SPRAY NOZZLE ASSEMBLY

Dan Kulie, Brookfield, and Ansel A. Worley, Lombard, Ill., assignors to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York


2 Claims. (Cl. 118—308)

ABSTRACT OF THE DISCLOSURE

A spray nozzle simultaneously coats both the flat end surface and the cylindrical walls within a container with a uniform layer of coating material. Coating material is forced from a cylindrical chamber into one of two concentric cylindrical tubes to form two separate streams of material. The outer stream is projected in a 360° spray substantially perpendicular to the tubes to coat the interior walls of the container while the inner stream passes through a venturi nozzle to coat the inside end of the container.

This invention relates to a spray nozzle assembly and, more particularly, to a spray nozzle assembly for spraying protective coatings on interior surfaces of articles or containers. It is an object of this invention to provide an improved assembly of such a character.

One particular application for such a spray nozzle assembly arises in the packaging of electrical circuits within containers generally referred to in the art as “cans.” Some of the more complex types of such electrical circuits are assembled such that a plurality of electrical components are interconnected on a suitable supporting member to form a network assembly. The electrical components of the completed network assembly are then inserted in an open-end, rectangularly shaped metal container with a portion of the supporting member of the assembly providing a top for closing the open-end of the container. The container is partially filled with a semicured resinous material before insertion of the assembly, and after the assembly is inserted, the resinous material cures to its fully cured state, thereby to form both a dielectric and a shock dampening medium between the various electrical components of the assembly.

To increase the reliability of the above described type of network assemblies, it is often desirable, prior to filling the metal containers with the resinous material, to coat the interior surfaces of each of the containers with a material that provides a thin dielectric lining that is both hard and impervious to moisture. Epoxy resins are particularly suitable materials for producing such a hard, moisture impervious, dielectric lining within the metal containers.

To be acceptable, an epoxy resin lining must be uniform in both thickness and density. The spray nozzle assembly of this invention is well suited for use in applying a uniformly thick and dense coating of an epoxy resin to the interior surfaces of a metal container.

In accordance with a preferred embodiment of this invention, a first conduit member is coaxially positioned and supported within a second conduit member so that a first passageway is defined by the interior of the first conduit member and a second passageway is defined by the space between the first and second conduit members. Each of the passageways is connected to a supply of entrained epoxy resin so that both passageways may carry therethrough a separate stream of entrained resin. A nozzle, associated with the second conduit member, directs resin passing through the first passageway forwardly of the conduit members, and directs resin passing through the second passageway outwardly, substantially perpendicular of the conduit members from at least selected areas of the second conduit member.

Further apparatus is provided for mounting the conduit members and nozzle supported thereby for reciprocal movement along a central axis of a container, preferably heated. As the assembly is reciprocated with entrained epoxy resin being supplied to both of the passageways, the entrained resin emerging from the first passageway is directed primarily against the interior closed end of the container and the entrained resin emerging from the second passageway is directed primarily against the interior side walls of the container, whereby a uniform coating of resin is applied over the interior surfaces of the container.

It is another object of this invention to provide a spray nozzle assembly for applying a uniform coating of resinous material over at least an end wall and a side wall of an article.

It is still another object of this invention to provide a spray nozzle assembly for applying a uniform coating of epoxy resin over all of the interior surfaces of an open-end container.

It is a further object of this invention to provide a spray nozzle assembly having the various characteristics described above while being inherently reliable and efficient in operation, of rugged construction, and economical to manufacture.

This invention, together with further objects and advantages thereof will be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an isometric view showing the general details of the spray nozzle assembly of this invention.

FIG. 2 is a partial, longitudinal sectional view showing in elevation the spray nozzle assembly of FIG. 1; and

FIG. 3 is a sectional view showing in greater detail the principal portions of the spray nozzle assembly shown in FIG. 2.

In the drawings there is illustrated a particular embodiment of this invention which is well adapted to apply a uniform coating of epoxy resin to the interior surfaces of a heated container. It is to be understood, however, that the spray nozzle assembly as embodied herein is equally applicable for use in spraying many other types of resinous coating materials on the surfaces of articles.

