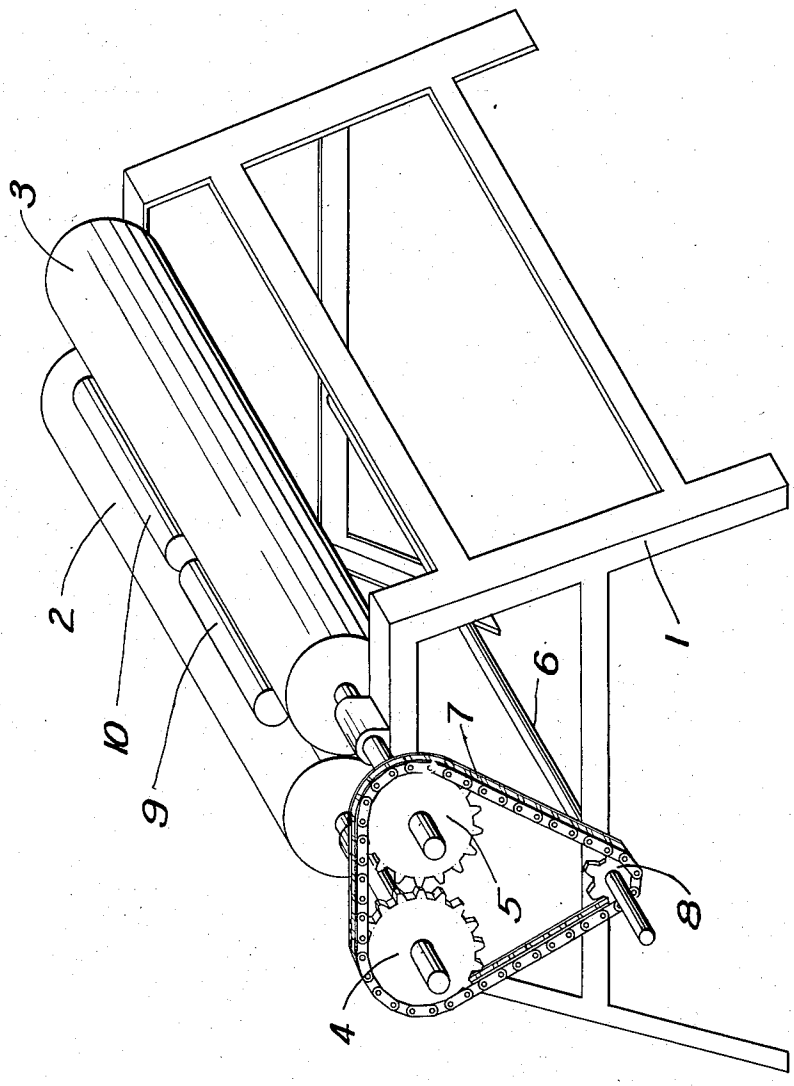
Feb. 10, 1959 H. A. GAGE 2,873,209

LEVELING METAL COATINGS

Filed Feb. 12, 1945



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United States Patent Office 2,873,209 Patented Feb. 10, 1959

2,873,209

LEVELING METAL COATINGS

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Application February 12, 1945, Serial No. 577,382

2 Claims. (Cl. 117—51)

This invention relates to the application of metal coatings to cylindrical objects such as rods, tubes and the like by the hot dip method. It is especially concerned with improvements in the manipulation of such freshly-dipped objects to provide smooth uniform coatings.

In coating objects with molten metal by the hot dip process, it is necessary to cool the object below the melting point of the coating in some manner which will not injure or remove portions of the coating. This is especially true when it is desired to obtain a completely continuous coating to provide thorough protection of the object against corrosion. Suspension of the objects by means of racks during cooling leaves rack marks along which the coating has a different thickness and sometimes different physical properties from those of the coating at other points along the surface. For handling cylindrical objects it has been proposed to employ a supporting device comprising rotating discs upon which the object is supported. This method like the method employing racks leaves marks on the object where it is supported by the rotating discs.

It is an object of the present invention to provide uniform coatings on the entire surface of cylindrical objects so that they may be adequately protected not only along the entire peripheral surface but at both ends as well. Further objects will appear from the following general description and detailed illustrations of the invention.

