

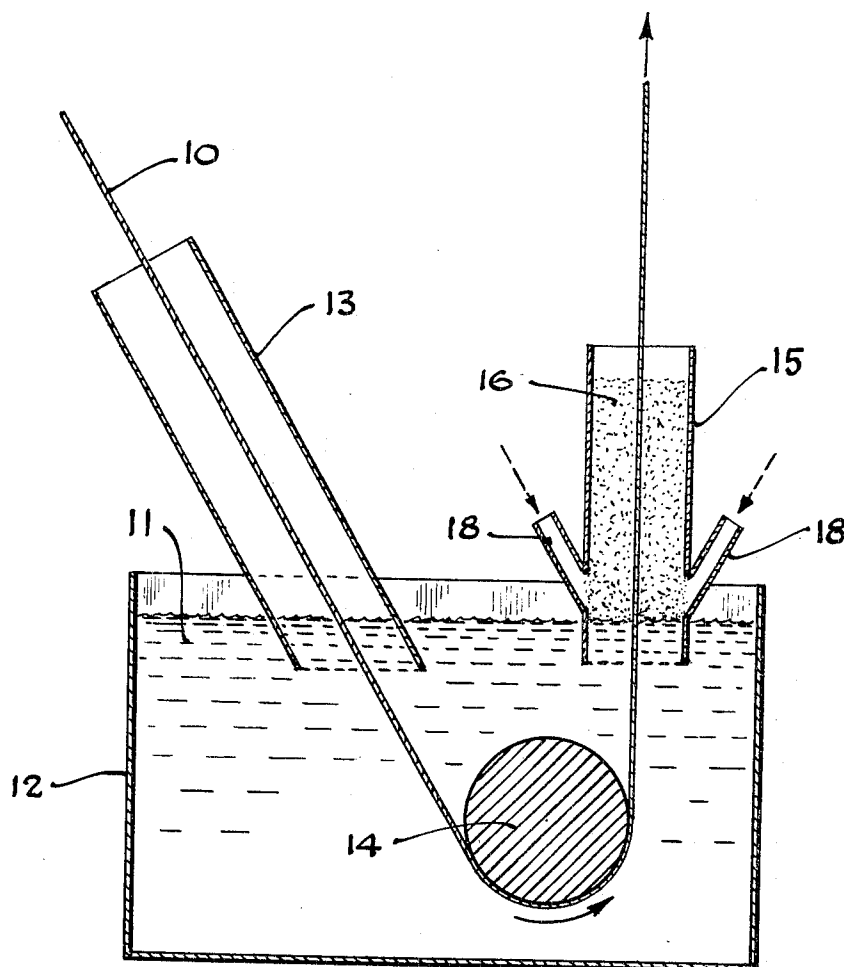
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H. L. TAYLOR

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METHOD FOR PRODUCING WIPED METAL COATINGS

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Inventor
Harold L. Taylor
By Hibben, Noyes & Bicknell
Attorneys

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METHOD FOR PRODUCING WIPED METAL COATINGS

Harold L. Taylor, Hammond, Ind., assignor to Inland Steel Company, Chicago, Ill., a corporation of Delaware

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3 Claims

ABSTRACT OF THE DISCLOSURE

A process and apparatus for "wiping" the surface of a strip, such as a ferrous metal strip, to remove a portion of a fluid coating, such as a molten protective metal coating, wherein the strip with the coating in a molten state is passed through an expanded or fluidized bed to provide a residual thin coating of uniform thickness which is free of longitudinal streaks or wipe marks.

This invention relates to a method of producing a wiped coating on a supporting surface, and more particularly to an improved method of providing a wiped protective metal coating applied on a metal surface.

In the production of thin protective metal coatings, such as galvanized and aluminum coatings on a steel strip, it is common practice to pass the steel strip through a molten bath of the protective metal and remove the excess metal remaining on the steel strip as it is withdrawn from the molten metal bath by contacting the surface of the coated strip with a wiper roll or with a strip of asbestos which serves as a wiper for removing all but the desired thin layer of metal.

