

Aug. 12, 1958

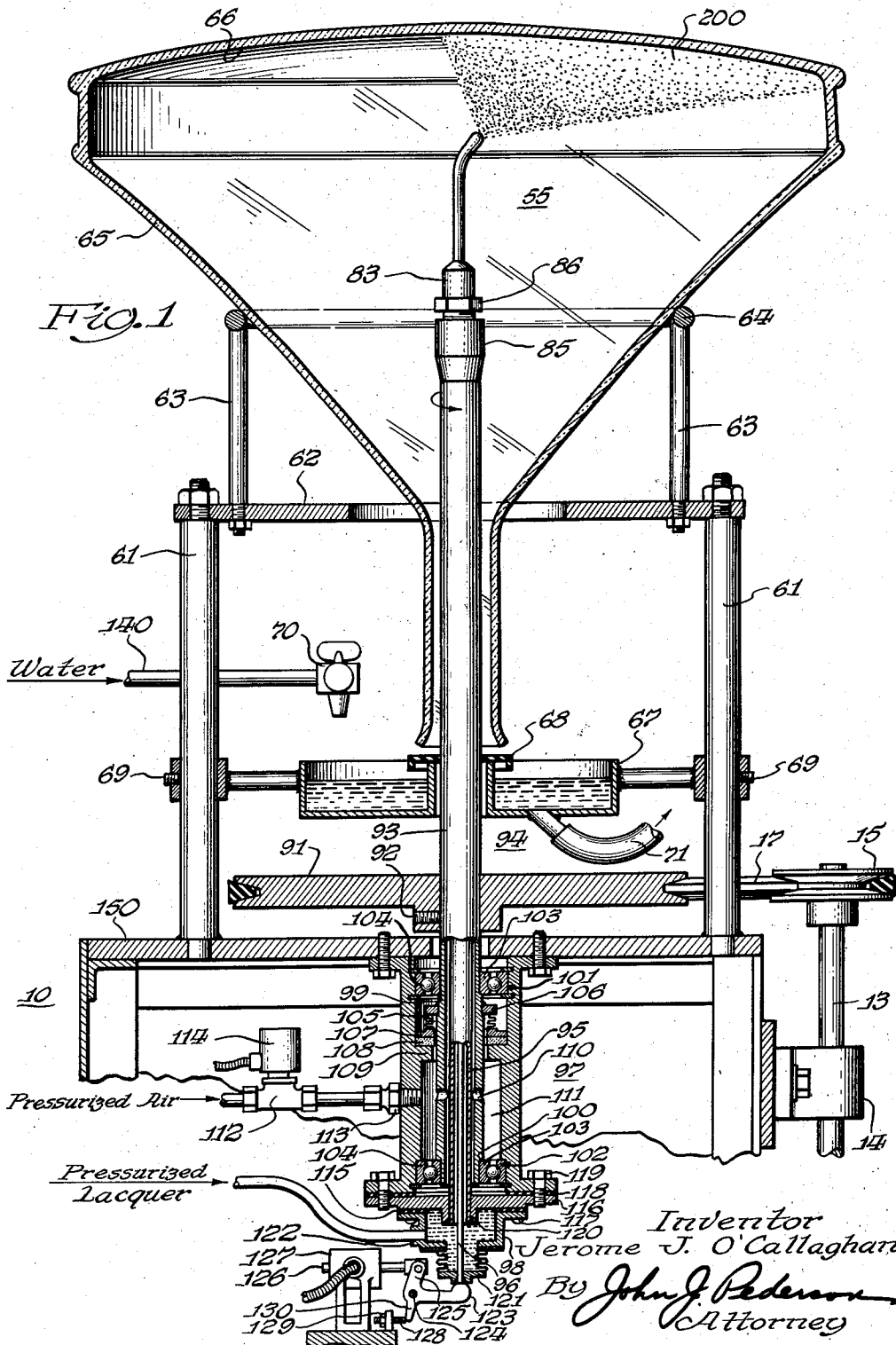
J. J. O'CALLAGHAN

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CATHODE-RAY TUBE MANUFACTURING APPARATUS

Filed July 26, 1957

2 Sheets-Sheet 1



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Fig. 2

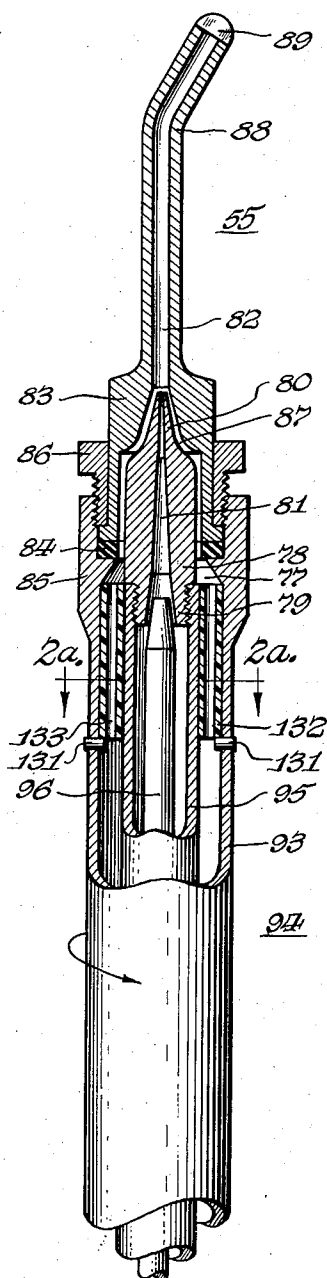


Fig. 2a

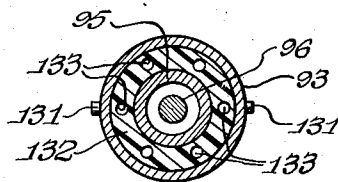
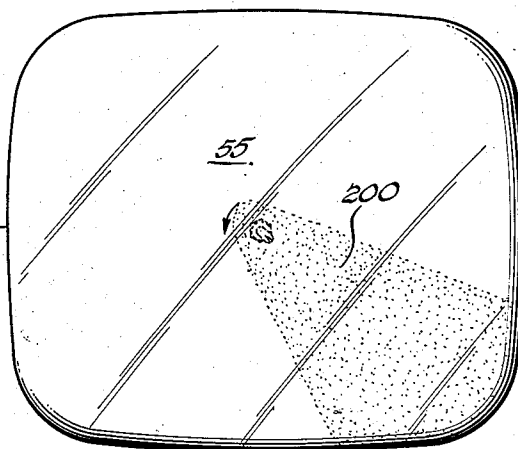


Fig. 3



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CATHODE-RAY TUBE MANUFACTURING APPARATUS

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2 Claims. (Cl. 118—317)

This invention relates in general to cathode-ray tubes and in particular to apparatus for applying an organic film to the exposed luminescent screened faceplate of cathode-ray tubes.

Preparatory to the aluminizing process in the manufacture of aluminized cathode-ray tubes, a lacquer film is applied to the prepared luminescent screen affixed to the inside surface of the envelope faceplate. This lacquer film serves as a foundation upon which aluminum vapor can be deposited and must be so applied as to form a uniform and taut base if the subsequently deposited aluminum is to provide a mirror-like backing for the luminescent screen.

A conventional lacquer filming method is based on a flotation process which utilizes a water column upon which lacquer is deposited. Subsequent decantation of the water permits the lacquer film to adhere to the luminescent screen. An obvious shortcoming of this process is the time consuming element. Another known lacquer filming process involves the use of stationary spraying apparatus in conjunction with a mechanism which rotates the cathode-ray tube envelope while the lacquer is sprayed on to its luminescent surface. In practicing this method, rotating the envelope is necessary in order to distribute the lacquer uniformly over the luminescent screen. This spinning requirement raises difficulties in the adaptation of such a method to automation activities since the individual cathode-ray tube envelopes must be positioned upon the spinning mechanism or otherwise disassociated from the conveyor which transports the envelopes during the manufacturing process prior to the lacquer spraying operation.

The copending application of Nathan D. Levin for "Cathode-Ray Tube Manufacturing Method and Apparatus," filed concurrently herewith and assigned to the present assignee, discloses and claims a spray filming method and apparatus in which the envelope is held stationary and a rotating lacquer spray is employed. The present invention is directed to an improvement of the basic apparatus for performing the method described and claimed in the Levin application.

In accordance with the invention, therefore, it is a primary object to provide a novel apparatus for applying an organic film to the luminescent screened surface of a cathode-ray tube envelope.