In accordance with the present invention, cylindrical objects to which molten metal coatings have been applied by the hot dip method are placed in the trough formed by two parallel spaced rotating rollers having continuous, smooth surfaces and the objects are rotated by the rotation of the rollers until the coatings have solodified. By this procedure rods or cylinders may be provided with smooth even coatings without the presence of rack marks or other faults.

The rods or cylinders may be constructed of material having low thermal conductivity or low heat capacity or they may be provided with heating means to prevent a too rapid temperature drop. Carbon and steel rods have been employed with satisfactory results. An asbestos cement composition commercially available under the trade name "Transite" is especially suitable. Rolls of this material may be machined and burnished to provide a smooth surface.

The process of the invention is applicable to the coating of rods, pipes, and the like composed of any of the metals used in the manufacture of structural shapes, for example, iron, copper, nickel, lead, zinc, cadmium, tin, aluminum, and magnesium, and their alloys such as steel, bronze, brass, pewter, and the like, with the conventional coating metals, for example, zinc, lead, tin, cadmium, and aluminum, and their alloys such as bronze, brass, solder, zinc-aluminum, aluminum-silicon and the like. The coating metal, of course, should be selected from among those metals or alloys having melting points sufficiently below the melting point of the coated metal to permit their application without destruction of the article being coated.

The accompanying drawing illustrates one form of apparatus which may be used for accomplishing the purposes of the invention.

The apparatus illustrated comprises a metal frame 1 supporting a pair of polished asbestos cement composition rollers 2 and 3, spaced apart slightly and having sprockets 4 and 5 coupled to drive shaft 6 by chain 7 and sprocket 8.

In operating the apparatus the rate of rotation of the rollers can be varied widely. Surface speeds between 10 and 150 feet per minute are usually the most practicable. The cylindrical objects, after removal from a molten bath, are freed from excess metal and immediately placed in the trough defined by the rollers 2 and 3 and allowed to remain for a time at least long enough for the coating to solidify. The numerals 9 and 10 designate objects so placed.

The following examples further illustrate the invention.

Example 1

Three solid metallic uranium rods, each 1.04 inches in diameter and 4 inches in length were pickled for 30 seconds in 50% HNO_3 solution and then were coated by dipping in a molten metal bath comprising 94% zinc and 6% aluminum by weight at a temperature between 475° and 485° C.

The samples were removed from the molten metal bath and immediately placed in the trough formed by two carbon rods having a diameter of 5½ inches, spaced ⅝ inch apart and rotating in the same direction at 130–140 R. P. M. The uranium rods were rotated until the coatings had solidified. They were then removed and examined. The coatings were found to be smooth, even, and free from surface defects.

Example 2

A solid metallic uranium rod 1.1 inches in diameter and 4 inches in length was cleaned by dipping for 20 seconds in aqueous 50% HnO_3 solution containing 1% HCl and was then coated with zinc by dipping it through a flux comprising 30% lithium chloride, 50% potassium chloride and 20% sodium chloride into a molten bath of pure zinc at a temperature of 532° C. The rod was held in the molten metal for one minute during which the temperature of the metal dropped to 522° C.

The rod was removed from the bath, shaken briskly to remove excess metal, and promptly placed in the trough formed by a pair of smooth Transite rollers, each 5½ inches in diameter, spaced ⅝ inch from each other and rotating at a speed of 130–140 R. P. M. The coated metal rod was rotated in this manner until the zinc coating had solidified. It was then cooled to normal temperature by quenching in water. The resulting coating was smooth and uniform throughout the length of the rod and over both ends of the rod.

Example 3

A metallic uranium rod cleaned by immersing for 5 minutes in 50% HNO_3 at 65° C. was dipped through a flux of about 565° C. solidification point, prepared by adding to 90 parts of flux of 53% KCl, 42% LiCl and 5% NaCl, 10 parts of NaF, and into a molten metal bath comprising 88% aluminum and 12% silicon at 620° C. After 3 minutes in the aluminum-silicon alloy bath the rod was withdrawn and rolled on cold steel rolls until the coating solidified. The rod was completely coated with a smooth, even coating of the aluminum alloy.

