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WIRE COATING APPARATUS

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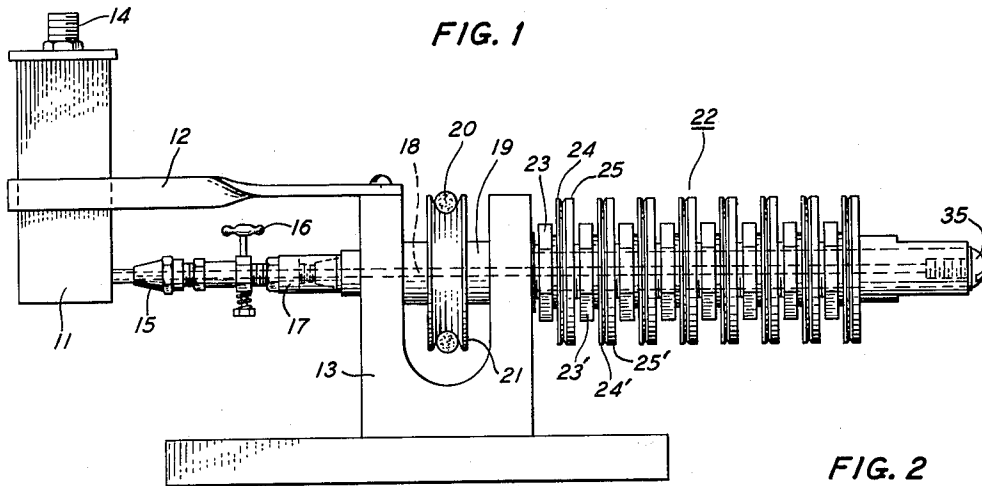


FIG. 2

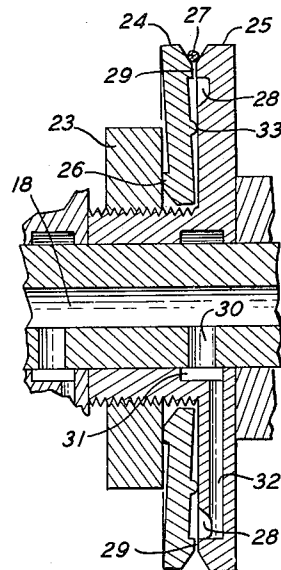
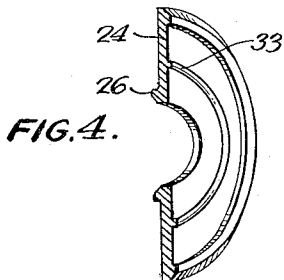
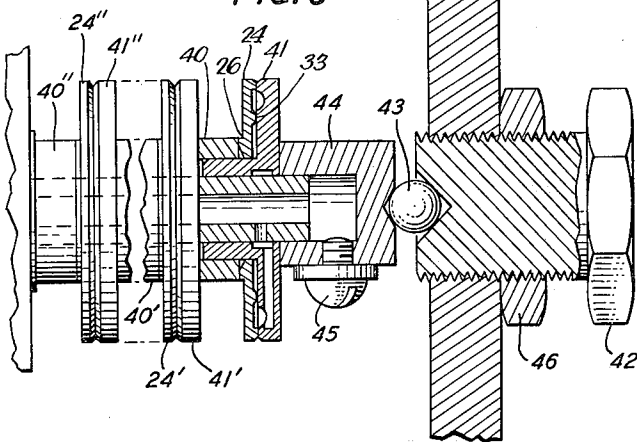


FIG. 3



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This invention relates to filament coating apparatus and, more particularly, to high speed wire enameling roller applicators of the type in which the coating material is not exposed to the atmosphere until the instant it is to be applied to the filament.

The die-wipe and wire dipping type of wire coating devices are in widespread use but have a substantial drawback in the adverse effect of the atmosphere on the open vats of enamel incident to both these methods. In addition to scumming, and viscosity changes which may affect the thickness of the coating, being open to the atmosphere may also result in the "poisoning" of certain coating materials to such an extent that the coating material may not cure, or harden, thoroughly. In the die wipe method, there is also the danger of scraping partially cured wire, with an attendant accumulation of material around the die opening and a resultant reduction in the effective dimension of the die opening. It has also been previously proposed to supply roller applicators from an internal supply of coating material through several discrete apertures opening on the filament bearing surface of the roller. However, because of the uneven flow caused by the spaced discrete outlets for coating material and the lack of orifice adjustment means, as well as other deficiencies, the earlier machines of this type have not enjoyed widespread popularity.

