

UNITED STATES PATENT OFFICE

2,442,195

CLEANING AND ELECTROPLATING PROCESS

James T. Clenny, Swampscott, Mass., assignor to
General Electric Company, a corporation of
New York

No Drawing. Application July 31, 1945,
Serial No. 608,089

1 Claim. (Cl. 204—34)

1

The present invention relates to the surface treatment of metal articles with the object of removing adherent surface contaminations, including inorganic material such as rust and scale, and also organic material such as grease and oil. The cleaned surface, by a step in the same process, is prepared by the electrolytic deposition of a metal which will facilitate the subsequent application by casting or otherwise of an unlike metal and thereby cause it to make a firm union with the cleaned and coated surface.

My invention is applicable in particular to cleaning of metal castings, rolled plate, or forgings, and the subsequent application thereto of an unlike metal, for example Babbitt metal, to produce composite articles. My invention is particularly applicable to the manufacture of bearings.

Heretofore metal objects which were coated with oil or grease, and also with rust or other oxides, have been subjected to a succession of independent stripping operations in order to remove such undesired surface contaminations. The cleaning operations in some cases were followed by an electrolytic treatment for depositing a coating metal. Commonly the cleaning operations included pickling in an aqueous solution of a strong acid which is not desirable and is not suitable for carrying out a plating operation.

In accordance with my invention I have provided a procedure comprising the combination of a plurality of electrolytic steps carried out successively in a single fused electrolyte in which the metal object to be cleaned functions alternately as anode and cathode. As a consequence, the treatment of the metal is simplified, shortened in time and made more efficient.

For example, in the course of manufacture of ferrous bearings for rotating machinery, it is required to remove adherent rust, scale and grease, and it is desirable also that the cleaned metal surface next should be coated with a non-ferrous metal which both protects the cleaned surface of the ferrous metal from reoxidation and prompts alloyage with a non-ferrous metal.

These objects of my invention are attained by a combination of chemical and electrochemical operations carried out in sequence in a fused alkali electrolyte which may consist of a strong alkali, preferably caustic soda, having dissolved therein a suitable copper compound which is especially adaptable to the manufacture of bearings, for example one to ten per cent of copper oxide (CuO). However, oxides and metallic salts of other oxidation-resisting non-ferrous metals may be used. In general, metals of the group

2

consisting of copper, nickel and silver can be used in a similar manner for various applications as protective coatings on metal surfaces.

The castings are immersed in such alkali bath which may be heated to a temperature in the range of 400 to 500° C. The articles to be treated are connected to an electric circuit charged with direct current at a potential of about three to six volts, the polarity of the castings first being made positive. The negative cooperating electrode may be constituted by the container for the electrolyte or by a suitably spaced electrode which is connected to the negative terminal of the circuit. The resulting passage of current causes oxidation and removal of the grease and other organic matter from the surface of the metal article. The anodic treatment is continued for only a short time. About one minute is satisfactory, the length of time not being critical. The current value may be about 150 to 200 amperes per square foot of surface.

The polarity thereupon is reversed, the article being cleaned becoming the cathode. The cathodic treatment is continued at approximately the same current density until adherent scale and rust are removed. In general, about seven minutes is satisfactory.

The third step is carried out by reducing the voltage, and thereby the current, to approximately one-tenth of the original density and by charging the casting again to positive potential, that is, reversing the polarity. By this step the spongy, loosely adherent copper which was deposited as an unavoidable incident during the previous step is caused to go into solution.

Finally, the metal article is charged negatively, that is, becomes cathodic for the electrolytic action occurring in the fused bath. During the fourth step, which is continued for about ten minutes, copper is deposited as a homogeneous, adherent layer on the ferrous metal object by electrolytic action, the current still being maintained at about 25 amperes per square foot.

The ferrous metal object, upon the completion of the copper coating step, is removed from the fused bath and immersed in water. The water dissolves the adherent coating of electrolyte. The surface of the ferrous metal article upon removal from the fused bath is copper-colored and retains this color after its immersion in water. The indications are that the copper coating becomes alloyed with the surface of the ferrous metal article.

As the final step, the surface of the copper-coated metal article is coated with a suitable

3

flux, for example, a flux containing zinc and ammonium chlorides. The following flux is illustrative:

	Per cent
Zinc chloride	50
Ammonium chloride	4
Free hydrochloric acid	6
Water on a weight basis	40

Upon removal from the flux bath, the article is then coated with tin, either by being preferably immersed in a bath of molten tin or having the molten tin applied in any other convenient way.

The tinned surface finally is united by surface alloyage with Babbitt metal which may consist of alloys of copper, antimony and tin in the following alternative proportions:

8 1/3 copper, 8 1/3 antimony, 83 1/3 tin; or 4 copper, 8 antimony, 88 tin.

The molten Babbitt metal may be cast against the ferrous metal. The casting may occur in a centrifugal casting machine, the bearing shell being externally cooled to cause the Babbitt metal to be solidified in desired position and to insure a satisfactory structure containing little or no segregating of alloying constituents.

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

The process of cleaning and copper plating the surface of a ferrous metal article which comprises immersing said article in a fused caustic soda bath containing from one to ten per cent copper oxide and heated to a temperature of from 400 to 500° C. and while the article is continuously immersed in said bath passing a direct current through said bath and article to subject the article to the following series of electrolytic

4

operations: (a) as the anode for about one minute at a potential of about 3 to 6 volts and at a current density of from 150 to 200 amperes per square foot to remove organic matter from the surface of the article; (b) as the cathode at the same current density for about seven minutes until adherent rust and scale are removed; (c) as the anode at a current density about one-tenth the value employed in steps a and b to remove spongy copper deposited during step b; and (d) as the cathode at a current density of about 25 amperes per square foot to deposit on the surface of said article a homogeneous coating of copper.

JAMES T. CLENNY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,004,673	Monnot	Oct. 3, 1911
1,417,896	Fletcher	May 30, 1922
1,600,355	Otis et al.	Sept. 21, 1926
1,795,512	Schmidt et al.	Mar. 10, 1931
1,909,149	Hitner	May 16, 1933
2,042,800	Pike	June 2, 1936
2,134,457	Tainton	Oct. 25, 1938
2,311,139	Tainton	Feb. 16, 1943
2,327,676	Spence	Aug. 24, 1943
2,366,477	Bayley	Jan. 2, 1945
2,395,694	Spence et al.	Feb. 26, 1946

FOREIGN PATENTS

Number	Country	Date
425,385	Great Britain	Mar. 13, 1935