

Aug. 20, 1974

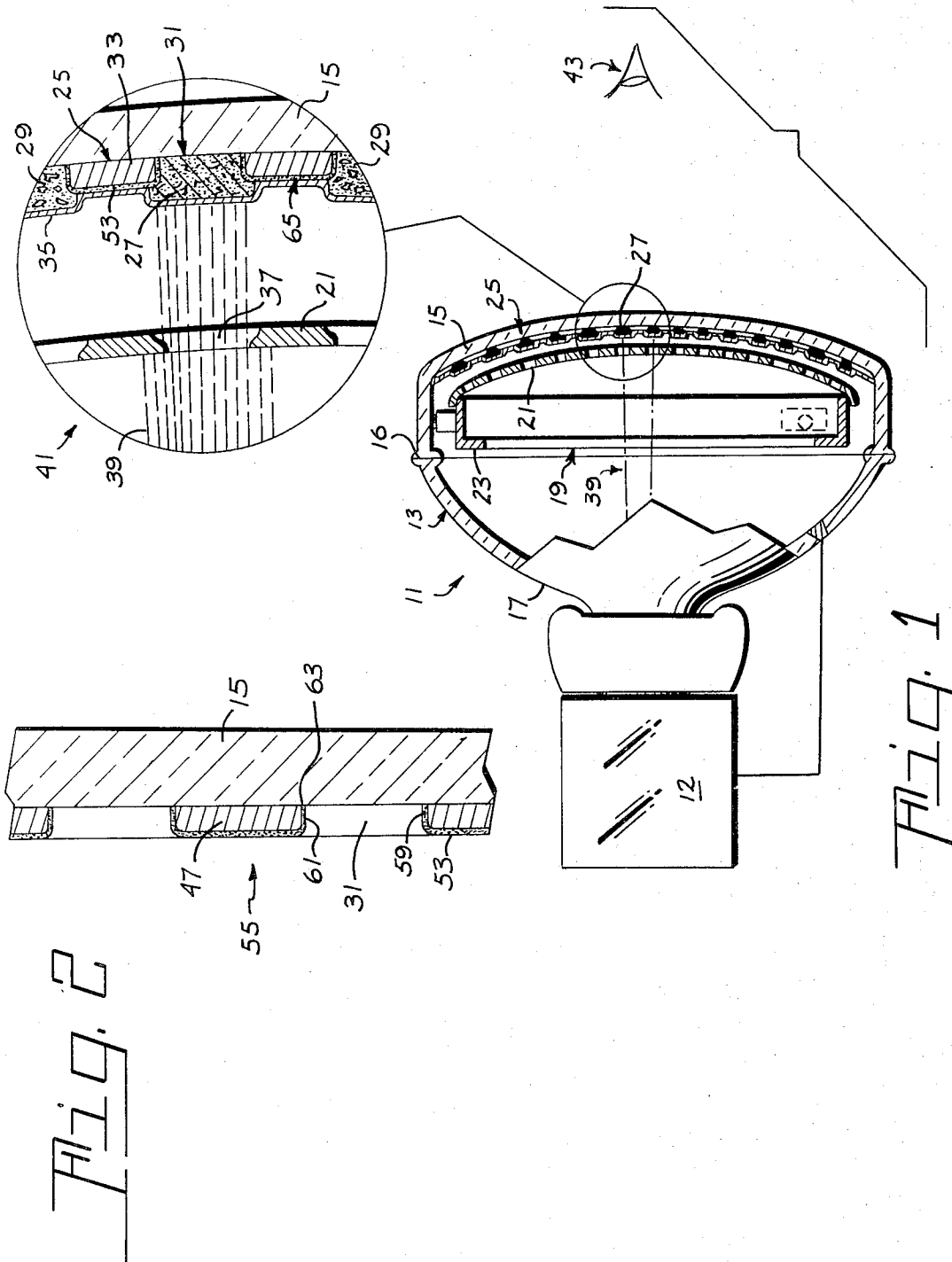
C. H. REHKOPF ET AL

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APPARATUS FOR FABRICATING A CATHODE RAY TUBE SCREEN STRUCTURE

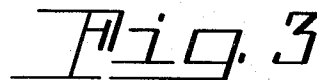
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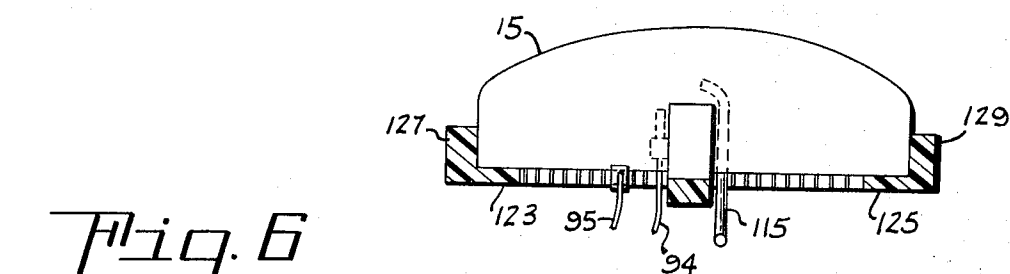
