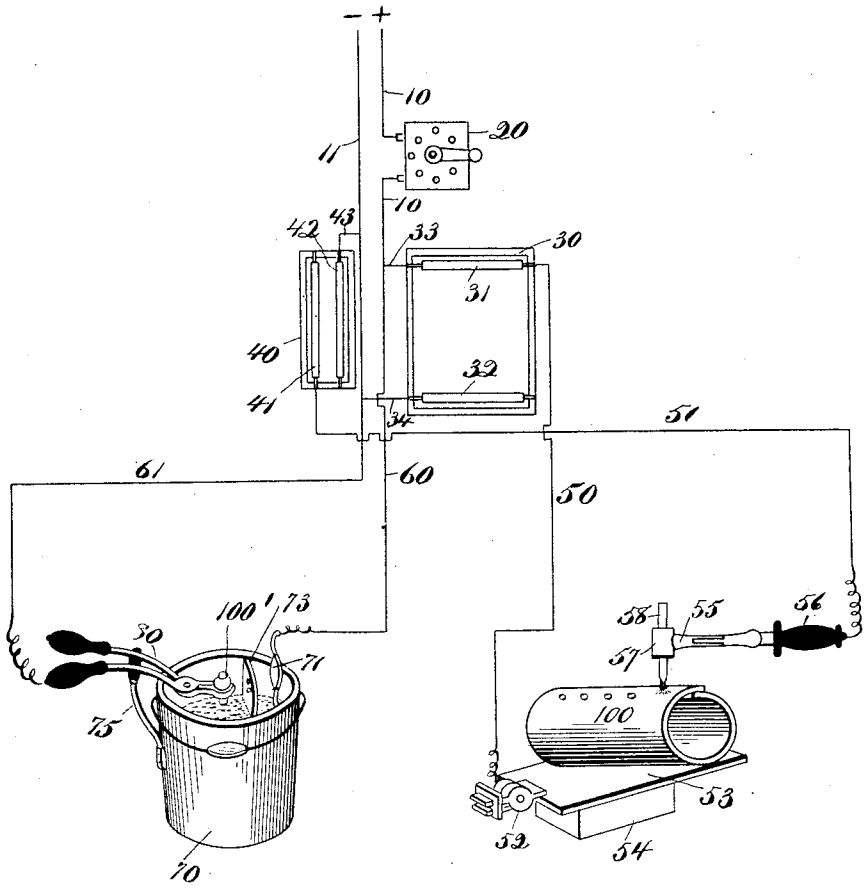
(No Model.)

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

ELECTRIC METAL HEATING APPARATUS.

No. 537,008. Patented Apr. 9, 1895.



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UNITED STATES PATENT OFFICE.

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ELECTRIC METAL-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 537,008, dated April 9, 1895.

Original application filed September 5, 1892, Serial No. 445,148. Divided and this application filed October 11, 1894. Serial No. 525,623. (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 Middlesex, in the State of Massachusetts, citizens of the United States of America, have invented certain new and useful Improvements in Electric Metal-Heating Apparatus, of which the following is a specification.

This invention relates to the heating of metal by electricity for forging, shaping, riveting or welding operations.

The invention consists in an apparatus as hereinafter described and claimed in which the working circuits are so arranged in connection with the main circuit and the resistance that the latter will be automatically cut out while the work is being heated and thrown in when the work is withdrawn, said resistance serving as a cushion to absorb the sudden shock incident to the removal of the work.

The accompanying drawing represents this improved electric metal heating apparatus partly in plan and partly in perspective.

The conductor 10 is connected with the positive pole of an electric converter, dynamo, storage battery or other suitable source of electricity, and the conductor 11 is connected with the negative pole of the same source, these conductors constituting the main circuit. A rheostat 20 may be disposed in the main circuit, a portion of the conductor 10 being broken out to receive it, or the rheostat may be dispensed with.

A high resistance tank 30 for containing a liquid resistance has a positive pole plate or terminal 31 suspended at one end and a negative pole plate or terminal 32 at the other end. The positive terminal 31 is connected with the positive conductor 10 of the main circuit by the wire 33, and the negative plate 32 is connected with the negative conductor 11 of the main circuit by a wire 34. The positive and negative plates may be composed of lead, or other suitable material, preferably such as will not decompose under the action of the current and liquid, and the resistance in the tank consists of water or other suitable liquid. We have used as a resistance liquid a weak solution of sal ammoniac, or a weak solution of soda.

A low resistance tank 40, for containing a liquid resistance, has suspended therein a positive plate or terminal 41 disposed at one side of the tank, and a negative plate or terminal 42 disposed at the opposite side of the tank, said plate 42 being connected by a conductor 43 with the negative conductor 11 of the main circuit. The positive and negative plates of this tank may be composed of lead or other suitable material, and the solution into which said plates depend is preferably composed of water with sufficient soda to bring its specific gravity to 1.080 at 60° Fahrenheit. Any other suitable liquid may be employed, the resistance of which is less than that of tank 30.

One of the work circuits of this apparatus comprises a wire 50 connected at one end with the positive plate 31 of the resistance tank 30, and a conductor 51 connected at one end with the negative plate 41 of the resistance tank 40. A work-holder is connected with the outer end of the conductor 50, and a carbon holder is connected with the outer end of the conductor 51. In the instance illustrated in the drawing, the work-holder comprises a clamp 52 and a work-plate 53 engaged by said clamp, said plate 53 resting on an insulated block or support 54.

