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METHOD OF AND APPARATUS FOR PREVENTING EDGE BUILD-UP OF COATING MATERIAL ON DIP-COATED STRIP

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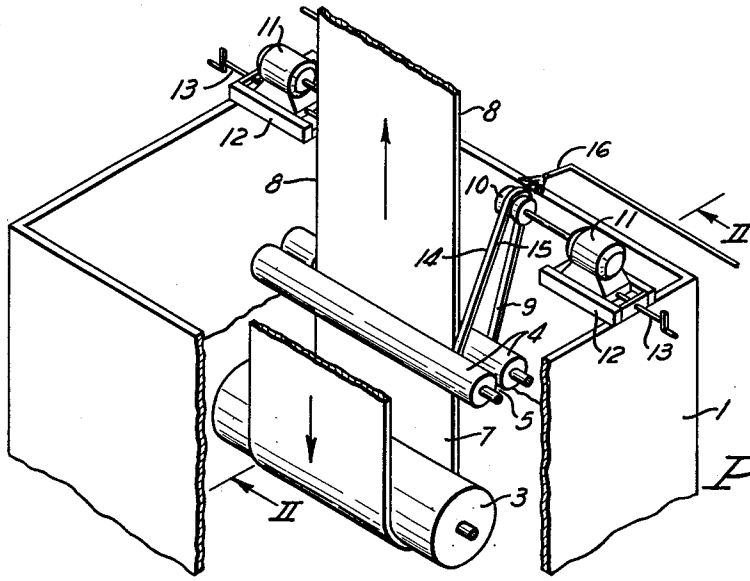


Fig. 1

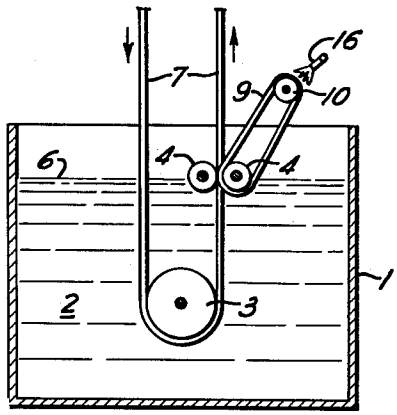


Fig. 2

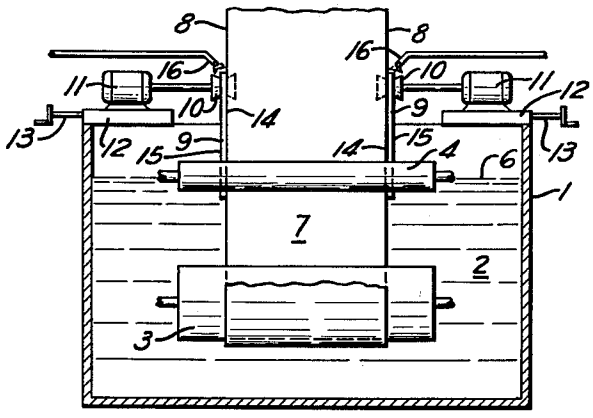


Fig. 3

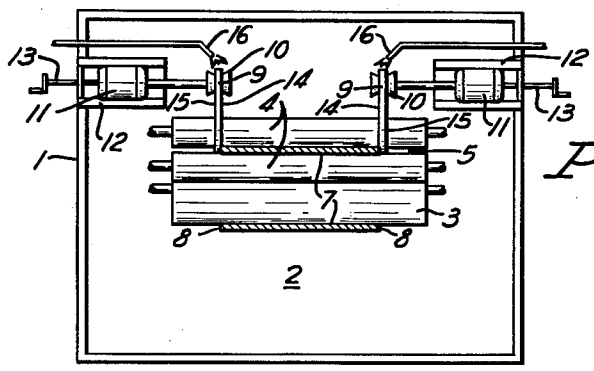


Fig. 4

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METHOD OF AND APPARATUS FOR PREVENTING EDGE BUILD-UP OF COATING MATERIAL ON DIP-COATED STRIP

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This invention relates to dip-coated strip product and, as indicated, to a method of and apparatus for preventing heavy accumulations of the coating material along the edges of the strip. While not so limited, it is particularly adapted to continuous strip coating operations.

For purposes of definition, the term "strip" as used herein is intended as generic to strip product in continuous form which is coated by a continuous operation and in sheet form which is coated by an intermittent operation.

Strip product is coated to provide, for example, corrosion protection, improved surface appearance and finish, a base coat for further additional finishing operations, and lubrication for subsequent operations. The material used for coating may be any of a large number of materials that can be applied to the strip by immersing in a bath of the coating material. Typical examples of such coating materials are as follows: metals such as zinc, lead, tin, tin and lead, aluminum, etc.; organic finishes such as lacquer, varnish, paint, enamel, etc.; and plastic resins such as polyvinyl chloride, polyvinyl acetates, etc.

