

[54] **APPLICATOR FOR POWDERED RESINOUS MATERIAL**

3,233,581 2/1966 Levake 239/223 X
3,237,598 3/1966 Zahn 239/186 X

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[51] Int. Cl. **B05b 3/18**

[58] Field of Search 239/184, 186, 187,
239/225, 227

[56] **References Cited**

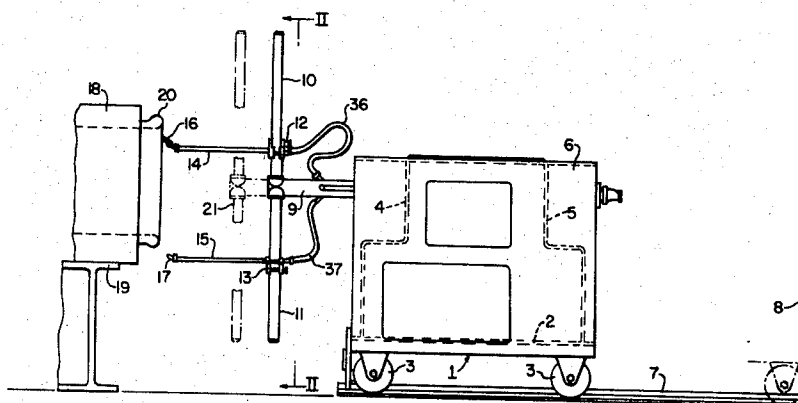
UNITED STATES PATENTS

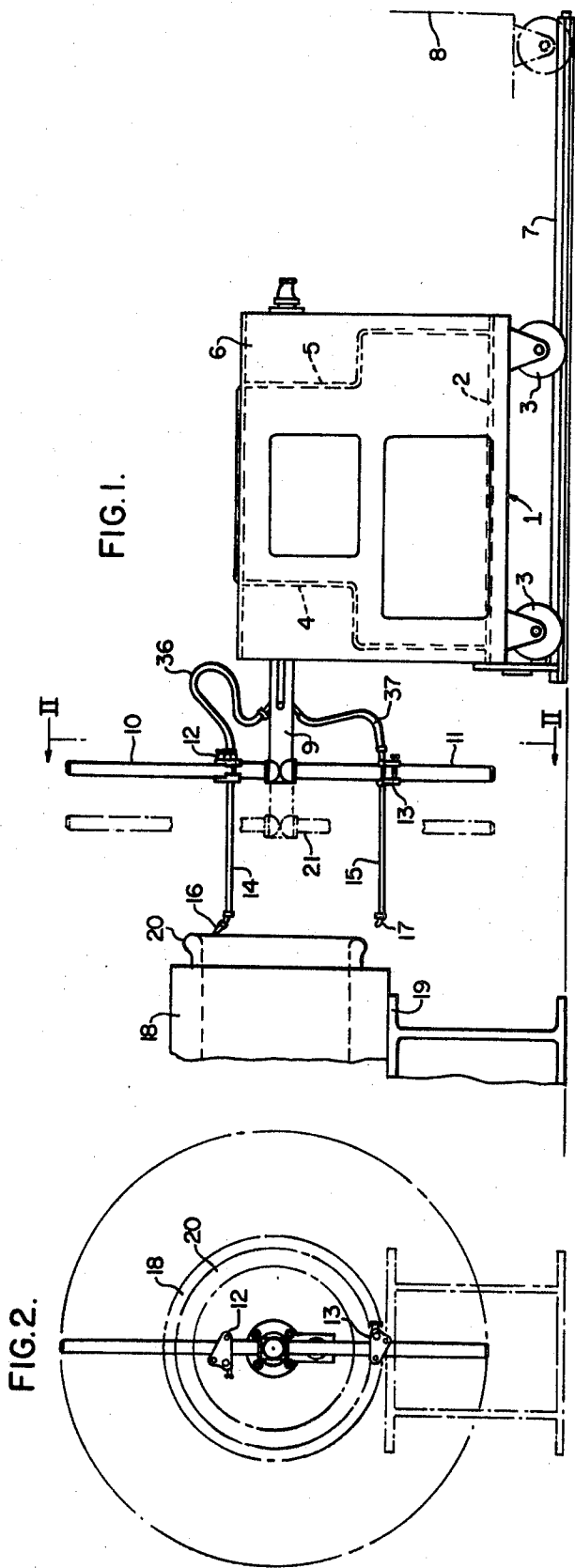
3,276,695	10/1966	Giardino et al.	239/186 X
2,754,227	7/1956	Ransburg	239/186 UX
2,388,517	11/1945	Bailey et al.	239/186
3,109,262	11/1963	Weaver et al.	239/186 UX