The principal object of the present invention is to apply coating material to filamentary strands at higher speeds than those which are presently employed in the wire coating industry.

A subsidiary object is to provide a filament coating apparatus of the internal supply type which has a continuous uniform flow of coating material to the filament.

In accordance with the invention, a grooved roller applicator of the internal material supply type is provided with an annular reservoir for coating material having a continuous peripheral outlet to the groove in which the filament rides.

One feature of the invention resides in the adjustable peripheral coating material outlet, whereby the flow may be varied to control the coating thickness or may be cut off, as desired.

Another feature resides in the pulley structure with the outlet opening at the bottom of the V-shaped groove so that all the material fed through the outlet is applied to the wire, leaving virtually no excess.

Other features and advantages will become apparent from the following detailed description of certain specific embodiments of the principles of the invention which are illustrated in the drawings. In the drawings:

Fig. 1 illustrates a coating applicator unit in accordance with the invention;

Fig. 2 is an enlarged cross section of a single applicator pulley;

Fig. 3 shows an alternative form of applicator construction providing for mechanical adjustment of flow of coating material while the apparatus is running; and

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Fig. 4 is a detailed view of a spring disc which forms an important part of the devices of Figs. 1 through 3.

The coating apparatus of Fig. 1, which will be described in greater detail hereinafter, involves a mechanically rotatable pulley assembly which is adapted to coat a plurality of wires or other filaments which ride in grooves in the individual pulleys of the assembly. The apparatus is, of course, also suitable for a multi-coat process, such as the application of successive coats to a single strand which is returned to successive pulleys of the applicator assembly. Coating material is supplied to the grooves in which the wires ride from within the pulley, and the coating material is open to the air for the first time as it flows through the continuous peripheral outlets to the grooves.

Proceeding to a detailed consideration of Fig. 1, the supply of coating material is located in reservoir 11, which is shown supported by bracket 12 from base 13. Pressure is applied to the coating material by means of the coupling 14 through which pressurized inert gas is admitted to the reservoir 11. Coating material from the reservoir flows through fixed coupling 15, the flow control valve 16, and the rotatable coupling 17 to the passage 18 through the center of the rotating shaft 19. The belt 20 rotates the shaft 19 through the drive pulley 21.

The applicator pulley assembly 22 is secured to the shaft 19 and is supplied with coating material through the passage 18. Each applicator pulley subassembly is made up of a nut 23, a spring disc 24, and a grooved wheel 25, which will be described in greater detail in connection with Fig. 2. In Fig. 2, a wire 27 is shown riding in the groove formed by the beveled edges of spring disc 24 and wheel 25. An annular secondary reservoir of coating material 28 is separated from the groove in which the wire rides only by the peripheral outlet 29 and is supplied with coating material from the central passage 18 in the shaft 19 through the radial aperture 30, the annular groove 31, and the radial passages 32. The flow of coating material from the secondary reservoir through the peripheral outlet 29 into the groove in which the wire rides may be adjusted by means of the nut 23. As this nut 23 is tightened, the spring washer 24 flexes and becomes slightly dished as it pivots about the annular ridge 33, and the outlet 29 is made wider, permitting more coating material to flow outwardly. The annular configuration of the fulcrum ridge 33 also serves to confine the coating liquid to the annular reservoir 28 and prevents inward flow toward the threads of the nut 23 and wheel 25. The ridge 33 is machined so that in the unflexed state of washer 24 the ridge 33 does not protrude quite as far as the peripheral ridge of this washer which forms one side of the outlet 29. Thus, a slight pressure by the nut 23 on the shoulder 26 will seal the annular reservoir 28 at the outlet 29. Then, slight additional pressure causing contact of ridge 33 with grooved wheel 25 will completely seal the annular reservoir 28. Further pressure upon the shoulder 26 will cause flexing of the washer and will open the outlet as noted above.

The arrangement of Fig. 3 is designed to permit adjustment of the outlets 29 without stopping the machine. This is accomplished by substituting a sliding fit between the collar 40 and wheel 41 of Fig. 3 for the screw threads of the comparable parts 23 and 25 of Figs. 1 and 2 adding the adjusting screw 42 to apply pressure through the ball 43 and sleeve 44 as well as the above-noted parts 40 and 41 to the various spring washers 24, 24', etc. In Fig. 3 pressure is applied to each spring disc 24 through the ridge 33, and the shoulder 26 acts as fulcrum about which the disc flexes. A suitable lock nut 46 may be employed to hold the desired adjustment.

