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PROCESS FOR METALIZATION, ESPECIALLY ALUMINIZATION OF IRON ARTICLES

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Fig. 1.

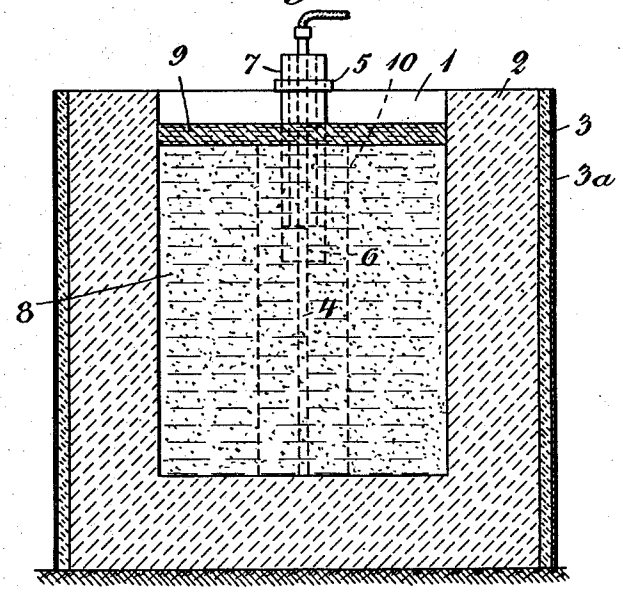
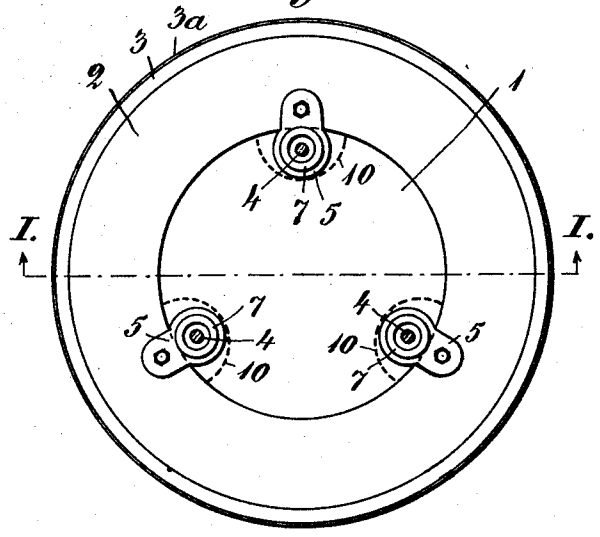


Fig. 2.



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PROCESS FOR METALIZATION, ESPECIALLY ALUMINIZATION OF IRON ARTICLES

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The present invention relates to a process for metalization of articles, and more particularly to a process for aluminization of iron articles.

In the aluminization of metal articles, the most difficult problem is to obtain a suitable material for the smelting crucible or furnace. When using directly heated iron crucibles, the heating from outside will destroy the same in a short time. Indirect heating, for instance by means of electric resistance wires or the like inserted into and isolated from the molten aluminium metal, would be conceivable, but is difficult to carry out in practice in a satisfactory manner. Moreover, in both cases, there is the further difficulty that the crucible is attacked from within by the molten aluminium metal, which also results in a contamination of the latter.

When using crucibles or furnaces of refractory materials, which are more resistant, the above-mentioned difficulties are partly eliminated, but also in this case it is difficult to carry out the heating in a satisfactory manner, especially with regard to the fact that the crucible must have a free opening for insertion and withdrawal of the articles to be treated. Heating by means of electric resistance bodies inserted into the molten aluminium layer is out of question on account of the corroding activity of the aluminium metal, which would quickly result in a destruction of said resistance bodies.

The present invention now relates to a process by means of which said difficulties are completely removed.

According to the invention this is attained by arranging the metalization metal on top of a layer of molten salts, which has a higher specific gravity than the molten metal, and keeping said metal in a molten state by heat transmission from the molten salt layer. In said process the heating of the molten salt layer is, preferably, carried out electrically by the aid of electrodes inserted into the molten salt layer, which serves as an electrical resistance.

By means of said process according to the invention it is possible to carry out the heating of the molten metal in a satisfactory manner, without any injurious effect on the smelting crucible or furnace. In addition hereto several other favourable results are obtained, as stated below.

According to a preferred mode of carrying out the invention, the metal to be used for metalization, for instance aluminium, is applied on top of the molten salt layer only in a thin layer, and the articles to be metalized are immersed through the molten metal layer into the molten salt layer. Here they are left, until they have obtained a temperature suitable for the metalization, when they are conveyed upwards through the molten metal layer and receive a coating of said metal.