[57] **ABSTRACT**

An automatic device for spraying powdered resin onto coils of a motor or similar electrical devices comprising a shaft that is rotatable horizontally and movable axially, comprising at least one nozzle on one end of the shaft for spraying a powdered resin on a coil located adjacent the nozzle, means for rotating the shaft, and means for moving the shaft axially, whereby the nozzle may be automatically rotated around the coil and moved longitudinally thereof to deposit a predetermined thickness of a coating of powdered resin on selected areas of a coil.

9 Claims, 6 Drawing Figures





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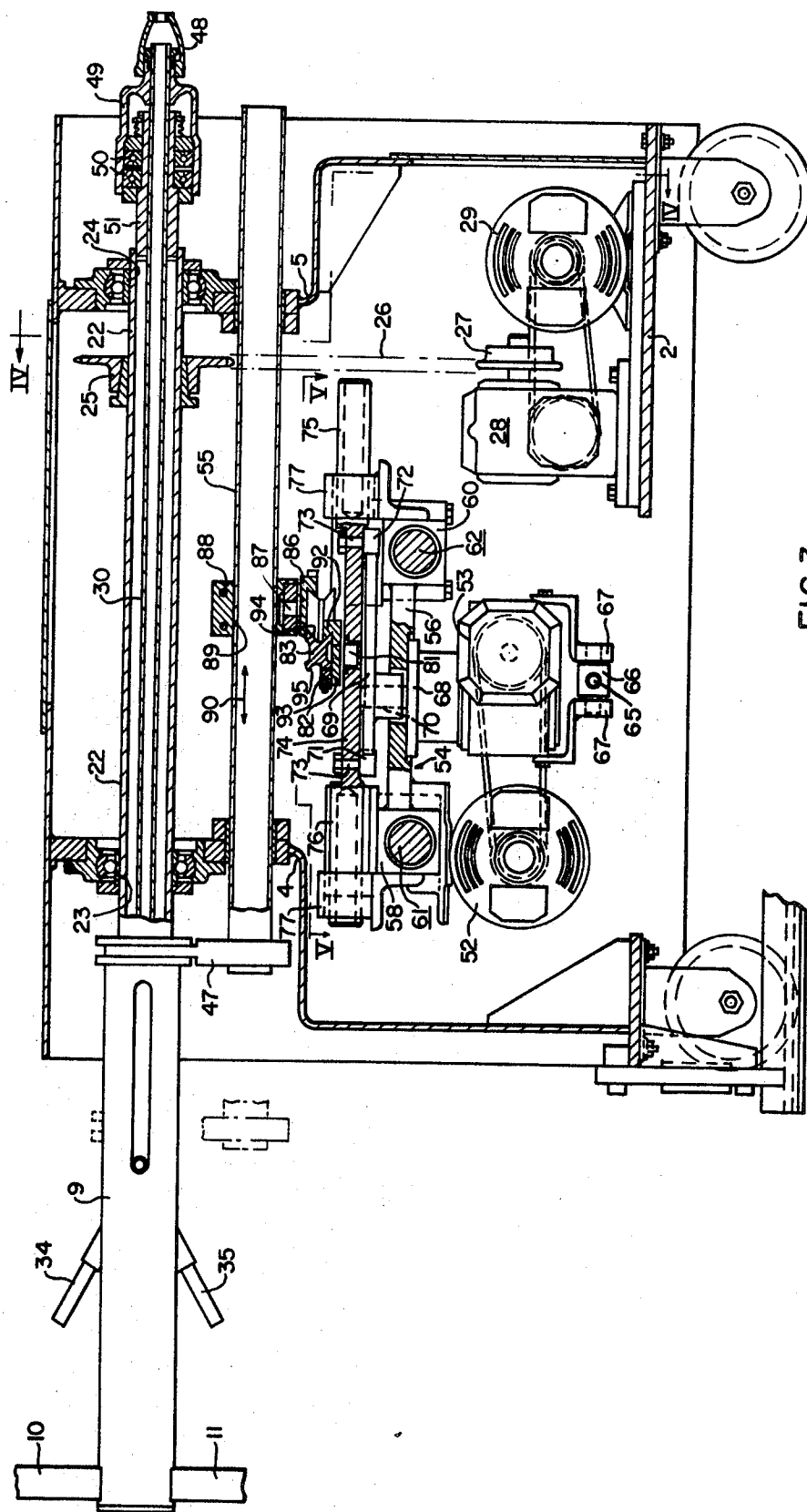


FIG. 3.

