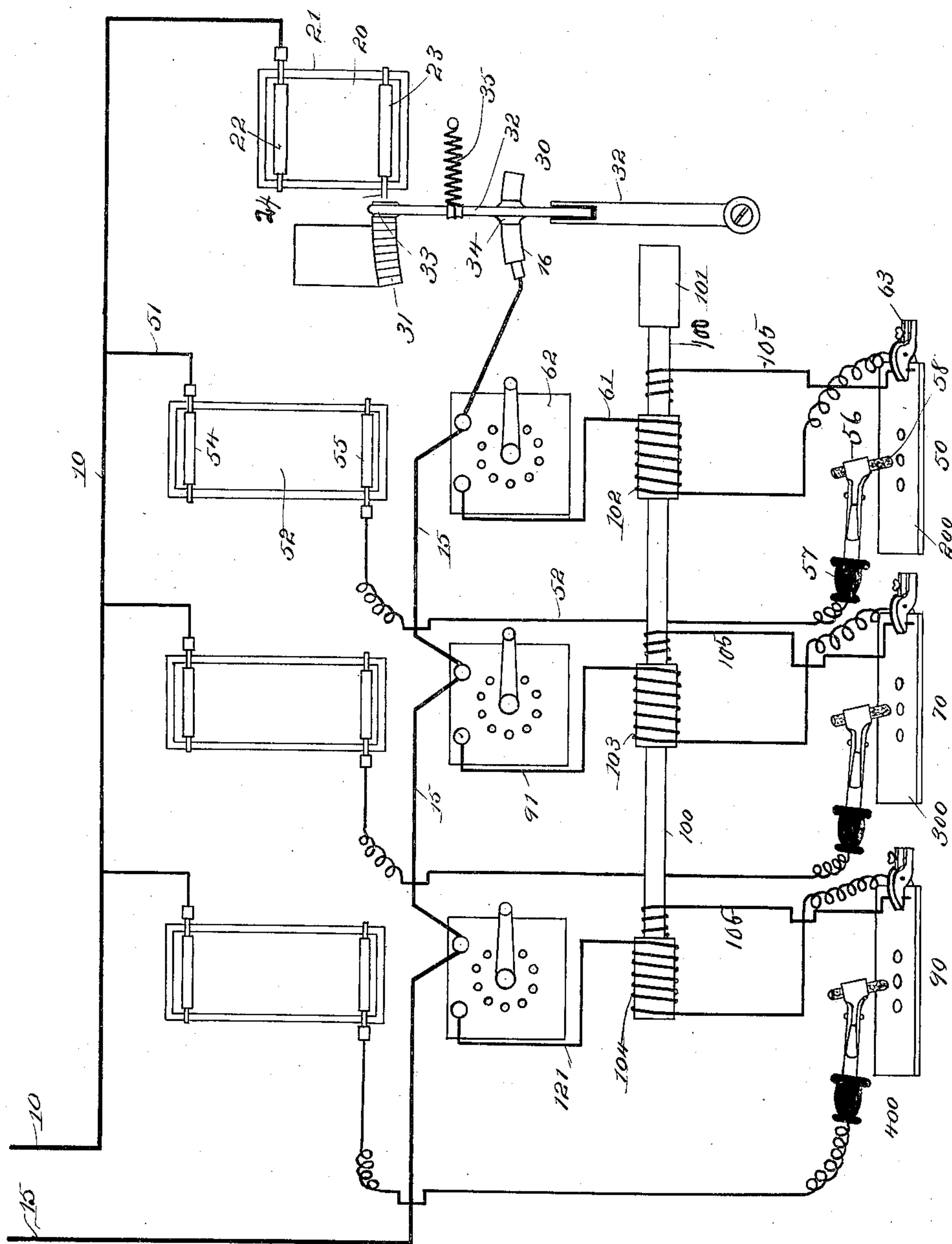


(No Model.)

