

Oct. 11, 1966

G. E. CHILDS ETAL

3,278,451

FLEXIBLE SMOKE EXPANSION CHAMBER

Filed Nov. 14, 1963

2 Sheets-Sheet 1

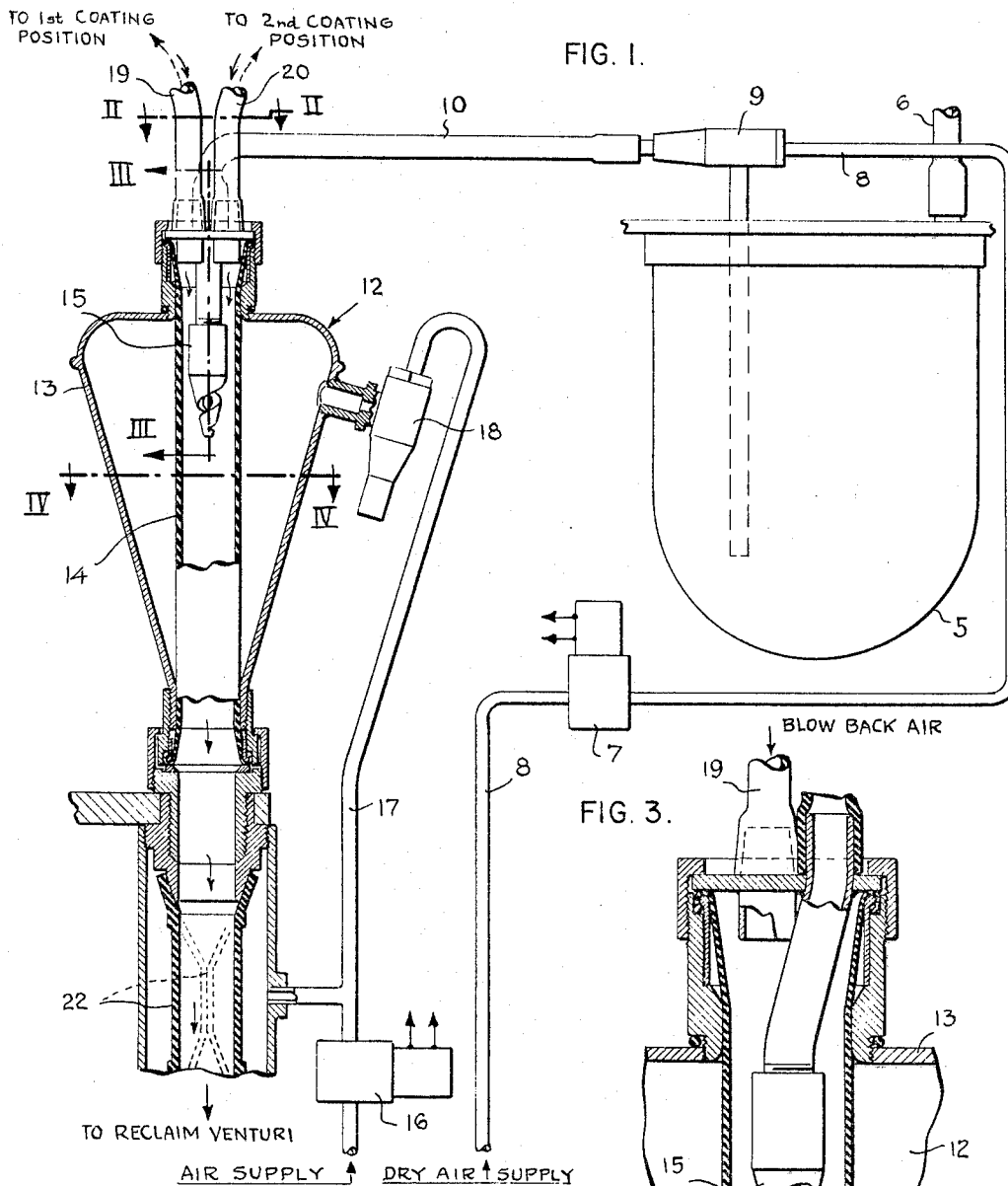


FIG. 2.

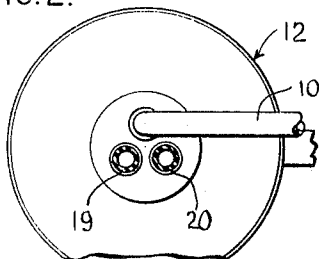


FIG. 4.