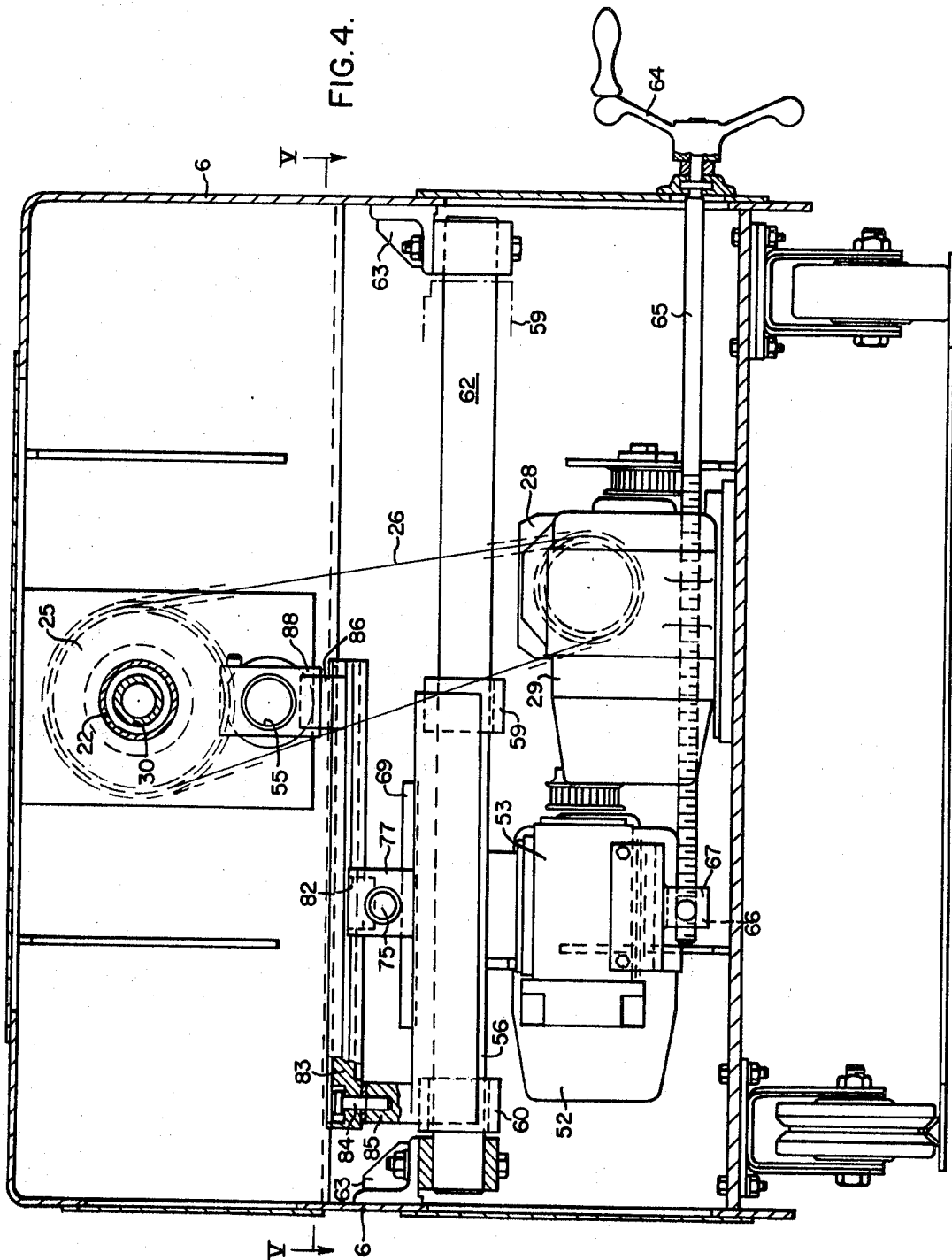
