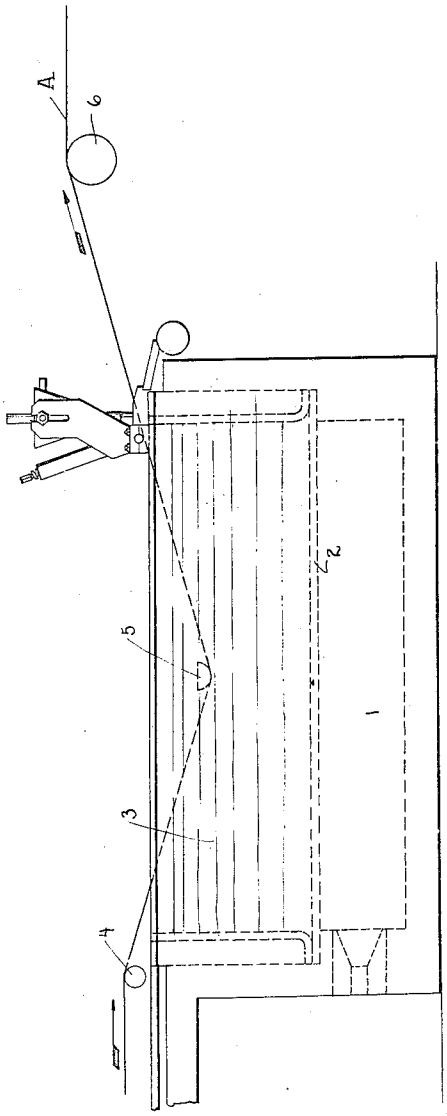
Sept. 21, 1937. H. V. WILLIAMSON ET AL 2,093,857

METHOD AND APPARATUS FOR HOT GALVANIZING IRON OR STEEL ARTICLES

Filed Oct. 4, 1934 2 Sheets-Sheet 1

FIG. 1



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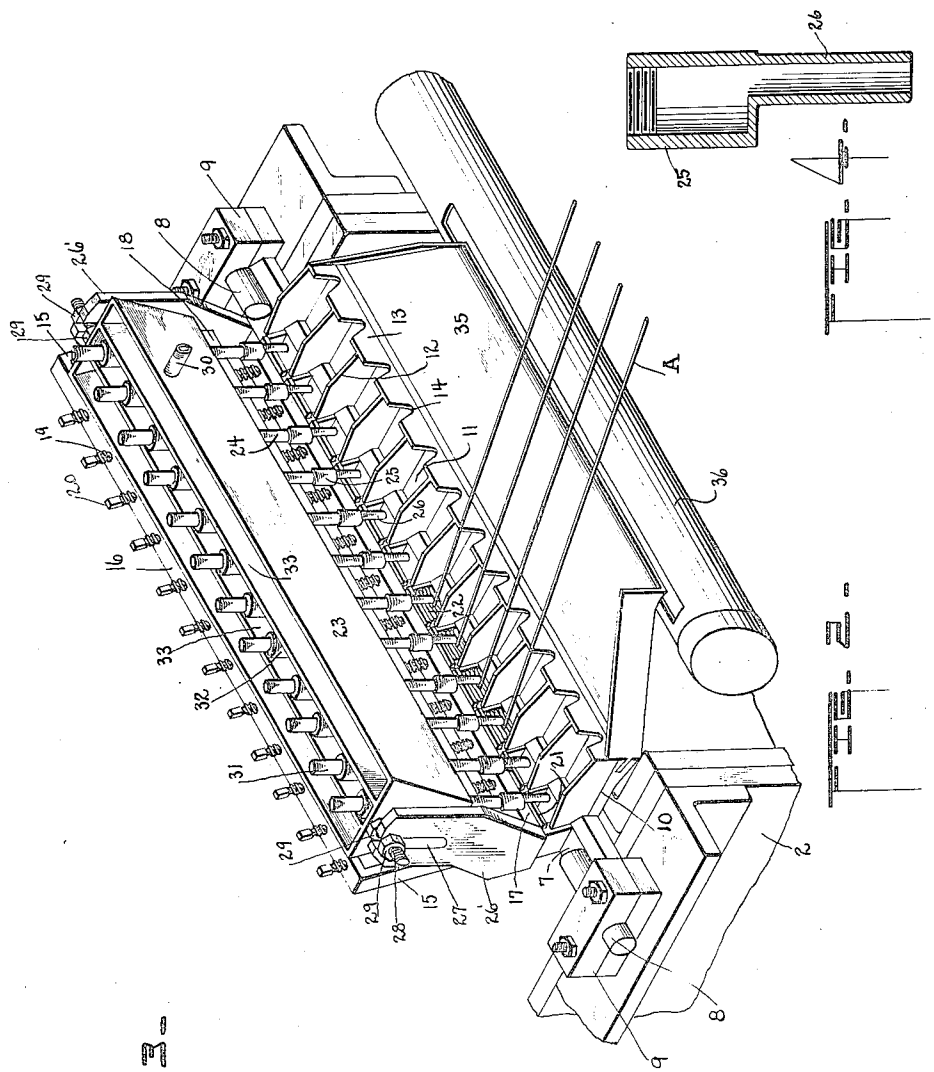