As best seen in FIGS. 1, 2 and 3 of the accompanying drawings, a preheated, open-end container 16, such as aluminum can be heated to a temperature of approximately 450° F. is positioned between a pair of holding members 11—11. Each of the holding members 11 is secured to a base plate 12 by a pair of screws 13—13. The container 10 rests on a lower support 14 which is secured to the base 12. The container is preheated so that epoxy resin sprayed thereagainst will absorb heat therefrom and melt sufficiently to adhere thereto.

The open end of the container 10 is positioned against a sealing member 16. The sealing member, which is made of any suitable material such as heat resistant soft rubber, has a central opening 17 therethrough (see FIG. 2) for purposes to be described hereinafter. The sealing member is secured to a guiding and supporting member 18 that projects perpendicularly from and is secured to the base 12.

A spring 19 acts between a member 21 affixed to the base 12 and a forward, enlarged end 22 of a movable plunger 23 (see FIG. 1). The enlarged end 22 of the plunger engages the closed end of the container 10. The spring 19 normally biases the open end of the container into sealing contact with the sealing member 16. The plunger 23 is movable out of engagement with the container by
movement of a handle 24 in the direction of arrow A in FIG. 1. The handle 24 is pivotally attached at its lower end by a pivot pin 26 to a support member 27 which is in turn secured to the fixed support 21. An intermediate portion of the handle 24 is secured by a pivot pin 28 to an end of the moveable plunger 23 which passes through a guide opening 29 in the fixed support 21. The handle 24 is moved in the direction of arrow A whenever it is desired to remove one container from the assembly and insert another container therein. Upon release of the handle, a newly inserted container will be forced into sealing contact with the sealing member 16.

When a preheated container 10 is placed in the assembly of this invention, the interior surfaces thereof are uniformly coated with epoxy resin by the apparatus now to be described. A suitable type of epoxy resin for this purpose is marketed by Armstrong Products Company, Incorporated of Warsaw, Ind., under the designation-type 394A resin.

As best seen in FIGS. 2 and 3, a first conduit member 31 of circular cross section is supported longitudinally within a second conduit member 32 of circular cross section by means of two sets of spaced, thin, fin-like spacing and supporting members 33—33, the members 33—33 of each being spaced in quadrature about members 31 and 32. Each member 33 extends in a direction parallel to a common center axis of the two conduit members, with the thickness dimension of members 33 being thin enough so as not to inhibit appreciably the flow of epoxy resin thereby.

A first passageway 34 is defined by the interior of the first conduit member 31 and a second passageway 36 is defined by the annular shaped space defined between the first conduit member 31 and the second conduit member 32. The two passageways communicate with a single cylindrical chamber 37 (see FIG. 3) at the rear facing ends of the conduit members 31 and 32. The single chamber 37 is circumferentially defined by an adaptor tube 38. The interior surface of one end of the tube 38 engages and is secured to the exterior surface of the second conduit member 32. The interior surface of the other end of the tube 38 extends beyond the ends of the members 31 and 32 to receive the coupling member 39 securely therein.

Epoxy resin, entrained in an air stream, is carried to the single chamber 37 through a tube 41 connected by a conventional connector assembly 42, to the tube coupling member 39. As the entrained resin passes out of the chamber 37 it is split into two independent flow streams, one of said flow streams through the first passageway 34 and the second stream passing through the second annular passageway 36. The epoxy resin may be entrained in air and supplied to the tube 41 by any suitable apparatus, such as a model 171 flocking gun sold by Bink's Manufacturing Company, Incorporated. When the model 171 gun is utilized, air under twelve pounds pressure is supplied to the gun to entrain the proper amount of epoxy resin.

