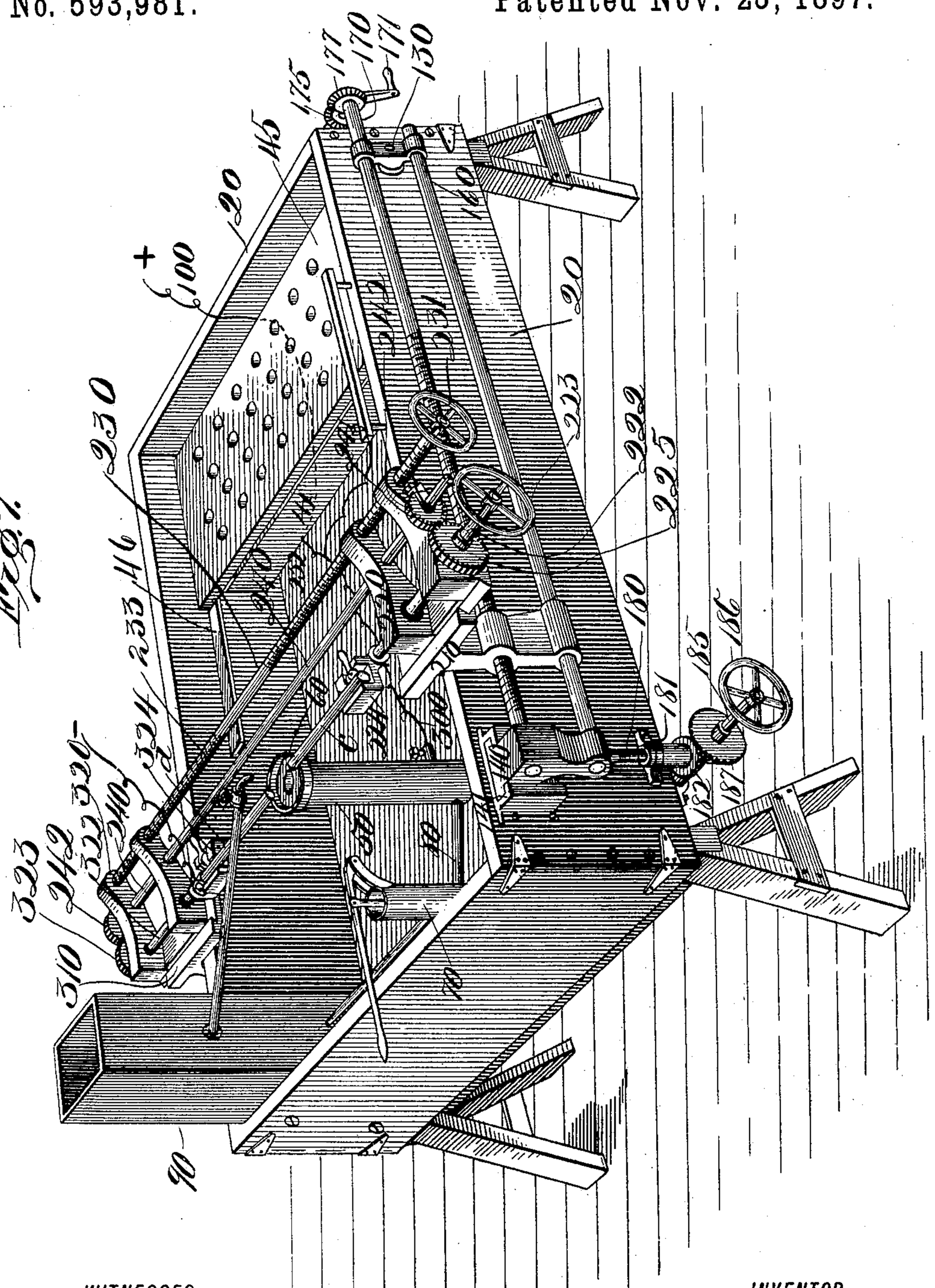
(No Model.) 4 Sheets—Sheet 1.

G. D. BURTON.

APPARATUS FOR ELECTRICALLY HEATING METALS AND ORES.

No. 593,981. Patented Nov. 23, 1897.

Fig. 1.



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No. 593,981. Patented Nov. 23, 1897.

Fig. 2.

