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ANTIPICKUP ROLL CONSTRUCTION AND UTILIZATION FOR PLATING LINES

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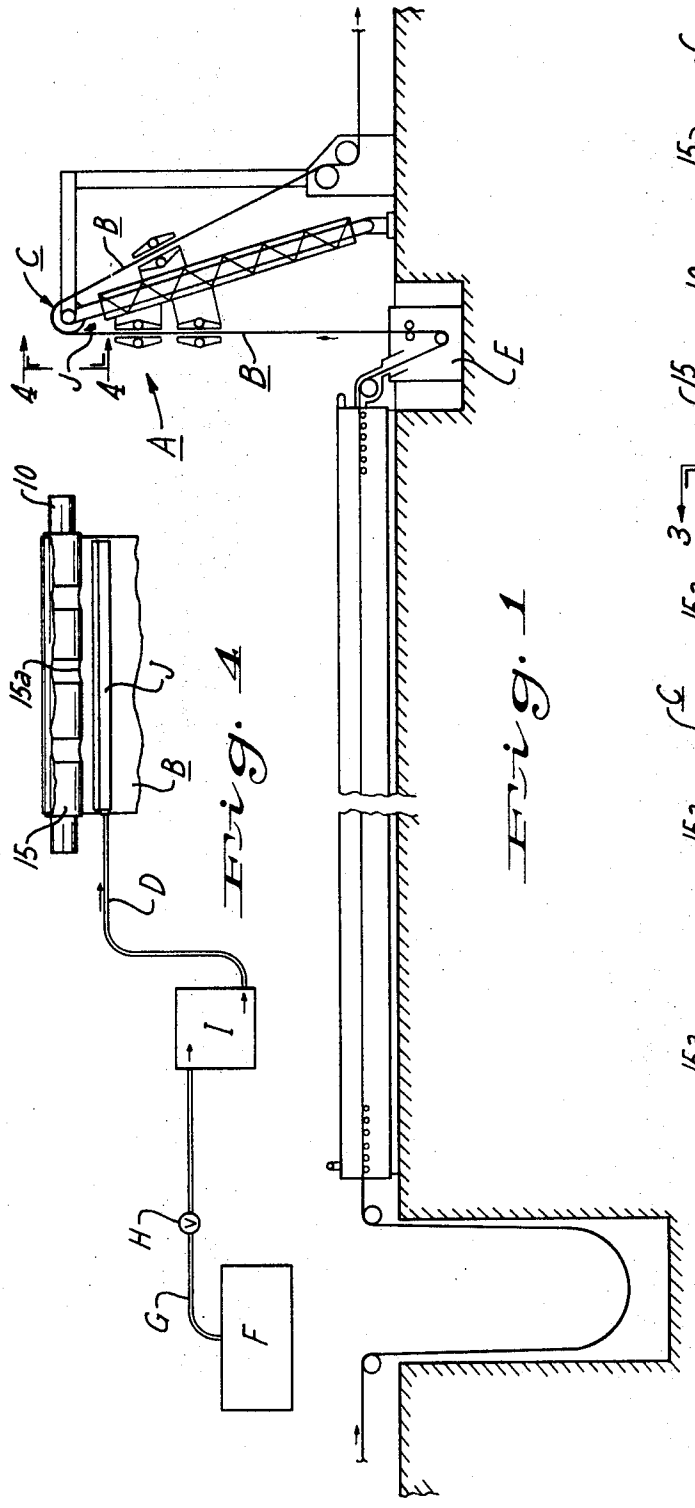