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ELECTRIC METAL WORKING APPARATUS.

No. 488,468.

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# UNITED STATES PATENT OFFICE.

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## ELECTRIC METAL-WORKING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 488,468, dated December 20, 1892.

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*To all whom it may concern:*

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

This invention relates to the heating of metals for forging or welding purposes by means of the electric arc.

The object of the invention is to provide means for conveniently utilizing one main circuit for different metal heating arcs and automatically regulating the current to conform to the number of such arcs in use.

The drawing represents a plan view of this improved electric arc metal working apparatus.

The apparatus comprises a main circuit and several branch working circuits connected in parallel with the main circuit and completed by the work to be heated.

The wires 10 and 15 are the main circuit wires which are connected with an electric converter, a dynamo, a storage battery or other suitable source of electricity. A resistance 20 is placed in the main circuit for throwing the current into the branch working circuits, the outer ends of the wires 10 and 15 being connected with said resistance. The resistance 20 is shown in the drawing in the form of a tank 21 containing an electrolytic solution, and anode and cathode plates 22 and 23, the wire 10 being connected with the plate 23. An automatic variable resistance 30 is interposed in the main circuit and serves to regulate the current to correspond to the number of arcs in use. This variable resistance, when constructed as shown in the drawing, comprises a series of resistance coils 31, connected by the wire 24 with the plate 23 of the resistance tank 21, a horizontally swinging lever 32 carrying a contact brush 33 at its outer end for contact with said coils and an

intermediate contact brush 34, a plate 16 on which the intermediate contact brush bears, and a spring 35 for retracting said lever to its normal position. The lever 32 is composed of two parts insulated from each other, the inner portion being composed of magnetic metal and the outer end being composed of conductive material. The contact brush 34 may be in the form of an anti-friction roller which traverses the plate 16 when the lever is swung from left to right or vice versa. The outer end of the main circuit wire 15 is connected with the plate 16, and said plate serves as a conductor for passing the current from said lever to said circuit wire.

The working branch circuits 50, 70 and 90 are connected in multiple arc with the main circuit. The working branch circuit 50 comprises a wire 51 connected with the main circuit wire 10 a wire 52 connected with the wire 51, a resistance being interposed between said wires 51 and 52 in the form of an electrolytic tank 53 having terminal anode and cathode plates, 54 and 55, the outer end of wire 51 being connected to the plate 54 and the inner end of wire 52 being connected with the plate 55. The outer end of the wire 52 is provided with a carbon pencil holder 56 having an insulated handle 57 and carrying a carbon pencil 58. The other side of the working circuit 50 comprises a wire 61 which is connected with the other main circuit wire 15, preferably by means of a rheostat 62. The outer end of the wire 61 is provided with a clamp 63 for holding, clamping or forming contact with the metal plate or article to be heated. The other working circuits are of similar construction to the circuit 50.

An electro-magnet for automatically actuating the variable resistance 30 is common to the several working circuits and consists of a soft iron bar 100 provided with an enlarged head 101 at one end disposed adjacent to the swinging lever 32 of said variable resistance 30, and coils 102, 103 and 104 wound about said bar and formed from the wires 61, 91 and 121 of the several working circuits.



In the use of this improved arc heating apparatus, the work to which heat is applied, as for instance, plates 200, 300 and 400 are placed in their respective clamps or holders, as 61 of the several working circuits and the insulated handles as 57 are grasped by the operators and the carbon pencils of said holders are brought in contact with said plates whereby the circuits are completed, and then said pencils are lifted from contact with the plates whereby electric arcs are formed. The holder carrying the carbon pencil may be moved about on the plate to the point or points where the heat is desired. When the heating is completed the holder is lifted whereby the pencil is withdrawn, the circuit broken and the arc destroyed. A soft iron wire as 105 is connected at one end to the bar 100 of the electro-magnet and at the other end to the work disposed in the given circuit, whereby the metal to be worked is somewhat magnetized. This magnetization of the work causes a steady and unbroken arc. The current of the main circuit flows through the resistance 20 when no arc is established in either working circuit, and when one or more of the working circuits are in use, only a portion of the current passes through said resistance. As soon as an arc is established in either of the working circuits, the bar 100 becomes magnetized and pulls over the lever 32 of the variable resistance 30 whereby the brush 33 at the outer end of said lever moves over the resistance coil 31 and throws a greater number thereof in circuit with the main circuit, increasing the resistance thereof to correspond with the work being done.