FIG. 2.

FIG. 4.

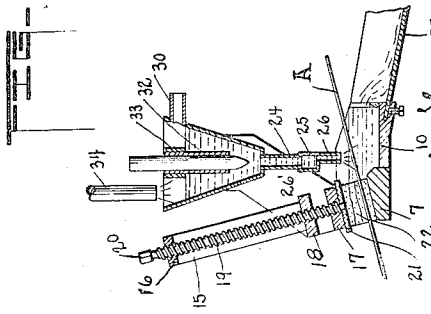


FIG. 3.

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METHOD AND APPARATUS FOR HOT GALVANIZING IRON OR STEEL ARTICLES

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14 Claims. (Cl. 91—12.5)

This invention has reference to a new and improved method of hot galvanizing iron or steel articles and of quenching or chilling the coating and article with water before permitting the coated article to come in contact with the atmosphere and thereby prevent even the normal oxidation which ordinarily occurs at the finish of the usual steps of zinc coating; and to an apparatus for employing the method.

The invention has for its principal object to zinc coat iron or steel articles by the hot galvanizing method whereby to produce a "silver bright" article, as distinguished from the usual bluish tint zinc coated article. Such a zinc coating has its appeal from a sales standpoint in regard to attractive luster or finish, especially when the article coated is wire, and where the coating is smooth and of very light weight. By our method we produce a coated wire having these characteristics and such as will permit of severe forming without appreciable cracking or peeling of the coating and the subsequent abrasion of the forming dies of various machines is considerably reduced by the use of a smooth, bright finish. Coated wire so produced finds its greatest use in pail bale handles; coat hangers; hooks, etc., wire baskets, crates, and tying wires of all descriptions.

Further objects of the invention will more fully appear from the following description taken in connection with the accompanying drawings, illustrating a preferred embodiment of the invention, in which:

Fig. 1 is a more or less diagrammatic, longitudinal sectional view through a hot galvanizing apparatus for zinc coated wire and with my improvements associated therewith for wiping and quenching or chilling the coated wire by means of water;

Fig. 2 is a perspective view of a unit assembly embodying wiping elements and means of water application for producing a "silver bright" luster or finish to the zinc coating;

Fig. 3 is a transverse sectional detail through the unit assembly showing the wiper and water applying means, and

Fig. 4 is a sectional detail of an adjustable nozzle for supplying a cold stream of water to the bath and coated wire, immediately as the wire leaves the wipes.

Like characters of reference denote corresponding parts throughout the figures.

While our method and apparatus may have general application to the hot galvanizing of zinc coated iron or steel articles, we prefer in this instance to disclose its application particularly in connection with the zinc coating of wire, as its uses in connection with wire are numerous and varied.