Fig. 4

Fig. 1

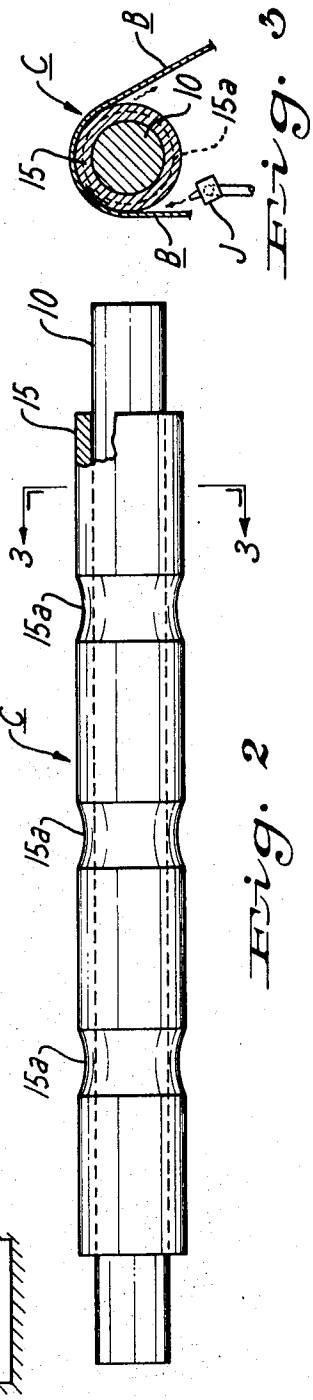

Fig. 2

Fig. 3

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ABSTRACT OF THE DISCLOSURE

An after-positioned guide roll for a continuous galvanizing line has a specially constructed composite structure comprising a substantially solid main body and a surface-treated protective sleeve thereon which is resistant to pick-up of hot coating material, such as zinc or an alloy of zinc and aluminum that is carried on the surface of a workpiece. The sleeve is given a special heat treatment and thereafter provided with a highly adherent, relatively finely textured red rust (ferric oxide) on its outer peripheral surface, is securely-mounted in position on the main body, and has a group of longitudinally spaced-apart, annular groove portions that define fluid flow passageways about the roll.

The invention relates to an improved guide roll construction and utilization for workpieces that are being moved from a plating bath such as a hot dip galvanizing bath or dip. An important phase of the invention deals with eliminating the adverse effects of roll pickup of portions of coating material from a coated or plated workpiece.

The overhead or cooling tower guide roll for a galvanizing or zinc coating line has heretofore tended to pick up the zinc containing coating or galvanizing metal from a previously applied or dipped and still hot workpiece as it is advanced thereover. This pickup not only causes a loss of coating from the standpoint of the workpiece, but progressively builds-up on the roll surface and particularly gives rise to great difficulty in a so-called continuous line operation. The picked-up and retained coating will tend to mar the finished surface of a workpiece during its movement thereover and irrespective of whether or not the roll is of an idler or of a driven type. The processing line must be frequently stopped to remove such surface adhering coating material.

There have been many attempts to eliminate the above difficulty, such as the use of a glass cover, the use of a stainless steel roll, or the employment of a continuous buffing action on the surface of the guide roll. It has been found that buffing actually makes subsequent pickup much more easy and, as a result, the present-day practice has been to use either the glass cover or a stainless steel roll and to try to knock-off the picked-up material rather than scrape it from the roll.

In view of the above, it has been an object of the invention to provide a solution to the problem heretofore presented from the standpoint of roller-guided movement of a workpiece after it has been plated or hot dip galvanized.

Another object has been to provide an inexpensive, practical and efficient roll construction for substantially eliminating the pickup of galvanized coating material from a hot dipped workpiece.

A further object of the invention has been to devise a composite or two-part roll construction which will provide for and enable the utilization of a ferric oxide peripheral surface on the roll which surface has little or no affinity for the galvanized coating.

A still further object of the invention has been to provide improved procedure for roll-guiding of a hot galvanized workpiece through a cooling tower or the like.

These and other objects of the invention will appear to those skilled in the art from the illustrated embodiment and the claims.

By way of illustration, FIG. 1 is a somewhat diagrammatic fragmental view in side elevation illustrating the utilization of a typical hot galvanizing or plating line with a cooling tower and its tower roll.

FIG. 2 is a horizontal side view of a roll constructed in accordance with the invention.

FIG. 3 is an end section of the roll of, on the scale of and taken along the line 3—3 of FIG. 2; it further illustrates means for utilizing the roll in an optimum manner with an inert gas, also in accordance with the invention.

