

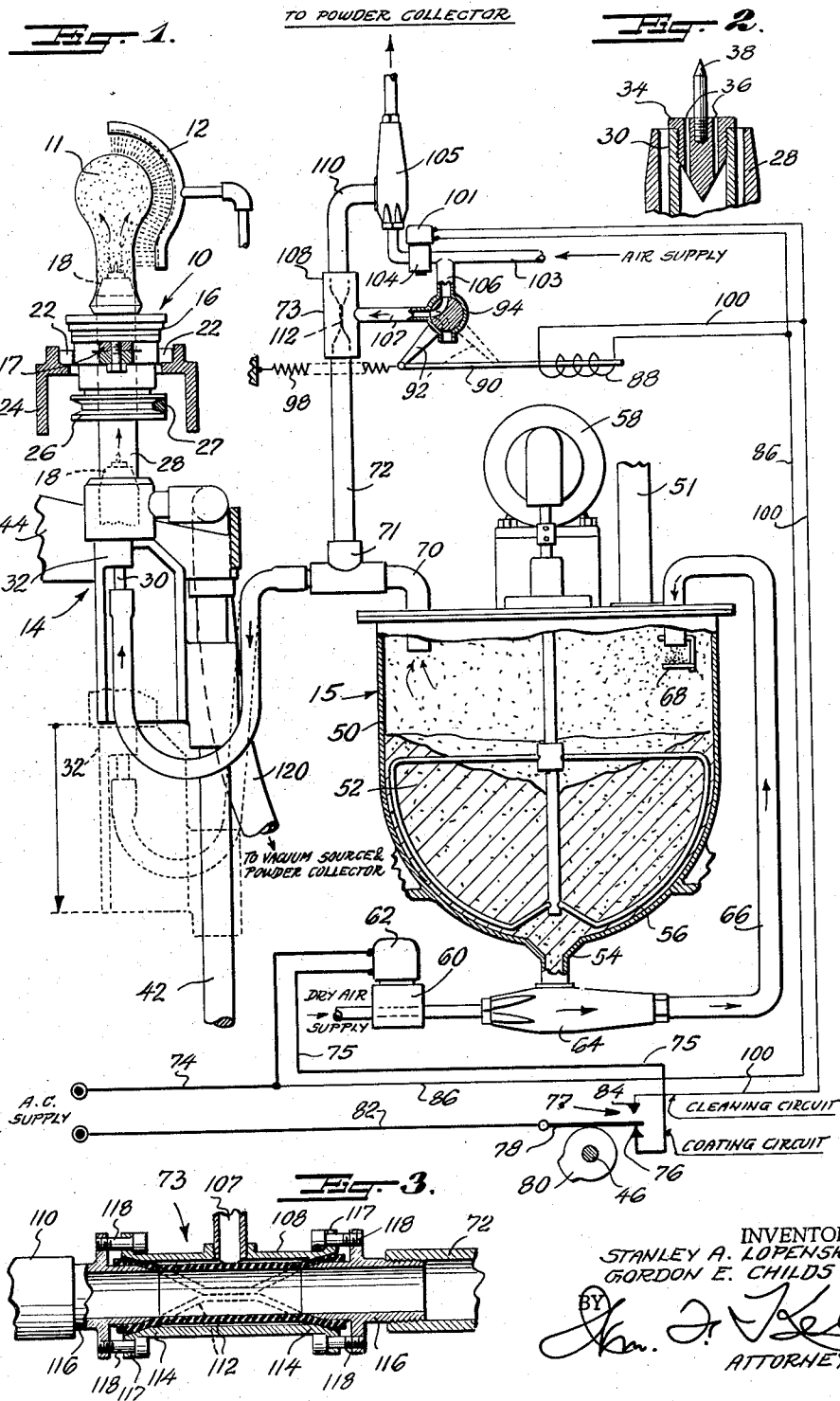
May 5, 1959

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2,884,895

COATING NOZZLE CLEANING APPARATUS

Filed Aug. 27, 1957



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COATING NOZZLE CLEANING APPARATUS

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Application August 27, 1957, Serial No. 680,543

4 Claims. (Cl. 118—49.1)

The present invention relates to an automatic machine for electrostatically coating incandescent-lamp envelopes and of the type shown in application Serial No. 603,636, filed August 13, 1956, by S. A. Lopenski et al., now U. S. Patent No. 2,811,131, but, more particularly, it relates to an improved cleaning device for removing any excess powder from the coating-nozzle assembly and associated powderfeed conduits of such a machine after each coating operation.