Example 4

An iron rod was pickled in an aqueous 12% HCl pickling bath for 5 minutes at room temperature. The rod

was rinsed and then dipped for 5 minutes in a preflux of zinc chloride ammonium chloride eutectic to which had been added 10% KCl, 10% NaCl and enough NH_4Cl to raise the freezing point to 350° C. The flux temperature was 400° C.

The flux-coated rod was then dipped into a molten bath of 2S grade aluminum at a temperature of 730° C. for 1 minute. 2S grade aluminum is a commercially pure wrought aluminum containing at least 99% aluminum and small amounts of iron and silicon. The term is well known in the art and is precisely defined in the "Metals Handbook" (1939 ed.), pages 1246 and 1247.

The coated rod was withdrawn from the aluminum bath and rolled as in Example 2 to solidify the coating. It was then quenched in cold water. The iron rod was completely covered by a metallic aluminum coating.

Example 5

An iron rod having an electrodeposited coating of iron and over this an electrodeposited flash coating of copper was held in a 53% KCl, 42% LiCl, 5% KCl flux for 2 minutes and then in an underlying bath of 88 parts of aluminum and 12 parts of silicon at 600° C. for 60 seconds.

The rod was removed from the bath and rolled for 30 seconds as in Example 2 to solidify the coating, then quenched in water. The rod was completely covered by a coating of aluminum-silicon alloy.

In each of the examples set forth above, the rotation of the uranium rods was effected in an atmosphere of air at room temperature. The air was allowed to circulate freely so that the rods and rollers were exposed substantially continuously to an atmosphere at a temperature below the melting point of the coating material and were cooled by this cooling medium as well as by radiation. If desired, the rollers may be placed in a cooling chamber through which a cooling medium is circulated.

The feature of employing as a coating material an aluminum-containing zinc alloy and the feature of employing an alkali-metal halide flux are not claimed herein as these features constitute the subject matter of U. S. patent applications, Serial Number 588,060 filed April 12, 1945, now Patent No. 2,848,796, granted August 26, 1958, by Lowell D. Eubank and Ernest R. Boller, and Serial Number 583,176 filed March 16, 1945, now Patent No. 2,847,321, issued August 12, 1958 by Lowell D. Eubank.

It will be understood that I intend to include variations and modifications of the invention and that the preceding examples are illustrations only and in no wise to be construed as limitations upon the invention, the scope of which is defined in the appended claims, wherein—

I claim:

1. In the application of metallic coatings to cylindrical uranium articles by hot dipping, the method of providing a level metal coating completely encasing said article which comprises dipping the article in a molten bath of a metal of the group consisting of zinc, lead, tin, cadmium, and aluminum and alloys thereof, placing the article while the coating is yet molten between a pair of driven, horizontal, closely spaced parallel rollers having smooth unyielding surfaces of low thermal conductivity extending at least the full length of said article, rotating said rollers in the same direction at substantially the same peripheral speed whereby the article is rotated and the molten metal coating smoothed, exposing said article to a cooling atmosphere at a temperature below the melting point of the coating metal, and continuing said rotation until the coating has solidified.

2. The method of coating a cylindrical uranium article that comprises cleaning the article by immersion for approximately five minutes in 50% nitric acid at a temperature of approximately 65° C., dipping the cleaned article through a flux prepared by adding 10% sodium fluoride to 90% of a flux comprising approximately 53% potassium chloride, 42% lithium chloride, and 5% sodium chloride into a molten metal bath comprising approximate 88% aluminum and 12% silicon at a temperature of approximately 620° C. for a period of approximately three minutes, withdrawing the coated article from the molten bath, placing the article while the coating is yet molten between a pair of driven, horizontal, closely spaced, parallel rollers having smooth unyielding surfaces extending at least the full length of said article, rotating said rollers in the same direction at substantially the same peripheral speed whereby the article is rotated and the molten coating smoothed, exposing said article to a cooling atmosphere at a temperature below the melting point of the coating metal, and continuing said rotation until the coating has solidified.

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