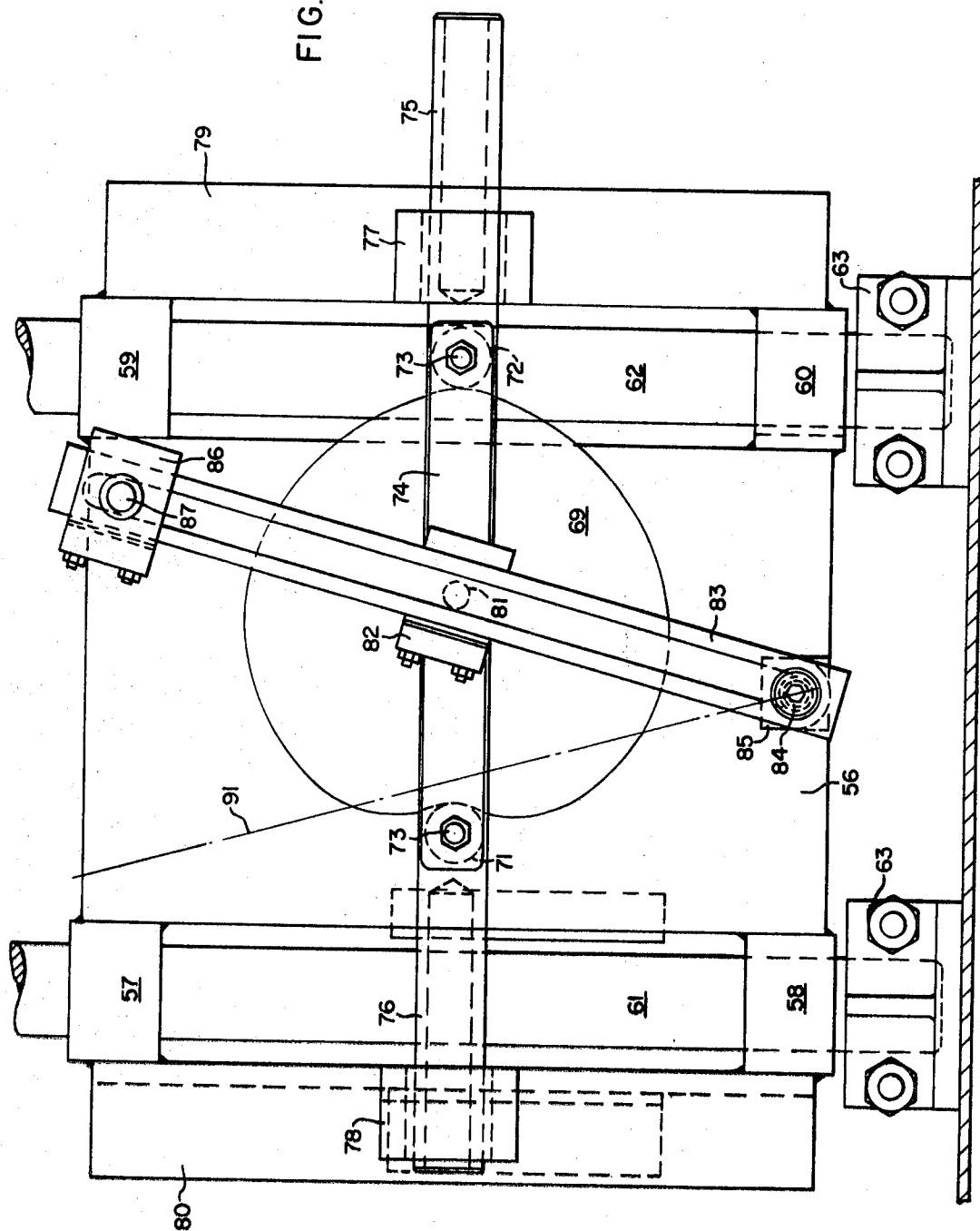