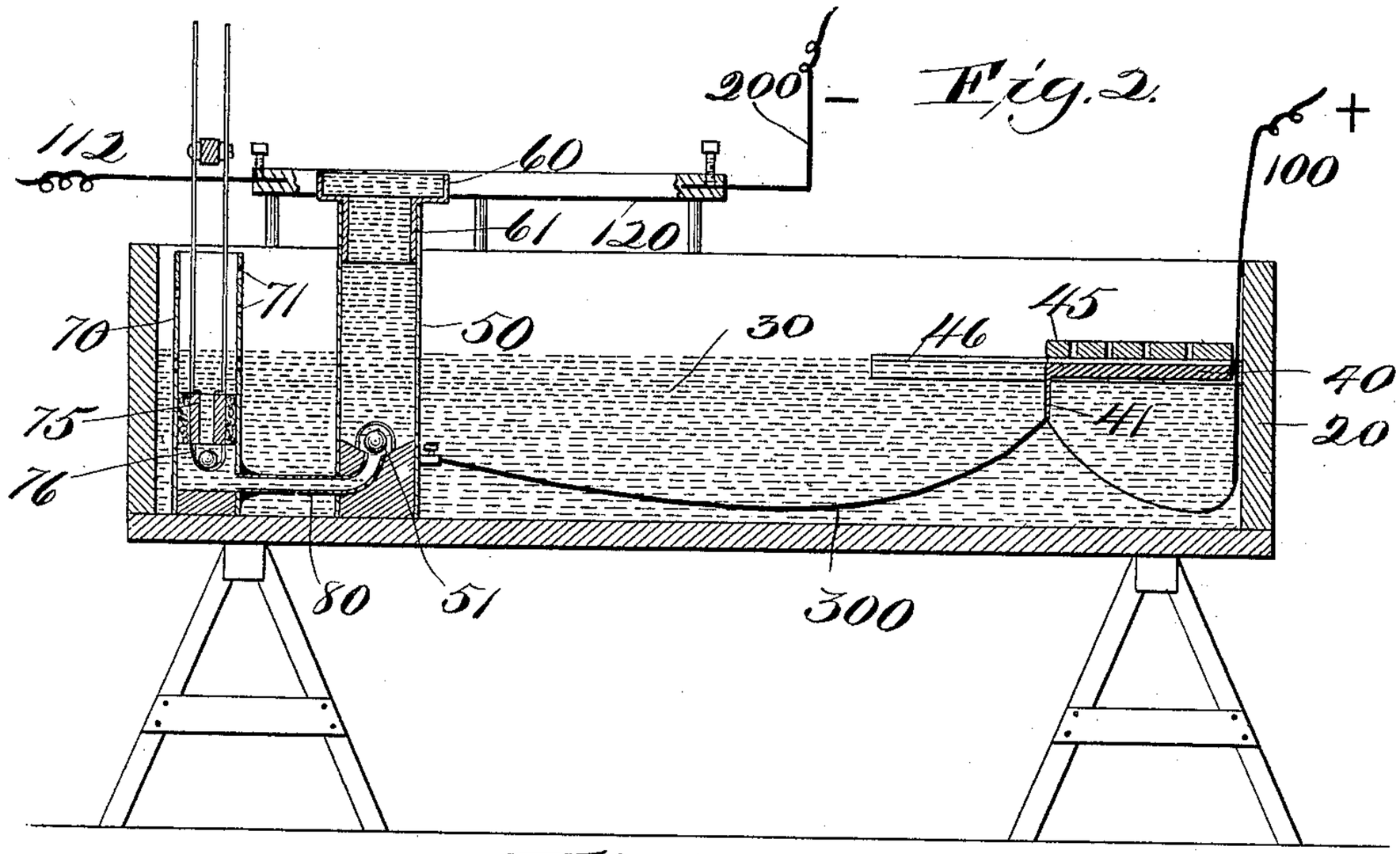
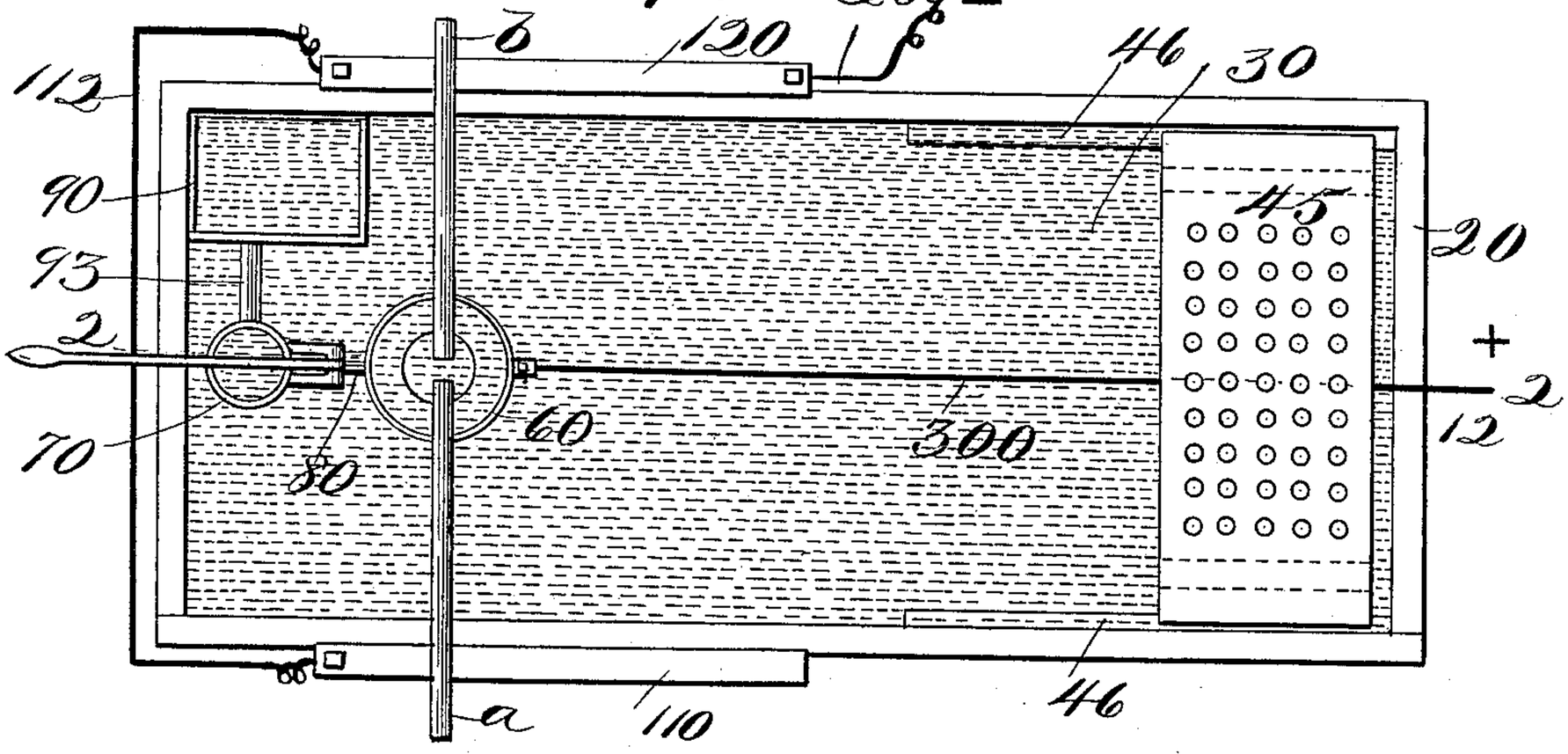


