

Sept. 8, 1959

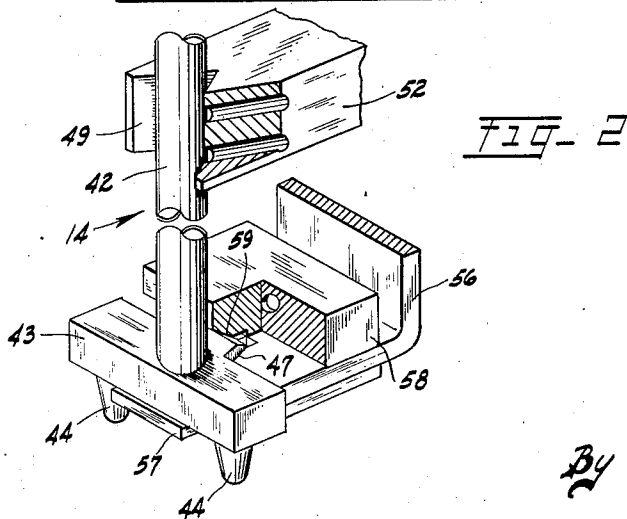
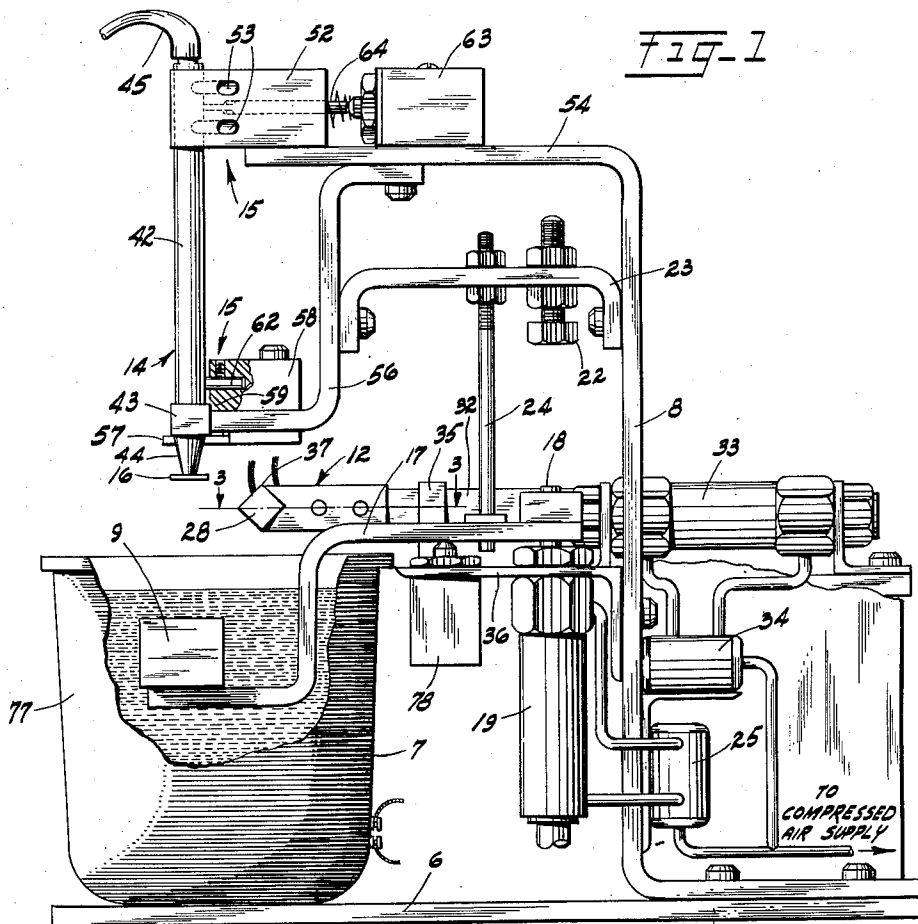
J. A. ROEDER ET AL