And, FIG. 4 is a somewhat diagrammatic view of slightly larger scale than and taken along the line 4—4 of FIG. 1.

A guide roll such as used in an overhead relation in the cooling tower of a galvanizing line is usually operated as an idler roll. I have conceived of utilizing an especially constructed sleeve which will not require brushing or conventional hammering operations for removing adherent coating material. It also eliminates the need for expensive material, such as stainless steel.

In accordance with the invention, a metal sleeve **15** of, for example, an inexpensive, relatively low carbon steel (less than about .90% C), is formed to substantially the full, strip-receiving effective length or width of a guide roll C of a suitable shape-retaining thickness, such as of at least about 24-gauge, but preferably of heavier thickness. The sleeve **15** is shown provided with notch, recess, concave or groove portions **15***a*, each having an intermediate or maximum depth of about ⅛ of an inch, and as being equally spaced along the sleeve. For example, the valley or groove portions **15***a* of open annular shape may have about 3⅝-inch centers with 1¼-inch banding widths to give a spacing therebetween of about 3 inches. Each groove portion **15***a* may be formed as a segment of a 1¼-inch circle and defines an annular fluid-flow passageway about the sleeve **15** and with respect to the opposed surface of a workpiece that is to be substantially continuously moved thereover.

The sleeve **15**, after having been shaped and provided with groove portions **15***a*, is given a passivizing heat treatment and its surface oxidized. This may be accomplished by annealing it at a temperature of about 1800° F., soaking for about four hours, cooling and then machining and polishing. The sleeve **15** is given a high mirror finish by the machining and polishing. It is then subjected to or given a second or normalizing annealing treatment at a lower temperature of about 1200° F., soaked for about two hours, and thus provided with a so-called blue anneal. In the next step, the blue annealed sleeve is pickled in a hydrochloric (muriatic) acid until all scale is removed. The pickling is followed by a first rinse in cold water, a second rinse in hot water and a final rinse in cold water. After having been removed from the cold water, it is permitted to dry at room temperature and to rust until an adherent relatively finely textured, ferric (red) oxide at least covers its outer peripheral surface.

It has been determined that the thus conditioned steel sleeve **15** is very passive after annealing and rusting, and that its surface has no affinity for the galvanized coating, whether or not it is of substantially pure zinc or contains aluminum as an alloy, for example, about .30 to .80% of aluminum, with the remainder being zinc. The special grooving on the sleeve **15** is important in facilitating or speeding the removal of heat to thus keep the roll cooler and prevent warping of the roll C as well as of the workpiece B.

The construction also makes practical an optimum operation wherein an inert gas or fluid, such as nitrogen,

is sprayed or applied between the peripheral surface of composite roll C and the under surface of entering workpiece B. It provides a thin film between the workpiece and the surface of the roll, as furthered by the use of the spaces or passageways provided by the portions **15***a*. The nitrogen functions to not only cool the workpiece and the roll but also aids in keeping the applied galvanized coating non-reactive to the roll surface. In this connection, the cooling rate may be controlled by regulating the temperature of the fluid and its rate of application. The application of such a gas is particularly advantageous when a relatively heavy guage of workpiece is being processed which, by reason of its body, will tend to be more retentive of the heat having, for example, a temperature of about 600° F. at the point of entry to the roll C. It is also particularly advantageous where, as here, a continuous high speed movement of a strip workpiece B is contemplated. It provides a non-reactive cooling agent which serves also as a protecting means for the strip B to supplement the cooling action of air blasts that may be applied to the strip in its movement from a galvanizing bath or pool E up through a cooling tower A.

