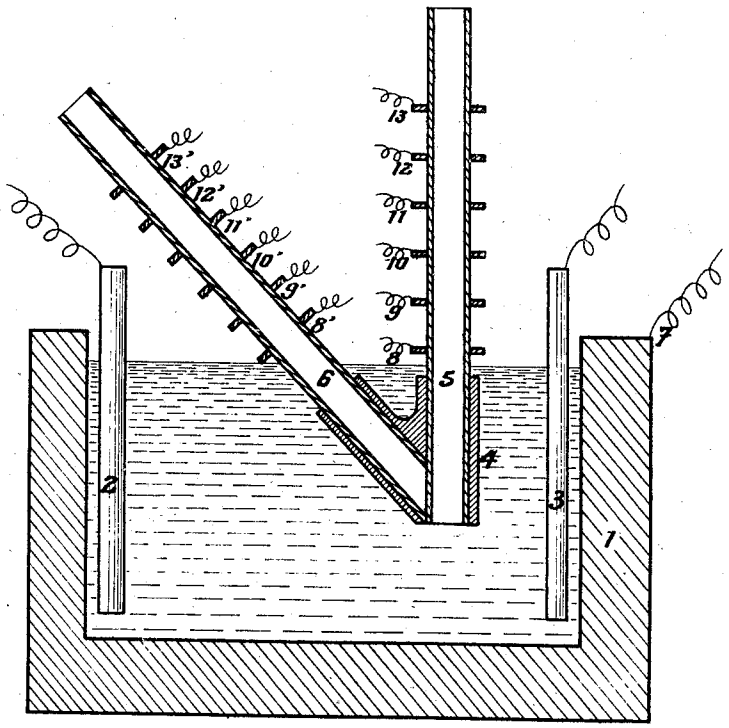
Jan. 3, 1928. 1,654,910

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PROCESS FOR TREATING ARTICLES IN METALLIC BATHS

Filed Oct. 28. 1925 2 Sheets-Sheet 1

Fig. 1



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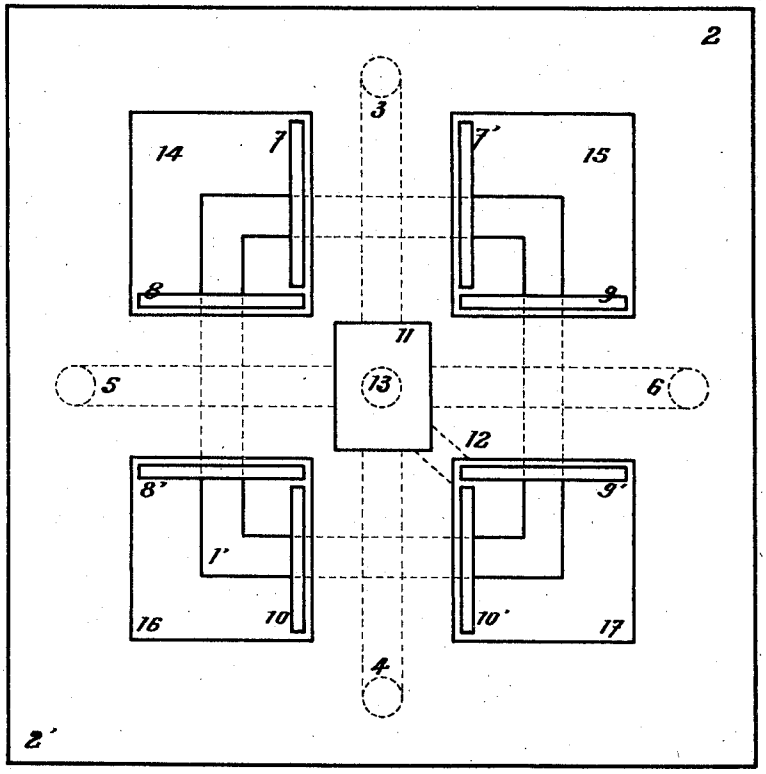
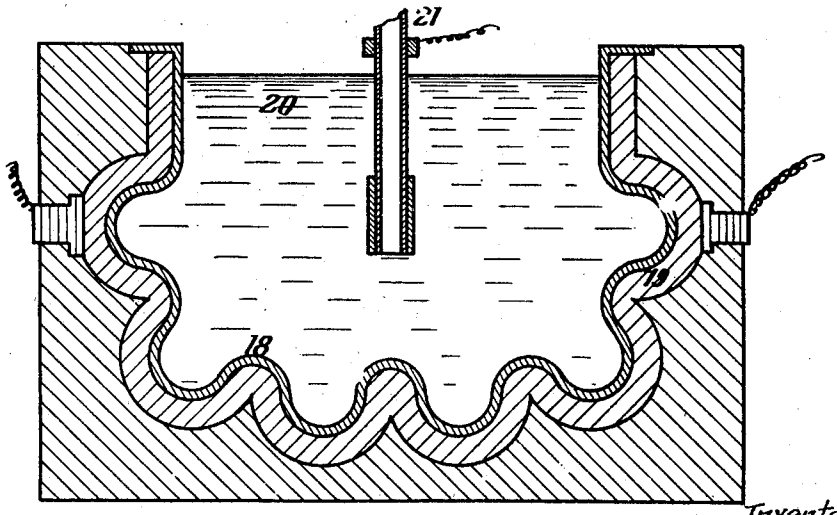


