APPARATUS FOR COATING WIRE FILAMENT WITH LIQUID

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ABSTRACT

A pair of soft elastic porous bodies disposed in face-to-face engagement for movement therebetween of a wire filament. One of the bodies is saturated with wire coating liquid under pressure from a manifold on which the saturated body is mounted, the other body absorbing coating liquid from the saturated body. The manifold with the one body is mounted for adjustment movements toward and away from the path of movement of the wire filament, and the other porous body is biased toward engagement with the manifold mounted body and the wire passing between the bodies. A wiping roll is positioned to tangentially engage the wire filament as it moves away from the porous bodies and rotates in a direction to wipe the wire filament in a reverse direction to that of movement of the filament.

5 Claims, 6 Drawing Figures
APPARATUS FOR COATING WIRE FILAMENT WITH LIQUID

BACKGROUND OF THE INVENTION

This invention is in the nature of an improvement over prior wire coating or enameling devices using rotary metallic cylindrical applicators, die applicators of the type using metal or felt wiping dies or pads, some having apertures through which a wire filament moves, and bath or spray-type coating applicators. Examples of such prior applicators are disclosed in U.S. Pat. Nos. 1,968,687, 1,994,802; 2,394,066; 2,740,375 and 3,194,210. In some prior structures, wire must be threaded through small apertures; in others, difficulty has been experienced in obtaining a uniform coating over a length of wire filament.

SUMMARY OF THE INVENTION

An important object of this invention is the provision of apparatus for coating a moving wire filament with liquid, which applies a coating having a uniform thickness over the entire surface of the filament.

Another object of this invention is the provision of wire coating apparatus, utilizing wire-engaging applicator elements which are inexpensive and easy to replace when worn.

Still another object of the invention is the provision of wire coating apparatus which includes a pair of coater bodies of soft elastic porous material having outer opposed wire filament engaging surfaces, a frame structure mounting the porous bodies and including a manifold for delivering coating liquid to one of the porous bodies and for movement of the other of the bodies toward and away from engagement with the one body. A pump is provided for delivering coating liquid to the manifold under pressure, and a guide roll is journaled in the frame structure for guiding wire filament between the porous bodies. A rotatively driven wiper roll is journaled in the frame structure for tangential engagement with coated wire filament moving away from the coating bodies and rotates in a direction wherein the filament engaging portion of the roll moves rearwardly or reverse to the direction of movement of the filament.

A doctor blade is utilized to remove coating liquid from the wiper roll. One of the porous bodies, in the nature of a sheet of felt, is held on the manifold by a clamp arrangement, whereby the sheet may be quickly and easily removed and replaced when necessary. The opposite body, in the nature of a strip or block of felt, is one of a pair mounted in grooves on opposite sides of a mounting bar that is slidable mounted in the frame structure for movements sloping downwardly toward and upwardly away from the felt sheet mounted on the manifold.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary view in front elevation of a wire filament coating apparatus produced in accordance with this invention; FIG. 2 is a fragmentary view in side elevation, some parts being broken away and some parts being shown in section, and some parts being shown diagrammatically; FIG. 3 is an enlarged fragmentary section taken substantially on the line 3—3 of FIG. 1; FIG. 4 is an enlarged fragmentary section taken substantially on the line 4—4 of FIG. 1, some parts being broken away; FIG. 5 is a greatly enlarged fragmentary section taken substantially on the line 5—5 of FIG. 3; and FIG. 6 is a view in exploded perspective of the manifold of this invention, some parts being broken away and some parts being shown in section.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In the drawings, a supporting frame structure is indicated generally at 1, the same comprising a horizontally disposed main frame member 2 in the nature of a heavy metallic cross-sectionally rectangular tube, a pair of horizontal forwardly and rearwardly extending plate-like members 3 welded or otherwise rigidly secured to opposite end portions of the main frame member 2, a channel member 4 having opposite ends secured to the front and rear portions of the plate-like members 3 by nut equipped bolts or the like 5, and supporting legs 6 extending downwardly from the members 3 and connected by end members 7 and a lower cross frame member 8. The plate-like members 3 are reinforced by gussets 9 that are welded to the members 3 and to the opposite ends of the main frame member 2. The frame structure 1 further includes a pair of laterally spaced parallel side frame members 10 that are welded or otherwise anchored at their lower ends to the main frame member 2 and extend upwardly therefrom, a pair of reinforcing gussets 11 each welded to the lower end portion of a different one of the side frame members 10 and to the adjacent end portion of the main frame member 2, and a top frame member 12 having opposite ends welded or otherwise anchored to the upper ends of the side frame members 10. Further, the frame structure 1 includes a channel-like support member 13 that is rigidly secured at its upper end to the main frame member 2, and which extends downwardly therefrom to support a geared head motor 14 by means of nut-equipped bolts 15.