Heretofore wire, wire cloth and wire netting which have been immersed in a molten bath of protective metal have been "wiped" by passing through a bed of loose granular material to remove surplus molten coating metal and insure uniform distribution of the coating metal over the strands of wire, as disclosed in U.S. Pats. No. 361,550, No. 474,567 and No. 1,050,897. None of the prior art methods of providing wiped metal coatings, however, have successfully provided wiped metal coating of uniform thickness on a strip which is also free of longitudinal streaks or similar objectionable wipe marks.

It is therefore an object of the present invention to provide an improved method and apparatus for producing a uniformly thin wiped protective metal coating having a coating thickness in the range of approximately .00008 to .001 inch depending on the coating material and the processing conditions.

Other objects of the present invention will be apparent to those skilled in the art from the following detailed description and claims when read in conjunction with the accompanying drawing which shows a schematic diagram of apparatus for performing the process of the present invention.

The present invention is an improvement over the above mentioned wiping processes wherein an article is passed through a static granular bed and comprises passing an article having a fluid coating of a molten protective metal applied on at least one surface thereof upwardly through a bed of heat resistant granular material which, because of its surface tension properties, is substantially impervious to wetting by the molten metal and while the granular material is in an expanded or fluidized state. The amount of coating metal on the surface of the article, such as an endless strip of ferrous metal, is controlled within a thickness range of approximately about .00008 to .001 inch by regulating the degree of expansion or fluidization of the bed, the temperature of the bed, and the height of the bed. Less metal coating is removed by

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the expanded bed the greater the degree of expansion of the bed, and the smaller the height of the bed.

In practicing the present invention with the apparatus illustrated in the accompanying drawing, a galvanized coating is applied by a hot dip process to a steel strip 10 which has first been subjected to a conventional cleaning and conditioning treatment in accordance with good galvanizing practice in order to prepare the strip for hot dip galvanizing. The clean black plate steel strip 10 is then immersed in a molten zinc galvanizing coating bath 11 of conventional or any suitable composition maintained in a molten state in a suitable container 12. In the apparatus shown, the strip 10 is passed between a conventional guide means 13 disposed at a suitable angle with respect to the surface of the hot dip coating bath with the strip passing around a submerged roller or sinker roll 14 disposed in the container 12 adjacent the lower surface thereof and below the surface of the coating bath 11 and is passed upwardly along a substantially vertical path through the open lower end of a duct 15 which extends below the surface of the bath 11. The duct 15 preferably extends from a point a few inches below the surface of the bath 11 vertically to a point about 24 inches above the surface of the bath 11.

The duct 15 serves as a retainer means for a bed 16 of granular or powdered material having a particle size which can be readily fluidized when a gas is passed upwardly through the bed of granular material at a suitable rate of flow. The lower surface of the bed 16 is supported by the upper surface of the bath 11. The granular particles must not be wetted by the molten metal of the bath 11. Where a molten zinc bath is used, the granular particles forming the bed 16 can, for example, be particulate carbonaceous matter composed of graphite or crushed charcoal. In any specific application, however, the type of granular material which is employed to form the bed 16 will be determined by the nature of the coating material comprising the molten bath, the desired appearance to be provided on the finished strip and the desired coating weight.

When the strip 10 is passed through the bed 16 the granular material is in the form of a fluidized or expanded bed and to effect such fluidization the duct 15 is provided with inlet ports or slots 18 along the opposite sides adjacent the lower end of the duct 15 at a point directly above the surface of the molten metal bath. The slots 18 extend along the entire width of the duct 15. A fluidizing gas, such as nitrogen, is passed inwardly through the slots 18 at a rate of flow sufficient to fluidize or expand the bed 16 to the degree required to effect the desired wiping of the metal strip 10.

It will be evident that as the strip 10 moves upwardly through the fluidized or expanded bed 16 the particles forming the bed 16 are agitated continuously and will contact the fluid coating on the surface of the strip 10 and will wipe or scrape a part of the fluid coating metal from the surface of the strip. And, since the particles are not wetted by the molten zinc or other coating metal, the metal removed by the particles flows downwardly into the bath 11.