In FIG. 1, A represents a typical cooling tower into which and upwardly along which a workpiece, such as a continuous strip B, is moved for cooling purposes after it has passed through a hot dip pit or the tank E in a galvanizing line. Also, in this figure, C represents an idler tower roll over which the hot galvanized strip or sheet may be continuously passed for accomplishing a guided cooling action. The roll C, as shown in FIGS. 2 and 3, has a primary, inner, base or main body part **10** of solid cylindrical shape and the sleeve or collar part **15** may be mounted thereon in a conventional manner, as by a frictional or sweat-on fit to, in effect, become an integral covering part thereof. As previously indicated, the sleeve part **15** has a series of annular valley or groove portions **15***a* in a spaced-apart relation therealong that are preferably equally-spaced longitudinally of the roll; each grooved portion **15***a* represents a segment of a circle, has a concave shape, with its greatest depth at the mid point of its width. The groove portions **15***a* provide cooling spaces along the roll C and, in effect, passageways for the reception and flow movement of the inert gas, such as nitrogen, when applied along the width of the metal strip or workpiece at substantially the point of entry or initial engagement of the galvanized strip B with assembled, composite roll C. See the spray header J of FIGS. 1, 3 and 4 which will preferably have a width substantially corresponding to the width of the sleeve **15** to apply the fluid or gas along its full transverse extent.

The sleeve **15** is especially constructed for its utilization as a strip engaging surface that is resistant to the hot-applied coating on surfaces of the workpiece B. The sleeve **15** may be either first formed with the groove portions **15***a* or, as an alternative, the main body **10** may have groove portions formed thereabout and the sleeve, if of relatively thin section, may be slid endwise thereon and then shaped or rolled to conform thereto and to provide complementary groove portions **15***a*. The sleeve **15** is fully conditioned, as in accordance with the previously described procedure, to have a red oxide or rusted surface thereon before it is applied to the main body **10** and utilized in guiding the workpiece B thereover.

In FIGS. 3 and 4, the spray jet header J for applying an inert fluid or gas, such as nitrogen, between the surface of the galvanized workpiece or strip B and the peripheral surface of the roll C has, as illustrated, a location immediately adjacent to and in front of the roll C for introducing the gas at the point of entry or engagement of the under surface of the galvanized workpiece B with

the roll C. The gas is shown being supplied under positive pressure from a suitable source, such as a pressure tank F, along line G, through a control valve H and, if desired, through a cooling unit I along line D and out through spray header J. The pressure of application may vary, depending upon the speed of the workpiece but, in general, may be in the neighborhood of about 33 to 50 pounds per square inch. For maintenance purposes, the sleeve **15** may be replaced on the main body **10**, since the main body, itself, is subjected to minimum wear and tear, and further, since it can effectively be maintained at a much lower operating temperature employing the invention.

It will be apparent to those skilled in the art that various modifications may be made in the disclosed representative apparatus and procedure without departing from the spirit, scope and content of the invention.

I claim:

1. In an improved guide roll for moving a hot galvanized metal workpiece of material continuously over its outer peripheral surface, a substantially solid metal main body of cylindrical shape, a ferrous metal enclosing sleeve of cylindrical shape securely mounted on said body, and said sleeve being provided with a highly adherent red ferric oxide over substantially the entire peripheral surface having relatively no affinity for the galvanized metal of the workpiece.

2. In a guide roll as defined in claim **1**, said main body being of ferrous metal, and said sleeve being a relatively passive steel of relatively low carbon content of not greater than about 0.9%.

3. In a roll as defined in claim **2**, groove portions about the outer periphery of said sleeve and having an open concave annular shape.

4. In a roll as defined in claim **1**, a group of spaced-apart annular groove portions about said sleeve for providing fluid passageways between the outer peripheral surface of the roll and an engaging surface of the workpiece along which cooling fluid may be moved.

5. In a roll as defined in claim **4**, said groove portions being equally spaced along said sleeve and being of lesser width extent than remaining outer peripheral portions therebetween of said sleeve that are to be engaged by the workpiece moving therealong.

6. In a roll as defined in claim **5**, each of said groove portions having a maximum depth at its mid point thereof of about ⅛ of an inch, a width of about 1¼ inches, and a substantially equally spaced relation with respect to each other.

7. In a roll as defined in claim **6**, said equally spaced relation being about 3 inches.

8. In a roll as defined in claim **3**, spaced-apart annular groove portions about an outer peripheral surface of said main body, and said groove portions of said sleeve having a securely-engaging complementary-fitted positioning within the groove portions of said main body.

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