2,902,971

ARTICLE COATING APPARATUS

Filed Feb. 12, 1957

2 Sheets-Sheet 1



Sept. 8, 1959

J. A. ROEDER ET AL
ARTICLE COATING APPARATUS

2,902,971

Filed Feb. 12, 1957

2 Sheets-Sheet 2

FIG-3

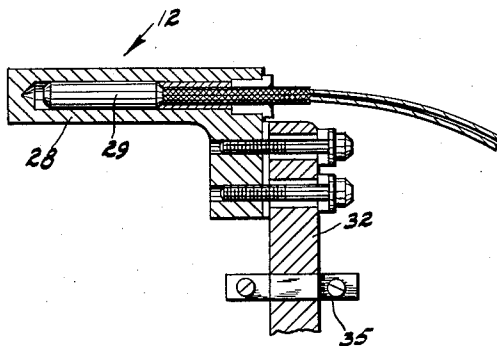


FIG-5

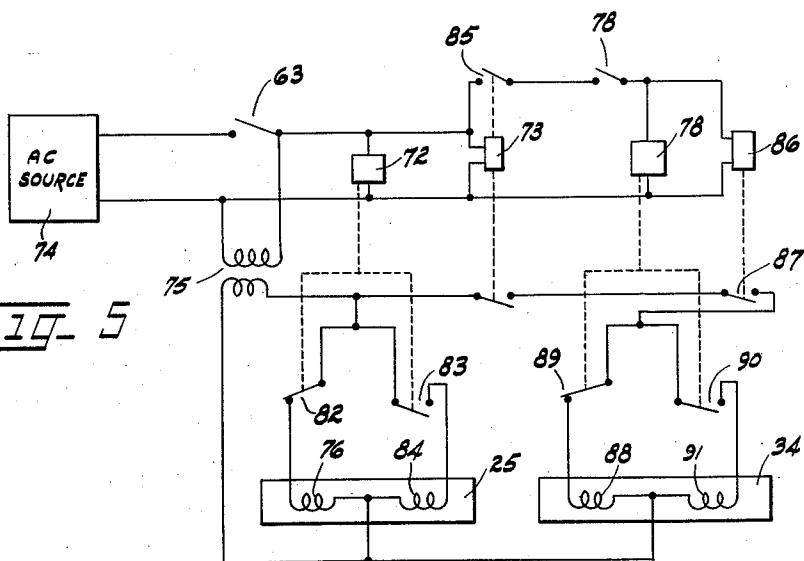
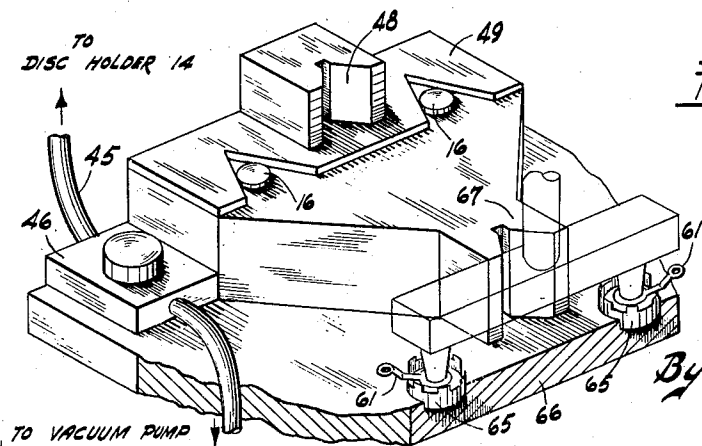


FIG-4



Inventors
J.A. ROEDER
W.J. TESCHE
By *W. H. Barnes*
Attorney

1

2,902,971

ARTICLE COATING APPARATUS

Joseph A. Roeder, Quakertown, and Walter J. Tesche, Coopersburg, Pa., assignors to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

Application February 12, 1957, Serial No. 639,712

2 Claims. (Cl. 118—11)

This invention relates to article coating apparatus and particularly to the application of protective coatings over prescribed areas of articles such as asymmetrically conductive discs or wafers of varistors.