This manner of working has the great advantage that it is possible to carry out the metalization with the least possible quantity of metal, whereby also the inevitable losses of metal in the process are reduced. In addition hereto, the molten salts may act as a pickling agent for cleansing and purification of the surface of the metal articles before the metalization. When the articles are then, after the immersion in the molten salt layer, removed therefrom they arrive without admission of air directly into the molten metal layer, whereby an oxidation of the purified metal surface before the metalization is completely out of question. This is a great advantage which effectively contributes to the obtaining of the best possible result of the metalization.

When working in this manner it is suitable to adjust the specific gravity of the molten salt layer in such a way that said specific gravity is lower than that of the articles, for instance iron articles, to be metalized, in order to facilitate the immersion of said articles into the molten salt layer.

As component or components of the molten salt layer any suitable salt or salts may be used, provided that the molten salt layer will obtain a higher specific gravity than that of the molten metal. It has proved, for instance in the aluminization of iron articles, that barium chloride is an especially suitable salt which also has such a cleansing and purifying effect upon the surface of the iron articles, as stated above.

Besides barium chloride the molten salt layer may also contain other suitable chlorides, for instance sodium chloride and potassium chloride, as well as barium bromide and other easily melting salts, each per se or several together. In any case the additions are adjusted in such a way that the molten salt layer will obtain a higher specific gravity than the molten metal layer used.

Further it may be suitable, especially in the aluminization of articles, to add fluorides, for instance sodium aluminium fluoride, sodium fluoride or the like. On account of the dissolving effect of the fluorides upon oxides, the fluorides contribute favourably to the cleansing and purification of the surfaces of the iron articles and further they also keep the molten aluminium layer free from oxides. When using fluorides, at

least a part thereof forms a thin layer on top of the molten aluminium metal and protects it from oxidation by the oxygen of the air.

For carrying out the process according to the invention a smelting furnace or crucible built up or moulded with suitable refractory bricks or other refractory material may advantageously be used. Since the contact surface between the metal layer and the wall of the crucible or furnace is comparatively small, especially when using a thin metal layer, the difficulties connected with the use of iron crucibles as described above are reduced to a minimum, and in view hereof it may also be possible to use iron crucibles.

For the heating of the molten salt layer it is preferred to use electrodes which suitably may be inserted into the molten salt layer from above through the molten metal layer and isolated therefrom by means of refractory tubes or the like which surround the electrodes and extend down through the metal layer into the underlying molten salt layer.

A furnace with such an arrangement is illustrated in the annexed drawing.

Fig. 1 shows a vertical section through the furnace after line I—I in Fig. 2, and Fig. 2 is a view of the same from above.

In the drawing, 1 designates a smelting furnace or crucible with walls 2 of refractory material, externally provided with an isolating covering 3 and a sheet metal lining 3a. Three iron electrodes 4 are arranged in the furnace and are held in position by cramps 5 fixed to the walls of the furnace. The lower ends of the electrodes are supported by the bottom of the furnace. Fixed on the electrodes, for instance by means of welding, are arranged parts 6 which serve to support refractory tubes 7 surrounding the upper part of the electrodes. The reference number 8 designates the molten salt layer, for instance comprising substantially barium chloride, and the number 9 the molten metal layer, for instance aluminium. The refractory tubes 7, which serve to isolate the electrodes from the molten metal layer 9, are to extend into the molten salt layer 8 to such a depth that the electric current cannot pass between the electrodes through the metal layer, which might cause short-circuit of the current.

When the process is to be started it may be suitable to first introduce the salts in the furnace and smelt the same, whereupon the metal (aluminium) is introduced, for instance in the form of pieces, and is smelted by heat transmission from the molten salt layer, the temperature of which in case of aluminization being suitably about 760–800° C. Further, fluorides, for instance sodium aluminium fluoride may suitably be added.

The treatment is then carried out by immersing the articles through the molten metal layer down into the molten salt layer, as indicated above, whereupon the article, when it has obtained a suitable temperature, is passed upwards through the metal layer. If desired, this treatment may be repeated several times in such a way that the article is alternately immersed into the salt layer and lifted up into the metal layer. During the immersion the article may suitably be kept in continual movement in such a way that fresh portions of the molten salts and fresh metal continually will come in contact with the surface of the article. Contaminations which may be formed during the metalization process, for instance by the action of molten aluminium on the surface of the iron articles, sink down into the salt layer and accumulate at the bottom of the furnace, from where they may be removed. Thus, said contaminations cannot impair the metalization process, as might otherwise be the case, if they were accumulated in the molten metal layer.