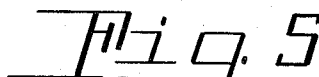
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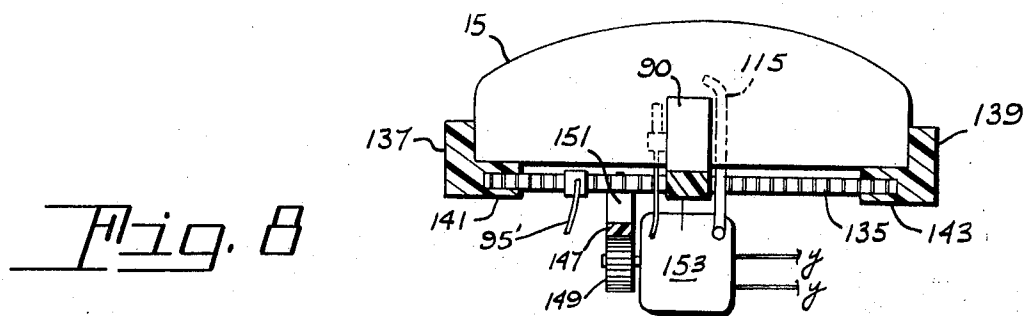
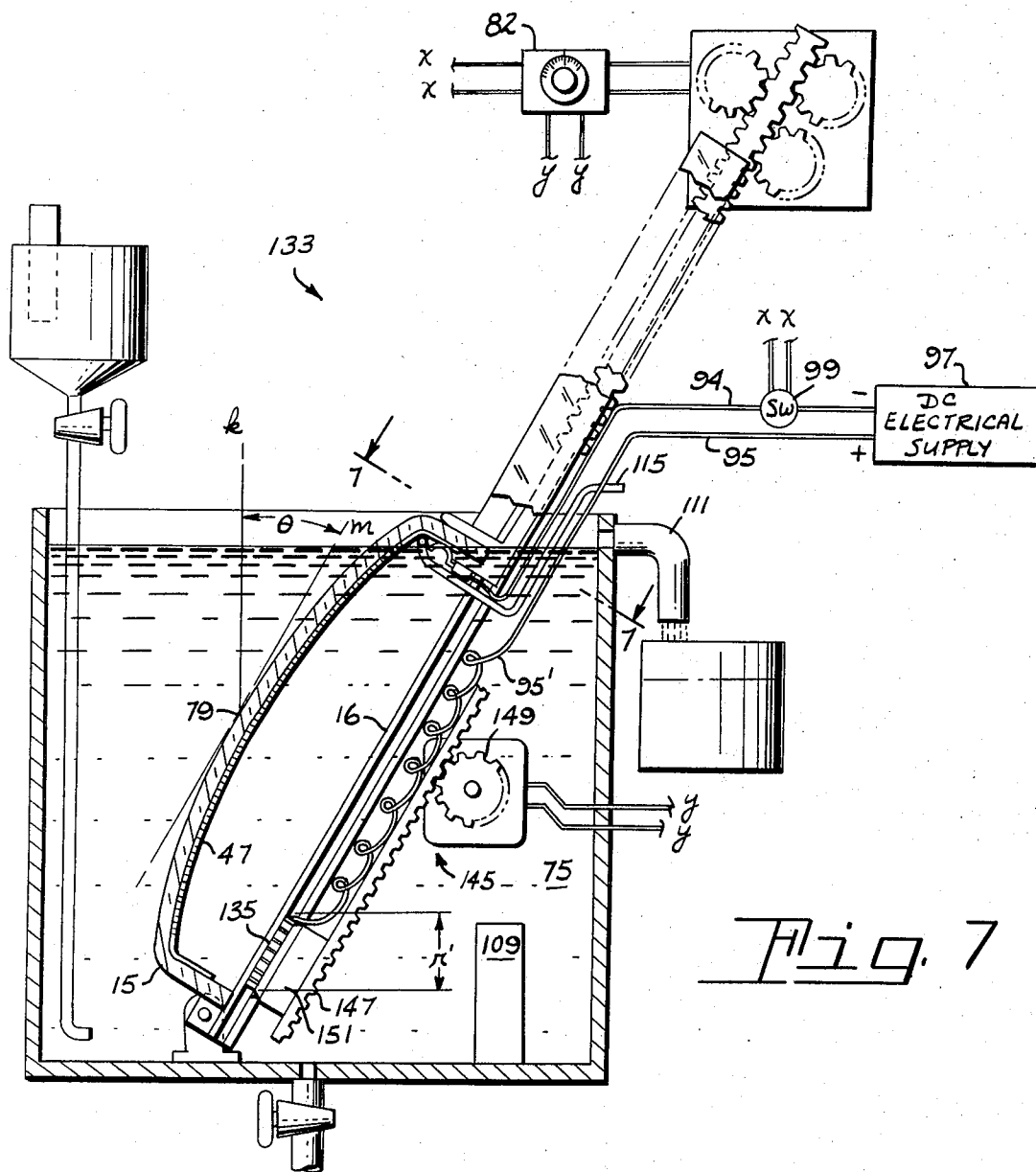
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APPARATUS FOR FABRICATING A CATHODE RAY TUBE SCREEN STRUCTURE