Fig. 3.



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APPARATUS FOR ELECTRICALLY HEATING METALS AND ORES.

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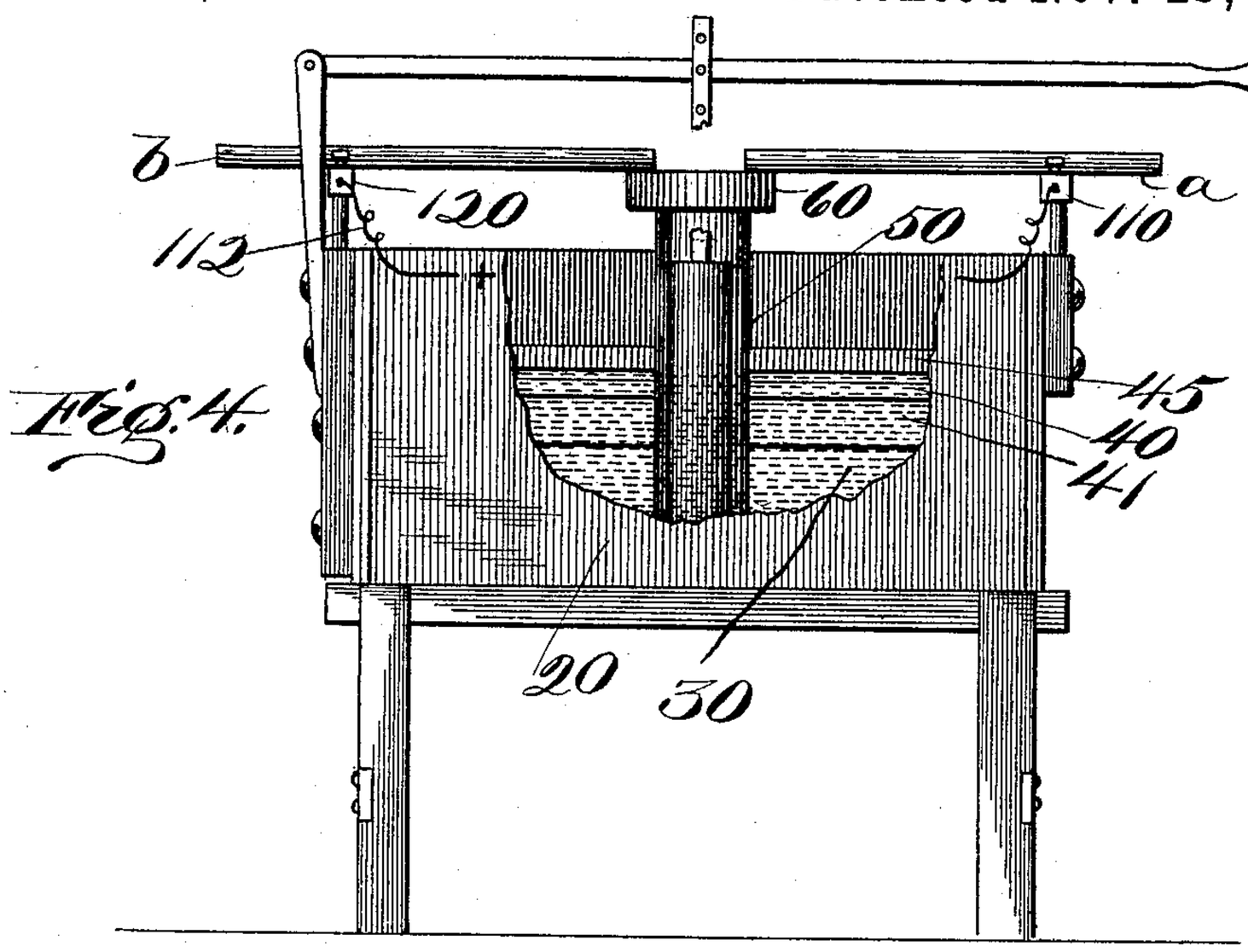

Fig. 4.