Heretofore, a mechanical cleaning device has been employed to remove any excess powder which may have accumulated in the coating-nozzle assembly, in the powder-feed conduits and in the powder-return conduits of such a machine. If such a cleaning device is not utilized, the excess powder has a tendency to form agglomerations in the coating conduits, which agglomerations are frequently picked up on the next coating cycle and deposited as such in the lamp envelope, thus impairing the quality of the coating. The utilization of such a mechanical cleaning device in connection with electrostatic-coating machines has heretofore been subject to certain disadvantages. For example, each of the cleaning devices which heretofore have been positioned at each of the coating stations has been provided with a spring biased "blow-back" arm which carries a flexible air conduit connected to an air compressor and to a discharge port in the arm. When the heads which carry the lamp envelopes are in the coating station and the nozzle assembly is inserted upwardly within the heads preparatory to coating an envelope, a pulley on the head contacts the "blow-back" arm to hold it out of alignment with the coating-nozzle assembly. As the pulley indexes with the head out of the coating station and the coating nozzle assembly is retracted within the head, an arm-biasing spring causes the arm and the discharge port to swing supposedly into alignment with the depressed coating-nozzle assembly to permit a blast of air to drive any powder remaining in the coating nozzle and associated feed and return conduits, back into the expansion chamber and into the powder collector, respectively.

In order to operate such a cleaning device satisfactorily exact alignment of the port in the "blow-back" arm with respect to the coating-nozzle assembly must be achieved. Due to collection of the powder and the absence of lubrication in the moving parts, the arm often sticks and the desired alignment is not always obtained. Also, the abrasive effect of the powder and the head on the moving arm causes wear therein and thus requires frequent replacement thereof. In addition this contiguous mechanical cleaning device has heretofore interfered with adjustment of the height of the coating nozzle. Further, since the coating-nozzle assembly must be lowered below the plane of the arm before cleaning, cleaned and raised again after cleaning within the period of index (i.e. $\frac{3}{4}$ of a second), the time available for the cleaning of the coating-nozzle assembly and associated

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powder conduits is limited to a rather brief portion thereof. Also, because of the time element the vertical path of movement of the coating-nozzle assembly is limited.

It is the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to the prior-art machines by the provision of an improved device for cleaning the coating-nozzle assembly and associated powder-feed conduits of a coating machine, which device has no mechanical moving parts in contact with the powder, does not interfere with the nozzle-height adjustment, eliminates the requirement of accurate alignment of the cleaning device with the nozzle assembly and increases the time available for the cleaning operation.

Another object of the present invention is the provision of a device which provides better cleaning of the coating-nozzle assembly and powder-feed conduits and reduces the cost of maintenance thereof.

The aforesaid objects of the invention, and other objects which will become apparent as the description proceeds are achieved by providing a device for cleaning the coating-nozzle assembly and associated powder-feed conduits of an electrostatic-coating machine which device comprises a pneumatic valve located in the powder-feed conduits and adapted by fluid pressure and an associated control means to remain closed during the coating operation and open during the cleaning operation and having means associated with the pneumatic valve for creating a vacuum suction therein.

For a better understanding of the invention reference should be had to the accompanying drawings wherein like numerals of reference indicate similar parts throughout the several views and wherein:

Fig. 1 is a side-elevation view, partially in vertical section, of an envelope-supporting head, coating-nozzle injector assembly and associated silica-smoke generator disposed at a coating station of an electrostatic silica-coating machine and showing the associated cleaning device of the present invention in the closed or inoperative position.

Fig. 2 is an enlarged fragmentary vertical-sectional view of the coating-nozzle assembly, coating tube and coating sleeve of the coating-nozzle injector assembly.

Fig. 3 is a vertical-sectional view of the pneumatic valve associated with the cleaning device of the present invention and showing the valve in the open position.

Although the principles of the invention are broadly applicable to automatic apparatus for the deposition of any finely-divided powder on articles, the invention is particularly adapted for use in conjunction with the deposition of silica powder on incandescent-lamp envelopes and hence it has been so illustrated and will be so described.