It is also an object of this invention to provide novel lacquer filming apparatus which renders unnecessary any manipulation of the cathode-ray tube envelope during the filming operation.

It is a corollary object of this invention to provide lacquer filming apparatus amenable to automation.

Another important factor to be considered in spray filming techniques concerns the lacquer material itself, which because of its inherent volatility and tackiness poses handling and sealing difficulties. It is thus apparent that in addition to managing the envelope, due consideration must be accorded the materials utilized as well as the storage and dispensing thereof.

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Accordingly, it is a further object of this invention to provide spray filming apparatus which obviates the requirement of complex lacquer seals.

In accordance with the invention, apparatus for applying an organic film to the luminescent screened surface of a cathode-ray tube envelope includes means for supporting the envelope in a fixed position with its axis vertically oriented and with the faceplate of the envelope uppermost. A coaxial conveyor comprises film solution conveying means and includes a stationary inner conduit coupled to a liquid supply of lacquer material, and a rotatable outer conduit coaxial with said inner conduit. The outer conduit is coupled to a supply of compressed gas. The coaxial conveyor extends vertically into the cathode-ray tube envelope and includes a nozzle, fixed to the upper extremity of the outer conduit, which communicates with both conduits. Further, means are provided for rotating the outer conduit with respect to the inner conduit to produce a rotating spray of atomized lacquer material within the envelope and directed toward the luminescent screen.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The organization and manner of operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in the several figures of which like reference numerals identify like elements and in which:

Figure 1 is a side elevation view, partly in section, of a film spraying apparatus embodying the invention;

Figure 2 is a sectional view of the nozzle arrangement utilized in the film spraying apparatus;

Figure 2a is a cross-sectional view taken along the line 2a—2a of Figure 2; and

Figure 3 is a top view of the cathode-ray tube envelope depicted in Figure 1.

The film spraying apparatus as shown in Figure 1 includes a table 10 which supports a drive motor (not shown) that is coupled to a shaft 13 which is journaled within a bearing 14 and fixed to a driver pulley 15. Pulley 15 is coupled to a centrally located drive wheel 91 through a drive belt 17. A conventional lock screw 92 secures drive wheel 91 to the outer rotatable conduit 93 of a coaxial conveyor device 94 which is terminated at its upper extremity by a nozzle 55 which comprises an atomizer and is specifically described below in relation to Figure 2. Coaxial conveyor 94 further comprises a stationary inner conduit 95 and a displaceable metering pin 96.

A pair of uprights 61, fastened to surface 150 of table 10, mount an apertured guide plate 62 which in turn carries the demountable uprights 63. Uprights 63 are terminated by a ring 64 which supports and vertically orients a cathode-ray tube envelope 65 having a prepared luminescent screened surface 66. Vertically positionable upon supports 61 is a drain pan 67, which includes a deflector pad 68, centrally disposed about coaxial conveyor 94. Pan 67 is positionably secured by conventional fasteners 69. A water supply inlet 140 (source not shown) is terminated by a control valve 70 and provides a constant wash for pan 67. An outlet tubing 71 is connected to drain pan 67.

Rotatable conduit 93 of coaxial conveyor 94 communicates with an air pressure chamber 97 which is secured to surface 150 of table 10 whereas conduit 95 and pin 96 are terminated by a lacquer well 98 in a manner to be more fully described below. Conduit 93 is provided with an upper bearing support shoulder 99 and a lower shoulder 100 for seating the bearings 101, 102 respectively, which bearings comprise rotatable inner races 103 inti-

mately contacting conduit 93 and stationary outer races 104 secured to chamber 97.

A hermetic rotatable air seal comprises a bellows 105, sealed to conduit 93 by a ring 106, and a rotatable lapped-surface bearing 107 depending therefrom and journalled upon a stationary lapped-surface bearing insert 108 supported by a pedestal 109. In order to insure an adequate air seal, rotatable bearing surface 107 can comprise stainless steel whereas stationary bearing insert 108 is preferably of a dissimilar material, e. g., a graphite material. Vents 110 communicate between enclosure 111 of chamber 97 and the space included between rotatable conduit 93 and stationary conduit 95. A source of pressurized air is coupled through a control valve 112 to an inlet fitting 113 fixed to chamber 97. An electrically operated solenoid 114 is operably associated with valve 112.