Coatings of the above materials are usually applied, according to conventional practices, by immersing the strip in a bath of the coating material through which its movement is directed under a sink roll by suitable guides. After passing under the sink roll, the strip travels through a pair of exit rolls that are partially submerged in the bath and define a pass through which the strip is withdrawn from the bath. By regulating the pressure of the exit rolls on the strip and by the provision of grooves on the surfaces thereof, the thickness of the coating on the strip is controlled. The coating thickness is also controlled to a degree by controlling the viscosity of the coating material by adjusting its temperature or the quantity of solvent therein. The exit rolls also control the uniformity of the coating over the length and width of the product.

The conventional practice of dip-coating strip product, particularly continuous strip product, results in an excessively heavy local deposition or build-up of a bead of coating material along opposite edges of the strip. This is due to the fact that the pass defined by the exit rolls becomes filled with coating material along the length of the exit rolls not in contact with the strip. Since the opposite edges of the strip are directly in contact with the coating material that has been drawn into the pass by rotation of the exit rolls, such edges pick up more coating material than is applied to the strip surfaces. In operation, the action of the exit rolls against the strip surfaces reduces the amount of coating applied to the strip surface. Since this action is not present on the strip edge, surface tension and cohesion cause the strip edges, which are in direct contact with the liquid coating material in the exit roll pass, to pull out additional coating material. This produces a heavier coating per unit of area on the strip edge than is applied to the strip surface.

After the coated strip is withdrawn from the exit rolls, and before subsequent cooling, solvent evaporation, or other factors causing solidification of the coating material, there is a short period of time during which the liquid condition of the coating material is subject to surface tension that redistributes the excess coating material to form a bead that extends inwardly from the edges of strip.

The problem of edge bead formation on dip-coated strip has been recognized and various methods of minimizing this condition have been proposed. For this purpose, blasts of hot or cold air have been directed against the strip edges to blow off excess coating, flame jets directed against the strip edges have been used to reduce the viscosity of the coating material in order that it may flow off by gravity or be blown off by the action of the flame jet, and mechanical devices such as scraper blades, rotating cutters and additional squeegee rolls have been used. Such proposals have not proven uniformly successful in practice, and the problem of edge bead formations on dip-coated strip product continues.

One of the principal objects of this invention is to eliminate edge bead formations on coated strip product of the character described above. To this end, and in accordance with the principles of this invention, a pair of filler elements are inserted in the exit roll pass along opposite edges of the strip moving therethrough which operate as barriers to prevent the flow of coating material into the exit roll pass and thus direct contact of the strip edges with coating material while in the exit roll pass. In this manner, the edges of the strip product do not pick up excessive quantities of coating material and the problem of edge bead formation is thereby effectively eliminated.

Other objects and advantages of the invention will become apparent from the following description and the accompanying drawings which illustrate somewhat diagrammatically a preferred embodiment of the invention. In the drawings:

FIGURE 1 is a perspective view showing a conventional arrangement of coating apparatus including a sinker roll and exit rolls that are provided with an apparatus constructed according to the principles of this invention;

FIGURE 2 is a sectional view taken substantially along the line II—II of FIGURE 1;

FIGURE 3 is an elevational view looking from the left of FIGURE 2; and

FIGURE 4 is a plan view of the apparatus shown in FIGURES 2 and 3.

The drawings illustrate diagrammatically a conventional arrangement of continuous strip coating apparatus that includes a pot 1 containing a bath 2 of coating material, a sink roll 3, and a pair of exit rolls 4 that define an exit pass 5 and are partially submerged below the surface 6 of the bath 2. The sink roll 3 and exit rolls 4, in accordance with conventional practice, have separate drives (not shown) for effecting their rotation and movement of the strip being coated through the bath. In operation, the strip 7 travels in the direction indicated by arrows in the drawings and in moving through the bath 2 passes under the sink roll 3 and is withdrawn through the exit pass 5 between the exit rolls 4. In conventional operations, the end portions of the pass 5 outwardly of the opposite edges 8 of the strip 7 become filled with coating material which has direct contact with the strip edges 8. As a consequence the edges 8 drag larger quantities of coating material out of the bath than is applied to opposite faces of the strip between the exit rolls 4, and this results in the formation of a thick bead of coating material along the edges 8 in the manner described above.