Each side frame member 10 has mounted on its inner surface one of a pair of horizontally disposed support rails 16 on which is mounted a subframe 17 comprising a pair of laterally spaced vertical end plates 18 that are each disposed in laterally inwardly spaced parallel relationship to an adjacent one of the side frame members 10, and a cross bar 19 disposed at the rear edges of the end plates 18 and welded at its opposite ends to the end plates 18. Also welded to the end plates 18, adjacent their upper edges, are a pair of mounting bars 20 each adapted to extend longitudinally of and rest upon a different one of the support rails 16. Each of the mounting bars 20 is formed with a pair of longitudinally spaced downwardly opening notches 21 for reception of the flange 22 of a different one of a pair of threaded adjustment nuts 23 that are screw threaded on studs 24 which project forwardly from the support rails 16.

The end plates 18 are formed to provide one of a pair of aligned vertical slots 25 that extend downwardly from the upper edge of their respective end plate 18,
each slot being notched or widened near the upper edge of its respective end plate 18, as indicated at 26. Further, each end plate 18 is formed to provide a second slot 27 that slopes downwardly and rearwardly from the front edge of each end plate 18 toward the lower end portion of its respective slots 25, as shown in FIGS. 2 and 3. Each of the slots 27 adjacent the front edge of its respective end plate 18 is formed to provide an upwardly opening notch 28, the slots 27 being in alignment, as are the slots 25. The end plates 18 are connected at their lower ends by an open-topped drain pan 29 and by a rigid bar 50 that slopes rearwardly and downwardly within the tray 29, and having its upper edge portion 31 disposed slightly below the level of the bottoms of the slots 25, see particularly FIG. 3.

An elongated hollow cylindrical manifold 32 includes a cylindrical wall 33 and a pair of opposite end walls 34, the cylindrical wall 33 being provided with a pair of rows of longitudinally spaced discharged openings 35. The end walls 34 are provided with generally rectangular guide lugs 36 each of which is slantly mounted in a different one of the slots 25 in the end plates 18. The lugs 36 are so disposed relative to the rows of discharge openings 35 that, when the lugs 36 are properly disposed in the slots 25, one of the rows of openings 35 is on a level with the axis of the manifold 32, the other row of openings 35 being angularly spaced above said one row of openings 35. Preferably, the axes of the upper row of openings 35 are disposed approximately 45 angular degrees above the horizontal. An inlet fitting 37 is mounted in the manifold 32 preferably diametrically opposite the lower row of openings 35, the lower row of openings 35 being in the front portion of the manifold 32, the inlet fitting 37 projecting rearwardly. A conduit 38 is secured to the fitting 37, and is shown diagrammatically in FIG. 2 as extending to a reservoir 39 of coating liquid, such as enamel. A conventional fluid pump 40 is interposed in the conduit 38 for the purpose of supplying wire coating liquid under pressure to the manifold 32. A by-pass conduit 41 is connected to the conduit 38 between the pump 40 and manifold 32, and leads back to the reservoir 39, the conduit 41 being provided with a pressure relief valve 42.