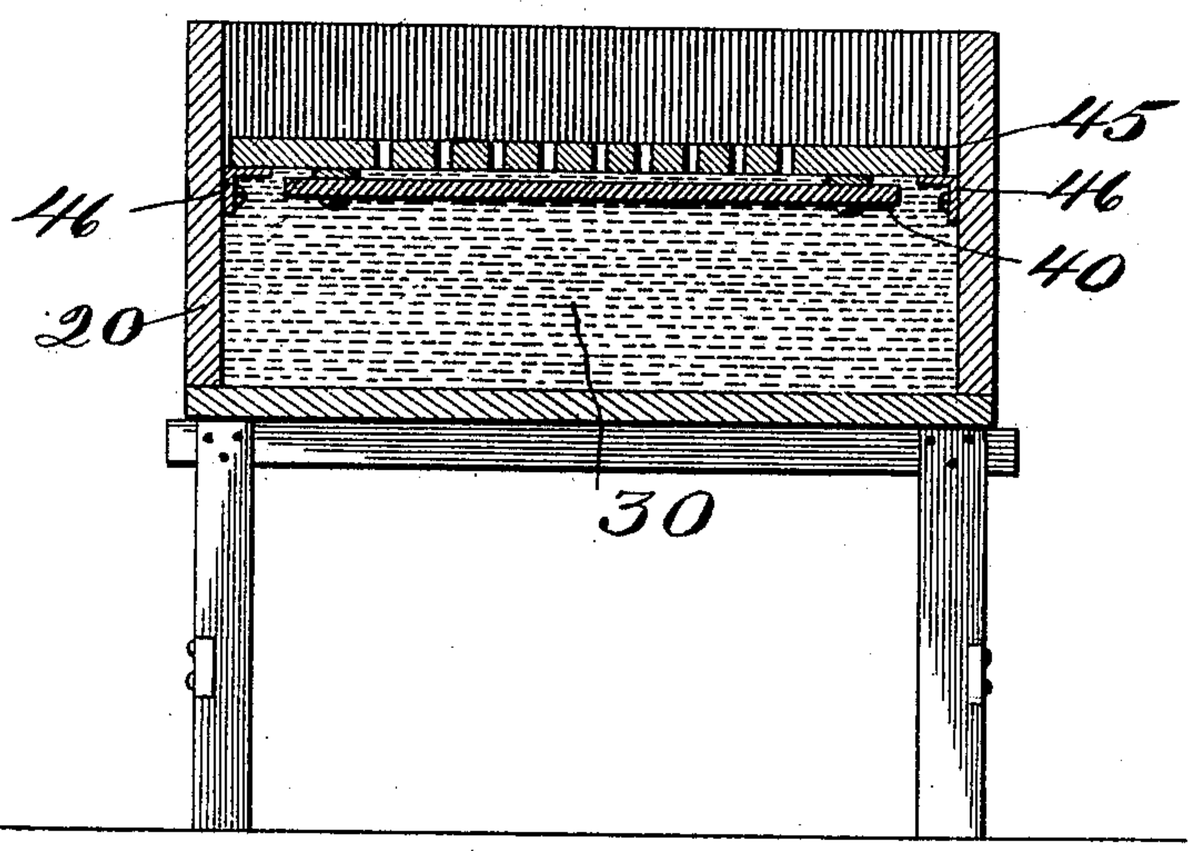

Fig. 5.

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APPARATUS FOR ELECTRICALLY HEATING METALS AND ORES.

No. 593,981. Patented Nov. 23, 1897.

Fig. 6.