The asymmetrically conductive element utilized in dry disc rectifiers, such as the Western Electric Company type 44A copper oxide varistor, is a so-called copper oxide disc which is metallic copper with an adherent film or layer of copper oxide on one of its flat faces. The discs, and terminals in contact with the opposing faces thereof, are assembled in metal housings or cans having apertures through which the terminals protrude. In such devices, the junction between the oxide and the metal must be protected from exposure to the air and moisture to avoid deterioration of its asymmetric properties. This protection has been provided heretofore by vacuum-impregnating the assemblages with a waxy material such as polyethylene-polybutene compound, the compound penetrating and filling the interiors of the housings through the terminal apertures therein. While effective for its intended purpose, this procedure has the disadvantage of requiring the use of considerable volume of the compound and the introduction of a degreasing or other cleaning operation to remove the compound from the terminals and the outsides of the housings.

The object of the invention is to improve such devices and reduce the cost of making them by limiting the application of the protective coating to areas where they are required thereby conserving coating material and eliminating the need for a cleaning operation.

A preferred embodiment of the invention for doing this utilizes a movable vacuum holder for holding the disc by engaging the central portion of the oxide layer on the one face which need not be, and is not coated with the sticky compound so that the vacuum holder may be manipulated freely to discharge the coated discs therefrom into the housings in the assembly of the devices. The loaded vacuum holder is positioned in a support accurately locating one or more of the discs horizontally above a vertically movable ladle normally submerged in a heated reservoir for melting the compound and keeping it fluid at a uniform viscosity. An actuator automatically lifts the ladle through the heated compound in the reservoir, filling it to overflowing when the disc holder is placed in its support. The ladle is moved up only until the lower portion of the discs including the edges thereof are submerged in the filled ladle, the meniscus of the compound extending slightly on to the top oxide layers to surround completely the exposed edges of the rectifying junctions. The ladle is held in the raised position sufficiently long to permit the compound to coat the discs adequately when it is automatically lowered and a heated scraper member is reciprocated across the lower faces of the discs to remove surplus compound therefrom. The disc holder is then removed from the support moved to an associated assembly jig where the discs are dis-

2

charged therefrom in proper assembly relation with the terminals preassembled in the housings for the devices.

These and other features of the invention will be more fully understood from the following detailed description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a side elevational view of an apparatus for coating varistor discs;

Fig. 2 is an enlarged view, with portions broken away, of the disc holder support structure of the apparatus of Fig. 1;

Fig. 3 is an enlarged view along the plane of line 3—3 of Fig. 1, showing the scraper member in cross-section;

Fig. 4 is a perspective view of the supply and assembly jig; and

Fig. 5 is a schematic diagram of the control circuit for the fixture.

Referring now to Fig. 1 of the drawing, the main parts of the apparatus shown therein include a reservoir 7 for the liquid protective coating material 77, a main frame 8, a vertically movable ladle 9 normally submerged in the material 77, a reciprocable scraper 12, a movable vacuum-controlled disc holder 14 and a support 15 for accurately locating the holder 14 so that the varistor discs 16 will be supported in a prescribed vertical position. The reservoir 7 is temperature-controlled and heated so that the viscosity of the waxy compound therein will remain substantially uniform and free flowing during the operation of the device. For polyethylene-polybutene compound, the temperature of the melt is maintained at about 130 degrees centigrade. Heating means for such a reservoir are well known in the art and are not included in the drawing.

The ladle 9 is supported on an arm 17 connected to the movable actuator element 18 of a double-acting air cylinder 19 attached to a bracket 36 on the frame 8. The ladle is movable vertically to a prescribed vertical position as determined by an adjustable stop member 22 on a bracket 23 on the frame 8. A fixed guide member 24 also supported from the bracket 23 is slidably positioned within a hole through the ladle arm 17 in order that the ladle 9 will traverse a prescribed vertical path whenever the air cylinder 19 is actuated. In its raised position discs 16 on the holder 14 will have their lower faces and the peripheral edges submerged in the filled ladle, the meniscus of the compound extending over and on to the top oxidized faces of the discs, as seen in Fig. 1. The operation of the air cylinder 19 is controlled by a solenoid control valve 25 on the frame member 8, the operation of which will be discussed below in connection with the description of the control circuit of Fig. 5.