Lacquer well 98 is hermetically sealed by the lacquer seal 115 to a mounting plate 116 and secured thereto by the conventional screws 117. The mounting plate 116 and an air seal gasket 118 are hermetically sealed to chamber 97 and fastened by bolts 119. The lower extremity of pipe 95 is vented to well 98 and secured within the apertured shoulder 120 of mounting plate 116. The terminus of metering pin 96 is fixed to a diaphragm 121 depending from well 98. An inlet 122 admits lacquer, which can comprise isobutyl methacrylate, under pressure to well 98. An arm 123 pivotally mounted upon a pin 124 is in permanent contact with diaphragm 121 and has a crank element 125 driveably engaged to the displaceable plunger 126 of an electrically operated solenoid 127. A restoring spring (not shown), disposed within solenoid 127, engages plunger 126 to bias arm 123 in a counter-clockwise direction when solenoid 127 is deenergized. A threaded bar 128 provided with a lock nut 129 cooperates with a tab extension 130 of arm 123 to comprise a limit arrangement for metering pin 96.

Figure 2 comprises a sectional view of the upper extremity of conveyor device 94 (including nozzle 55) which illustrates the structural cooperation between device 94 and nozzle 55. Protruding from the inner periphery of rotatable conduit 93 are shelves 131 which support a rotatable bearing 132 of nylon, or other suitable material, provided with longitudinal apertures 133 for communicating between an annular chamber 77 and conduit 93. Bearing 132 further affords a measure of rigidity to coaxial conveyor 94.

An insert 78 has a threaded portion 79 at its lower extremity for attachment to a correspondingly threaded inner surface of stationary conduit 95. Insert 78 maintains a conical portion 80 at its upper extremity and includes a tapered channel 81 for communicating at its upper end with the central bore 82 in nozzle 55 and at its opposite end with conduit 95. The base 83 of nozzle 55 is seated upon a gasket 84 and is demountably secured within the crown 85 which terminates outer rotatable conduit 93 by a collar 86. The conical portion 80 of insert 78 in conjunction with the inner surface of nozzle base 83 defines a passage 87 between annular chamber 77 and bore 82. Preferably, nozzle 55 is provided with an offset portion 88 incorporating an asymmetrical discharge orifice which terminates bore 82 of nozzle 55, as described and claimed in the copending application of Francis J. Kinsch for "Cathode-Ray Tube Filming Apparatus" filed concurrently herewith and assigned to the present assignee.

In operation the subject invention contemplates the application of a lacquer film to the luminescent screened surface 66 of a cathode-ray tube envelope 65, by directing a rotating spray of an air-lacquer mixture thereupon. With reference to the above described apparatus, it is apparent that upon energization of a driving motor, rotational energy is translated through shaft 13 and driver pulley 15 to propel drive wheel 91 via belt 17. The driven arrangement comprises merely the outer conduit

93 of coaxial conveyor 94 which is secured to drive wheel 91. In order to obviate the requirement of periodically replenishing a lacquer supply the described apparatus provides for an external pressurized lacquer source coupled to well 98 which is coupled to the stationary inner conduit 95 in order to obviate the requirement of a rotating lacquer seal. An initiating procedure amenable to automation techniques may be utilized which employs a conventional timing mechanism (not shown) to first energize the driving motor to bring rotatable conduit 93 to a predetermined operating speed. Thereafter electrical energization of solenoid 114 opens valve 112 to admit pressurized air to chamber 97. The pressurized air is introduced to rotating conduit 93 through vents 110 and conveyed to nozzle 55. Actuation of a second solenoid 127 initiates the flow of pressurized lacquer from well 98 to nozzle 55. Specifically, energizing solenoid 127 displaces plunger 126 which drives crank element 125 so as to pivot arm 123 in a clockwise direction about pin 124. This pivotal rotation of arm 123 permits metering pin 96 to withdraw from tapered channel 81. The travel of arm 123 ceases when extension 130 contacts bar 128 which, in comprising an adjustable limit arrangement, determines the flow rate of lacquer through conduit 95 to channel 81.