FIG. 5.



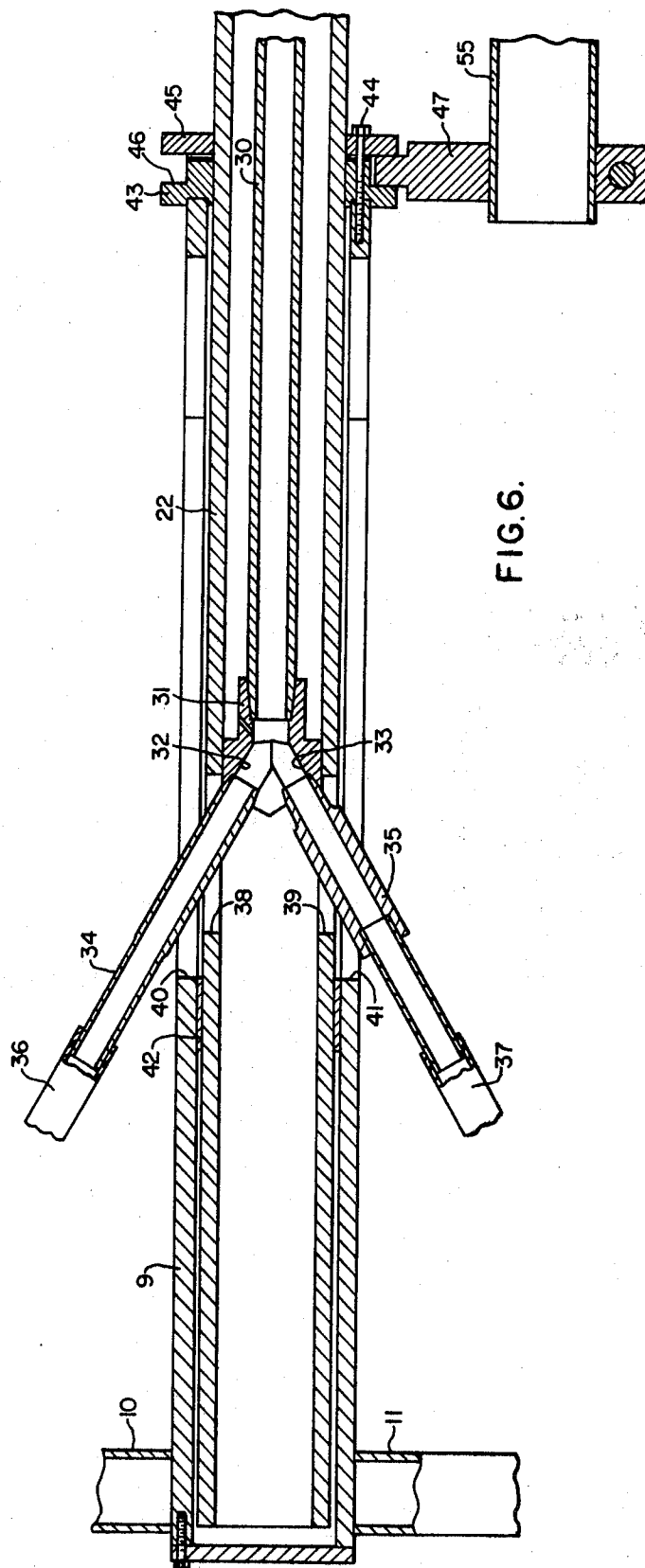


FIG. 6.

APPLICATOR FOR POWDERED RESINOUS MATERIAL

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a device for automatically spraying powdered resinous material, and more particularly, it pertains to a device for the application of a resinous com-position as insulation on the end turns of windings of motors and other electrical apparatus.

2. Description of the Prior Art

Electrical apparatus such as motors and generators employ stators and rotors embodying insulated coils comprising central core portions and end turn portions. The preparation of coils, windings, or conductors for insertion in the slots of magnetizable cores by prior methods have involved the time consuming and costly process of applying insulation tape, wrappers, and celles to a plurality of conductor turns forming the coil portions, such as disclosed in U.S. Pat. No. 3,054,770. The process was particularly involved where it was employed in the repair of coils for motors and generators. Any elimination or reduction of the amount of taping and wrapping required for the preparation and/or repair of coils and windings without sacrificing the required insulation properties would result in a corresponding reduction of labor and cost of the ultimate product. Moreover, subsequent heat treatment cycles required by such prior art practices are time-consuming and require additional capital investment for equipment. More particularly, in the area of form-wound apparatus, stators, rotors, armatures, direct current field coils, and rotating field coils, the methods remain the same; i.e., mostly hand-taping, varnish treatment and approximately 12-hour baking cycles.