In accordance with the principles of this invention, and to avoid the formation of a bead of coating material along the opposite edges 8, the exit rolls 4 are provided with a pair of axially spaced endless straps 9 which are respectively trained over one of the exit rolls 4 and a

guide sheave 10. Each of the sheaves 10 is rotated by a separate variable speed electric drive motor 11, which has a slide support on a carriage 12 for adjusting its axial position and thereby the axial position of the sheave 10 driven thereby and the position of the strap 9 in the exit roll pass 5. A manually operable screw adjustment 13 is provided for regulating the position of the motor 11 and sheave 10 with respect to the carriage 12. This adjustment is preferably made in such manner that the inner edges 14 of the straps 9 have wiping contact with the outer edges 8 of the strip 7.

The straps 9 have a thickness that is equal to or a little less than the width of the pass 5 and the strip 7 being withdrawn therethrough. The portions of the straps 9 that are within the pass 5 thus act as barriers to prevent the flow of coating material into the portions of the pass 5 that extend outwardly from the opposite edges 8 of the strip 7. As a consequence, the strip edges 8 do not have direct contact with the coating material in the pass 5. Instead, the outer edges 15 of the straps 9 have direct contact with the coating material in the pass 5 and the excess of coating material, which normally causes beading or edge build-up on the strip product in conventional coating operations, is applied to the straps 9. Flame jets 16 are applied against the strap 9 adjacent the sheave wheels 10 to remove the excess coating material from the strap 9.

In addition to preventing edge build-up of coating material on the strip edges 8, the straps 9 can be used to control the amount of coating material removed from the strip edges 8. This may be accomplished through the variable speed motors 11 by varying the speed of rotation of the sheaves 10 to control the relative speed of movement of the strap edges 14 over the strip edges 8 and thereby the quantity of coating material removed from the edges 8.

While endless straps 9 trained over sheaves 10 that are driven at a variable speed represent the preferred embodiment of this invention, it will be understood that the flow control action of the straps 9 in the exit roll pass 5 can be effected by modified structures, and that modifications of the invention for this purpose are contemplated. In this respect, it will be apparent that the flow control action of the straps 9 in the exit roll pass 5 may be effected, for example, by stationary members mounted therein or by a banding ring concentrically mounted on one of the exit rolls 4 and rotating therewith.

From the foregoing, it will be apparent that the straps 9 of the invention operate to prevent edge build-up or beading of coating material along the edges 8 of strip as it is withdrawn from a coating bath through a pass defined in a pair of partially submerged exit rolls 4. Attention is particularly directed to the manner in which the straps 9 operate as barriers to prevent the flow of coating material from the bath 2 into the portions of the pass 5 extending outwardly from the strip edges 8. Attention is further directed to the fact that the variable speed drive for the straps 9 according to the preferred embodiment of the invention provides an effective control with respect to the amount of coating material that is removed from the strip edges 8.

While one embodiment of my invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

I claim:

1. In coating apparatus including a bath of material through which strip is passed to apply a coating of said material thereto, and a pair of exit rolls partially submerged in said bath and defining a pass through which the strip is withdrawn from said bath, the combination therewith of a pair of straps received in said pass in spaced positions having contact with and respectively extending outwardly from opposite edges of the strip moving therethrough, said straps having a thickness corresponding to the width of the exit roll pass and operating as barriers to prevent the flow of coating material from said bath into said pass along the edges of said strip, and means for moving said straps through said pass in the direction of strip travel therethrough whereby the edge build-up of coating material is applied on the outer edges of said straps and not on the said opposite edges of said strip.

2. A strip coating apparatus as defined in claim 1 characterized by each of said straps comprising a closed loop, and by said strap moving means comprising rotatable sheaves having an axis parallel to the axes of said rolls and over which said strap loops are trained.

3. An apparatus as defined in claim 2 characterized by the provision of means for adjusting the axial positions of each of said sheaves and thereby the positions of said strap loops in said pass.

4. An apparatus as defined in claim 2 characterized by the provision of variable speed drives for rotating said sheaves to control the speed of movement of said strap loops through said pass and thereby the amount of coating material removed from the edges of said strip.

5. A method of preventing edge build-up of coating material applied to strip by movement through a bath of said coating material and withdrawal therefrom through a pass defined by a pair of exit rolls partially submerged in said bath, which comprises inserting a pair of filler straps in said pass in positions having contact with and respectively extending outwardly from opposite edges of the strip moving therethrough to obstruct the flow of coating material from said bath into said exit roll pass in portions thereof outwardly of the edges of said strip, and moving said straps through said pass with and in the direction of the strip moving therethrough whereby the edge build-up of coating material is applied to the outer edges of said straps and not on the said opposite edges of said strip.

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