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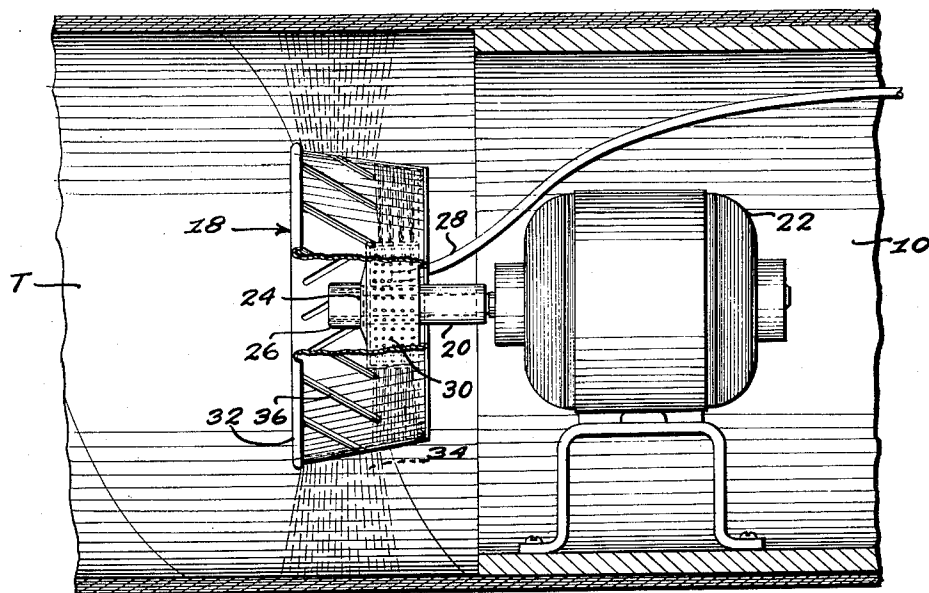
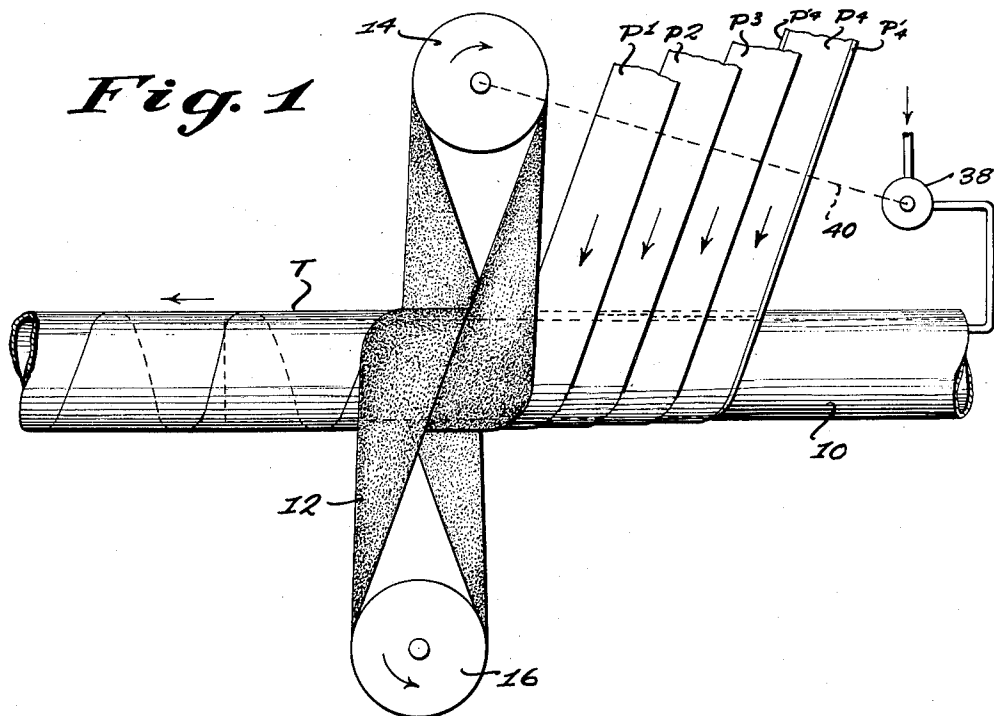
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MEANS FOR FORMING A SPIRAL WOUND PAPER TUBE STRUCTURE