With reference to Figure 2 (and Figure 2a), it is noted that upon admission to conduit 93, pressurized air passes through apertures 133, annular chamber 77 and passage 87 to confront pressurized lacquer at the entrance to bore 82 in nozzle 55. The juncture of passage 87 and channel 81 comprise, in effect, a volatilization chamber or atomizer which produces a turbulent mixture of air and lacquer for introduction to bore 82. Offset 88 directs the aforesaid mixture obliquely with respect to the axis of tube 65. An asymmetrical orifice terminates bore 82 and transforms the air-lacquer mixture into the diverging mist 200, shown in elevation in Figure 1 and in plan in Figure 3. The configuration and density of mist 200 insures a uniform deposit of lacquer film on surface 66 by directing a comparatively heavy stream of air-lacquer mist outwardly towards the periphery of tube 65 while providing a progressively decreasing mist density as the axis of tube 65 is approached. Offset 88 further provides that the upward discharge of mist 200 perceptibly overlaps the geometric center of the tube in order to obviate a blank or non-uniform film layer on that area. The deflector pad 68 protects coaxial conveyor 94 and its associated apparatus by diverting excess lacquer to the adjustable drain pan 67 which is provided with a water circulatory system and continually drains to carry off such excess.

Upon completion of the spraying operation, deenergization of solenoid 114 operates valve 112 to seal off the pressurized air-source while deenergization of solenoid 127 permits the above mentioned restoring spring to retract plunger 126 and rotate arm 123 in a counter-clockwise direction to seat metering pin 96 within tapered channel 81 thus terminating the flow of lacquer to nozzle 55. It would be but a matter of simple expediency to utilize a conventional timing mechanism to initiate, time, and terminate the above-mentioned spray filming operations in a predetermined sequence, in conjunction with drive motor operation, to apply lacquer film layers having a high degree of uniformity to cathode-ray tube envelopes.

In summary, the subject invention, as embodied in the spray filming apparatus depicted in Figure 1, avoids the limitations of the prior art by incorporating coaxial air and lacquer conduits which are adaptable to rotatable film spraying operations without the requirement of a rotating lacquer seal, thereby obviating the necessity of coping with the inherently disagreeable qualities of lacquer material generally encountered under such conditions. The disclosed embodiment provides for a permanent lacquer source and utilizes but a single rotating

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element, i. e., outer conduit 93. Furthermore in view of the fact that nozzle 55 (as well as uprights 63) admits of facile interchangeability, the application of this novel apparatus to a variety of spray filming operations is enhanced. In obviating the requirement of spinning the cathode-ray tube envelope, simplified adaptation to automation facilities is realizable since the described apparatus of Figure 1 can be readily positioned upon vertically displaceable platforms to permit insertion of nozzle 55 within a cathode-ray tube envelope. The requirement for repositioning the envelope upon the spraying apparatus, which is inherent in apparatus taught in the prior art, is avoided; in the application of the subject invention to automation activities, the cathode-ray tube envelope need never be disassociated from its conveyor.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. Apparatus for applying an organic film to the exposed surface of a luminescent screen affixed to the faceplate of a cathode-ray tube envelope comprising: means for supporting said envelope in a fixed position with its axis substantially vertically oriented and said faceplate uppermost; solution conveying means comprising a stationary inner conduit and a rotatable outer conduit

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coaxial with said inner conduit, said coaxial conduits extending vertically into said envelope from below; a liquid supply of lacquer material coupled to said inner conduit; a supply of compressed gas coupled to said outer conduit; a nozzle fixed to the upper extremity of said outer conduit and communicating with both said conduits; and means, including means for rotating said outer conduit with respect to said inner conduit, for producing a rotating spray of atomized lacquer material within said envelope and directed toward said luminescent screen.

2. Apparatus for applying an organic film to the exposed surface of a luminescent screen affixed to the faceplate of a cathode-ray tube envelope comprising: means for supporting said envelope in a fixed position with its axis substantially vertically oriented and said faceplate uppermost; solution conveying means comprising a stationary inner conduit and a rotatable outer conduit coaxial with said inner conduit, said coaxial conduits extending vertically into said envelope from below; a liquid supply of lacquer material under pressure coupled to said inner conduit; a supply of compressed gas; means including a rotary air seal for supplying said gas to said outer conduit; a nozzle including a volatilization chamber fixed to the upper extremity of said outer conduit and communicating with both said conduits; and means, including means for rotating said outer conduit with respect to said inner conduit, for producing a rotating spray of atomized lacquer within said envelope directed toward said luminescent screen.

No references cited.