An elongated spacer bar 43, preferably made from round metallic rod stock, has a pair of downturned ends 44 that are received within a pair of discharged openings 35 at opposite ends of the upper row thereof, as shown in FIGS. 3 and 6. A first coating body 45 is in the nature of a sheet of soft elastic porous material, such as felt, and is mounted on the manifold 32 by being partially wrapped around the top, front and bottom portions of the manifold 32 and in overlaying relationship to the spacer bar 43, see particularly FIG. 3. As there shown, the lower portion of the sheet 45 is interposed between the bottom portion of the manifold 32 and the upper edge portion 31 of the rigid bar 30. The sheet 45 is releasably held in place on the manifold 32 by an elongated clamping rod 46 having its opposite ends slidably disposed in the slots 25, and a pair of clamping screws 47 that are screw threadedly mounted in a mounting bar 48 which overlies the clamping rod 46 and has its opposite ends disposed in the widened or notched portions 26 of the slots 25. As shown, the clamping bar 46 and mounting bar 48 are disposed in upwardly spaced parallel relationship to the manifold 32, the clamping screws 47 engaging the clamping rod 46 to cause the portions of the porous sheet 45 engaging the clamping rod 46 and bar 30 to be securely clamped therebetween and the adjacent portions of the manifold 32. Also, as particularly shown in FIG. 3, the spacer bar 43 provides for a pocket between the manifold wall 33 and the overlaying portion of the porous sheet 45 which pocket becomes filled with coating liquid from the upper row of discharge openings 35 to aid in saturating the porous body or sheet 45 with coating liquid. The coating liquid, being under pressure from the pump 40, quickly and effectively saturates the porous body 45 throughout its length and width.

A pair of secondary bodies of soft elastic porous material, such as wool felt, are indicated at face of and are mounted each in a dovetail groove 50 in an opposite side of an elongated rigid mounting block or bar 51, disposed forwardly of the manifold 32 and first porous body 45. At its opposite ends, the mounting bar 51 is provided with aligned longitudinally outwardly projecting stub shafts 52 each of which is slantly mounted in a different one of the slots 27 in the end plates 18. The stub shafts 52 not only permit the mounting bar 51 to gravitate downwardly into engagement of the outer face of one of the bodies 49 with the front or outer surface of the first body or sheet 45, but also permit the mounting bar 51 to be rotated on its own axis so that either one of the bodies 49 may be disposed selectively in face-to-face engagement with the porous body or sheet 45. The notches 28 in the slots 27 provide support for the mounting bar 51 in forwardly spaced relationship to the porous body 45 to provide for easy threading of wire filament, indicated at 53, between the opposed first and second bodies 45 and 49.

In the coating operation, the wire 54 moves upwardly between the inter-engaging porous bodies 45 and 49 from a source of supply, not shown, of the wire 53, and toward a curing oven, not shown, but wherein the enamel or other coating substance on the wire is cured or dried. Means for guiding the wire 53 toward the coating bodies includes a circumferentially grooved guide roll 54 that is journaled in bearing brackets 55 carried by the channel member 4, as shown in FIGS. 1 and 2. While but one strand or filament of wire 53 is shown, it will be appreciated that a plurality of filaments or lengths thereof may be fed through the coating apparatus as far as the lengths of the porous bodies 48 and 49 can accommodate them. With reference to FIG. 5, it will be seen that the soft yielding characteristics of the felt bodies 45 and 49 cause the same to yield to form channels for reception of the wire filament 53 when the bodies 45 and 49 are in face-to-face engagement. The coating liquid, being under pressure from the pump 40, thoroughly saturates the porous body 45, as above indicated, some of the coating liquid being absorbed by the adjacent second porous body 49. Thus, as the wire 53 moves upwardly between the bodies 45 and 49, coating liquid is wiped thereupon by the saturated bodies 45 and 49, surface tension of the coating liquid causing the same to adhere to the wire 53 in the minute apertures adjacent the wire 53, indicated at 56. These small apertures are formed by distortion of the bodies 45 and 49 around the wire filament 53. In view of the fact that fluid is being constantly supplied to the body 45, through the manifold 32, the liquid seeps downwardly through the body 45 and drops into the drain pan 29. From thence, the excess coating liquid descends through a drain tube 57 into a tray 58 that is
mounted on the main frame member 2 and which is provided with a return conduit 59, by means of which the coating liquid may be assumed to be returned to the reservoir 39.