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2 Sheets-Sheet 1



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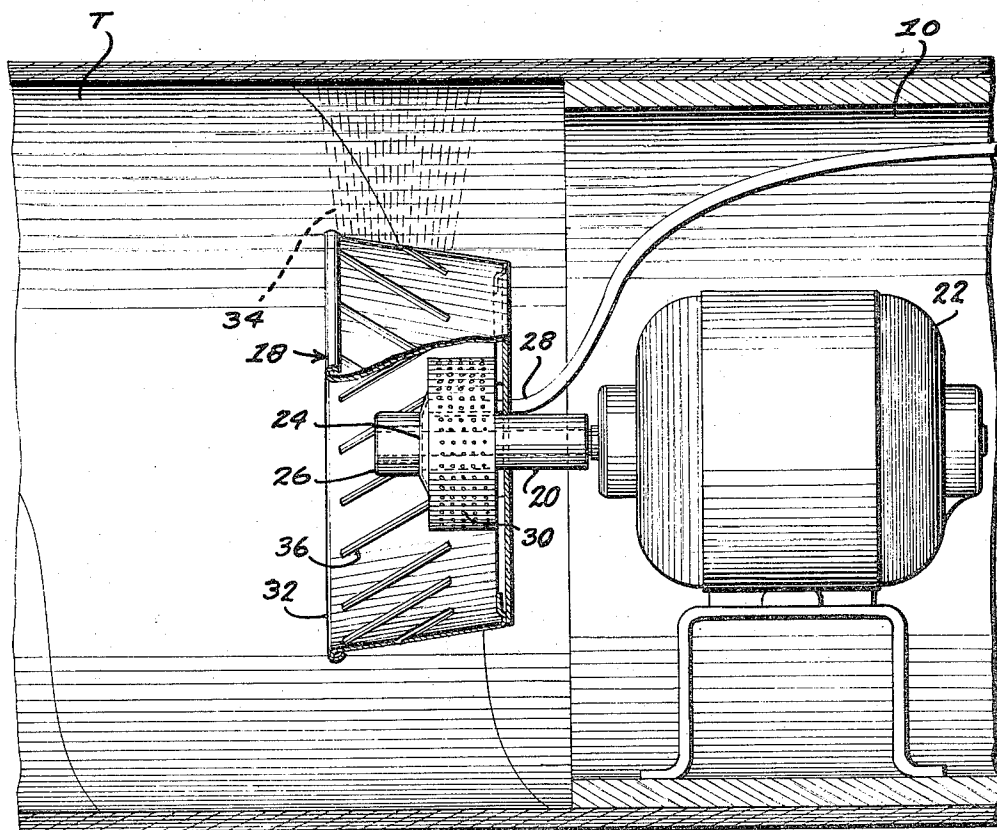


Fig. 3

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1

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MEANS FOR FORMING A SPIRAL WOUND PAPER TUBE STRUCTURE

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4 Claims. (Cl. 93—80)

This invention relates to the manufacture of spiral wound paper tubes, and more particularly to a method and means for forming a tube structure of this sort while applying a continuous inner surface coating thereto in a manner that provides for regulating the coating application from the spiral winding operation.

Briefly described, the present invention is characterized by the spiral winding of a multi-ply paper tube so as to deliver the wound tube continuously in the direction of its axis, and the centrifugal application of a continuous coating to the inner surface of the tube as it is delivered while regulating the feeding rate of coating material for this centrifugal application in relation to the spiral surface speed at which the tube is wound.

Spiral paper tubes are commonly wound in the above noted manner by means of a fixed mandrel about which a winding belt is wrapped to draw paper ply strips thereon spirally so as to form a tube corresponding in diameter to that of the mandrel. With such a winding arrangement, the spiral surface speed at which the tube is wound depends on the winding belt speed independently of the diameter of tube being formed, and this circumstance is utilized according to the present invention to obtain automatically an even and properly regulated coating application by controlling the coating material supply rate in relation to the winding belt speed. The result is not only to complete in one operation what has heretofore required two, but also to control the coating application much more effectively and efficiently than is possible in a separate coating application.