In Fig. 1 an outline of a typical zinc furnace 1 is shown, in which is removably supported a zinc pan 2 containing molten zinc 3. The wire to be coated is directed to the pan over a guide or roller 4, thence under a sinker 5 within the pan and thence over a roller 6, after the coated wire leaves the pan. It is at the exit end of the pan that we locate the unit assembly embodying the wipes and the water quenching or chilling means, as shown in Fig. 1 and detailed in Figs. 2 and 3.

While the present invention does not involve the usual and customary steps of annealing, pickling, fluxing and drying the wire before subjecting the wire to the hot galvanizing bath, these steps are of course factors which are here recognized because time and temperature play their part, depending on the gauge or size of wires to be coated. The larger the wire, the longer immersion in the zinc bath, keeping the speed constant. In practice, due to the fact that the zinc bath has certain physical limitations, it is sometimes necessary to reduce the rate of travel of the wires in order to permit the wires to remain in the bath for the necessary length of time. In some cases, particularly where elongation requirements are a factor, it is necessary to operate at slower speeds with certain heats of steel which are not extremely ductile.

The unit assembly, embodying the wipes and the water applying means, to which reference has been made, is best seen in perspective in Fig. 2 and in section in Fig. 3. This unit comprises a base member 7 with extension trunnions 8 from its opposite ends and said trunnions are manually rockable in split bearings 9 provided with nuts and bolts for securely holding the trunnions firmly in adjusted positions. The lower half of each of these split bearings is secured to preferably angle irons secured to the outside of the side walls of the pan 2. Extending the length of the base, between the trunnions, and disposed forwardly thereof for a suitable distance, is a trough 10 which is divided into a multiplicity of water compartments 11 by a multiplicity of transversely arranged partitions 12, the upper edges of which are inclined upwardly from the front wall 13 for a predetermined distance and then rearwardly approximately paralleling the bottom wall of the trough. The front wall 13 of each compartment is provided with a V shaped

overflow notch 14, preferably centrally disposed, with the base of the V shaped notch being located above the bottom of the trough, a suitable distance. The upper face of the base 7 is preferably inclined forwardly and upwardly from its rear edge, see Fig. 3, whereas the bottom of the trough 10 is substantially horizontal or flat and the front wall 13 and partitions 12 are disposed vertically and at right angles thereto. Extending upwardly from the base 7, at each end of the trough 10, and disposed at right angles to the upper surface of the base, are supports 15 connected at their upper ends by a cross-frame 16. Extending lengthwise of the base 7, between the supports 15, are a pair of spaced bars 17 and 18, the lower face of the former being preferably above the rearwardly inclined upper edge of the partitions 12, while the bar 18 is spaced a suitable distance above the bar 17. Threaded through the cross-frame 16 and the bars 17 and 18 are compression screws 19 having their upper ends squared, as at 20, to be engaged by a suitable tool for threading the screws downwardly or for retracting the same, in manner well understood where compression wipes are used. In this connection there is a screw 19 coincident with each water compartment 11, and the lower end of each screw where it protrudes through the lower bar 17 is connected with a pressure plate 21, and in such a manner that the plate may be lowered and raised bodily while at the same time the screw is actuated. Between each pressure plate 21 and the upper surface of the base 7 are arranged a series of asbestos wipes 22.