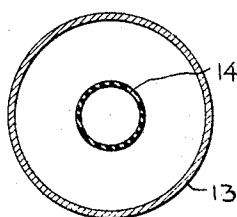
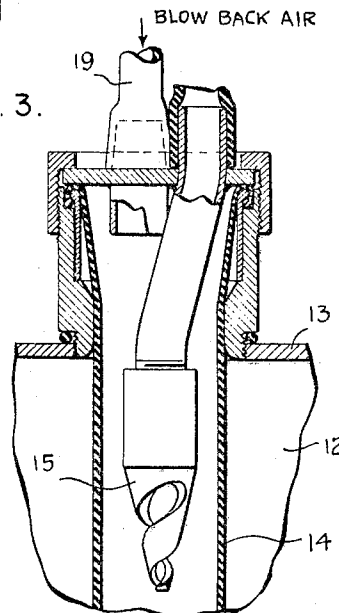


FIG. 3.



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TO 1st COATING
POSITION

TO 2nd COATING
POSITION

FIG. 5.

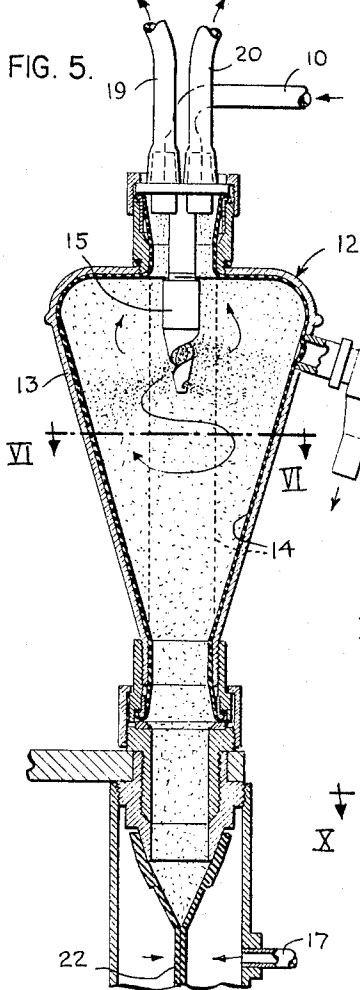


FIG. 6.

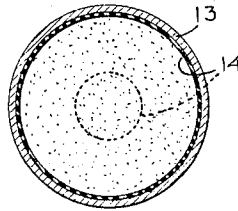
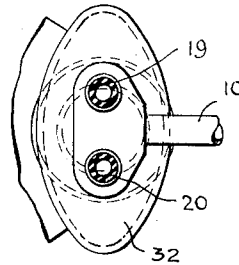


FIG. 8.



TO COATING POSITIONS

FIG. 7.

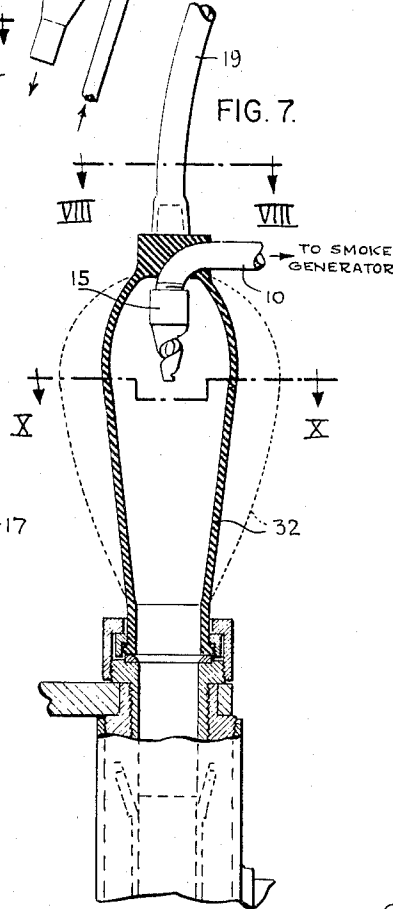


FIG. 9.