With specific reference to the form of the invention illustrated in the drawings and, referring particularly to Fig. 1, an envelope-supporting head of a machine for electrostatically coating incandescent-lamp envelopes 11 and of the type shown in the above-mentioned application, Serial No. 603,636, is indicated by the reference numeral 10. Since the head 10 and associated burner 12, nozzle-injector assembly 14 and silica-smoke generator 15 of the machine are conventional and per se, form no part of the present invention, it is deemed sufficient to only briefly describe their structure and operation.

The head 10 comprises a hollow body portion 16 rotatably mounted in a chain conveyor 17 and provided with a chuck 18 contoured to receive and support the neck portion of an incandescent-lamp envelope 11. To provide support means for the conveyor 17, as it is indexed with the heads 16 from work station to work station by a conventional mechanism (not shown), roll-

ers 22 carried thereby ride on a stationary table 24 of the machine. In order to rotate the head 10 and hence the lamp envelope 11 during the silica-coating operation, a pulley 26 is affixed to the bottom of the body portion 16 and is driven by means of a belt 27.

To provide support means for a powder-return sleeve 28 and a concentric inner powder-feed tube 30, a bridge 32 affixed to such sleeve 28 and its integral tube 30 is reciprocally mounted on guides 42 (only one of which is shown in Fig. 1) affixed to the frame portions 44 of the machine by a conventional connecting linkage (not shown) and a cam (not shown) on a main cam shaft 46 of the machine, thereby reciprocating a nozzle assembly carried by the tube 30 between the dotted line position and the solid line position shown in Fig. 1. This nozzle assembly, as shown more in detail in Fig. 2, comprises a nozzle 34, provided with a plurality of coating outlets 36 and a probe 38, which projects axially from the nozzle 34, and is threadably connected thereto.

The silica-smoke generator 15 comprises a reservoir 50 to which a quantity of silica powder 52 is fed through an inlet line 51 and in which the powder is continually agitated toward an outlet 54 in the bottom thereof by a paddle 56 driven continuously by a motor 58. To provide means of extracting the silica powder 52 through the outlet 54 dry high-pressure air is fed from an air supply (not shown) through a valve 60, controlled by a solenoid 62 in a "coating" circuit and through a constricted orifice in a venturi 64 thereby producing a partial vacuum in the latter which picks up silica from the outlet 54 by suction to form silica smoke. This silica smoke is forced through a tube 66 into the reservoir 50 and against a target 68 positioned therein where agglomerates are broken up. The finely-divided particles of silica smoke are then forced by the air-pressure through a powder-feed conduit 70 extending through a T connection 71 to the above-mentioned powder-feed tube 30 and thence through the tube 30 and the nozzle 34, when the latter is in the solid-line position shown in Fig. 1, and into the lamp envelope 11. As shown in Fig. 1 the T connection 71 is connected by a conduit 72 to a pneumatic valve 73 of the cleaning device of the present invention, which valve 73 is closed by fluid pressure during the coating operation and opened by closure of a "cleaning" circuit to cause operation of control means associated with the valve 73 during the cleaning operation, as hereinafter explained in detail.

This "coating" circuit includes a conductor 74 extending from one side of a voltage supply, indicated generally by the legend "A.C. supply," to one side of the coil of the solenoid 62, with such circuit then extending from the other side of said coil through a conductor 75 to a contact 76 of a microswitch 77, the operating arm 78 of which is controlled by a cam 80 on the main cam shaft 46 of the machine. This circuit is completed by a conductor 82 extending from the operating arm 78 to the other side of the "A.C. supply." When the cam 80 moves the operating arm 78 into engagement with the contact 76, thereby closing the "coating" circuit and energizing the coil of the solenoid 62, the latter opens the valve 60 to admit dry high-pressure air to the venturi 64 and begin the above-described coating operation.

After the coating of the envelope 11 has been completed, the cam 80 will then have rotated sufficiently to open the "coating" circuit and then moving the operating arm 78 of the switch 77 into engagement with another switch contact 84 in the "cleaning" circuit, thus interrupting the "coating" circuit and causing deenergization of the solenoid 62, with attendant closure of the valve 60 and resultant cessation of the feeding of the silica powder to the nozzle assembly and the lamp envelope 11.