The laterally extending arm 28 of the scraper 12 is heated by a resistance element 29, energized from a source not shown, in order to keep the compound from solidifying and accumulating thereon. Arm 28 is mounted to a horizontally reciprocable member 32 connected to the actuator of a double-acting air cylinder 33, whose operation is controlled by a solenoid control valve 34. When actuated, the air cylinder 33 reciprocates the scraper arm 28 along a horizontal plane, as viewed in Fig. 1, so that the top edge 37 will pass across the lower faces of the discs 16 on the holder 14 and scrape surplus compound therefrom. A fixed guide element 35 on the bracket 36 keeps the member 32 from twisting to maintain the scraper arm 28 horizontally disposed.

The disc holder 14 is movable between the support 15 of the wax applicator and the jig shown in Fig. 4 which may be located in front or alongside of the coating apparatus. The holder 14 includes a hollow steel shaft 42 having a bifurcated end piece 43, an internal passage

being provided from the hollow shaft through the end piece to the disc-supporting lower extensions 44. The hollow shaft 42 is connected through flexible tubing 45 to the output of a vacuum pump through a control valve 46 conveniently mounted alongside of the jig of Fig. 4. The valve 46 is normally open to provide suction at the extensions 44 to hold the discs 16 securely thereto. When the push button valve 46 is depressed, the vacuum path to the extensions 44 is broken and discs supported thereon will drop off as required, for example, in the assembly of the coated discs in the housings 65. The end piece 43 of the holder is provided with a locating wedge 47 extending therefrom which may be slidably positioned in the V-slot of locating blocks 48 and 67 on the jig of Fig. 4, which permits locating extensions 44 either above the V-notches in a plate 49 on the top of the jig wherein varistor discs 16 to be coated may be picked up by the holder 14 or for depositing coated discs in assembled relation with terminals 61 in housings or cans 65 accurately positioned in holes in a base plate 66 for the jig. In loading the discs on the holder, the operator need only slide the discs 16 into the V-slots, with the oxidizing layer side facing upwardly, then move the holder 14 down, sliding the locating wedge 47 in the guide block 48. Once the holder has been loaded, it is positioned in the support 15 of the coating apparatus which is shown in detail in Fig. 2.

An upper member 52 of the support 15 is mounted on the frame extension 54 and has a vertically extending V-groove 49 for receiving the shaft 42 of the disc holder, permanent magnets 53, mounted in each of the inclined faces, providing magnetic attraction for the shaft 42. The lower portion of the support 15 is mounted on the member 56 on the frame extension 54. The lower end of the member 56 has a V-notch for receiving the wedge 47 of the end piece 43 and an extension 57, mounted on the bottom of the member 56, provides an accurate vertically located platform for receiving the bottom surface of the end piece 43. A permanent magnet 62 in a block 58 on the member 56 provides an attractive force to hold the lower portion of the shaft 42 thereto. This block 58 also has a vertical bevelled surface 59 for engaging a similarly bevelled surface 60 on the top of the wedge 47 of the end piece 43. When the holder 14 is positioned on plate 57 with the wedge 47 nested within the V-slot at the end of member 56 and against the bevelled surface 59 of the block 58, discs 16 on the holder will occupy a predetermined vertical position with respect to the raised position of the ladle 9 and also the scraping edge 37 of the scraper arm 28.

A microswitch 63 on the frame extension 54 having an actuator 64 extending through the upper locating block 52 is operated when the holder 14 is positioned in the support 15. This switch triggers the automatic operation of the fixture which will be discussed below.