For the purpose of more closely controlling the distribution of the enamel coating on the wire 53, a wiping roll 60 is provided in upwardly spaced relation to the subframe 17 and coating parts carried thereby. The wiping roll 60 is provided with aligned axial stub shafts 61 that are journaled in suitable bearings 62 at the upper end portion of the side frame members 10, for tangential engagement of the outer cylindrical surface of the roll 60 with the wire 53. The drive motor 14 is provided with an output shaft 63 on which is mounted a drive pulley 64. A driven pulley 65 is mounted on one of the shafts 61, and an endless flexible drive belt 66 is entrained over the pulleys 64 and 65. Preferably, the motor 14 operates to rotate the wiper roll 60 in a direction wherein the wire engaging surface portion thereof moves in a direction reverse to the direction of movement of the wire 60, to wipe excess coating liquid from the wire 53. Coating liquid is removed from the wiper roll 60 by a doctor blade 67 that is mounted in an elongated mounting block 68 having shaft portions 69 and 70 at its opposite ends, these being pivotally mounted in L-shaped notches or slots 71 in the side frame members 10. A generally horizontally disposed rod 72 projects forwardly from the shaft 70, and has adjustably slidably mounted thereon a weight 73 which urges the holder 68 in a direction of rotation on the common axes of the shafts 69 and 70 to move the doctor blade 67 toward engagement with the wiping surface of the wiping roll 60. A knob 74 at the outer end of the rod 72 limits forward movement of the weight 73, and is used as a handle when it is desired to swing the doctor blade 67 out of engagement with the wiper roll 60. An open-topped tray 75 underlies the bar 68, and is rigidly secured at its opposite ends to the frame side members 10, by machine screws or the like 76.

Due to the fact that the coating enamel or liquid is delivered to the porous body 45 under pressure, the effects of coating materials of different viscosities on the thickness of each coat placed upon the wire 53 are minimized. We have found that, in the above-described arrangement, cheaper grades of felt can be used in the applicator bodies than must be used in present day felt-wiping dies. Further, the soft and elastic character of the bodies 45 and 49 permits the same to be used with wires 53 of various diameters, and effectively coat the same.

While a commercial form of the wire coating apparatus of this invention has been shown and described, it will be understood that the same is capable of modification without departure from the spirit and scope of the invention, as defined in the claims.

What is claimed is:

1. Apparatus for coating a moving wire with liquid comprising:
   a. an elongated manifold having a plurality of spaced outlet openings arranged in a longitudinally extending row, and a liquid inlet opening spaced from said row of outlet openings;
   b. a first body comprising a sheet of felt cloth partially encompassing said manifold and having an inner surface overlying said openings and a wire engaging outer surface;
   c. means for releasably holding said sheet in engagement with said manifold;
   d. a second body of soft elastic porous material having a wire-engaging outer surface;
   e. means mounting said second body in wire engaging face-to-face engagement with said first body whereby said second body absorbs coating liquid from said first body;
   f. and means for guiding said wire between said bodies;
   g. the elasticity of said bodies being such that each thereof yields to partially encompass said wire moving therebetween.

2. Apparatus for coating a moving wire with liquid, comprising:
   a. a supporting frame structure;
   b. means for guiding wire for longitudinal movement thereof relative to the frame structure;
   c. a first body of soft elastic porous material having a wire-engaging outer surface;
   d. body mounting means on said frame structure mounting said first body for wiping engagement of said first body with said wire and comprising, a sub-frame mounted on the frame structure for movements transversely of the path of movement of said wire, and a manifold carried by said sub-frame;
   e. means for holding said sub-frame in desired positions of said movement thereof;
   f. means including said manifold for delivery of a constant supply of wire coating liquid under pressure to said first body;
   g. a second body of soft porous material having a wire-engaging outer surface;
   h. and mounting means mounting said second body for movements toward and away from engagement of the outer surface thereof with said wire and with the outer surface of said first body, said mounting means being yieldingly urged in a direction toward said engagement of said outer surface;
   i. the elasticity of said bodies being such that each thereof yields to partially encompass the wire moving therebetween.

3. The apparatus defined in claim 2 in which said manifold defines fluid inlet and outlet passage means, said first body overlying said outlet passage means, said body mounting means further including clamping elements carried by said subframe for clamping said first body on said manifold.

4. The apparatus defined in claim 2 in which said mounting means for the second body comprises a rigid mounting bar, said sub-frame including spaced portions defining guideways, said mounting bar having opposite end portions disposed in said guideways and supported therein.

5. The apparatus defined in claim 4 in which said guideways slope downwardly toward said manifold, whereby said mounting bar is gravity biased toward face-to-face engagement of said second body with said first body.