Fig. 2.

Fig. 3



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UNITED STATES PATENT OFFICE.

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PROCESS FOR TREATING ARTICLES IN METALLIC BATHS.

Application filed October 28, 1925, Serial No. 65,407, and in France October 31, 1924.

This invention relates to processes for applying metal to articles by treatment in a metallic bath.

The invention consists in the application to tinning, coppering, brazing, zincing, gilding, silvering and the like, by immersion in a bath in fusion, as well as to electro-thermic operations generally, of the combination of two methods of electric heating, one by the direct introduction into the bath of calories emanating from an electric current of low voltage by means of one or more immersed pieces serving as electrodes electrically heated up to red heat on a small length above the level of the bath, in order to prevent at that point the solidification of the metal around said immersed pieces and to rectify the cooling of the bath following upon the immersion of the cold electrode parts; the other, by the rapid heating of the bath by means of an induction or resistance electric oven, the whole arrangement being joined together to automatically improve during the period of working the thermic constancy and yield in the effective part of the bath. The invention also consists in a special arrangement intended to realize in the induction ovens said automatic improvement in the thermic constancy and yield in the effective part of the bath, and based upon the joining, at a point placed in the centre of the magnetic core, situated in a horizontal plan of the branches of multiple fusion baths placed in a vertical plan, in order to form, at such point of junction, an open working chamber, which may be made narrower to raise the temperature and obtain heating from the bottom, which may be vertically extended to reduce the effects of brazing and pinching, with a primitive bath cast and incorporated with the masonry work.

Furthermore the invention comprises a special arrangement to carry out such thermic improvement in resistance electric ovens, namely, the use of undulated heating surfaces; and the use of superimposed electrode studs or contacts along the pieces for the purpose of obtaining the progressive tempering electrically.

The invention will now be described with reference to the accompanying drawings in which:—

Figure 1 is a sectional elevation of a vat.

Figure 2 is a plan view of a further vat, and

Figure 3 is a sectional elevation showing an improved form of heating surface for the vat.

A fire-proof vat, Figure 1, Sheet 1, contains tin, brazing, soldering, copper etc., heated by any external gas, coal, oil or other furnace and kept at the lowest temperature of fusion to reduce the oxidation of the molten bath to a minimum.

In order to prevent a sudden fall of temperature and any solidification of the fused metal which would be caused by the immersion in the bath of cold metallic pieces, any two electrodes 2 and 3 are immersed in the bath and conduct thereto, during the immersion, a low tension electric current which compensates and prevents the loss of heat by conveying thereto calories emanating from the electric current of low voltage graduated according to the mass of the immersed cold pieces, so as to maintain the temperature of the bath constant.

The period of the passage of the current and its intensity is regulated by the operator by means of an ordinary rheostat and interruptor operated by hand or by a pedal.

The gas, oil or other independent furnace may also be replaced by a current of low tension only and of a determined intensity to maintain the fusion. In such case, at the moment of immersion, an additional intensity of the current will prevent the cooling of the bath and keep it at a constant temperature during the whole period of the immersion. The two electrodes 2 and 3, may also be replaced by a metallic vat. The latter, with the bath it contains, serves as one electrode, whilst the pieces to be immersed, serve as the other electrode.