Any type of coating material that may be handled centrifugally can be applied according to the present invention. Various sorts of adhesive coatings may be applied, for example, in cases where it is desired to prepare the paper tube structure for mounting as a covering layer or the like. Also, inks or other color coats may be applied to obtain special inner surface colorings when desired. In addition, the present invention can be employed to particularly good advantage for providing specially conditioned inner tube surfaces when needed, such as in the use of paper tube structures for concrete forms where the inner tube surface must withstand effectively the abrasive action of concrete as it is poured therein in order to be readily stripped from the concrete after forming, and for convenient illustration the present invention is described further below in relation to the formation of a paper tube structure adapted particularly for this latter purpose and in connection with the accompanying drawings, in which:

Fig. 1 is a more or less diagrammatic and fragmentary illustration indicating the arrangement of suitable means for forming a spiral wound paper tube structure in accordance with the present invention;

Fig. 2 is an enlarged fragmentary sectional detail illustrating further the arrangement of the means provided for the centrifugal coating application; and

Fig. 3 is an enlarged fragmentary sectional detail simi-

2

lar to Fig. 2 but further enlarged and additionally sectioned.

Referring now in detail to the drawings, Fig. 1 illustrates an arrangement of a cylindrical winding mandrel 10 having a winding belt 12 trained thereat between pulleys 14 and 16 with one reach of the belt 12 spirally wrapped about the mandrel 10 for drawing a plurality of paper ply strips P1, P2, P3 and P4 spirally about the mandrel 10 to form a spiral wound paper tube T thereon. The foregoing arrangement, which follows conventional practice, also normally incorporates a fixed mounting (not shown) for the mandrel 10 at the end thereof extending to the right in Fig. 1, and means for driving at least one of the winding belt pulleys, such as 14, to actuate the spiral winding operation which results in continuously forming the paper tube T and delivering it off of the left hand end of the mandrel 10 as seen in Fig. 1.

The left hand end of the mandrel 10, off of which the paper tube T is continuously delivered, is further fitted according to the present invention with a centrifugal coating means as indicated generally by the reference numeral 18 in Fig. 2. This centrifugal coating means 18, in the embodiment illustrated, comprises a driven shaft 20 powered suitably from an electric motor 22, or the like, that is mounted within the mandrel 10 to position the shaft 20 axially thereof and extending therefrom at the above noted delivery end. On the extending end of shaft 20 an inner dispersing chamber 24 is fixed at a hub portion 26 formed on one side thereof. The dispersing chamber 24 is of generally cylindrical form with an annular opening at the other side thereof to allow extension of a supply conduit 28 therethrough for feeding coating material therein, and the peripheral surface of the dispersing chamber 24 is perforated, as indicated at 30, for centrifugal delivery of coating material therefrom to an outer distributing head 32 fixed concentrically on the dispersing chamber 24.

This outer distributing head 32 has a peripheral surface of conical shape that slopes outwardly from an imperforate circumferential section 34 opposite the dispersing chamber 24 to a section in which diagonal slots 36 are spaced circumferentially, with the slots 36 extending outwardly and forwardly in the direction of rotation and overlapping in extent axially of the distributing head 32. By virtue of this arrangement, coating material fed to the dispersing chamber 24 is centrifugally delivered evenly over the imperforate surface section 34 of the outer distributing head 32 from which centrifugal force further delivers the coating material to the diagonal slots 36 through which it is thrown outwardly in an evenly distributed spray to coat the inner surface of the spiral wound paper tube T as it is delivered off of the winding mandrel 10.

The centrifugal coating means 18 is normally operated for coating application in this manner at a speed of the order of 3600 r.p.m., and is driven at a constant speed during operation. Control of the coating application, to obtain the proper coating thickness and the like, is obtained by regulating the feeding rate of coating material supplied through the conduit 28 to the centrifugal coating means 18. This regulation is effected by means of a pumping mechanism, as illustrated at 38 in Fig. 1, which is connected as indicated at 40 for operation from the driven winding belt pulley 14 so as to regulate the coating material feed in relation to the spiral surface speed at which the paper tube T is wound, and thereby automatically adjust the coating application properly to the size of paper tube T being formed and the practicable winding speed therefor.

This arrangement provides an important operating advantage in adapting the present invention for use readily in forming a wide range of tube sizes, as operating

conditions change substantially with changes in tube size and it would be extremely burdensome if it were necessary to adjust the coating application specially with each change in tube size. For example, a paper tube T of about 18 inches in diameter could normally be wound so as to deliver from the mandrel 10 at a linear rate of about 100 feet of tube length per minute, whereas an increased tube diameter in the neighborhood of 48 inches could not be delivered at a rate of more than about 40 feet per minute. With such a wide variation in operating conditions it is extremely important to have the coating application arranged to follow these variations readily and the provision of the present invention for regulating the coating application in relation to the spiral winding operation accomplishes this result with exceptional effectiveness.