Referring now to Fig. 5, the automatic operation of the wax applicator will be described. The control circuit is triggered by the operation of microswitch 63 when the disc holder 14 is placed in the support 15. This microswitch closes to complete the circuit from an alternating current source 74 to a transformer 75, a timer 72, and a time delay relay 73. When the transformer 75 is energized, the winding 76 of the solenoid control valve 25 is energized through the normally closed contacts 82 of the timer 72 to supply compressed air from a source, not shown, to the air cylinder 19 to immediately raise the ladle 9 through the fluid polyethylene-polybutene compound 77, the filled ladle 9 being lifted to a vertical position as controlled by the stop member 22 which makes contact with the raised actuator 18 of the air cylinder. In the raised position, the accurately located lower faces and the peripheral edges of the discs 16 are submerged in the wax-filled ladle with the meniscus of the compound extending slightly over the junction edge of the copper

and the oxide layer of the upper face, as seen in Fig. 1. After a time delay of about five seconds, the timer 72 will time out, opening its normally closed contacts 82 to de-energize the solenoid winding 76 and close its contacts 82 which thereupon energizes a solenoid valve winding 84 to cause the air cylinder 19 to retract and lower the ladle 9 to its submerged position in the reservoir. On returning to the lowered position, the ladle arm 17 closes microswitch 78 which energizes a second timer 73 and a relay 86 through the contacts 85 of the now operated time delay relay 73 which prepares the circuit for operation. The operated contacts 87 of relay 86 complete the energizing circuit of winding 88 in the solenoid control valve 34 which operates to supply air to the air cylinder 33 to move the scraper 12 across the lower surfaces of the discs 16 to wipe the surplus wax therefrom. After about three seconds, the timer 73 times out, opening contacts 89 to de-energize the winding 88 and closes the contacts 90 to energize the winding 91 of the solenoid control valve 34 to cause the air valve 33 to retract the scraper to its original position. When the holder 14 is removed from the support 15, to drop the coated discs 16 in the jig, microswitch 63 will again open and thereby reset the timers to prepare the apparatus for its next operation. The contacts of delay relay 73, which are timed to close after the ladle 9 is raised and before it is lowered, are included in the energizing circuit of timer 78 and its associated solenoid control valve 34 to prevent false operation of the scraper immediately after the triggering switch 63 is closed and before the ladle is raised opening switch 78.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for applying viscous coatings to articles with flat surfaces, comprising having a heated, temperature-controlled coating material reservoir for maintaining the viscous material in a fluid state, a ladle normally submerged in the material in the reservoir, means for supporting the articles with the flat surfaces thereof disposed in a common horizontal plane above the reservoir, means for lifting the ladle through the material, means for arresting the motion of the ladle to position the ladle above said horizontal plane to submerge only prescribed portions of the articles, means for automatically lowering the ladle when the articles are coated, an elongated element having a scraping edge lying within said common plane, a heater for the element to keep scraped coating material from adhering thereto, means for reciprocating the element to move the scraping edge in the common plane past the articles to remove excess material from the coated flat surfaces thereof, and means responsive to the lowering of the ladle for actuating the reciprocating means after the articles are coated.

2. An apparatus for applying viscous coatings to articles with flat surfaces, comprising having a heated, temperature-controlled coating material reservoir for maintaining the viscous material in a fluid state, a ladle normally submerged in the material in the reservoir, a holder for the articles for supporting the articles with the flat surfaces thereof disposed in a common plane above the reservoir, a support for the holder for positioning said common plane horizontally at a predetermined height above the reservoir, means responsive to the placement of the holder in the support for lifting the ladle through the material, means for arresting the motion of the ladle to position the ladle above said horizontal plane to submerge only prescribed portions of the articles, means for automatically lowering the ladle when the articles are coated, an elongated element having a scraping edge lying within said horizontally disposed common plane,

5

a heater for the element to keep scraped coating material from adhering thereto, means for reciprocating the element to move the scraping edge in the common plane past the articles to remove excess material from the coated flat surfaces thereof, means responsive to the lowering of the ladle for actuating the reciprocating means after the articles are coated, and means rendering the reciprocating means inoperative for a predetermined time after the holder is placed in the support to permit coating the articles before the scraper is actuated.

10

6

References Cited in the file of this patent

UNITED STATES PATENTS

2,163,712	Shearer	July 27, 1939
2,545,909	Zabel	Mar. 20, 1951
2,611,335	Dilts	Sept. 23, 1952
2,675,780	McLaughlin et al.	Apr. 20, 1954
2,735,398	Orrell et al.	Feb. 21, 1956