For instance, in order to braze a frame direction union 4 for bicycles, at its two tubes 5 and 6, the whole being prepared with borax in the ordinary way, the vat and the bath

form one electrode 7 and the two tubes which project beyond the level of the bath form the other electrode 8 and 8'.

This arrangement offers two advantages: the first is to effect the introduction of calories emanating from the electric current of low voltage into the bath direct by the contact of the pieces to be brazed, which are thus brought to red heat as soon as they enter the bath, which prevents the solidification of the metal round the pieces; and the second is to permit the progressive tempering of the brazed tubes by a more or less deep immersion without solidification round the tubes.

The progressive tempering is thus electrically obtained without additional immersion of the tubes by a succession of contacts of diminishing intensity branched off on the piece or pieces performing the duty of electrode.

The first of said contacts 8 and 8' are fixed to the pieces at a short distance from the level of the bath; when they are used current of greatest intensity is supplied to the bath.

When the contacts 13 and 13', which are farthest from the bath, are employed, the current of the weakest intensity is supplied to the bath.

The intermediary contacts 9 and 9', 10 and 10', 11 and 11', 12 and 12', are adapted to supply the currents of progressively decreasing intensity.

All these contacts which form the electrode terminal may be mounted together or in groups on the same clamping element to facilitate the mode of attachment.

The tubes 5 and 6 or any other pieces are also progressively tempered and decrease from the contact 13 and 13' up to the level of the bath.

In all the operations of renovation, tempering, annealing or recovering by immersion in salt baths in fusion, the application of heat as herein described offers all the advantages of regularity in the temperature as stated above.

In the foregoing description, it is provided that the external heating of the bath may be effected by any method of heating.

Amongst such methods of heating, it is found that resistance or induction electric ovens are most suitable to the variations of detail and form capable of representing advantageous improvements both in regard to the heating of the tinning, brazing, coppering and other baths and to the various electro-thermic applications now in use.

The object of these improvements is to localize and concentrate rapidly the maximum amount of heat in the effective part of the bath, where such concentration is to compensate and rectify the decrease of temperature arising from the immersion of the cold pieces, scraps or other material under treatment, in order to reduce the speed of cooling and maintain said effective part of the bath at a constant temperature, which permits the treatment of a larger number of pieces or weights of the material in the same period of time.

By combining this effect of calorific concentration at a given point, for the purpose of the electric superheating above described, by the introduction into the bath of calories emanating from an electric current of low voltage by means of an immersed piece serving as an electrode, results in the association of two means of electric heating which simultaneously concur in producing in the same apparatus and automatically, during the period of working or immersion, the maximum speed of heating and the constant temperature in the effective part of the bath.

In order to carry into effect such automatic concentration in induction ovens, as now constructed, serious difficulties are encountered.

This conception based on the horizontal position of the circulation fusion bath or baths, renders their working defective, when it is desired to use more than two of them together, for instance, four or six, and as the points of contact form a square, a hexagon, etc., the result is that it is impossible to concentrate them on a single point. On the other hand, the upper branch of the magnetic core situated in this case in the vertical plane, passes exactly above the points of junction and becomes therefore a hindrance in utilizing them as a working chamber.

These disadvantages are reduced or avoided by inverting the respective positions of both and of the core.

If around the core situated in the horizontal plane, several circular fusion baths are placed in the vertical plane, four for instance, around each branch of the core, the junction of these four baths becomes easy, owing to the parallelly tangential profile of the four surfaces in contact, which naturally become joined together into a single bundle in the centre of the core, where the concentration of the induced current is most intense, and form at that point a common fusion or working chamber which assumes the form of a cylinder or vertical pocket which performs the part of a crucible and the surface of which is not interfered with by a branch of the core.

In Figure 2, Sheet 2, drawn by way of guidance only, 1, 1' is a magnetic core, the branches of which arranged in the fire-proof masonry work 2, 2' on a horizontal plane, are surrounded by four circular baths, 3, 4, 5 and 6, arranged in a vertical plane. Around each bath there is a pair of bobbins

parallel to the bath 7, 7'; 8, 8'; 9, 9'; 10, 10'. Each of the baths is enclosed in the masonry, and they all (four in number or more, as desired) terminate at the centre of the apparatus in a working chamber 11 opened above and closed below.