A rheostat as 62 in the working circuit may be manipulated by the operator to throw more or less current into the given working circuit according to the amount required for the work being done.

The resistance tanks, as 53, disposed in the working circuits avoid a metallic circuit back to the machine, the liquid serving as a cushion to absorb sudden shocks or impulses of the current when the load is suddenly applied or removed, whereby sparking at the dynamo or other source of electrical energy is prevented. The liquid may consist of water, or water with sal-ammoniac or other soluble salts, which will lessen somewhat the resistance of the water.

We claim as our invention:

1. In an electric metal working apparatus, the combination of a main circuit, a variable resistance disposed in said circuit, a branch working circuit connected with said main circuit, one terminal of said working circuit being provided with a work holder and the other terminal with a movable holder having an insulated handle, and carrying a carbon pencil, and an electro-magnet the core of which is disposed in proximity to said variable resistance for actuating the latter, the coil of said

magnet being formed from one of the wires of the working circuit.

2. In an electric metal working apparatus, the combination of a main circuit, a variable resistance disposed in said circuit, a branch working circuit connected with said main circuit, one terminal of said working circuit being provided with a work holder, and the other terminal with a movable holder having an insulated handle and carrying a carbon pencil, and an electro-magnet the core of which is disposed in proximity to said variable resistance for actuating the latter, the coil of said magnet being formed from one of the wires of the working circuit, and a wire connecting the core of said magnet with the work.

3. In an electric arc metal working apparatus, the combination of a main circuit, a branch working circuit connected with said main circuit, the terminals of said branch circuit being provided respectively with a carbon holder and a work holder, a variable resistance in the main circuit comprising a series of resistance coils, a pivoted lever provided with a brush for contact with said coils, a plate connected with one of the wires of the main circuit, a brush on said lever in contact with said plate, and a spring for retracting said lever, and an electro-magnet, the core of which is disposed in proximity to said lever for actuating it, the coil of said magnet being formed from one of the wires of the working circuit.

4. In an electric arc metal working apparatus, the combination of a main circuit, two or more branch working circuits connected therewith, the terminals of each branch circuit being provided respectively with carbon and work holders, a variable resistance in said main circuit, and an electro-magnet the core of which is common to said working circuits, one end thereof being disposed in proximity to said variable resistance, and the cores of said magnet being formed from the wires of said working circuits.

5. In an electric arc metal working apparatus, the combination of a main circuit, two or more branch working circuits connected therewith, the terminals of each branch circuit being provided respectively with carbon and work holders, a variable resistance in said main circuit, and an electro-magnet the core of which is common to said working circuits, one end thereof being disposed in proximity to said variable resistance, and the coil of said magnet being formed from the wires of said working circuits, and rheostats disposed in said working circuits.

6. In an electric arc metal working apparatus, the combination of a main circuit, a working circuit connected therewith, the terminals of said working circuit being provided with carbon and work holders respectively, a resistance tank in said working circuit, a vari-



able resistance tank in the main circuit, and an electro-magnet for actuating said variable resistance operated by the working circuit.

5 7. In an electric arc metal working apparatus, the combination of a working circuit having a conductor adapted for connection with the metal to be heated or worked, a conductor provided with a movable terminal for forming an electric arc in connection with said  
10 work, and a liquid resistance disposed in said working circuit and serving as a cushion for

the current on the formation and cessation of the arc.

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