The amount of fluidizing gas required to effect a particular degree of bed expansion is determined by the type of granular material forming the bed, the fluidizing gas temperature and the reaction, if any, desired in the bed. The general relationship existing between the gas properties and the bed solids in providing a fluidized or expanding bed of particulate matter is well known and is described in Bulletin No. 504, United States Bureau of Mines, entitled "Fluid Flow Through Packed And Fluidized Systems" (1951).

The temperature of the bed 16 can, if desired, be controlled by any suitable method. One method is to use

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oxygen or air as the fluidizing gas in combination with a bed of carbonaceous material and introduce the oxygen-containing gas at a temperature which effects combustion of the carbonaceous particles forming the bed. Controlling the flow rate of the oxygen-containing gas then controls the bed temperature. A second method of controlling the temperature of the bed, of course, is to use an inert gas, such as nitrogen, as the fluidizing gas and heat the gas sufficiently to effect the desired bed temperature.

In a specific application of the present process a 20-gauge strip of conventional galvanizing steel about 48 inches wide, after being thoroughly cleaned, is continuously immersed in a molten zinc bath having a melting point of about 785° F. and is then passed upwardly through a rectangular tubular duct member about 65 inches wide and 5 inches deep and 24 inches long disposed vertically with one end extending below the surface of the bath, as illustrated in the drawing. The tubular duct is packed to a height of about 8 inches (when in the non-expanded state) with granular particles of pea-sized coke having about a 16-mesh particle size which is equivalent to a diameter of about one-eighth inch. Nitrogen gas at a temperature of 800° F. is introduced into the lower end of the tubular duct 15 through passages in the lower end thereof, such as slots 18, at a pressure of about 81 p.s.i.a. and at a rate of about 500 cubic feet per minute to effect fluidization of the said granular coke bed. As the zinc coated strip is passed upwardly through the fluidized bed a portion of the molten zinc on the surface of the strip is removed by the continuously moving granular particles of coke and the molten zinc removed by the granules flows downwardly into the molten zinc coating bath. The strip emerging from the upper end from the fluidized bed has a uniform zinc coating with a weight of about 0.5 oz. per square foot per side and is free of surface streaks and wipe marks.

While the present invention has been illustrated in connection with providing a wiped zinc coating, a strip can be similarly coated with a molten metal other than zinc. For example, the present invention can be used to apply a molten protective metal coating of aluminum, magnesium, alloys of aluminum and magnesium or of tin, as well as a non-metallic coating, such as an acrylic resin or a like plastic, on a suitable base surface.

The present embodiment of the invention has been illustrated in connection with the application of a hot dip

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metal coating, but it should be understood that a metal strip can be coated with a molten metal by any desired means other than by hot dip coating, such as by roll coating, or by other means well known to those skilled in the art.

The phrases "in at least a partially fluidized state" and "at least partial fluidization" when used in the disclosure and claims are intended to designate a bed of particulate matter which is "fluidized," as well as a bed which is partially fluidized or in expanded state where the gas flowing through the bed is insufficient to support or "float" all of the particles forming the bed but sufficient to effect a reduction in the density of the bed as compared with the density of the static bed when no gas is passing therethrough.

I claim:

1. A method of providing a wiped fluid coating which comprises; moving an article having a fluid coating on a surface thereof through a particulate bed of granular material which is substantially impervious to wetting by said fluid coating, and maintaining said bed of granular material in at least a partially fluidized state by continuously passing a non-oxidizing gaseous medium upwardly through said material in the direction of movement of said article.

2. A method as in claim 1, wherein said bed is maintained in a fluidized state while said article is passed there-through.

3. A method as in claim 1, wherein said article is a strip of ferrous metal and said fluid coating is a protective molten metal coating selected from the group consisting of molten zinc, aluminum, magnesium, tin and alloys thereof.

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ALFRED L. LEAVITT, Primary Examiner

J. R. BATTEN, Jr., Assistant Examiner

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