Charles H. Rehkopf and Kenneth Speigel, Seneca Falls, N.Y., assignors to GTE Sylvania Incorporated

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U.S. Cl. 204-299

11 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus is provided for superposing an electrophoretic coating on a previously applied electrically conductive apertured webbing disposed on the interior surface of a color cathode ray tube viewing panel. Inclined panel supportive means is located in an open top container holding an electrophoretic coating suspension. The panel is placed thereon in a manner whereof the panel opening and the panel interior surface are oriented in a slanted downward direction to provide for a substantially upward electrophoretic deposition of the coating onto the conductive webbing on the panel. A perforated electrode member is formed for positioning relative to the opening of the panel. Panel movement means effects immersion and withdrawal of the panel from the coating suspension, and a direct current voltage source connected to the electrode member and the panel webbing supplies the electrical potential for coating deposition.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application contains matter disclosed but not claimed in two related U.S. patent applications filed concurrently herewith and assigned to the assignee of the present invention. These related applications are: Ser. No. 357,942, filed May 7, 1973, Attorney's Docket D-7220; and Ser. No. 357,931, filed May 7, 1973, Attorney's Docket D-7221.

BACKGROUND OF THE INVENTION

This invention relates to color cathode ray tubes and more particularly to apparatus means for modifying the apertured coating portion of the multiplex screen structure disposed over the viewing panel thereof.

Cathode ray tubes, utilized to present multi-color display imagery for color television and the like, usually have patterned multi-element screen structures comprised of repetitive groupings of related phosphor materials of which dot-like areas of round, ovate or elongated shapings are common depositions.

A conventional tube construction employs an apertured pattern member, having round, ovate or elongated openings therein, positioned in spaced relationship with the patterned screen, which in a post deflection type of tube, functions as an electrode in the finished tube, and is commonly utilized in the prior deposition of the patterned elements of the screen on the inner surface of the glass viewing panel. In the common shadow mask tube construction, the multi-element screen pattern is likewise formed by using a spatially positioned apertured pattern member. In both types of tubes, each of the openings in the pattern member is related to a specific grouping of phosphor elements in a spaced manner to enable selected electron beams traversing the apertures to impinge the proper pattern elements therebeneath. Normally the individual phosphor elements of the screen pattern are separated from one another by relatively small interstitial spacings which enhance color purity by reducing the possibility of adjacent color-emitting phosphor elements being excited by a specific electron beam.