The unit assembly, as now described, is so placed and disposed that a coated wire A leaving the zinc bath travels in substantially a straight line, inclined upwardly, from the sinker 5 in the pan 2 to and over the roller 6 and between asbestos wipes 22 and through a water compartment 11 in the trough 10, as is seen in Fig. 3. The combination of elements thus far described constitutes the wipe portion of the assembly, even though the water containing trough 10 is included. The trunnions 8 permit tilting of the wiping part of the apparatus and the trough 10, in order to obtain the best water application in conjunction with the position of the coated wires being treated. In practice, it is desirable, and in fact necessary, for the wipes (that is the asbestos parts of the wipes) and the compression screws to be perpendicular to the travel of the coated wires. This will prevent the wires from cutting in either the bottom part of the asbestos wipe or the upper section. The positions of the wires are more or less determined by the installation of the pan 2 and the roller 6. While this adjustment, in practice, is made only when a new pan 2 is installed, or when extra large wires are being galvanized, nevertheless the simple means of obtaining this adjustment, by means of the trunnions 8, on the ends of the wipe, is a valuable adjunct to the wiping, because it eliminates the former practice of obtaining this adjustment (that is perpendicular to the travel of the wire) by means of wedges and shims.

The angle at which the coated wires travel, as they leave the bath, and the consequent adjustment of the trunnions 8 will control the height of the water in the trough 10, see Fig. 3. As will be readily understood, it will be desirable, at times, to use two or more top asbestos wipes 22 in order to have the wires, in their travel, submerged under the maximum amount of water. In no case should the water in the trough be permitted to flow over the top of the wipes 22 and in this way enter the pan 2, because if it does it will freeze the zinc back of the wipes and cause the wires to break. The angle of travel of the wire from the zinc bath is contingent somewhat upon the position of the roller 6 and its location in reference to the sinker 5. To obtain the best results, the angle of withdrawing the wire from the zinc bath should be as acute as the apparatus will permit.

Water is furnished and applied to the coated wires immediately on their emerging from the wipes 22 in the following preferred manner. 23 designates a reservoir which is at least as long as the trough 10 and adjustably supported thereabove. The sides of the reservoir preferably converge inwardly and downwardly and coupled to the bottom of the reservoir and depending therefrom are a plurality of discharge pipes 24, one above each compartment 11 in the trough 10. Adjustably connected to the lower end of each pipe 24 is a discharge nozzle 25, see Figs. 3 and 4, which depend to a convenient point for discharge of water into the compartments 11 of the trough 10 and onto the coated wires travelling through the water in said trough. The connection of each nozzle 25 with a pipe 24 is concentric so that it may be adjusted about said pipe. The discharge end 26 of each nozzle is eccentric to its body which gives a wide range of adjustment so that the end of the nozzle may be located above a wire with the travelling wire intersecting the axis of the flow of water from the nozzle.

The reservoir 23 is supported at its opposite ends by stationary supports 26' from the base 7. These supports, at their upper ends, are provided with vertically arranged slots 27 and extending from each end of the reservoir are threaded members 28 which pass through and have a bearing in the slots 27 of the supports 26' to permit of vertical adjustment of the reservoir on its supports and also serve as a fulcrum point about which the reservoir and its discharge nozzles may have pivoted adjustment. Locking nuts 29 on the threaded members are employed to secure the reservoir in fixed and adjusted positions. Thus it will be seen that the position of the wipes in relation to the angle of travel of the coated wires and the height of the water in the trough, may be determined by adjusting the wipe support and trough on the trunnions 8 and the reservoir with its discharge nozzles may be raised and lowered as well as pivoted on the members 28 and the nozzles adjusted, so that a proper direction of flow of water on the wires may be obtained.

The reservoir 23 is provided with an overflow pipe 30, and means are provided to shut off the water outlets from the reservoir to the discharge pipes 24. These means comprise a plurality of vertically adjustable plugs 31 having tapered lower ends serving as closing valves when caused to enter the inlet ends of the pipes 24 and said plugs have a sliding and frictional fit within sleeves 32 supported in depending positions within a frame 33 disposed longitudinally in the upper part of the reservoir. Water may be supplied to the reservoir through a feed pipe 34 from any suitable source, and the volume required adjusted and maintained by a suitable valve, not shown, because in practice it is often desirable that the height of water, which determines its pressure, be considerably less than that which is

obtained by the maximum weight as controlled by the overflow pipe 30.

