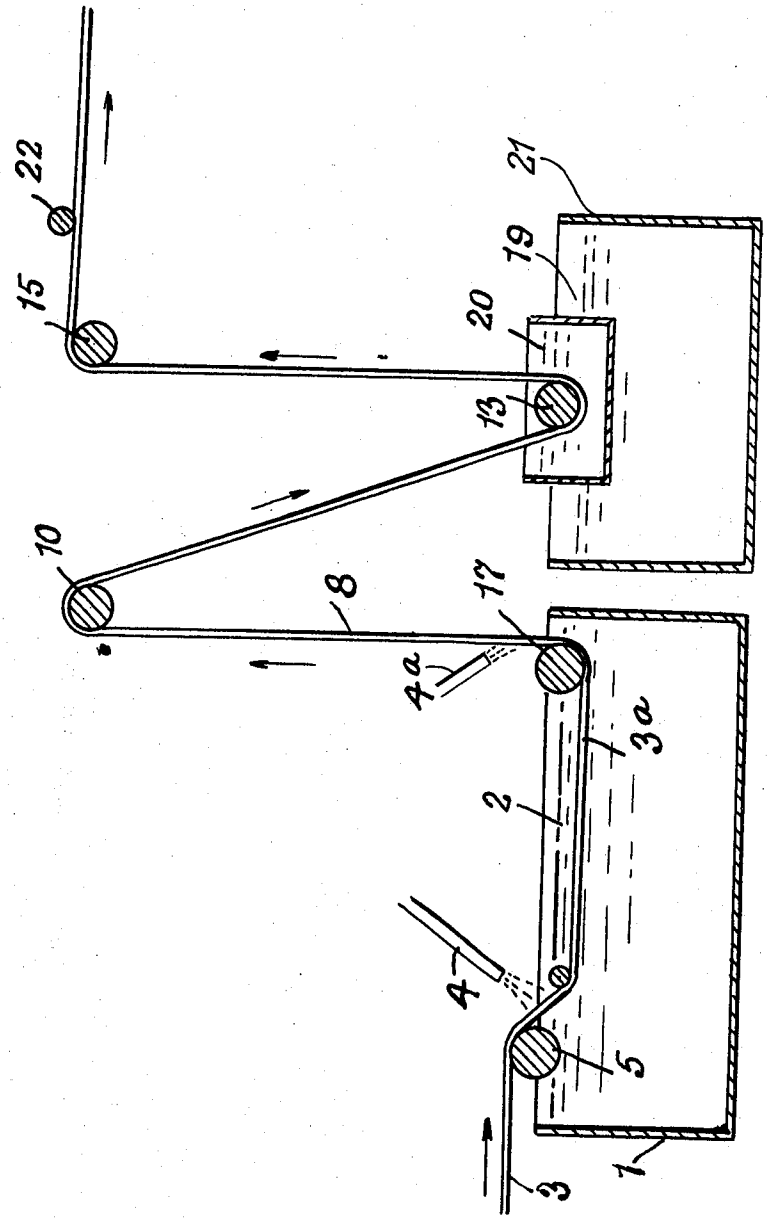
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METHOD FOR GALVANIZING

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METHOD FOR GALVANIZING

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ABSTRACT OF THE DISCLOSURE

A method and apparatus for galvanizing wire, in which the wire received directly from the drawing operation and without any annealing or acid cleaning is placed in contact with an electric charge bar or is otherwise heated to a relatively high temperature such as of the order of 1500 degrees F. The heated wire is then passed through a molten zinc bath, the temperature of which may be about one-half of that of the wire or of the order of 850–900 degrees F. The temperature of the molten zinc bath is maintained as low as possible so as to obtain the greatest temperature differential between the outer surface of the wire and the temperature of the molten zinc bath. After having been passed through the zinc bath to receive a primary coating of the zinc the wire is passed out of the bath in a vertical direction, again placed in contact with an electric charge bar which maintains the wire at a high temperature during its vertical travel, then changing the direction of travel and allowing the wire to cool. Thereafter it is again subjected to immersion in a molten zinc bath for a relatively short time to receive another zinc coating over the primary coating received from its first immersion. The twice-coated wire is then treated to an electrical charge and is then cooled and moved away for further disposition.

The present invention relates to a galvanizing method and apparatus, and particularly adaptable for the application of a zinc coating to wire.