It has been found that contrast in color screen imagery can be improved by filling the interstitial spacing between the phosphor elements with an opaque light-absorbing material. Primarily, the inclusion of this fill-in material enhances contrast by preventing ambient light from being reflected by the aluminum backing on the screen in the interstitial areas not covered by phosphor elements. Thus, by incorporating such material, each phosphor element is defined by a substantially non-translucent encompassment which collectively comprise a multi-opening pattern in the form of a windowed webbing having a lace-like array of opaque interconnecting interstices. Such web-like screen structures have been fabricated, either before or after phosphor screening, by several known processes wherein photo-deposition techniques constitute a fundamental part. An example of one type of web-forming procedure is disclosed in Ser. No. 41,535 by R. L. Bergamo et al., filed May 28, 1970, now abandoned, and assigned to the assignee of this invention.

It has been found that further improvement can be realized from a mask-screen relationship wherein the respective phosphor covered windows of the opaque webbing in the finished multiplex screen are slightly smaller than the apertures in the related pattern member. This aperture-to-window relationship is referenced in the art as a "window-limited" screen. In this type of screen construction, when a phosphor dot is impinged by an electron beam, that is "sized" by an aperture in the pattern member, the excited phosphor area completely fills the associated window area with a luminescent hue.

Several techniques have been employed to achieve a patterned multiplex window-limited color screen structure. By one procedure, the dimensional differential between the final-sized apertures and the windows in the opaque interstitial webbing is achieved by chemically etching the apertures in the mask member after the multiplex screen structure has been completed. As a result of the aperture etching procedure, metallurgical inconsistencies of the mask material have been evidenced such as ragged aperture peripheries, a weakening of the mask material per se, and destruction of the desirable dark oxide coating on the surface of the mask. Furthermore, with reference to the economics of tube production, etching of the mask apertures is an inherently costly procedure as it precludes any subsequent reuse of masks which ordinarily could be salvageable from the final stages of the tube manufacturing operation.

In another screen forming procedure, wherein the sizes of the apertures in the pattern member are not altered, a pattern of clear polymerized polyvinyl alcohol dots is light disposed on the inner surface of the panel, on those areas subsequently to be windows in the opaque webbing, by photo exposure through the related apertured pattern member. After development, the resultant island-like polymerized dots are reduced in size by an erosion-technique involving careful treatment of the dot pattern with a chemical degrading agent. This procedure requires close timing and control, after which the panel is rinsed. Next, an opaque material such as, for example, a graphite coating is applied to completely cover the pattern of the reduced-in-size clear dots and the adjacent bare interstitial glass areas. Then, an oxidizing agent is applied to completely degrade the pattern of coated dots thereby loosening the superjacent opaque coating thereon, whereupon the materials so loosened are removed by a subsequent water development step. Thus, there is formed an opaque interstitial web having multitudinous windows defined as bare glass areas that are of a dimensional size smaller than the related apertures in the pattern member. The phosphor pattern elements are then disposed on these window areas by photo exposure through the initially dimensioned apertures in the pattern member by one of

the several processes known in the art. While the afore-described dot-erosion procedure is an acceptable production technique, it necessitates the inclusion of additional processing steps, requires close control and effects a common etching result over the whole dot pattern. There is no provision for selectively treating discrete portions of the pattern to provide a graded sizing of the final window areas.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to reduce the aforementioned disadvantages by providing an apparatus for fabricating an apertured webbing in the screen structure having window areas that are slightly smaller than the apertures in the related pattern member without affecting the initially formed openings in the pattern member. Another object is the provision of an apparatus for applying a coating to a previously applied first patterned coating disposed on a CRT viewing panel to provide additional advantages to the first coating.

These and other objects and advantages are achieved in one aspect of the invention by the provision of an apparatus for superposing an electrophoretic coating on a priorly applied electrically conductive patterned webbing that is disposed on the interior surface of a CRT viewing panel. This apparatus includes an inclined panel support means that is located within a container, holding an electrophoretic coating suspension, and extended through the open top thereof. The viewing panel placed thereon has its opening and inner surface oriented in a slanted downward direction to facilitate a substantially upward electrophoretic deposition of coating onto the patterned conductive webbing on the panel. A perforated electrode member is discretely formed for positioning relative to the opening of the panel in spatial relationship to the inner surface of the panel and the conductive webbing thereon. Panel movement means effects immersion and predetermined withdrawal of the panel from the coating suspension. A direct current voltage source, connected to the electrode member and the panel webbing, supplies the required electrical potential to effect the desired superposed coating deposition.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a color CRT in an operable environment and partially in section showing the relationship of the apertured pattern member to the associated multiplex screen structure disposed on the glass viewing panel of the tube;