This "cleaning" circuit comprises a conductor 86 which extends from a junction point with the line voltage conductor 74 to one side of a coil 88 of a solenoid, the armature 90 of which is pivotably connected to a stem 75

92 of a two-way valve 94 and which armature 90 is normally biased to the left, as viewed in Fig. 1, by a spring 98. This "cleaning" circuit is then completed by a conductor 100 which extends from the other side of the coil 88 to the contact 84, the operating arm 78 and the line-voltage conductor 82. It will also be noted that the coil of a second solenoid 101 is connected to the conductors 86 and 100 and hence in parallel with solenoid 88.

During the coating operation when the "cleaning" circuit is not energized, high-pressure air from an air supply (not shown) is supplied through a conduit 103 and a branch circuit 106 and the two-way valve 94 to an inlet conduit 107 for a housing 108 of the pneumatic valve 73. This housing 108 is connected by a conduit 110 to a venturi 105 to which high-pressure air is supplied through conduit 103 and a valve 104 operated by the solenoid 101. At this time the solenoid-operated valve 104 in conduit 103 is closed so that no high-pressure air enters the venturi 105 from the conduit 103.

Energization of this "cleaning" circuit causes simultaneous energization of the coil 88 and the coil of the solenoid 101. Such energization of the coil 88 moves the armature 90 to the right, as viewed in Fig. 1, thereby turning the valve stem 92 counterclockwise from the solid-line position shown in Fig. 1 to the dotted-line position shown therein, thus closing valve 94 to block the supply of high-pressure air to the pneumatic valve 73 and opening the latter to the atmosphere which accordingly places this valve 73 in the solid-line position shown in Fig. 3. Such energization of the coil of the solenoid 101 opens the valve 104 and thus permits the flow of high-pressure air to the venturi 105.

Pneumatic valve

The operating means of the pneumatic valve 73 (Figs. 1 and 3) comprises a resilient member 112, which extends slightly beyond the outwardly-diverging beveled end-portions 114 of the housing 108, and is held in hermetic engagement therewith by means of sealing members 116, each of which is adjustably secured to a flanged portion 117 of the housing 108 by means of bolts 118. As shown in Fig. 3, these sealing members 116 may be threadably connected to the conduits 110 and 72 respectively.

Thus, during the coating operation when the two-way valve 94 is in the solid-line position shown in Fig. 1, the high-pressure air admitted through the conduits 103 and 106, valve 94, and the inlet conduit 107 to the housing 108, compresses the resilient member 112 thereby stretching the latter and causing it to collapse, from the solid-line position shown in Fig. 3 to the dotted-line position shown in Figs. 1 and 3, with the attendant closure of the pneumatic valve 73 and the resultant prevention of movement of the silica smoke through the line 72 to the pneumatic valve 73. However, when the "coating" circuit is interrupted by operation of the cam 80 and the "cleaning" circuit is closed thereby, this causes the simultaneous energization of the coil 88 and the coil of the solenoid 101 with the resultant cut-off of the high-pressure air to the housing 108 and the opening of valve 104 so that such high-pressure air is now supplied to the venturi 105. The resilient member 112 then retracts from its collapsed dotted-line position shown in Figs. 1 and 3, and returns to its normal solid-line position shown in Fig. 3, thus enabling the rush of the high-pressure air through a constricted orifice in the venturi 105 to create a partial vacuum within the nozzle assembly (Fig. 2), powder-feed tube 30, powder-feed conduit 70, conduit 72, valve 73 and conduit 110, and to remove by suction any excess powder therein and to deposit it in a powder collector (not shown). It will be understood that a powder-return line 120 (Fig. 1) extending from the powder-return sleeve 28 to the powder collector (not shown) and connected to a vacuum source (not shown) cooperates with the above-described cleaning device of the present invention

to cause the continuing removal of excess silica powder from the powder-return sleeve 28 and the powder-return line 120.