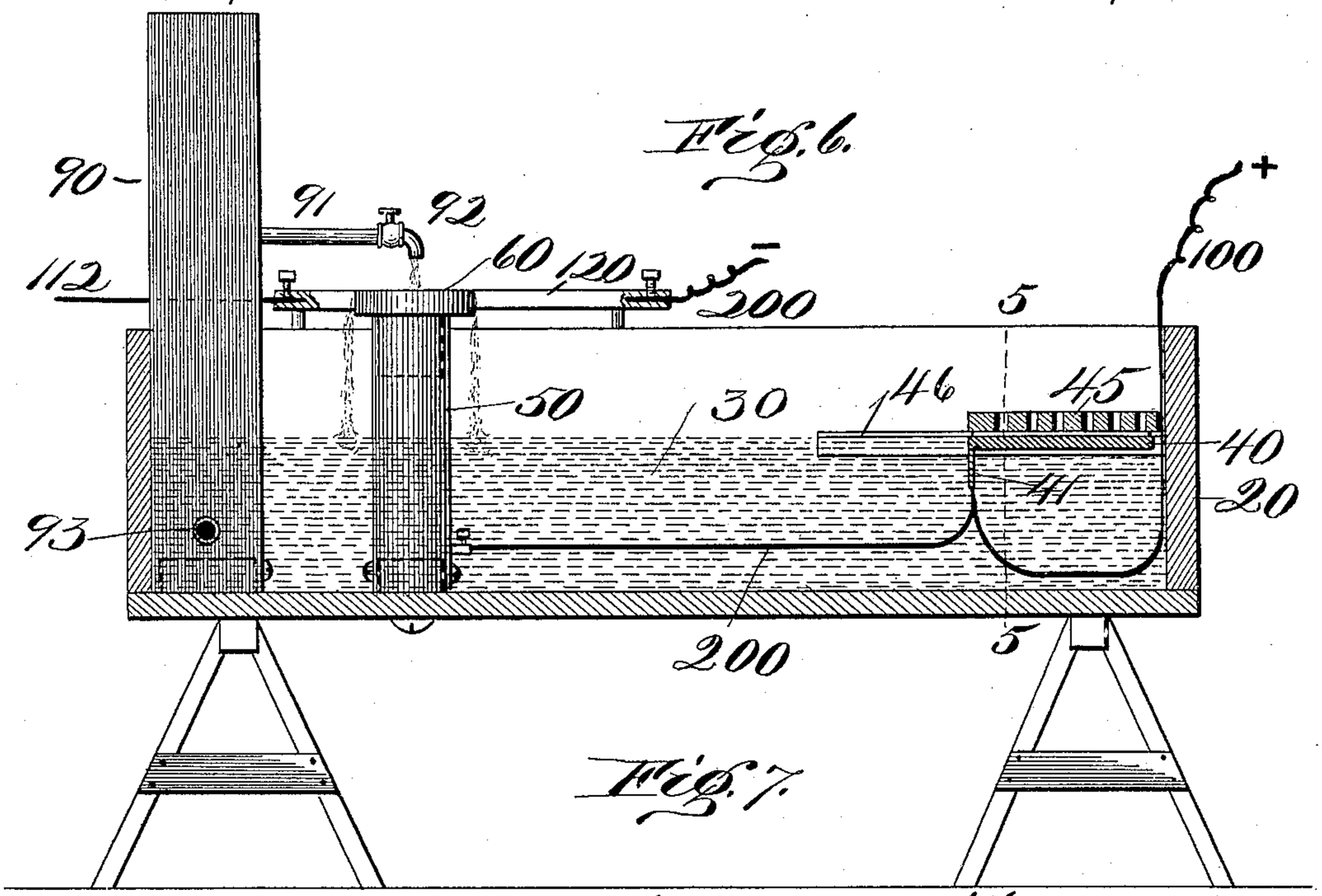
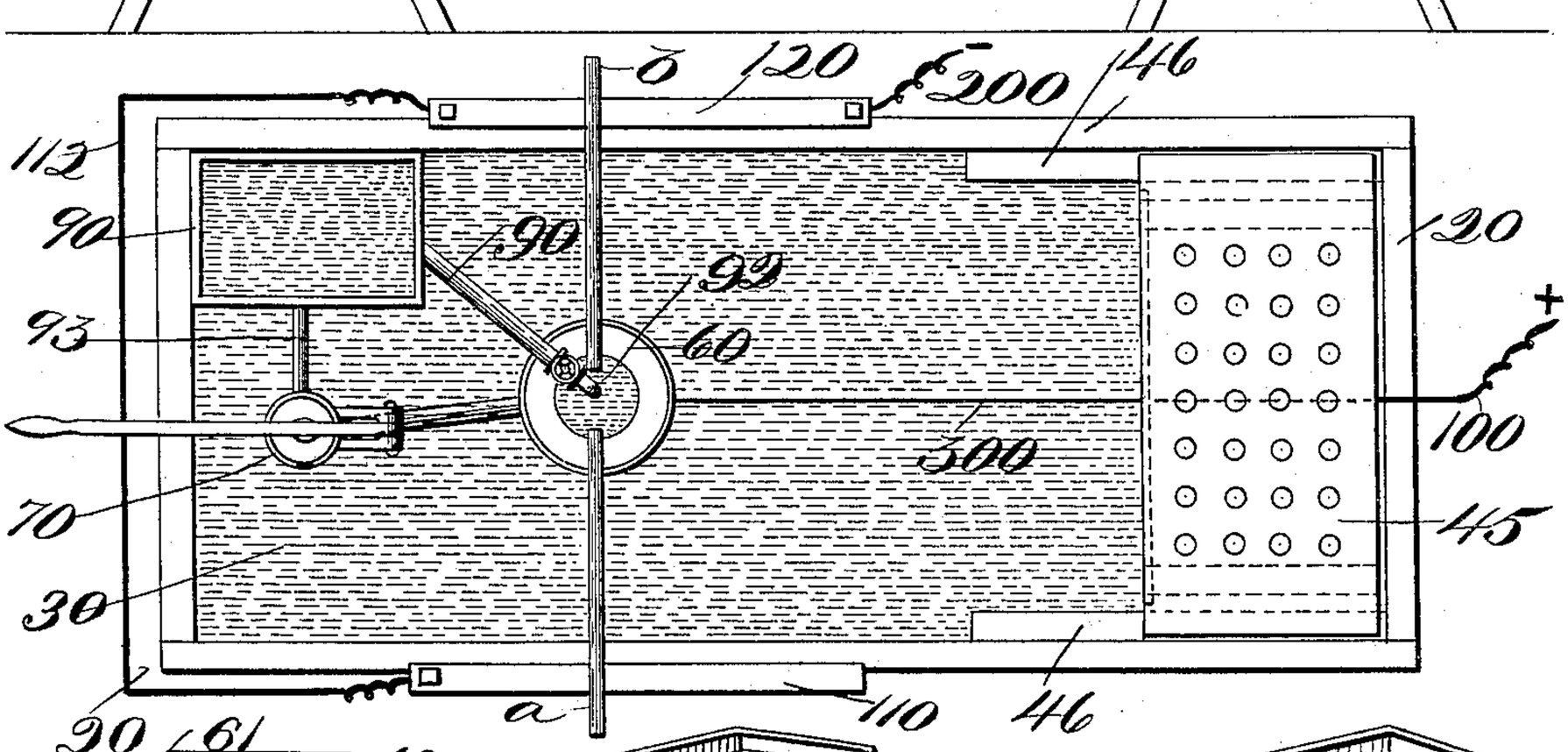


Fig. 7.