The carbon holder 55 comprises an insulated handle 56 and a sleeve 57 in which a carbon pencil 58 is clamped. In this case the work is placed on a work-plate 53 and receives the current through said plate, delivering said current into the carbon pencil of the pencil holder through the arc formed between said pencil and the work. Another work circuit comprises a conductor 60 connected with the positive conductor 10 of the main circuit at the point where it connects with the conductor 33, and a conductor 61 connected with the negative conductor 11 of the main circuit at the point where the conductor 43 connects therewith. The outer end of the conductor 60 is connected with a positive plate 71 disposed in a work tank 70. This tank 70 contains a solution of equal parts of sal soda and cream of tartar of the specific gravity of

1.255 at 77° Fahrenheit, or a solution of any other suitable liquid may be employed, preferably a solution containing a chemical salt. The solution should be one, however, which is capable of developing hydrogen gas around the metal while being heated, either by the accumulation of the gas by decomposition of the fluid by electrolysis around the heating metal, or by the deposit of the hydrogen from the opposite electrode around it as the heating process is going on. This tank is provided with a vertical porous partition 73 which permits the passage of the electric current and protects the positive plate from contact with the work. The tank is also preferably provided at the side opposite the positive plate with a rest 75 for supporting the work tongs or clamps 80, said rest comprising a bar of insulated material attached by brackets to the side of the tank.

In the use of the working circuit at the right of the figure, the work, as 100, is placed in connection with the conductor 50 by means of the work plate 53 and clamp 52, or other suitable means, and the carbon holder 55 is so manipulated by the operator who grasps the handle thereof, as to bring the carbon pencil 58 in contact with the work for an instant, to complete the circuit. The holder is then moved so as to withdraw said carbon pencil a sufficient distance to establish the required voltaic arc between said pencil and the work. The current then passes from the positive conductor 10 through the conductor 33 to the positive plate 31, thence through the conductor 50 to the work-holder and the work, thence to the carbon pencil, forming a voltaic arc between said pencil and the work, thence through the carbon holder to the conductor 51, thence through said conductor to the positive plate 41 of the resistance tank 40, thence through the liquid in said tank to the negative plate 42, and thence through the conductor 43 to the negative conductor 11 of the main circuit. The carbon holder is manipulated by the operator so as to bring the arc to any desired point on the work. The rheostat 20 may be used for regulating the amount of current desired for the work. The tank 40 serves to absorb the electric shocks incident to the sudden breakage of the arc.

In heating metals requiring a high temperature, such as iron and steel, the polarity of the carbon and work-holders is as above described, but for zinc, copper and other metals which heat at a low temperature the current may be reversed, in which case the positive conductors become negative and the negative positive, and the carbon pencil becomes positive and the work-holder negative.

In using the working circuit at the left of the figure, the current passes from the positive conductor 10 through the conductor 60 to the positive plate 71 in the tank 70, thence into the solution in said tank and through the porous partition 73, thence from said solution to the work, as 100′, supported in the work-holder 80. In passing from the liquid to the work, an arc is formed below the level of the solution around said work, or the portion thereof to be heated. The current then passes through the work-holder and thence through the conductor 61 to the negative conductor 11 of the main circuit. The voltaic arc formed around the work tends to quickly heat said work, and when the forging temperature is reached the work-holder is withdrawn from the tank and the current is short-circuited through the tank 32 and conductor 34. The partition 73 in the working tank serves to prevent contact of the work or work-holder with the positive plate 71. The polarity may be reversed in this case if desired.

The tank 30 has sufficient resistance to keep up the required current pressure to operate the working circuit 60—61. When the current in said working circuit is broken this tank short circuits the current and absorbs the shock incident to the breakage of said working circuit.

The tank 40 disposed in the work circuit 50—51 serves as a primary cushion for said circuit during the working thereof, while the tank 30 serves as a secondary cushion for said circuit as a short circuiting device when the current of said circuit is broken. This arrangement and connection of the circuits avoids the use of two separate tanks of different resistances for each working circuit as is shown in our Patent No. 488,469 and yet secures the advantage of the double resistance tank for one of the working circuits.

This application is a division of our application, Serial No. 445,148, filed September 5, 1892.

We claim as our invention—

1. In an electric metal heating apparatus, the combination of the main circuit conductors, a resistance tank, as 30, whereof the positive and negative plates are respectively connected to said main circuit conductors, and a working circuit whereof one conductor is connected with one terminal of said resistance tank and the other conductor is connected with one of the main conductors.

2. In an electric metal heating apparatus, the combination of the main circuit conductors, a high resistance tank, as 30, whereof the positive and negative plates are respectively connected to said main circuit conductors, a working circuit whereof one conductor is connected with one terminal of said resistance tank and the other conductor is connected with one of the main conductors, and a low resistance tank, as 40, disposed in said working circuit.

3. In an electric metal heating apparatus, the combination of the main circuit conductors, a resistance tank, as 30, whereof the positive and negative plates are respectively connected to said main circuit conductors, two working circuits, one of the conductors of one of said circuits being connected with one of said main conductors, and the other with

one terminal of said tank, and the conductors of the other working circuit being connected directly with the main circuit conductors.

4. In an electric metal heating apparatus, the combination of two main conductors, a resistance tank, as 30, whereof the positive and negative plates are connected with said conductors, a second resistance tank, as 40, connected with the negative main conductor, a working circuit whereof the conductors are connected with the positive plates of said tanks, and a working circuit whereof the conductors are connected directly with the main conductors.

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