The foregoing problems are of great moment where repair shops for such apparatus are involved. Repair shops handle apparatus of a wide variety of sizes and types and are therefore necessarily based upon non-standardized procedures. For example, repair shops must be prepared to handle rotatable apparatus varying in diameter from four inches to 6 feet or more. In such circumstances, the methods employed should be adapted to a maximum output at a minimized cost.

SUMMARY OF THE INVENTION

It has been found in accordance with this invention that the foregoing problems may be overcome by providing an automatic device for spraying powdered resin onto the external portions of a motor or similar electrical equipment which device includes a rotatable shaft that is movable axially, a pair of nozzles disposed on one end of the shaft for spraying powdered resin, one nozzle adapted to spray powdered resin on the outer surface and another nozzle adapted to spray a controllably predetermined thickness of powdered resin on the inner surface of heated coil end portions where it melts and adheres, motor means operatively connected to the shaft for rotating the same, and other means including a motor and cam for moving the shaft axially as the shaft is rotated.

Among the advantages of the device of this invention is that the coils are sprayed automatically with a coating of resinous material having a uniform thickness, thereby eliminating any error otherwise created by a manual performance.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view of the device of the present invention;

FIG. 2 is a vertical sectional view taken on the line II—II of FIG. 1;

FIG. 3 is a vertical sectional view through the device;

FIG. 4 is a vertical sectional view taken on the line IV—IV of FIG. 3;

FIG. 5 is a horizontal sectional view taken on the line V—V of FIG. 3; and

FIG. 6 is an enlarged fragmentary vertical sectional view through the outer extension portion of the reciprocating shaft.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The device of the present invention is generally indicated at 1 in FIG. 1. It includes a base plate 2, castors 3, and supporting members for the internally operative parts which members include frames 4 and 5 as well as a housing 6. The castors 3 comprise four in number, each located at one corner of the base plate 2. The castors 3 are mounted on short segments of track 7 to facilitate movement of the device 1 between the position shown in FIG. 1 and a retracted position as shown by the broken line 8.

The left end of the device 1, as viewed in FIG. 1, has a tubular member 9 extending horizontally therefrom. A pair of arms 10 and 11 extend in opposite directions from the outer end portion of the member 9. A pair of clamps 12 and 13 are adjustably attached to the arms 10 and 11, respectively, for the purpose of mounting tubes 14 and 15 in desired positions. The tubes 14 and 15 are provided with nozzles 16 and 17 at the outer ends thereof for the purpose of spraying powdered resinous material.

As shown in FIG. 1, a portion of a wound stator 18 of a motor is mounted on a table 19 which stator is provided with a core and windings including end turns 20 which extend outwardly from the interior of the stator core 18. The stator 18 is preferably hot — for example, at 350° to 375°F. The purpose of the device 1 is to provide the end turns 20 with an insulating coating of resin and, for that purpose, the nozzle 16 is directed toward the interior surface of the end turns 20 while the nozzle 17 is directed towards the external surface thereof. When the tubular member 9 is rotated (FIG. 2), the nozzle 16, being adjusted and held by the clamp 12 for the particular desired position, moves around the inner surface of the end turns 20 and applies a coating of powdered resin thereon. Similarly, the nozzle 17 being adjusted and held by the clamp 13 is directed to the outer surface of the end turns 20. Inasmuch as the tubular member 9 oscillates horizontally between the retracted or solid line position and the advanced or broken line position 21, the nozzles 16 and 17 move similarly over the desired area to be coated on the inner and outer surfaces of the end turns 20 of the motor coil.

Although the resin may adhere to the end turns and form a dust-like coating of about 0.001 inch under ambient temperature conditions, a coating of substantial thickness is formed when the coils are preliminarily heated to at least the melting point of the resin, for example, 350°F. At that temperature the resin melts and forms a sticky base for holding additional powdered particles of resin that would otherwise not adhere in

place. Subsequently, after two or more applications, the stator is placed in an oven where the resin is cured at about 400°C for one hour, for example, for epoxy resins. Suitable powdered resins for such use are well known.

The means for rotating the member 9 as well as means for oscillating the member horizontally are enclosed within the housing 6 as shown in FIGS. 3 to 6. The tubular member 9 is telescopically mounted on a shaft 22 (FIGS. 3 and 6) and within bearings 23 and 24 that are separately mounted on the frames 4 and 5. A sprocket 25 is mounted on the shaft 22, which sprocket is driven by a continuous link chain 26 which extends over and between said sprocket and a sprocket 27 at the output end of a speed reducer 28 which is driven by a motor 29. As shown in FIG. 3, the motor and speed reducer are mounted on the base plate 2 of the device.