Overflow water from the trough 10 passes out through the notches 14 in the front wall of the trough and onto an apron 35 from which the water is discharged into a slotted pipe 36 and conveyed to the sewer. This apron extends forwardly and downwardly from the trough 10 and has preferably side walls converging to its discharge end. The slot in the pipe 36 will permit of such adjustments as may be made in the wipe support.

In operation, the coated wires leave the zinc bath at approximately 900° F. and immediately enter between the asbestos wipes and on leaving the wipes pass through water in the trough 10, the level of the water being above the wires at the point of exit of the wires from the wipes, and by employing a steady stream of water without a great deal of force on the wires, by the use of the reservoir and nozzles, no air bubbles are permitted to form along the wire and the dull gray spots are reduced. By immersing the coated wires, as they leave the wipes, in water and constantly applying a cold stream thereon, we are able to quench or chill the coating of zinc to the point where oxidation does not occur, yet the heat of the wire is sufficient to dry any adhering water which remains on the surface.

Water quenching or cooling per se is not broadly new but so far as we are aware such applications are and have been made after the wire has come into contact with the atmosphere. By our method and apparatus the coated wire does not come into contact with the atmosphere until after the water treatment. The preferred speed of travel of the wire is that speed which will permit obtaining the correct physical properties, a uniform coating free from any defects caused by excessive vibration or pinching off due to freezing of the "Dillberry" (an expression which describes an envelope or accumulation of surplus zinc and skimmings which collects around the coated wires back of the wipes and between the wipes and the surface of the molten zinc), and at a speed which permits the water to sufficiently quench or chill the wire so that when it leaves the water in the trough 10 it is cooled to a point where oxidation, if any, is reduced to a minimum. The coating obtained by this method of galvanizing is extremely smooth, light in weight and permits severe fabrication. The gauge or size and roundness of the wire may be held within very close limits due to the thinness of the coating plus its uniformity. The smoothness of the coating obtained lends itself to many operations. The attractiveness of the "silver bright" finish makes the wire very desirable for articles which are not subjected to severe exposure, and the brightness is a sales point for many of the articles manufactured from such wire. The resulting coating obtained while only moderately protective, nevertheless is ample for many uses to which this wire is put. It also is of such a thin nature that permits the welding of this product without excessive obnoxious fumes during he welding operation.

While the coated wire enters the trough 10 at a temperature in the neighborhood of 900° F., the water in the trough is continuously being replenished from the reservoir 23 through the nozzles 25. Change of degree in volume of water may be obtained by changes in sizes of nozzles and the depth of water in the reservoir 23, but the practical limitations here are quite narrowly restricted, owing to the size of the reservoir, the overflow therefrom, the overflow notches in the front wall of the trough and the fact that the streams of water from the reservoir must not splash excessively. It is obvious, therefore, that with a large size wire it is necessary to operate at a slower speed than with the smaller gauges, in order to obtain the quenching or chilling effect necessary before permitting the wire to contact the atmosphere. Practice has shown that it is not possible to operate by our method at too slow a speed due to the fact that the zinc which is removed by the wipes and forming a "Dillberry" back of the wipes may become solidified or frozen to such an extent that it pinches off the fine wires. This defect we have noticed when coating a #14 gauge wire at a speed of less than 80 ft. per minute. It is also noticeable on the heavier gauges of wire when operating at less than 70 ft. per minute, by a decided chattering or vibration, which in turn causes a roughness of the coating.

In practice, it is desirable that the discharge of the water from the trough 10 be approximately equal to that which is supplied from the reservoir through the nozzles 25, so that the trough 10 may always be filled with water. The constant pressure of water and volume is controlled by means of the reservoir and its overflow. The reservoir will provide an ample volume of water, yet a lazy stream in order to minimize the bubbles which would form if a rapid stream of water was injected into the trough. By the use of the shut off plugs 31 the flow of water to any of the compartments 11 in the trough 10 may be cut off. By means of the overflow 30 any non-uniformity in the supply of water to the reservoir may be taken care of.