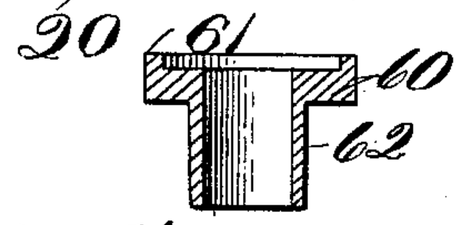


Fig. 8.

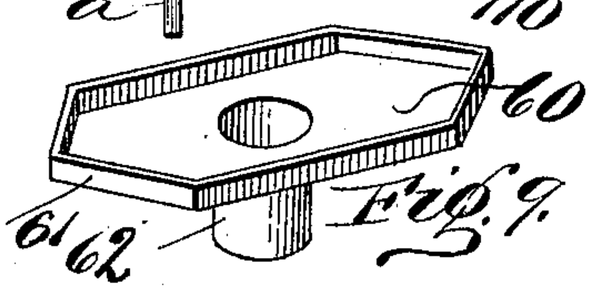


Fig. 9.

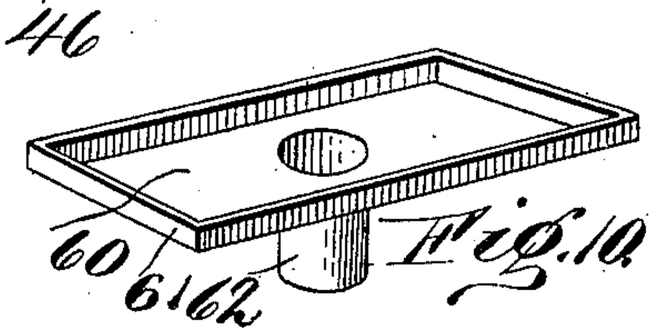
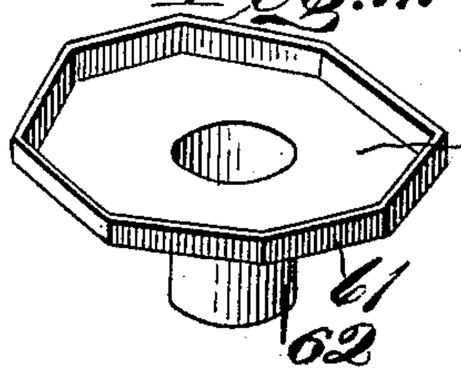


Fig. 10.

Fig. 11.



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UNITED STATES PATENT OFFICE.

GEORGE D. BURTON, OF BOSTON, MASSACHUSETTS.

APPARATUS FOR ELECTRICALLY HEATING METALS AND ORES.

SPECIFICATION forming part of Letters Patent No. 593,981, dated November 23, 1897.

Application filed February 20, 1897. Serial No. 624,286. (No model.)

To all whom it may concern:

Be it known that I, GEORGE DEXTER BURTON, a citizen of the United States of America, residing at Boston, in the county of Suffolk, in the State of Massachusetts, have invented certain new and useful Improvements in Apparatus for Electrically Heating Metals and Ores, of which the following is a specification.

This invention relates to an apparatus for heating metals to a fusing-point or to a working heat and for smelting ores by means of an electric or voltaic arc formed between the ores or metal and an electrolytic bath.

The objects of the invention are to provide a simple, cheap, and convenient apparatus adapted for heating in various ways various forms and shapes of material to be heated by this means.

The invention consists in certain novel features of construction and combination of elements hereinafter set forth and claimed.

Figure 1 of the accompanying drawings represents a perspective view of an apparatus embracing this invention. Fig. 2 represents a longitudinal section of such an apparatus on line 2 2 of Fig. 3, omitting certain parts shown in Fig. 1. Fig. 3 represents a plan of the apparatus shown in Fig. 2. Fig. 4 represents an end elevation of one form of the apparatus, a part of the end wall being broken off. Fig. 5 represents a transverse section of an apparatus on line 5 5 of Fig. 6. Fig. 6 represents a longitudinal section of one form of the apparatus. Fig. 7 represents a plan view thereof. Fig. 8 represents a vertical section of a detachable hearth forming a part of the apparatus. Figs. 9, 10, and 11 represent different forms of detachable hearths.

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

This apparatus comprises a vessel 20 for containing an electrolytic solution 30. This vessel, preferably in the form of a tank, is constructed of or lined with material which is a non-conductor of electricity. It is preferably composed of wood or papier-mâché.

An electrolytic bath 30 is disposed in the tank 20 and partially fills said tank. This bath consists of any suitable electrolyte, being one which will cause, with the electric current under proper conditions, the formation of a voltaic arc between the metal to be heated and the liquid. The electrolyte should have a specific gravity greater than that of water and may consist of an acid or an alkaline solution, preferably the latter. A solution of sal-soda of a specific gravity of 1.105 at 78° Fahrenheit answers the purpose; also, a solution of equal parts of sal-soda and cream of tartar of a specific gravity of 1.255 at 77° Fahrenheit; also, a solution composed of water, carbonate of soda, borax, and chlorid of sodium in the proportions of ten gallons of water to two pounds of carbonate of soda to one pound of borax and one pound of chlorid of sodium.