It should also be noted that the application of the coating material centrifugally according to the present invention makes it possible to apply a continuous inner surface coating to the paper tube T being formed without depending on the rotation of the tube T for covering the surface to be coated as is necessary with the usual spray gun type of coating arrangement. Also, because the centrifugal coating means 18 is operated at a constant speed to provide an evenly distributed and finely dispersed spray application of the coating material it is possible according to the present invention to provide for visual checking of the coating application for a minimum thickness by compounding the coating material so that it is transparent below the minimum coating thickness desired, but incorporates a sufficient predetermined quantity of dye or other coloring material to become opaque at and above the thickness desired, so that it becomes simply a matter of observing whether the coating is opaque to determine whether the minimum coating thickness desired has been applied.

In instances where it is desired to provide a substantially continuous inner tube surface for receiving the continuous coating application provided according to the present invention, the inner paper ply strip P4 supplied for forming the paper tube T may be provided with beveled edge portions P'4 along both edges and then spirally wound to overlap these beveled portions, in the manner disclosed in further detail in copending application Serial No. 624,404, filed November 26, 1956, so as to eliminate the usual spiral seam gap at the inner tube surface. A paper tube T formed with an inner ply P4 of this sort and coated interiorly with a latex emulsion material in accordance with the present invention has been found to provide particularly effective concrete forming means of the type previously mentioned above.

The present invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims.

We claim:

1. Means for forming a spiral wound tube structure comprising a cylindrical mandrel, means for spiral winding a multi-ply paper tube about said mandrel and continuously delivering the spiral wound tube axially off said mandrel, means mounted at the end of the mandrel off which said paper tube is delivered for applying a coating material centrifugally to the inner surface of said tube, and means interconnecting the spiral winding means and the centrifugal applying means for regulating the feeding rate of coating material to said centrifugal applying means in relation to the spiral surface speed at which said tube is wound on said mandrel.

2. Means as defined in claim 1 and further characterized in that said spiral winding means comprises a winding belt trained between pulleys with one reach thereof spirally wrapped about said mandrel and with at least one of said pulleys being driven, and said interconnecting means for regulating the coating material feed comprises a pumping mechanism connected for operation from said driven pulley.

3. Means for forming a spiral wound tube structure comprising a cylindrical mandrel, means for spiral winding a multi-ply paper tube about said mandrel and continuously delivering the spiral wound tube axially off said mandrel, means mounted at the end of the mandrel off which said paper tube is delivered for applying a coating material centrifugally to the inner surface of said tube, said centrifugal applying means comprising a driven shaft mounted axially of said mandrel and extending from the end thereof off which said paper tube is delivered, an inner dispersing chamber of generally cylindrical form fixed on said shaft, said dispersing chamber having an annular opening at one side for allowing coating material to be fed therein and having the peripheral surface thereof perforated for centrifugal delivery of said coating material therefrom, and an outer distributing head fixed concentrically on said dispersing chamber, said distributing head having a peripheral surface of conical shape sloping outwardly from an imperforate circumferential section opposite said dispersing chamber to a section in which diagonal slots are spaced circumferentially with the slots extending outwardly and forwardly in the direction of rotation and overlapping in extent axially of said head, and means for regulating the feeding rate of coating material to said centrifugal applying means in relation to the spiral surface speed at which said tube is wound on said mandrel.

4. Means for applying a coating material to the inside of an axially advancing tube, said applying means, comprising a cylindrical supporting member having a free end on which the tube is concentrically mounted for axial movement thereon, means for advancing the tube axially with respect to the support member, a shaft mounted in said supporting member and extending from the free end thereof, means for rotating said shaft, an inner dispersing chamber mounted on said shaft for rotation thereon, means for introducing a coating material into said inner chamber, said inner chamber having openings in its peripheral surface through which said coating material centrifugally passes, and an outer distributing chamber mounted on said shaft concentric with and surrounding said inner chamber for the receipt of coating material therefrom, said outer chamber having a peripheral surface of conical shape sloping outwardly away from said inner chamber and openings in the surface of said outer chamber spaced axially from the inner chamber openings, said coating material being received by the outer chamber surface from the inner chamber openings and passing centrifugally along the outwardly sloping outer chamber surface and through the outer chamber openings for application to the tube.

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