By extending said chamber vertically in a cylindrical or splay form above the upper level of the circular bath, in most cases of electro-thermic applications, a high working chamber is obtained in which the well-known effect of metal brazing is all the more reduced, as said chamber is higher whereby the separation of the melted metal from its slag is facilitated.

On the other hand by giving to the point of junction of the circular baths, a section smaller than the added sections of the whole of the bath, there is produced, at that spot, a throttling effect which, by increasing the resistance of the circuit at that point, results in an increase of temperature. Thus all the advantages of intensive heating, at the bottom and in the centre of the apparatus, are secured.

The effect of pinching which has a tendency to occur at the overheated and constricted point, is successfully prevented in this vertical arrangement of the bath by the pressure of the column of metal contained in the working chamber placed above the constricted part. The tapping is effected through an aperture 12 or a furnace opening provided slightly above the upper level of the circular bath, so as to avoid the evacuation of the latter, in order not to break the induction circuit.

If it be desirable to break said circuit, it suffices to place a tapping aperture at the bottom of the working chamber 13 or in the lowest part of each of the circular baths.

Ventilation flues 14, 15, 16 and 17 provided in the masonry, between each bath, insure the cooling of the bobbins and of the magnetic core.

An optional but practical method for easily executing, in one body, all the circular baths with their working chamber within the masonry, consists in previously casting the metallic form of the same, filled to the requisite points, and then to incorporate said form with the body of masonry, when it is constructed. Such moulded form in one or more pieces and roughly soldered together, forms the first working bath intended to melt under the influence of the induced current.

By adding to this effect of the superheating by the constriction or joining of the baths, the special superheating effect by the direct introduction of heat by means of an immersed piece serving as an electrode, there is obtained in a single apparatus the combination of these two means of electric superheating, which automatically concentrates, during the working period, the maximum amount of heat in the effective part of the bath, in order to oppose the cooling caused by the immersion of the cold pieces of materials to be treated.

In such case, the tension of this additional current must at least be equal to that of the induced current of the oven and the new circuit must be closed by a second electrode dipped in the working chamber at a distance from the first.

These two electrodes may also act by forming arcs at the level of the bath.

In order to realize such effect of thermic concentration with resistance ovens, the surface of the vat 18 Figure 3, Sheet 2, instead of being flat, is undulated, especially below and at the bottom, and that of the resistance is also undulated, especially if use is made of semi-conductive materials to obtain said resistance 19. The heat is thus concentrated at the bottom of the bath 20, owing to the increase of the heating surface for the same volume.

The undulation may be placed in any part of the vat according to requirements.

The introduction into the bath of calories emanating from an electric current of low voltage by the immersed piece 21 forming an electrode, gives to the semi-conductive resistance, by the intermedium of the metallic vat 18, the benefit of the current brought by the electrode piece, which raises accordingly the temperature of the resistance and thus automatically heats the bath during the period of immersion or working by the combination of these two methods of electric heating applied together in a single apparatus.

Where the piece under treatment by immersion may be a bad conductor, said result of super-heating can be obtained by sending the additional superheating current through the vat itself by an interrupter connected with the vat and operated by the immersion motion.

What I claim and desire to secure by Letters Patent of the United States is:—

1. The method of applying metal to an article comprising immersing the article in a bath of the molten metal, and heating that portion of the molten metal immediately surrounding the immersed article to a temperature not less than that of the remainder of the molten metal by passing an electric current through the immersed article, used as one electrode, and the molten metal, used as the other electrode.

2. The method of applying metal to an article comprising immersing the article in a bath of the molten metal, and heating that portion of the molten metal immediately surrounding the immersed article to a tempera-

ture not less than that of the remainder of the molten metal by passing an electric current through the immersed article, used as one electrode, and the molten metal, used as the other electrode, and heating the immersed article to a red heat to a point just above the surface of the molten metal.

3. The method of applying metal to an article comprising immersing the article in a bath of the molten metal, heating that portion of the molten metal immediately surrounding the immersed article to a temperature not less than that of the remainder of the molten metal by passing an electric current through the immersed article, used as one electrode, and the molten metal, used as the other electrode, and regulating the heating by varying the intensity of the current passing through the article.

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