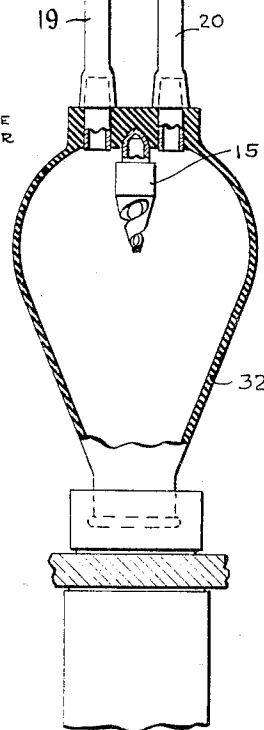
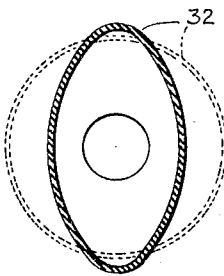


FIG. 10.



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FLEXIBLE SMOKE EXPANSION CHAMBER

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Filed Nov. 14, 1963, Ser. No. 323,727

4 Claims. (Cl. 252—359)

The present invention relates to electrostatic coating apparatus and more particularly to such apparatus for supplying powder suspended in a gaseous medium such as air to the interior of an incandescent lamp bulb to apply a coating thereto.

Electrostatic coating apparatus of this general nature is now well known to the art with one such apparatus for simultaneously coating a plurality of incandescent lamp bulbs with a powdered light diffusing coating being shown in U.S. Patent No. 3,017,852, as well as in our pending U.S. application, Serial No. 303,821, filed August 22, 1963, both assigned to the same assignee as the present invention. One of the most salient difficulties with this electrostatic coating apparatus has heretofore resided in the fact that the swirling dry powder creates a static charge causing agglomerates to form and adhere to the wall of the rigid expansion chamber during successive coating cycles. Such repeated cycles tend to increase this powder build-up to the point where the weight overcomes the charge on the powder particles causing periodic dislodgment thereof. This dislodgment in turn detrimentally affects the coating density of the lamp bulbs by supplying too much or too little powder, depending upon the moment of dislodgment of the agglomerates during the coating cycle.

It is accordingly the primary object of the present invention to provide an electrostatic coating apparatus for generating a powder-smoke and applying the powder therefrom to the surface of an electric lamp bulb and wherein the formation of powder agglomerates in the expansion chamber during operation of such apparatus is minimized.

Another object of the present invention is the provision of an electrostatic coating apparatus for applying a coating to an electric lamp bulb from a powder-smoke and wherein a flexible expansion chamber is utilized as part of such apparatus to eliminate the build-up of powder agglomerates which otherwise affect the density of the applied coating.

The foregoing objects of the present invention, together with other objects which will become apparent from the following description, are accomplished by providing an expansion chamber which so expands and contracts during the bulb coating cycles that any tendency toward build-up of powder agglomerates on the wall of such expansion chamber is minimized or eliminated by dislodgment thereof before any appreciable agglomerate formation can occur. Accordingly, by preventing the formation of such agglomerates, which otherwise are eliminated only through dislodgment due to their own weight, the density of the resulting coating is maintained more uniform.

The present invention may be more readily understood by reference to the accompanying drawings wherein:

FIGURE 1 is an elevational view in cross-section of the expansion chamber forming part of the electrostatic coating apparatus in accordance with the present invention,

FIG. 2 is a cross-sectional view taken on the line II—II of FIG. 1,

FIG. 3 is a fragmentary sectional view in elevation taken on the line III—III of FIG. 1,

FIG. 4 is a cross-sectional view taken on the line IV—IV of FIG. 1,

FIG. 5 is an elevational view in cross-section of the expansion chamber as shown in FIG. 1 but flexed to its expanded position during the actual coating cycle,

FIG. 6 is a cross-sectional view taken on the line VI—VI of FIG. 5,

FIG. 7 is an elevational view in cross-section of a modification which the expansion chamber of the electrostatic coating apparatus of the present invention may take,

FIG. 8 is a sectional view taken on the line VIII—VIII of FIG. 7,

FIG. 9 is a cross-sectional view similar to that of the modification shown in FIG. 7 but taken at ninety degrees relative to the latter, and

FIG. 10 is a cross-sectional view taken on the line X—X of FIG. 7.