In accordance with the principles of this invention, a nozzle, generally designated as 43 (see FIG. 3), provides separate exit ways for the entrained resin passing through the two separate passageways 34 and 36. The nozzle 43 consists of a venturi-type throat member 44 which defines a first orifice 45b which communicates with the first passageway 34, and a ring member 46 having a beveled outer annular surface 47 and a continuous radial surface 50 on the rear portion thereof, in part, defining a second orifice 45b which communicates with the second passageway 36. The two members 44 and 46 of the nozzle 43 are secured by a set screw 48 to one another, and to the forward portion of the first conduit member 31. The walls of nozzle 43 defining the two orifices 45a, 45b are contoured to direct the resin emerging from the first passageway 34 flares outwardly in passing through the orifice 45c (see FIG. 2), and is thereby directed forwardly of the conduit members 31 and 32. The entrained resin emerging from the second passageway 36 first impinges upon the beveled outer annular surface 47 of the ring member 46, and is then directed substantially radially outward of the conduit members 31 and 32 by the continuous radial surface 50 in a circumferential, fan-shaped pattern through the orifice 45b.

In order to have the epoxy resin emerging from the nozzle 43 uniformly coat all interior surfaces of the container 10, the conduit members 31 and 32 are reciprocated between a retracted position and an advanced position along the central axis of the properly positioned, preheated container 10. The conduit members are mounted for this movement by means of a gripping member 18 which is securely tightened about the adaptor tube 38 (see FIGS. 2 and 3) by a screw 51. A pin 52, secured to and projecting from the underside of gripping member 49, extends into a guide slot 53 defined between a pair of spaced guide members 54—54 (see FIG. 1). Adjacent ends of each of said guide members 54 are secured to the same one of two guide supports 55—55 fastened to the base 12. The guide supports 55—55 extend perpendicularly between the guide members 54—54 thereby to define opposite ends of the guide slot 53.

A guide opening 56, provided in the guiding and supporting member 18, receives the second conduit member 32 in a close fitting relationship. This guide opening insures accurate alignment of the nozzle 43 with the centerline of the container 10. The conduit members 31 and 32 and the nozzle 43 supported thereby are reciprocated by manual movement of the gripping member 49 in the directions of arrow B in FIG. 2. It is to be understood, of course, that any one of a number of conventional, automated reciprocating types of mechanical apparatus, such as a solenoid controlled, single or double acting air cylinder, or a cam operated cross-slide, could be employed for reciprocating the nozzle assembly embodied herein.

An additional pair of openings 57—57 are provided in the guiding and supporting member 18. This pair of openings cooperates with the central opening 17 in the sealing member 16 to provide exhaust passageways for excess epoxy resin sprayed into the interior of the container 10.

To utilize the spray nozzle assembly of this invention, the operator moves the gripping member 49 to the right as viewed in FIG. 2 until the pin 52 secured thereto engages the right guide support 55. When the gripping member 49 is in this position, the nozzle 43 is located in its retracted position a short distance to the left of the guiding and supporting member 18. The operator then inserts a preheated container 10 into the assembly and turns on the supply of entrained epoxy resin so that resin is supplied to the two passageways 34 and 36.

Thereafter, the operator moves the gripping member 49 to the left as viewed in FIG. 2 until the pin 52 supported thereby engages the left guide support 55 at which time the nozzle 43 is spaced a slight distance to the right of the closed end of the container 10. The operator then returns the gripping member to its rightmost position. In one particular application of casting containers for electrical components with the aforementioned type 394A resin manufactured by the Armstrong Products Company, the back and forth stroke of the gripping member is repeated. The two back and forth strokes of the gripping member are accomplished in approximately four seconds. While the nozzle 43 is being reciprocated twice along the interior of the container 10, the spray of entrained resin emerging through the orifice 45a of the venturi throat member 44 from the first passageway 34 is directed primarily against the closed end of the container 10. The continuous radial surface 50 of the ring member 46 directs the spray emerging through the orifice 45b defined the second passageway 36 primarily against the side walls of the container 10. As the epoxy resin impinges upon a
surface of the container, the resin melts by absorbing heat from the container and thereafter adheres to the surface.