The cleaning device of the present invention is operative from the time the "coating" circuit is deenergized by movement of the operating arm 78 away from the contact 76 until it is again energized by return of the operating arm 78 of the switch 77 into engagement with the contact 76, which period of time is substantially greater than the entire period of index of the machine. During the period of time in which the "coating" circuit is deenergized, the nozzle-injector assembly is retracted (i.e. moved downwardly) from the solid-line position shown in Fig. 1 to the dotted-line position shown therein, to permit the indexing of the head 10 and the now coated envelope 11 out of the coating station and into the next work station. While the nozzle injector assembly is in the lowered position an adjacent head 10, supporting an uncoated envelope 11, indexes into the coating station whereupon the nozzle-injector assembly is elevated into this now indexed head and envelope 11 to be coated, and the above-described cycle of operation is repeated by opening of the "cleaning" circuit and closure of the "coating" circuit by engagement of the operating arm 78 with the contact 76 of the switch 77.

It will be recognized by those skilled in the art that the objects of the present invention have been achieved by the provision of a cleaning device for a machine for electrostatically silica-coating incandescent-lamp envelopes, which cleaning device has no mechanical moving parts in contact with the silica powder, and since it is not contiguous to the coating-nozzle assembly does not interfere with the nozzle height adjustment. In addition, the cleaning device need not be accurately aligned with the coating-nozzle assembly for efficient operation during the cleaning operation. Further, by increasing the time available for the cleaning operation the cleaning device provides better cleaning of the coating-nozzle assembly and the associated powder-feed conduits thereby reducing the cost of maintenance of the latter.

While in accordance with the patent statutes one best known embodiment of the invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

We claim:

1. A device for removing any excess powder from the coating-nozzle assembly and associated powder-feed conduits of a machine for electrostatically coating lamp envelopes, comprising a valve connected to said powder-feed conduits and adapted to be closed by fluid pressure during the coating of said lamp envelopes by said machine, said valve being further adapted to be opened by the removal of said fluid pressure when the coating of said lamp envelopes has been interrupted, and means connected by operation of said valve to said coating-nozzle assembly and powder-feed conduits and operable to remove any excess powder from said coating nozzle assembly and powder feed conduits.

2. A device for removing any excess powder from the coating-nozzle assembly and associated powder-feed conduits of a machine for electrostatically coating lamp

envelopes, comprising a valve connected to said powder-feed conduits, control means operatively associated with said valve and operable to close said valve by fluid pressure during the coating of said lamp envelopes by said machine, said control means being further operable to open said valve by removal of said fluid pressure from said valve when the coating of said lamp envelopes is interrupted, and vacuum-suction means connected by operation of said valve to said coating-nozzle assembly and powder-feed conduits and operable to create a partial vacuum in said coating-nozzle assembly, powder-feed conduits and said valve when said valve is open for removing by suction any excess powder therefrom.

3. A device for removing any excess powder from the coating-nozzle assembly and associated powder-feed conduits of a machine for electrostatically coating lamp envelopes, comprising a housing connected to said powder-feed conduits, a hollow resilient member in atmosphere-sealing engagement with said housing, control means operatively associated with said housing and operable to introduce fluid pressure into said housing during the coating of said lamp envelopes by said machine and thereby cause said resilient member to collapse together, said control means being further operable to remove said fluid pressure from said housing when the coating of said lamp envelopes is interrupted and thus cause said resilient member to open, and vacuum-suction means connected to said coating-nozzle assembly and powder-feed conduits by said resilient member when the latter is open and operable then to create a partial vacuum in said coating-nozzle assembly, powder-feed conduits and said resilient member for removing by suction any excess powder therefrom.

4. A device for removing any excess powder from the coating-nozzle assembly and associated powder-feed conduits of a machine for electrostatically coating lamp envelopes, comprising a housing connected to said conduits, a hollow resilient member within said housing, sealing means for securing said resilient member in atmosphere-sealing engagement with said housing, control means operatively associated with said housing and operable to introduce fluid pressure into said housing during the coating of said lamp envelopes by said machine and thereby cause said resilient member to collapse together, said control means being further operable to remove said fluid pressure from said housing when the coating of said lamp envelopes is interrupted and thus cause said resilient member to open, and vacuum-suction means connected to said coating-nozzle assembly and powder-feed conduits by said resilient member when the latter is open and operable then to create a partial vacuum in said coating-nozzle assembly, powder-feed conduits and said resilient member for removing by suction any excess powder therefrom.

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