As shown in FIGS. 3 and 6, a pipe 30 is disposed within the shaft 22, the left end of which pipe (FIG. 6) is seated in an adaptor 31 by which the adaptor opening is divided into two outlets 32 and 33 which communicate with resin conduits 34 and 35. Flexible hoses 36 and 37 extend between the conduits 34 and 35 and the pipes 14 and 15 (FIG. 1) for delivering powdered resin to the nozzles 16 and 17. As shown in FIG. 6 the conduits 34 and 35 extend through the corresponding openings 38 and 39 in the shaft 22 and through corresponding longitudinal slots 40 and 41 in the tubular member 9. Accordingly, rotation of the shaft 22 is transmitted to the conduit 34 and 35 by contact of the side walls of the openings 38 and 39 with the conduits 34 and 35. Similarly, the conduits 34 and 35 transmit the rotation of the shaft 22 to the tubular member 9 by virtue of the conduits contact with the walls of the slots 40 and 41. But the member 9 is also free to move or oscillate longitudinally from the retracted position as shown in FIG. 6 to the extended position (FIG. 1) by means to be described herein below. As shown in FIG. 6 a centered bushing 42 is mounted on the outer surface of the shaft 22 for maintaining clearance between the member 9 and the shaft. The right end of the member 9 is attached to a collar 43 by annularly spaced bolts 44, which bolts also hold a collar 45 in place against the collar 43 to provide an annular groove 46 for receiving a semiannular U-shape portion of a yoke 47.

The right end of the pipe 30 communicates with a fitting 48 by which powdered resin is introduced into the pipe at a pressure of about 15 psi. To prevent the fitting 48 from rotating with the shaft 22, the fitting is mounted on a rotary union 49 which is provided with similar spaced bearings 50 that are mounted on a reduced portion 51 at the end of the shaft 22.

The means for oscillating or retracting and advancing the member 9 on the shaft 22 is shown more particularly in FIGS. 3, 4, and 5. The means includes a motor 52, a speed reducer 53, a motion converter generally indicated at 54 (FIG. 3), and an oscillating tube or arm

The motion converter 54 includes a carriage 56 which is a horizontal plate provided with four journals disposed in one pair 57 and 58 on one side of the carriage 56 and another pair 59 and 60 on the other side thereof. As shown in FIG. 5, the journals 57 and 58 are mounted on a horizontal guide rod 61. Likewise the journals 59 and 60 are mounted on a guide rod 62 par-

allel to the guide rods 61. Both guide rods 61 and 62 are mounted at their opposite ends by suitable brackets 63 which are attached to opposite side walls of the outer housing 6 such as shown for the guide rods 62 in FIG.

4. Accordingly, the carriage 56 is movable from the solid line position to the broken line position as shown for the journal 59 in FIG. 4. Means for moving the carriage between those two positions includes a hand wheel 61 mounted on the outer end of an elongated screw 65 which engages a nut 66 between a pair of similar brackets 67 which are attached to the lower side of the speed reducer 53.

As shown in FIG. 3 the speed reducer 53 includes an upper flange 68 which is secured to the undersurface of the carriage 56. Likewise, the motor 52 is suitably mounted below the carriage and between the journals 57 and 58.

The motion converter 54 also includes a cam 69 which is disposed at the upper end of a shaft 70 extending vertically from the speed reducer 53. Associated with the cam is a pair of cam followers 71 and 72 which are rotatably mounted on the lower ends of a pair of similar mounting pins 73. As shown in FIGS. 3 and 5, the pins are secured to a horizontal slide bar 74 having similar opposite end portions 75 and 76, which are slidably mounted in similar journals 77 and 78. A mounting bar 79 (FIG. 5) is mounted such as by welding on and between the journals 59 and 60 which bar provides a base for the journal 77. Likewise, a mounting bar 80 is mounted such as by welding on and between the journals 57 and 58 to provide a space for the journal 78.

A pin 81 is secured substantially centrally between the pins 73 in a bar 74. A C-shaped slide 82 is mounted on the upper end of the pin 81 which slide engages a lever 83 which as shown in FIGS. 4 and 5 is pivoted at a pin 84 on a block 85 mounted on the top surface of the carriage 56.