It is understood that the invention, although preferably described in connection with the aluminization of iron articles, is by no means restricted to said process, but can also advantageously be applied in the metalization with other metals, for instance magnesium or the like. Further, the process and manner of working as well as the furnace described above may be modified in any respects lying without the spirit and inventive idea of the invention.

Having now particularly described the nature of my invention and the manner of its operation what I claim is:

1. Process for applying a metal coating containing a metal of the group consisting of aluminum and magnesium to iron articles, which comprises arranging the coating metal on top of a molten salt layer consisting at least mainly of metal chlorides and having a higher specific gravity than the coating metal in molten condition, keeping said metal in a molten condition by transmission of heat from said molten salt layer, said heating being carried out electrically by the aid of electrodes introduced into said molten salt layer, immersing the article to be metalized through said molten metal layer into the molten salt layer, the specific gravity of said salt layer being lower than the specific gravity of the article to be treated, leaving the article in said salt layer, until it has attained a suitable temperature for the metalization, and then withdrawing the article into the molten metal layer, where it receives a coating of said metal.

2. Process for aluminization of iron articles, which comprises arranging a layer of molten aluminium on top of a molten salt layer at least containing metal chlorides, which has a higher specific gravity than aluminium but a lower specific gravity than iron, keeping said layer of aluminium in a molten state by transmission of heat from said molten salt layer, the heating of said salt layer being carried out electrically by the aid of electrodes introduced into said molten salt layer, immersing the iron article to be metalized through said molten aluminium layer into said molten salt layer, leaving it in said layer, until it has attained a suitable temperature for metalization, and then withdrawing the article into the molten aluminium layer.

3. Process for aluminization of iron articles, which comprises arranging a thin layer of molten aluminium on top of a molten salt layer comprising substantially barium chloride, keeping said layer of aluminium in a molten state by transmission of heat from said molten salt layer, the heating of said salt layer being carried out electrically by the aid of electrodes introduced into said molten salt layer, immersing the iron article to be metalized through said molten aluminium layer into said molten salt layer, leaving it in said layer, until it has attained a suitable temperature for metalization, and then withdrawing the article to the molten aluminium layer, where the aluminization takes place.

4. Process for aluminization of iron articles, which comprises arranging a thin layer of molten aluminium on top of a molten salt layer containing barium chloride, alkali chloride and sodium aluminium fluoride, keeping said layer of alu-

minium in a molten state by transmission of heat from said molten salt layer, the heating of said salt layer being carried out electrically by the aid of electrodes introduced into said molten salt layer, immersing the iron article through said molten aluminium layer into said molten salt layer, leaving it in said layer until it has attained a suitable temperature for metalization, and then withdrawing the article to the molten aluminium layer, where it receives a coating of aluminium.

5. Process according to claim 4, characterized in that the immersion of the iron article into the molten salt layer and the molten metal layer is repeated alternately, until the article has obtained a satisfactory coating of aluminium.

6. Process for application of a metal coating containing a metal of the group consisting of aluminum and magnesium to iron articles, which comprises arranging the coating metal on top of a molten salt layer comprising metal chlorides and having a higher specific gravity than the coating metal in its molten state, keeping said metal in a molten condition by transmission of heat from the molten salt layer, effecting the heating electrically by the aid of electrodes introduced into said molten salt layer, immersing the article to be coated through said molten metal layer into the molten salt layer, leaving it in said salt layer until it has attained a suitable temperature for the coating operation, and then withdrawing the article into the molten metal layer, where it receives a coating of the molten metal.

7. Process for application of a metal coating containing a metal of the group consisting of aluminum and magnesium to iron articles, which comprises arranging the coating metal in a thin layer on top of a molten salt layer comprising metal chlorides and having a higher specific gravity than the coating metal in its molten state, keeping said metal in a molten condition by transmission of heat from the molten salt layer, effecting the heating electrically by the aid of electrodes introduced into said molten salt layer, immersing the article to be coated through said molten metal layer into the molten salt layer, leaving it in said salt layer until it has attained a suitable temperature for the coating operation, and then withdrawing the article therefrom and moving it through the molten metal layer, where it receives a coating of the molten metal.

8. Process for applying a metal coating containing a metal of the group consisting of aluminum and magnesium to iron articles which comprises arranging the coating metal on top of a molten salt layer consisting at least mainly of metal chlorides and further also of fluorides of the group consisting of alkali metal fluorides and alkali aluminum fluorides and having a higher specific gravity than the coating metal in its molten state, keeping said metal in a molten condition by transmission of heat from the molten salt layer, effecting the heating electrically by the aid of electrodes introduced into said molten salt layer, immersing the article to be coated through said molten metal layer into the molten salt layer, leaving it in said salt layer until it has attained a suitable temperature for the coating operation, and then withdrawing the article into the molten metal layer, where the metalization takes place.

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