An anode-plate 40 is disposed in the tank and has a contact-surface with the liquid much greater than the area of contact of the article to be heated. This plate is composed of lead, copper, carbon, or other suitable conductive material, preferably connected to a non-conductive plate or support 45, which protects it from contact with the metal to be heated. This protective plate or support 45 is perforated to permit the flow of the liquid. The compound plate or bed thus formed is adapted to slide on ways 46 on the sides of the tank. The plate 40 is provided with a dependent flange 41, and a positive wire or conductor 100 connects said plate with the positive pole of the electric source.

A barrel 50 is disposed in the tank and extends above the surface of the solution 30 and above the edges of the tank. This barrel is preferably composed of lead or some good conductor of electricity and is connected by a wire 300 or otherwise with the positive pole, the connection in the illustration shown being through the liquid to the flange 41 of the anode-plate, then to the electric source.

A hearth 60, constructed of fire-clay or vitrified tile or other non-conducting material, is mounted at the top of the barrel 50. This hearth has a rim 61 around its edge and forms a shallow pan provided with a dependent tube 62, adapted to fit into the top of the barrel 50, said tube opening at its top into the said pan. This tube prevents any molten particles of metal which may be formed from coming in contact with the barrel and injuring it. This hearth is made in different forms, as indicated in Figs. 8 to 11, whereby it is adapted to different lengths or sizes of blanks to be

heated. One hearth may readily be detached from the barrel and replaced by another.

Any suitable means are provided for raising the level of the solution in the barrel, so as to cause it to overflow the hearth. The means shown in Fig. 2 consist of a pump 70 and a pipe 80, connecting said pump with said barrel. The barrel of the pump 70 is provided with perforations 71, which open into the solution. When the pump-piston is operated, the liquid is forced from the pump-barrel through the pipe 80 into the hearth-barrel 50, a valve 51 being provided in the hearth-barrel to prevent the backflow of the liquid. The piston 75 of the pump 70 is provided with a valve 76, which prevents the liquid rising through the piston on its downward stroke. Another means of elevating the liquid in the hearth-barrel is shown in Figs. 6 and 7. This means consists of a reservoir 90, extending or disposed above the tank and having a liquid-level above the hearth-barrel. This reservoir is provided with a discharge-pipe 91, having a faucet 92 disposed over the hearth-barrel. The solution may be elevated in the reservoir 90 through a pipe 93, connected with the pump 70.

A terminal 110 in the form of a bar composed of copper or other suitable conductive material is supported at the front edge of the tank in insulated studs, and another terminal 120 of similar form and construction is preferably disposed on the opposite side of the tank, at the upper edge thereof, as shown in Figs. 3 and 7. Both of these terminals are connected to the negative pole of the electric source. In the construction shown the terminal 120 is connected by a wire 300 with said source, and the terminal 110 is connected with said source through the terminal 120 by means of a wire 112, connecting said terminals. These terminals are preferably beveled and serve as rests on which a tool or implement for grasping the article to be heated may form contact for closing the circuit, or bars to be heated may rest directly on said terminals or either of them.

In the construction shown in Fig. 1 a fixed bracket 130 is attached to the front of the tank, near one end, and a vertically-sliding bracket 140 is adapted to move in a vertical way 141 on the side of the tank, near its other end. A rod 160 is supported at one end in the vertically-movable bracket 140 and at the other end in the fixed bracket 130, and a screw-rod 170 is supported at its opposite ends in said brackets and provided with a crank 171 at its outer end. A vertical screw-rod 180 is guided in an eye 181, attached to the side of the tank, and connected at its other end with the vertically-sliding bracket 140 and provided at its lower end with a beveled pinion 182 or other means whereby it may be rotated to elevate or depress the bracket 140. The tank is provided with similar mechanism on its opposite side. A longitudinally-traveling carriage 210 is supported on the rods 160 and 170 on the front side of the tank, and a similar traveling carriage 310 is supported on the corresponding rods on the opposite side of the tank. When the screw-rod 170 is rotated, the traveling carriage 210 at the front side of the tank is shifted in either direction longitudinally of the tank, according to the direction of rotation of said rod, and the traveling carriage on the opposite side of the tank is correspondingly moved in a similar manner. The screw-rod 170 is provided with a beveled gear 177, which meshes with a beveled gear 175, attached to a rod connected with the rods on the rear side of the tank, so that both screw-rods are turned and both traveling carriages moved simultaneously. A screw-rod 185, having a hand-wheel 186 and a beveled pinion 187, meshing with the beveled pinion 182 of the screw-rod 180, is connected with corresponding mechanism on the rear side of the tank, and this screw-rod serves for elevating and depressing the vertically-sliding bracket 140 and its corresponding bracket on the rear of the tank.

The traveling carriage 210 has a bed-plate on which a laterally-sliding carrier 220 is movable, and the rear traveling carriage 310 has a similar laterally-sliding carrier 320. A screw-rod 230, having a hand-wheel 231 and reversed screw-threads 232 and 233 near its opposite ends, engages the carriers 220 and 320 and when rotated moves said carriers toward and from each other. The laterally-sliding carrier 220 has a rod 222, provided with a hand-wheel 223 at its outer end and extending over the solution in the tank, being provided at its inner end with a metal-clamp 224. This rod is adapted to turn in its bearings and is insulated therefrom. The laterally-sliding carrier 320 has a similar inwardly-projecting rod 322, provided at its outer end with a pinion 323 and at its inner end with a metal-clamp 324. A rod 240 is journaled at its opposite ends in the carriers 220 and 320 and provided at its opposite ends with gears 241 and 242. A gear 225 on the rod 222 meshes with the gear 241 on the rod 240, and the rotary motion of the rod 222 is thus communicated to the rod 240 and thence through the gears 242 and 225 to the rod 322. The clamp metal-holder 224 is connected with the negative pole.