By adjustably supporting the reservoir the discharge of the water from the nozzles may be controlled so that the water may be discharged directly over the wires and at a point between the asbestos wipes and the point where the wires emerge from the trough 10. This adjustable feature is necessary when the wipes proper are tilted because it permits of leveling up the reservoir so that the streams of water will not hit the wires after they have left the trough 10. Furthermore, it will be noted that the V shaped notches providing for the overflow from the trough 10, are ample to take care of the condition when it is necessary or desirable to change any of the wipes; that is, the overflow will permit of draining of any or all of the compartments 11 of the trough 10, to a point where the water in the trough is below the bottom wipe, so that when these wipes are changed no water will flow back into the zinc bath proper.

What we claim is:—

1. The method of zinc coating iron or steel articles to produce a "silver bright" luster or finish to the coating, which consists in subjecting the article to a molten zinc bath; passing the coated article between compression wipes immediately on removal of the same from the bath prior to substantial atmospheric exposure, and quenching or chilling the zinc coating as the coated article leaves the wipes and before the coated article comes in contact with the atmosphere by immediately introducing the coated article into a body of water at a point below the surface thereof, and passing the coated wire therethrough.

2. The method of zinc coating iron or steel articles to produce a "silver bright" luster or finish to the coating, which consists in subjecting

the article to a molten zinc bath; passing the coated article between compression wipes immediately on removal of the same from the bath before substantial exposure to the atmosphere, and quenching or chilling the zinc coating as the article leaves the wipes and before exposure to atmosphere by immediately introducing the coated article into a water bath at a point below the surface thereof and maintaining a proper temperature of the water bath by constantly applying a cold stream of water thereto.

3. The method of zinc coating an iron or steel wire to produce a "silver bright" luster or finish to the coating, which consists in passing the wire through a molten zinc bath, wiping the coating and immediately introducing the coated wire into water bath and at a point below the surface thereof before the coated article comes in contact with the atmosphere, whereby to quench and chill the coating and thereby prevent oxidation.

4. In an apparatus of the character described, in combination with a molten zinc bath, a unit including compression wipes and a water bath supported at the exit end of the zinc bath whereby the zinc coated wires enter between the wipes immediately on leaving the zinc bath without substantial atmospheric exposure and on leaving the wipes are immediately submerged within and passed through the water in the water bath before the coated wires come in contact with the atmosphere, and means for supplying a cold stream of water to the surface of the water bath.

5. In an apparatus of the character described, in combination with a molten zinc bath, a unit including compression wipes and a water bath supported at the exit end of the zinc bath whereby the zinc coated wires enter between the wipes before substantial exposure to the atmosphere and immediately on leaving the zinc bath and are directly introduced into and pass through the water bath immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, means for supplying a cold stream of water to the surface of the water bath, means for adjusting the position of the wipes in relation to the plane of travel of the wires from the zinc bath, and means for adjusting the water supply to the water bath.

6. In an apparatus of the character described, in combination with a molten zinc bath, a unit comprising compression wipes, a water trough and reservoir supported at the exit end of the zinc bath whereby the zinc coated wires enter between the wipes immediately on leaving the zinc bath and prior to atmospheric exposure and are directly introduced into and pass through water in the trough immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, means for supplying water from the reservoir to the trough, means for adjusting the position of the wipes in relation to the plane of travel of the wires from the zinc bath, and means for adjustably supporting the reservoir and for regulating the point of discharge of water into the trough.

7. In an apparatus of the character described, in combination with a molten zinc bath, a unit comprising compression wipes, a water trough and reservoir supported at the exit end of the zinc bath whereby the zinc coated wires before substantial atmospheric exposure enter between the wipes immediately on leaving the zinc bath and are directly submerged within and pass through water in the trough immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, a plurality of adjustable discharge outlets for water from the reservoir to the trough, means for regulating the flow of water from the reservoir through said discharge outlets, an overflow from said reservoir, a source of water supply to said reservoir, means for adjusting the position of the wipes in relation to the plane of travel of the wires from the zinc bath, and means for adjustably supporting the reservoir and said discharge outlets.