FIG. 2 is an enlarged section of a portion of the screen structure showing the modification of the first panel disposed webbing by the superposed coating applied by the apparatus of the invention;

FIG. 3 is a partially sectioned view illustrating one embodiment of the coating apparatus wherein the electrode member is positioned within the viewing panel;

FIG. 4 is a view taken along the line 4—4 of FIG. 3;

FIG. 5 is a partial view illustrating a second embodiment of the coating apparatus wherein the electrode member is stationarily positioned within the coating suspension;

FIG. 6 is a view taken along the line 6—6 of FIG. 5;

FIG. 7 is a partial view illustrating still another embodiment of the coating apparatus wherein both the electrode member and the panel are separately movable within the coating suspension; and

FIG. 8 is a view taken along the line 8—8 of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the better understanding of the present invention, together with other further objects, advantages and capabilities thereof, reference is made to the following specification and appended claims in connection with the afore-described drawings.

While the ensuing description is primarily directed to an exemplary window-limited shadow mask-screen assembly, the concept for reducing the sizes of the windows in the screen structure is likewise applicable for tubes employing a focus mask-screen structure.

With reference to the drawings, FIG. 1 illustrates a shadow mask type of color cathode ray tube 11 in an operating environment designated diagrammatically as 12. The encompassing envelope 13 includes a glass viewing panel 15 which is bonded along the sealing edge 16 thereof to the funnel portion 17 of the envelope. Within the panel there is positioned a pattern member or mask 19 which comprises a domed metallic multi-apertured portion 21, having round, ovate or elongated openings therein, which is joined to a strengthening perimetrical frame 23. Disposed on the inner surface of the viewing panel 15 is a patterned multiplex screen structure 25 comprised of repetitive groupings of two or more elemental cathodoluminescent areas of different phosphor materials 27 and 29 overlaid on the discretely formed window areas 31 of the layered non-light-transmissive interstitial webbing portion 33 of the screen structure 25 as will be described later herein. A reflective aluminum film 35 covers the back of the screen structure and extends onto the peripheral sidewall region of the panel. Spaced rearward from the screen structure 25 is the metallic apertured pattern member 21 wherein a representative aperture 37 is dimensioned larger than the related window area 31. An exemplary electron beam 39, emanating within the tube, from a source not shown, is directed toward the mask-screen assembly 41. Upon striking the apertured pattern member 21, a portion of the beam that is "sized" by the aperture 37, traverses therethrough, impinges a related phosphor area 27 therebeneath and substantially excites the whole of the respective phosphor area to a state of luminescence. Since each of the excited phosphor areas in this "window-limited" screen structure is as large as or preferably larger than its associated window area 31, the total area of each window comprising the visible screen pattern is fully luminous. The resultant display in an operating tube is clearly discernible by the viewer 43.

In referring to the multiplex screen structure 25 in greater detail, the apparatus of the present invention relates to fabrication of the apertured opaque webbing 33 of the structure, which is a duo-layered formation.

The basic or first apertured webbing 47 as illustrated in FIGS. 1 and 2 is disposed by a plural-step process on the inner surface of the glass viewing panel 15. For example, a thin uniform layer of a substantially clear polyvinyl alcohol (PVA) solution photosensitized with a chromate material, such as potassium or ammonium bi or dichromate, is applied to the inner-surface of the panel by known techniques in the art. The apertured pattern member 19 is then positioned within the panel and the PVA coating exposed by beaming substantially actinic radiation, from predeterminedly located sources, through the multiple openings in the mask to photo-polymerize discrete portions of the panel coating in the areas subsequently occupied by the screen pattern phosphor elements. Upon removal of the apertured member from the panel, the exposed coating is developed by rinsing with water to remove the unexposed PVA, thereby providing a web pattern of substantially bare glass defining the interstitial spacings between the substantially clear polymerized pattern elements. These polymerized dot-like elements subsequently become window areas in the opaque interstitial webbing of the subsequently formed color screen structure, such as taught in the previously mentioned web-forming procedure disclosed in U.S. Patent Application Ser. No. 41,535 by R. L. Bergamo et al.

