heating receptacle for the metal, in the shape of a square box, it is obvious that it may be of any shape suitable to the metal to be heated. It may be found advisable to stand the metal on one end; in which case in the heating of large bars, the weight of the bar while resting on end would give a solid contact upon the electrode.

We claim as our invention—

1. In an electric forge, the combination of a receptacle provided with an inwardly flaring socket and opposite said socket with an outwardly flaring eye, and means connected with electric poles of opposite polarity for conveying a current of large volume to a bar supported in said eye and socket.

2. In an electric forge, the combination of a receptacle provided with an electrode set in the wall thereof and provided with means for supporting the end of the bar to be heated, and an electrode set in an opposite wall and provided with an outwardly flaring eye.

3. In an electric forge, the combination of a receptacle provided with an electrode set in the wall thereof and having an inwardly flaring eye or socket, and an electrode set in an opposite wall and provided with an outwardly flaring eye or socket.

4. In an electric forge, the combination of an electric heating receptacle, an electrode therein adapted to receive and support one end of a bar to be heated, and a detachable electrode constituting a part of the wall of said box and provided with an outwardly flaring eye for supporting another part of the bar to be heated.

5. In an electric forge, the combination of an electric heating receptacle provided with an electrode to fit in the wall thereof and having a series of inwardly flaring eyes or sockets, and an electrode set in an opposite wall and provided with a series of outwardly flaring eyes or sockets.

6. In an electric forge, the combination of an inclosed body composed in part of insulating material and in part of copper the copper part constituting electrodes connected with opposite electric poles and being provided with eyes and sockets, and a transparent top surmounting said body.

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