In Fig. 4, the spring disc 24 is shown separated from

the coating devices of Figs. 1, 2 and 3. The amount of coating fluid applied to the filament in the coating devices of Figs. 1 through 3 is controlled by flexing the spring washer 24. The washer 24 is flexed by applying pressure between the shoulder 26 and the ridge 33, both of which are clearly shown in Fig. 4.

In the operation of the coating applicator, the filaments to be coated are placed in the grooves of the coating applicator 22 and the peripheral outlets are opened, the drive motor (not shown) energizing the belt 20 is started, and the flow control valve 16 is opened. In the device of Figs. 1 and 2, the outlets are pre-set so that the flow of material is the same for each individual applicator. After the machine is in operation, changes in the rate of flow of coating material to accommodate different speeds of filament travel may be made in either embodiment by varying the inert gas pressure applied to the reservoir 11. In the embodiment of Fig. 3, the flow of coating material may also be varied, by means of the adjusting screw 42 which varies the outlet widths as noted above. Although there are no means provided in the device of Figs. 1 and 2 to open or close the outlets while the device is in operation, the removal of pressure from the material, in combination with the cessation of centrifugal pumping, will stop, or slow the flow down to a substantial extent, when the pulley assembly stops rotating.

When it is desired to remove unused coating material from the apparatus, the outlets 29 are closed, and the cleanout plugs 35 and 45 in Figs. 1 and 3, respectively, are removed. To clean out the pulley assembly, the outlets 29 are opened, and a solvent is forced through the entire system. A more thorough cleaning may be accomplished by taking the pulley assemblies apart and washing them in solvent. For industrial purposes, the applicator assembly may be removed intact and replaced by a clean one, and the detached unit may be subjected to a solvent extraction procedure. This method of cleaning would obviate the necessity of re-setting the individual applicator outlets 29 once they were properly adjusted for the particular coating material and wire.

By way of illustration, but not of limitation, considerable success has been achieved with the use of a coating assembly pulley having a diameter of approximately one inch, as shown drawn to scale in Figs. 1 and 2. Speeds of the order of magnitude of usual coil-winding speeds, in the range of 400 feet per minute, are practical with this apparatus, although no upper limit of coating speed is implied in this description. A variety of filaments and coating materials have been used, with glass yarn and copper wire being illustrative of the former, and viscous casting resin and low viscosity oilco-resinous enamels being typical of the latter.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In a high speed filament coating apparatus, a coating roller having a groove in which the filament rides, an annular coating material reservoir within the roller having a continuous peripheral outlet to said groove, said reservoir being of substantially greater width than said outlet, and an internal passage opening into said reservoir for supplying material to said reservoir.

2. A coating apparatus as set forth in claim 1 having means for changing the rate of flow of coating material while the roller is rotating.

3. A coating apparatus as set forth in claim 1 having means for changing the rate of flow of coating material, said means including an adjustment for changing the width of the peripheral outlet while the roller is rotating.

4. In a high speed coating apparatus for coating filaments in the open atmosphere with a rapidly drying coating material, a coating roller made up of two discs having matching beveled edges forming a peripheral groove in which a filament which is to be coated may ride, an annular localized reservoir located within said roller and having a peripheral outlet to said groove, said outlet being of substantially less width than said localized reservoir, a main enclosed reservoir of coating material, and an internal passageway interconnecting said reservoirs, whereby the coating material is not exposed to the atmosphere until it flows through said outlet.

5. A wire coating roller comprising a beveled washer, a matching beveled spring disc coaxial with and adjacent said washer, with the two bevels forming an external groove for a wire to be coated, an annular recess in one of said elements adjacent the beveled outer edge thereof, an annular fulcrum ridge on one of said elements located adjacent but inwardly from said recess and firmly abutting the other of said elements, and an annular pressure element abutting said spring disc inwardly from said fulcrum ridge, whereby the spring disc flexes about said fulcrum ridge, and a peripheral outlet between said groove and said recess is opened or varied in width when pressure is applied by said pressure element to said spring disc.

6. A liquid dispenser comprising a substantially rigid member, a deformable member, with said two members forming a liquid reservoir having an outlet, means for applying pressure to said deformable member to vary the opening of said outlet, and fulcrum means for said deformable member firmly abutting said rigid member and located between said liquid reservoir and said means for applying pressure, whereby said pressure-applying means is protected from said liquid reservoir.

7. In a high speed filament coating apparatus, a coating roller having a groove in which the filament rides, an annular coating material reservoir within the roller having a continuous peripheral outlet to said groove, means for varying the width of said outlet, said outlet being of substantially less width than said reservoir throughout its range of adjustment, and an internal passageway opening into said reservoir for supplying coating material to said reservoir.

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