The patterned panel is then overcoated with a uniform layer of a substantially opaque electrically conductive material, for example a carbon containing substance, such as a colloidal suspension of graphite, which, upon drying, is treated with a degrading agent such as hydrogen

peroxide. This treatment effects an effervescence and degradation of the coated screen pattern element areas of light-polymerized material and loosens the associated graphite thereon. The degradation materials and loosened graphite coating are thence removed by pressurized water thereby providing the first apertured webbing 47 which is both opaque and electrically conductive.

It is a purpose of the apparatus of the invention to expeditiously achieve a "window-limited" screen structure, wherein the windows in the multiplex screen are substantially equal to or smaller than the apertures in the pattern member, without altering the pattern member or the initially formed apertures therein in any manner. As shown in FIG. 2, to reduce the size of the window areas of the first webbing 47, a second apertured webbing 53 of a non-light-transmissive material is superposed on the first webbing by the electrophoretic apparatus of the invention to provide a duo-webbing structure 55. In the electrophoretic deposition of the second webbing, the second coating material, in addition to overlaying the first webbing material, is adherent to the defining peripheries 59 of the first webbing apertures. This peripheral adherence provides a fill-in or narrow mat-like-encompassment 61 within the delineating perimeter of each of the apertures of the first webbing to define a multiplicity of clear reduced-in-size windows 31 in the duo-webbing structure 55 that may be in the order of 1.0 to 4.0 mils smaller than the initial apertures in the first webbing.

The inner defining edge 63 of each window encompassment is substantially contiguous with the glass surface of the viewing panel.

The second webbing material is completely compatible with the internal components of the tube, and may be of a number of substances that are electrophoretically applicable. In keeping with the breadth of the objects of this invention, the coating apparatus taught herein is to be considered appropriate for disposing any compatible electrophoretically applicable material to a priorly applied patterned coating on the interior surface of a CRT viewing panel; wherein such superposed deposition provides additional advantages to the first coating or the ensuing multiplex screen structure of the tube. Therefore, the examples herein presented are not to be considered limiting. For purposes of illustration, a suitable substantially opaque substance may be one that is dark in color such as gray ferrous oxide, manganese oxide, and carbon black which is inclusive of graphite, lampblack and other particulate carbon materials. Such second webbing materials provide a visibly dark opaque continuation extending peripherally within the apertures of the first webbing.

The second webbing may also be of a compatible substantially white opaque material such as for example zinc oxide and aluminum oxide of a thickness to effectively provide a narrow peripheral light-colored fill-in to achieve the "window-limited" feature of the screen structure. When a light color fill-in material is employed, there is the added advantage of reflectivity within each phosphor element which tends to enhance the visible luminescent emission output of the subsequently disposed electron excitable phosphor elements of the patterned screen.

After forming of the duo-layered webbing, wherein the dimensions of the final apertures are reduced in size, a patterned color screen is discretely disposed thereover by one of several known processes. Usually, the screen is in the form of a spaced-apart multitude of at least two repetitive phosphor elements, 27 and 29, that are carefully overlaid on the second apertured webbing 53 in a manner that each window 31 in the webbing structure has a phosphor element disposed therein and thereover. The multiplex screen structure 25 is completed by applying a thin metallic reflecting film over the array of the respective spaced-apart phosphor element 27 and 29 and the interstitial areas 65 of the second webbing exposed therebetween.

The application of the second apertured webbing over the first apertured webbing priorly formed on a cathode

ray tube viewing panel, is expeditiously accomplished by the electrophoretic coating apparatus of the invention. To describe the apparatus, reference is directed to FIGS. 3 and 4 wherein one embodiment of the electrophoretic coating apparatus 69 is illustrated. A glass cathode ray tube panel 15, having a first apertured substantially opaque electrically conductive webbing 47 disposed on the inner surface of the viewing area thereof, has a foraminous or perforated electrode member 71 positioned therein in spatial relationship to the first apertured webbing. In this instance, the electrode is a formed foraminous member having an insulative frame 73 which is predeterminedly supported within the panel by means not shown. By way of example, the electrode member can be formed to effect a predetermined differential spacing between areas of the electrode and the webbing to provide the provision for selectively treating discrete portions of the webbing to promote a graded sizing of the final window areas. The electrode member is formed to have a curvature approximating that of the interior surface of the panel and has a functioning area at least equalling the area of the first apertured webbing 47 to be coated. The multitudinous openings 74 in the electrode are larger than the solids comprising the employed electrophoretic coating suspension to permit substantially unimpeded circulation of the suspension therethrough. The panel-electrode assembly is discretely oriented in an angular position and substantially immersed into an electrophoretic bath 75 which comprises a suspension of particulate solids in a liquid vehicle.