It is an object of the invention to provide a means and method of galvanizing by which a relatively heavy coating of the galvanizing material can be applied in a manner to cause the applied coating to be more flexible or pliable than other conventionally used coatings so that the tendency of the coating to peel or crack, and especially when the wire is bent, will be greatly reduced.

The accompanying drawing diagrammatically illustrates one type of means by which the improved method of the present invention may be carried out.

Therein, **1** indicates a vat, tank or other container wherein a fluid bath **2** of molten galvanizing zinc material is contained. This coating material **2** is preferably maintained at a constant high temperature of the order of 850–900 degrees F.

The wire to be galvanized is indicated at **3** and the same may come directly from the drawing operation and without any annealing or acid cleaning. The wire is fed into the tank or vat **1** at a constant rate of speed and is continuously moved through the bath **2** to receive a coating of the molten material. Prior to its entry into the vat or tank **1**, the wire **3** is heated to a very high temperature by being placed in contact with an electric charge bar or any other suitable heating means such as a gas flame as indicated at **4** and **4***a* in the drawing. The portion **3***a* of the wire that enters the tank or vat **1** and passes through the bath **2** is thus of a tempertaure considerably higher than the temperature of the bath, such as of the order of 1500 degrees F. Thus, the temperature of the molten bath may be said to be approximately one-half that of the surface temperature of the part **3***a* of the wire. Guide rollers **5** and **17** or any other suitable wire-feeding means may be employed for the constant and steady feeding of the heated wire through the bath **2**.

The wire proceeds in the direction of the arrows shown in the drawing and at the end of its run through the bath **2**, wherein it is coated, the coated wire moves vertically out of the tank or vat **1** at which point it comes in contact with an electric charge bar or is otherwise heated so that the temperature of the wire continues to be maintained at a high degree of heat during its vertical travel. While traveling vertically the heavy zinc and zinc-iron coating on the wire is in a semi liquid flowable state and tends to run downward, the coating gradually solidifying at or near the top of its vertical travel. The direction of the wire is then changed and the wire allowed to cool in air to a considerably lower temperature approximating the temperature of the atmosphere. It may also be here stated that when the wire is first moved to the heating means **4** and **4***a* it is moved to such means also through oxygen-free atmosphere.

After being cooled by air contact the wire is subjected to a second and preferably shorter galvanizing treatment. This second galvanizing treatment is performed by passing the previously-coated and cooled wire for a second passage through the bath **20** of the molten zinc. This can be done by returning the wire to the tank or vat **1** and quickly passing it through the bath **2**, or it can be done by passing the wire quickly through a second and separate vat or tank **19**, containing the bath **20**. In either event the bath through which the wire is passed should be heated to the temperature of 850–900 degrees F. are herein mentioned. The immersion of the wire in the second bath should be relatively short as compared to that of the first bath. The wire can be fed into and out of the tank or vat **19** by means of suitable rollers **10**, **13** and **15** or by any other suitable feeding means. The bath **20** may be in communication with a larger source of hot metal held in the larger reservoir **21**.

After having received its second immersion in the galvanizing bath, the twice-coated wire is moved out of the second bath (either **2** or **20**) and is then given a short high-amperage low-voltage charge of electricity corresponding to thtat used in electric welding by means of an electric shocking bar **22**. This tends to break up the zinc-iron crystals into cubes or discs or other small shapes or particles, thus reducing the tendency of the coating to peel or crack when the wire is bent. Then the coated wire is subjected to cooling, such as by passing it through a cooling chamber or by any other sutiable cooling means. The roller **15** may be used to guide the wire to a suitable point of disposition.

The proper control of time in which the wire is in the zinc baths and the temperature of the metal and the speed in which it passes through the molten metal will govern the thickness of the applied coating. While I have herein shown in the drawing means by which the various steps of the improved method can be carried out it is to be understood that such a showing is illustrative since other means may well be used without departing from the spirit of the invention.