In the use of the apparatus, as shown in Figs. 2 to 7, a bar of metal—*a*, for instance—is rested at its outer end on the electrode 110 and at its inner end on the hearth 60, and a similar bar *b* may have its inner end resting on the hearth 60 and its outer end on the terminal 120. Then the solution is elevated in the barrel 50 into the hearth and into electric contact with the bars *a* and *b* over said hearth, electric arcs being formed between the solution in the hearth and those portions of the bars overlying the hearth. The inner portions of the bars are thus quickly heated to the desired working heat. Or a bar of metal touching either or both of the electrodes

110 and 120 may have any part of its length disposed over the hearth 60 and in electric-arc connection with the liquid therein, and the part between the opposite rims or flanges of the hearth will be heated, or the bar may be passed gradually over the hearth while connected with the negative pole and be heated successively throughout any desired portion of its length, the extension of the barrel and elevation of the hearth above the sides of the tank permitting this to be done. Metal bars may be held in the hand or in clamps and rested on the terminals 110 or 120 and their inner ends projected near the surface of the liquid, whereby said ends will be heated, as described in patents heretofore granted to me.

In the use of the apparatus, as shown in Fig. 1, bars, as *c* and *d*, may be adjusted in the clamps 224 and 324, said bars having their inner ends resting on the hearth 60. The liquid being raised into said hearth, an electric arc is formed between it and that portion of the bar which projects over the rim 61 of the hearth. When the ends are heated to a welding heat, by turning the hand-wheel 231 the laterally-sliding carriers may be moved toward each other and the heated inner ends of the bars *c* and *d* brought into contact and subjected to pressure and a welding operation takes place, whereby a weld is formed between said ends. By these means on one side of the tank a single long piece may be fed across the tank and hearth and heated at any point along its length or throughout its length, as desired. The heating takes place over that part of the bar only which is between the opposite portions of the flange or rim of the hearth, and various lengths may be heated separately in different parts of the irregular-shaped hearth.

I claim as my invention—

1. In an electric metal-heating apparatus, the combination of a hearth, an electrolytic solution therein, holders for holding blanks to be heated on said hearths, and means for pressing said blanks together, said blanks being connected with one electric pole and the liquid with the other.

2. In a metal-heating apparatus, the combination of a tank for an electrolytic liquid, a receptacle in said tank, a detachable hearth surmounting said receptacle and above the level of the solution in the tank, and means for elevating said liquid from said receptacle so that it will overflow onto said hearth.

3. In an electrolytic metal-heating apparatus, the combination of a receptacle composed of a conductive metal and adapted to contain an electrolytic liquid, a detachable hearth in the form of a shallow pan surmounting said receptacle, and means for elevating said liquid into said hearth.

4. In an electrolytic heating apparatus, the combination of a receptacle composed of a conductive metal adapted to contain an electrolytic liquid, a hearth surmounting said receptacle and provided with a dependent tube which shuts into said receptacle and protects it, and means for elevating said liquid into said hearth.

5. In a metal-heating apparatus, the combination of a tank for containing an electrolytic solution, and an anode consisting of two united plates, a conductive plate and a perforated non-conductive protective plate.

6. In a metal-heating apparatus, the combination of a tank for containing an electrolytic solution, a detachable hearth in the form of a shallow pan elevated above the plane of the sides of the tank, and means for elevating the liquid from the solution in the tank onto said hearth.

7. In a metal-heating apparatus, the combination of a tank for containing an electrolytic solution, a detachable hearth in the form of a shallow pan elevated above the plane of the sides of the tank, means for elevating the liquid from the solution in the tank onto said hearth, and mechanical means for holding the metal to be heated over said hearth.

8. In a metal-heating apparatus, the combination of a tank for containing an electrolytic solution, a detachable hearth in the form of a shallow pan elevated above the plane of the sides of the tank, means for elevating the liquid from the solution in the tank onto said hearth, mechanical means for holding the metal to be heated over said hearth, and means for adjusting said holder.

9. In an electric metal-heating apparatus, the combination of a receptacle for an electrolytic solution, a detachable hearth in the form of a shallow pan disposed above the sides of said receptacle, means for elevating a liquid onto said hearth, holders for holding blanks to be heated on said hearth, and means for pressing said blanks together, said blanks being connected with one electric pole, and the liquid with the other.

10. In an electric metal-heating apparatus, the combination of a receptacle for the electrolytic solution, a detachable hearth in the form of a shallow pan on a plane above the sides of said receptacle, means for elevating said liquid from said receptacle so that it will flow onto said hearth, and means for governing the quantity of liquid conducted from the receptacle to said hearth.

11. In a metal-heating apparatus, the combination of a tank for containing an electrolytic solution, a hearth elevated above the plane of the sides of the tank, a reservoir elevated above the hearth, means for elevating the liquid from the solution in the tank into said reservoir, and means for supplying an electrolytic solution to said hearth from said reservoir.

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