Referring now more specifically to FIG. 1, the portion of the electrostatic coating apparatus as shown therein is similar to that disclosed and claimed in pending application, Serial No. 227,489, filed October 1, 1962 and assigned to the same assignee as the present invention, and hence further detailed description thereof is deemed unnecessary herein. Suffice it to say that, like such previously disclosed electrostatic apparatus, the present invention also comprises a smoke generator 5 which is fed with powder through a conduit 6 extending from the usual powder drum (not shown). Upon operation of a suitable electrically controlled valve 7 dry air is supplied from a suitable source, as indicated by the legend, through a conduit 8 and venturi 9. The air-suspended powder particles in the form of smoke are removed from the smoke generator 5 by the venturi action and are carried through a further conduit 10 into the interior of an expansion chamber 12.

This expansion chamber 12, as shown more in detail in FIGS. 1 and 3, comprises a metallic casing, or the like, 13 of graduated volume and provided with a co-axially disposed expansible tubular insert 14 of rubber or resilient plastic composition properly sealed to the expansion chamber 12 at the top and bottom thereof by usual type packing collars or the like as shown. Since the conduit 10 communicates directly with the interior of the expansible tubular insert 14 through an accelerating valve 15, which may be of the type shown and claimed in our aforesaid pending application, Serial No. 303,821, a swirling accelerated motion is imparted to the smoke particles as they enter this expansible tubular insert 14. The casing 13 of the expansion chamber 12, upon operation of an electrically operated valve 16, is subject to an air supply through a conduit 17 and differential venturi 18, the latter of which exhausts to the atmosphere. Accordingly, during the actual coating cycle when both the valves 7 and 16 are electrically opened, the pressure build-up of the swirling smoke powder entering the expansible tubular insert 14 together with the suction exerted thereon by the action of the air flowing through conduit 17 and differential venturi 18, causes this resilient insert 14 to expand until it contacts the interior wall of the casing 13 and assumes the contour thereof, as shown in FIGS. 5 and 6.

Simultaneously with expansion of the insert 14 the smoke powder is forced by the pressure thereof upwardly through the conduits 19 and 20 which extend to first and second position coating manifolds, respectively, for the application of an initial electrostatic coating, as well as a second such coating at another position when desired, to a group of electric lamp bulbs as disclosed in our above-mentioned pending application, Serial No. 303,821. During the coating cycle when the resilient tubular insert 14 is completely expanded the bottom thereof is sealed-off by a resilient pinch valve 22, as shown by the dotted

lines in FIG. 1 and by the full lines of FIG. 5, of the type disclosed and claimed in our prior Patent No. 2,884,895, granted May 5, 1959 and assigned to the same assignee as the present invention.

Upon completion of the actual coating cycle the electrically operable valves 7 and 16 are closed causing the pinch valve 22 to open, due to release of air pressure formerly exerted from conduit 17, and simultaneously the expanded resilient insert 14 collapses due to cessation of pressurized smoke from the smoke generator 5 through conduit 10 and the removal of the suction action from differential venturi 18. Inasmuch as the expansible tubular insert 14 is of rubber or plastic composition and hence of a dielectric material, there is substantially no electrostatic charge build-up on the walls thereof which contributes to minimizing the accumulation of powder agglomerates thereon. This is further minimized in accordance with the present invention by the expansion and collapsing of the resilient tubular insert which itself dislodges any powder normally adhering to the surface immediately after each coating cycle and hence all excess powder remains unchanged in density. Immediately following opening of the pinch valve 22 "blow back" air is introduced into the system which enters the expansion chamber 12 through one or both of the conduits 19 and 20 and thus removes excess powder through a reclaim venturi and conduit system and delivers it back to the powder supply drum as more fully shown and described in our aforesaid Patent No. 2,884,895.

The modification of the present invention, as shown in FIGS. 7 and 10, differs from that previously described herein by the elimination of the metallic casing 13 with the expansion chamber 32 itself being formed entirely of the same expansible dielectric material as previously mentioned relative to the expansible tubular insert 14. In such modification it is preferable, however, to increase the wall thickness of such expansible chamber 32 so as to withstand the pressure and to limit its expansion since it has no casing to confine it. Also it has been found desirable to make such resilient expansion chamber 32 of oval shape, as shown particularly in FIGS. 8 and 10, rather than of tubular configuration. This oval shape thus allows the expansion chamber to expand more in one plane than the other and thus approach a cylinder, as shown by the dotted lines in FIG. 10, and in addition allows the injected swirling smoke powder to circulate and build up in pressure in the resilient expansion chamber 32 from which it then flows to the coating manifolds through the conduits 19 and 20 in the same manner as previously described relative to FIGS. 1 to 6. Upon completion of the coating cycle the cylindrical expansion chamber 32 collapses to its original oval shape thus dislodging any accumulated powder agglomerates in identically the same manner as the collapse of the tubular insert 14.