The coating of resin applied to the container is generally uniform in thickness and density throughout the whole container. In this specific embodiment and described application of the invention, the resulting coating is approximately .005 inch thick. The uniformity of the coating results because spray is applied to the large surface area of the closed end of the container in a low density spray for almost the total spraying time. On the other hand, the spray for the side walls of the container is applied to a narrow, constantly changing surface area in a high density spray for a short period of time during each traverse of the container by the spray nozzle.

After the operator has completed the spraying operation, the container 10 is removed from the assembly. The container, with its newly applied coating of the aforementioned epoxy resin, is then placed for twelve minutes in a heating chamber held at a temperature of approximately 410° F. During this heating operation, the resin is fully cured whereby a uniform coating of hardened epoxy resin is produced on the interior walls of the container. As is well known in the plastics art, many resinous coating materials would require different temperatures and time periods for post curing, whereas others may require no post curing.

There has been disclosed herein a spray nozzle assembly for applying a uniform coating of resinous coating material which is inherently reliable and efficient in operation, of rugged construction, and economical to manufacture.

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

What is claimed is:

1. A spray nozzle assembly for applying a plastic material to the interior surfaces of an open-end container, comprising:
a flat base;
a pair of spaced L-shaped holding members mounted on a first section of said base for receiving said container between the upstanding arms of said holding members;
a pair of spaced guide members mounted on a second section of said base with the space between the guide members aligned with the center of the space between the holding members;
aplate-like supporting member mounted perpendicular to said base between said guide members and said holding members, said supporting member having a central guide opening and radially spaced exhaust openings therethrough;
a pair of concentric conduits, the inner of which projects beyond the end of the outer;
a tubular nozzle having an axial venturi therethrough, to define a first spray orifice, and an outer beveled annular section;
means mounting said nozzle on said inner conduit with the beveled annular section spaced from the end of said outer conduit to define a second spray orifice, said outer conduit having an outwardly projecting pin which is positioned between said guide members to mount said conduits for reciprocation within the central guide opening of said supporting member;
means for introducing a flow of entrained plastic material into the open ends of said first and second conduits to be projected in a spray from said first and second orifices;
a resilient sealing member fixed to the face of said supporting member adjacent the ends of said holding members;
means for resiliently clamping the open-end of a container positioned between said holding members against said sealing members; and
means for reciprocating said conduits and tubular nozzle through the guide opening in said supporting member to coat the interior of said container with plastic material whereupon any excess coating material escapes through the exhaust openings in said support member.

2. A spraying apparatus for applying a coating of substantially equal thickness to both the inner end surface and the inner side walls of a container which comprises:
first and second conduit members;
means for supporting said first conduit concentrically within said second conduit to define a first passageway within the interior of said first conduit and a second passageway within the annular space between said first and second conduits;
means for mounting said conduit members for reciprocation into and out of said container;
means connecting the rear ends of said conduit members to a supply of entrained coating material for impressing separate streams of entrained coating material to both said passageways;
a nozzle connected to the forward end of said first conduit having a first axial venturi opening for projecting a low density spray of the entrained coating material flowing through said first passageway in a forward manner to coat the end of said container and a second radially extending opening for projecting a high density spray of the entrained coating material flowing through said second passageway transversely of said conduits to coat the side walls of said container, the size of said first opening being related to the size of said second opening to insure that substantially the same thickness coating is applied to the end surface of the can as is applied to the side walls of the can upon reciprocation of said conduit members and nozzle; and
means for reciprocating the conduit members to uniformly coat the inside of said container.

References Cited

UNITED STATES PATENTS

364,101 5/1887 Gill et al. 239—520 X
3,117,726 1/1964 Schoberg 239—291
1,587,194 6/1926 Sladden 134—167 X
2,520,397 8/1950 Green 118—306
3,100,724 8/1963 Rocheville 118—308

CHARLES A. WILLMUTH, Primary Examiner.
J. McINTOSH, Assistant Examiner.