8. In an apparatus of the character described, in combination with a zinc bath, a unit comprising a series of compression wipes, one set for each wire, a water trough in advance of the wipes and a reservoir above the trough arranged so that the coated wires prior to substantial atmospheric exposure enter between the wipes immediately on leaving the zinc bath and are immersed in and pass through water in the trough immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, said trough divided into a series of separate water compartments, one for each wire, and having an overflow, a discharge pan to receive water overflowing from said trough, means to convey waste water from said pan, a plurality of discharge outlets from the reservoir for supplying streams of water to the trough, one above each compartment, means for adjusting the position of the wipes in relation to the plane of travel of the wires from the zinc bath, and means for adjustably supporting the reservoir.

9. In an apparatus of the character described, in combination with a zinc bath, a unit comprising a series of compression wipes, one set for each wire, a water trough in advance of the wipes and a reservoir above the trough arranged so that the coated wires prior to substantial atmospheric exposure enter between the wipes immediately on leaving the zinc bath and are immersed in and pass through water in the trough immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, said trough divided into a series of separate water compartments, one for each wire, and having an overflow, a discharge pan to receive water overflowing from said trough, means to convey waste water from said pan, a plurality of discharge nozzles depending from said reservoir, one above each compartment, and adjustable eccentrically whereby to be positioned for discharging a stream of water into said trough above a coated wire, means to control the flow of water from the reservoir to the discharge nozzle, means for adjusting the position of the wipes in relation to the plane of travel of the wires from the zinc bath, and means for adjustably supporting the reservoir.

10. In an apparatus of the character described, in combination with a molten zinc bath, a unit comprising compression wipes, a water trough and reservoir arranged so that the coated wires prior to substantial exposure to the atmosphere enter between the wipes immediately on leaving the zinc bath and are immersed in and pass through water in the trough immediately on leaving the wipes and before the coated wires come in contact with the atmosphere, means for pivotally supporting the unit in respect of the zinc bath, means for vertically and pivotally adjusting the reservoir in its relation to the trough, adjustable water outlets for regulating the discharge of water from the reservoir to the trough, means to carry off waste water from the trough,

and means to supply the reservoir with water from a source of supply.

11. In an apparatus of the character described, in combination with a molten zinc bath, a unit including wipes and a water bath supported at the exit end of the zinc bath, the inlet end of the wipes being in close proximity to the level of the zinc bath and the outlet end of the wipes being submerged below the level of the water bath, whereby the coated article is not substantially exposed to atmosphere until after its exit from the water bath.

12. In an apparatus of the character described, in combination with a molten zinc bath, a unit including wipes and a water bath supported at the exit end of the zinc bath, the inlet end of the wipes being in close proximity to the level of the zinc bath and the outlet end of the wipes being submerged below the level of the water bath, whereby the coated article is not substantially exposed to atmosphere until after its exit from the water bath, and means for pivotally adjusting the unit to control the level of water in the water bath.

13. In an apparatus of the character described, in combination with a molten zinc bath, a unit including wipes and a water trough supported at the exit end of the zinc bath, means for supplying a liquid to the water trough, one end of the wipes forming one of the walls of the water trough, the inlet end of the wipes being in close proximity to the level of the zinc bath and the outlet end of the wipes being below the level of the liquid in the water trough whereby the coated article is not substantially exposed to atmosphere until after its passage through the liquid in the water trough.

14. In an apparatus of the character described, in combination with a molten zinc bath, a unit including wipes, a water trough, a reservoir and ducts leading from the reservoir to the water trough, one end of the wipes forming one of the walls of the water trough, the inlet of the wipes being in close proximity to the level of the zinc bath and the outlet of the wipes being below the level of the liquid in the water trough whereby the coated article is not substantially exposed to atmosphere until after its passage through the liquid in the water trough.

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