It should thus become obvious to those skilled in the art that an electrostatic coating apparatus is herein shown and described in which the formation of powder agglomerates is minimized by the provision of a flexible expansion chamber of a resilient dielectric material. By the utilization of dielectric material for the expansion chamber the building-up of an electrostatic charge on the chamber wall is substantially eliminated. Moreover, the collapse of such chamber upon termination of each coating cycle causes dislodgment of any powder that does tend to accumulate on the chamber wall thus eliminating the formation of powder agglomerates which would otherwise affect the density of the powder applied to the electric lamp bulbs being coated.

Although several embodiments of the present invention have been shown and described it is to be understood that still further modifications thereof may be made without departing from the spirit and scope of the appended claims.

We claim:

1. A device for delivering powder smoke to an electrostatic coating apparatus comprising:

- (a) a smoke generator for suspending the powder particles in a gaseous medium and cyclically delivering the powder smoke therefrom,
- (b) an expansion chamber connected to said smoke generator for building up the volume of the powder smoke cyclically introduced into said chamber from said generator, said expansion chamber comprising a flexible material expansible under pressure of the powder smoke introduced therein and operable to cause dislodgment of accumulated powder agglomerates from the wall thereof upon the collapse of said flexible expansion chamber following each bulb coating cycle,
- (c) and a conduit extending from said expansion chamber for the transmission of said powder smoke to said electrostatic coating apparatus.

2. A device for delivering powder smoke to an electrostatic coating apparatus comprising:

- (a) a smoke generator for suspending the powder particles in a gaseous medium and cyclically delivering the powder smoke therefrom,
- (b) an expansion chamber connected to said smoke generator for building up the volume of the powder smoke cyclically introduced into said chamber from said generator, said expansion chamber comprising a flexible dielectric material expansible under pressure of the powder smoke introduced therein to prevent build-up of an electrostatic charge otherwise causing the accumulation of powder agglomerates on the wall of said expansion chamber and for dislodging powder accumulation upon the collapse of said flexible expansion chamber following each bulb coating cycle,
- (c) and a conduit extending from said expansion chamber for the transmission of said powder smoke to said electrostatic coating apparatus.

3. A device for delivering powder smoke to an electrostatic coating apparatus comprising:

- (a) a smoke generator for suspending the powder particles in a gaseous medium and cyclically delivering the powder smoke therefrom,
- (b) an expansion chamber connected to said smoke generator for building up the volume of the powder smoke cyclically introduced into said chamber from said generator, said expansion chamber comprising a coaxially disposed insert of flexible material expansible under pressure of the powder smoke introduced therein into contact with the interior wall of said expansion chamber and said insert being operable to dislodge powder accumulation upon the collapse of said flexible insert to its normal contour following each bulb coating cycle,
- (c) and a conduit extending from said expansion chamber for the cyclic transmission of said powder smoke to said electrostatic coating apparatus.

4. Apparatus for receiving periodically generated pulses of smoke comprising powdered material suspended in a gaseous stream, and for evenly distributing the powdered material in each pulse of the smoke for delivery to a powder coating outlet, while simultaneously preventing the accumulation of powder deposits which might be introduced into a later-received pulse of such smoke, said apparatus comprising:

- (a) expansion chamber means for receiving each said periodically generated smoke pulse and expanding the gas in each such pulse to evenly distribute the powder in the gaseous stream comprising each received smoke pulse, said expansion chamber means formed of resilient material which is normally in contracted position but which will expand when a smoke pulse is introduced therein;

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- (b) smoke pulse feed means opening into said expansion chamber means for introducing therein each said periodically generated smoke pulse;
- (c) outlet means opening from said expansion chamber means to conduct each expanded smoke pulse away from said expansion chamber means to said powder coating outlet; 5
- (d) deposited-powder outlet means positioned at the lower portion of said expansion chamber means for removal of any powder which might deposit within said expansion chamber means; and 10
- (e) actuating means for closing said deposited powder coating outlet during the period each said smoke pulse is received in said expansion chamber means, and said actuating means opening said deposited powder outlet means when said expansion chamber means is in normal contracted position to permit 15

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any powder remaining in said expansion chamber means to pass through said deposited powder outlet means.

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