By means of the apparatus disclosed or by any other apparatus capable of carrying out the steps of the described method, certain effects are obtained that are not obtained by present galvanizing methods. By the application of heat of a temperature far above the heating heretofore attempted in normal galvanizing operations the heat employed will tend to cause zinc to dissolve iron of the wire and will build up crystals on the surface of the wire that will give a coarseness or roughness to such surface so that the surface can, as a result, pick up and carry a relatively heavy primary coat of the zinc. The second coating, which is preferably applied in a relatively

short passage through the second bath, will not dissolve zinc from the first or primary coat. This is particularly so since the application of the first coating resulted in the wire having a zinc-iron nature or alloy with a coating of zinc-iron crystals. The second immersion following cooling after the first immersion, adds much pure zinc to the primary coating, causing a dispersal of iron and reducing the iron in the primary coating, thus making the coating more pliable and permitting the making of sharp bends in the galvanized wire and this despite the fact that the galvanized coating is of a relatively heavy nature.

By means of the apparatus and method herein disclosed, the zinc coating is heated to temperatures that could dissolve a twelve gauge wire in seconds and as a result will instantly form zinc-iron crystals that normally would require long periods in the pots and much time in the zinc and would cause slow production. Zinc-iron alloys can, by using only a portion of this heat, be produced with a greater iron content than heretofore. The alloy will have a greater melting point than the temperature of the molten zinc such as used in present-day industry.

Successive dips can be made in zinc of normal molten temperature without causing the first or primary coat to slough off and a primary coat of zinc-iron alloy will have a matte surface similar in appearance to fine sandpaper. Thus such a surface will be harsh, brittle, rather coarse and etched due to the dissolving action of the high temperature zinc. When the wire that has the first or primary coat emerges from its first dip in the molten metal to an oxygen-free area and moves upwardly through the air, the zinc adhering to the wire will be converted into hard zinc-iron crystals having a greater iron content than crystals produced by any present day methods.

Due to the unusual formation of zinc alloy much more zinc alloy will result and the second coat, added to the primary coat, will result in a heavier coat of the zinc. The thickness of the coating can be governed by the control of time in the zinc; the temperature of the metal and the speed of the wire in passing through the molten metal.

After the completion of the second dip into the molten metal, the wire is given a low voltage, high ampere electric shock by the device **22** such as can be produced by electric welding devices. This changes the zinc-iron alloy from columnar shapes to small cubes, discs or to other shapes and as a result the iron crystals which are the cause of cracks in the coating are shattered into thousands of pieces and are softened or not strong enough to damage the second or outer coating of commercial pure zinc. This also results in a number of countless slip joints that allow the brittle alloy to be bent sharply without cracking.

When the surface of the wire becomes etched as above stated, this will permit the molten zinc to unite with that portion of the metal that readily unites with the zinc. At the high temperature of the wire the zinc can easily dissolve a portion of the outer shell of the wire and unification of the two metals will occur.

As the wire enters the first pot to receive its first coat, the electric, gas or other heating means immediately heats the wire to high temperature. The molten zinc contacting the hot wire tends to attack the outer surface of the same and after a short time in the bath the wire exits from

the molten metal moving vertically as indicated at **8** and carrying much zinc as it moves. This zinc surrounding the wire while travelling through the air away from the pot is subjected to extreme heat while the metal in the pot does not change temperature.

Time in the molten zinc permits zinc-iron crystals or dross to form on the wire. This action might well be compared to the frost that accumulates in refrigerators.

While I have herein described a means and method for the galvanizing of wire, it is to be understood that by the use of the term "wire" herein, I intend to mean flat strips, tapes, sheets and any other metallic elements to which the galvanizing process can be applied in the manner herein set forth.

What I claim is:

1. A method of galvanizing iron-containing wire by contacting it with molten zinc comprising heating the wire to a temperature of the order of 1500° F., contacting the wire with the molten zinc heated to a temperature of the order of 850–900° F. to form a coating on the wire at least a portion of which is an iron-zinc alloy, withdrawing the wire from contact with the molten zinc and thereafter heating it to a temperature substantially above the temperature of the aforesaid molten zinc, said temperature being sufficient to build up the crystals on the wire surface and impart a rough and coarse surface thereto, cooling the wire to approximately atmospheric temperature, again contacting the wire with molten zinc at a temperature of approximately 850–900° F. to form additional coating on the wire, thereafter cooling the wire and subjecting it to a short charge with electric current of low voltage and high amperage of the order of that used for electric welding.

2. A method in accordance with claim **1**, in which the wire is passed in a vertical direction after the first contact with molten zinc and during the subsequent heating steps.

3. A method in accordance with claim **2**, in which the wire is enveloped by an oxygen-free atmosphere during contact with molten zinc.

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