The lever 83 extends across the carriage 56 and over the cam 69. A C-shaped slide 86 is slidably mounted on the upper portion of the lever 83 and is provided with a pin 87 to which is attached a clamp 88. The clamp 88 includes an opening 89 by which the clamp is fixedly mounted on the tube 55. The position of the slide 86 on the lever 83 is controlled by the position of the motion converter 54 on the guide rods 61 and 62. Accordingly, when the converter 54 is in the left-most position as shown in FIG. 4 as established by the position of the nut 66 on the screw 65 of the hand wheel 64, the slide 86 is at the end of the lever remote from the pivot pin 84 so that the tube 55 is oscillated back and forth as shown by the arrow 90 (FIG. 3) through a maximum stroke. On the other hand, when the nut 66 is at some other position on the screw 65 to the right of that shown in FIG. 4, the slide 86 is disposed on the lever 83 at a position approximate to the pin 84, whereby the tube 55 oscillates through a shorter stroke in response to constant movement of the lever 83 between the position shown in FIG. 5 and a position indicated by an imaginary line 91 (FIG. 5).

As shown in FIG. 3 the lower half portion of the lever 83 includes two opposite sides 92 and 93 which are inclined upwardly and inwardly towards each other and thereby facilitates a permanent engagement between correspondingly inclined portions of the slide 82. Likewise, the upper half portion of the lever 83 includes opposite sides 94 and 95, which are tapered downwardly

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and inwardly toward each other to facilitate engagement between corresponding part of the slide 86.

In operation, the device 1 provides means for automatically applying resinous powder in a uniform layer over the end turns of a motor in a minimum period of time and without loss of powder due to waste or excess application in an Y area. The device includes means for rotating a pair of nozzles for spraying the powder at the desired locations and on opposite sides of the end turns. More particularly, the nozzles may be adjusted to rotate around small radii or very large radii, depending upon the size of the motor. In addition, the device provides means for adjusting the oscillation or longitudinal stroke of the nozzles in accordance with the size of the end turns of a particular motor to which resinous powder is to be applied. Accordingly, the device of the present invention constitutes a highly satisfactory means for eliminating the time consuming hand methods of applying insulation to the end turns of an electric motor as previously used in the prior art.

What is claimed is:

1. A device for applying a coating of a powdered resin to an object comprising

1. a supporting frame;
2. a rotatable member mounted on said frame;
3. means for rotating said rotatable member;
4. means for reciprocating said rotatable member along its axis; and
5. at least one inwardly-directed and at least one outwardly-directed powdered resin-spraying nozzle connected to said rotatable member, each radially spaced from said axis, whereby said nozzles move simultaneously in a reciprocating and circular path.

2. A device according to claim 1 wherein said means for reciprocating said rotatable member reciprocates said rotatable member at a uniform speed.

3. A device for applying a coating of a powdered resin to an object comprising

1. a supporting frame;
2. a rotatable member mounted on said frame;

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3. means for rotating said rotatable member;

4. reciprocating means for reciprocating said rotatable member along its axis, said reciprocating means including:

- a. a heart-shaped cam;
- b. means for rotating said cam at a constant speed;
- c. at least one cam follower which rides against said cam and moves in a straight line; and
- d. means for transmitting the reciprocating motion of said cam follower to said rotatable member; and

5. at least one powdered resin-spraying nozzle connected to said rotatable member, radially spaced from said axis, whereby said nozzle moves simultaneously in a reciprocating and circular path.

4. A device according to claim 3 wherein said means for transmitting the motion of said cam follower to said rotatable member is a lever to which said rotatable member and said cam follower are connected, said cam follower being connected to said lever at a position in-between the fulcrum of said lever and the position where said rotatable member is connected.

5. A device according to claim 4 wherein the relative positioning of the connections of said rotatable member and said cam follower on said lever is adjustable.

6. A device according to claim 3 which includes one inwardly-directed nozzle and one outwardly-directed nozzle each connected to said rotatable member, and each radially spaced from said axis.

7. A device according to claim 3 which includes at least one arm extending radially from said rotatable member, said nozzle being adjustably attached to said arm.

8. A device according to claim 3 wherein said rotatable member is horizontal.

9. A device according to claim 3 wherein said powdered resin passes through the center of said rotatable member to said nozzle.

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