The suspended solids are preferably of sub-micron size particles having a mean size within the range of approximately 0.10 to 0.20 micron. The upper limit of particle size should not exceed substantially 5.0 microns. The liquid vehicle of the suspension is substantially of the type employed in coating a pattern mask for use in a color CRT screen structure as disclosed in U.S. Patent Application Ser. No. 310,706 by Kenneth Speigel and assigned to the assignee of the present invention. In keeping therewith, the liquid vehicle comprises a C₁-C₂ monohydric alcohol, such as methanol and/or ethanol, combined with a C₃-C₅ monohydric alcohol, such as a propyl, butyl or amyl alcohol, or mixtures of the same, and water. A small amount of aluminum nitrate is included to promote electrical conductivity. A generic formulation per liter of electrophoretic deposition comprises, for example:

C ₁ -C ₂ monohydric alcohol	cc--	100-800
C ₃ -C ₅ monohydric alcohol	cc--	200-900
Water	cc--	10-80
Suspended solids	gr--	5-20
Aluminum nitrate	gr--	0.1-0.2

An example of preferential electrophoretic formulation comprises per liter:

Methanol	cc--	310-330
2-propanol	cc--	650-670
Water	cc--	10-20
Suspended solids	gr--	5-8
Al(NO ₃) ₃ ·9H ₂ O	gr--	0.1-0.2

To effect the coating procedure, the panel is placed on the inclined panel supportive means 83 effecting a position such that the panel inner surface is oriented in a downward direction in a slanted or tilted manner to provide for a substantially upward deposition of the electrophoretic coating on the conductive webbing 47 to prevent the possibility of particulate material from the electrophoretic suspension from gravitationally settling on the area of the first webbing and the inner surface of the panel. The degree of slant or tilt of the panel supportive means 83 is primarily determined by the curvature of the panel. The amount of panel tilt is referenced by the intersection of the plane of the sealing edge of the panel 16 with the plane "k" perpendicular to the surface 77 of the electrophoretic bath. For purposes of clarity, in

FIG. 3, the angular orientation of the panel is delineated from the center 79 of the external curvature of the panel viewing area whereat a vertex is established by the intersection of the vertical plane "k" and the plane "m" tangential to the center 79 and parallel with the plane of the sealing edge 16. The value of $\angle \Theta$ is influenced by the curvature of the viewing panel and the webbing area to be coated. Nominally the value of the angle of tilt of the panel and its supportive means is in the order of 20 to 35 degrees.

The panel supportive means 83 is comprised, for example, of two slanted and spaced apart insulative parallel slides 85 and 87 upon which the panel 15, with the associated electrode member 71 therein, is placed and moved in a predetermined manner by actuation means 81 and control means 82 to effect immersion and removal thereof into and out of the electrophoretic suspension by exemplary movement means 89; the panel being temporarily clamped thereto by holding means 90. The coating suspension 75 is held by a non-conductive liquid-holding container 91 having a bottom portion with an encompassing side formation 92 of a height providing sufficient depth to accommodate the panel and associated electrode. The inclined panel supportive means are located within the container and extended through the open top 93 thereof. Insulated electrical connections 94 and 95 from a D.C. supply 97 are attached through switching means 99 to the electrode member 71 and the first panel webbing 47 to effect electrophoretic deposition of the second apertured webbing upon the first. In the example shown, the electrode member 71 is the anode and the first apertured webbing 47 the cathode to effect cataphoretic deposition of the suspension solids on the first webbing.

A supply of the coating suspension 75 is contained in reservoir 101 wherein agitation means 103, such as a mechanical, fluidic or ultrasonic vibrator maintains the solids in suspension. Valving means 105 regulates the flow of the coating suspension from the reservoir through the piping 107 to the apparatus coating container 91. Within the container, there is positioned at least one agitation means 109, such as the aforementioned ultrasonic, mechanical, or fluidic vibrators, which maintain homogeneity of the suspension therein and expedite flow of the suspended particles through the openings 74 in the foraminous electrode 71. At least one out-flow means 111 maintains the level of suspension within the container and discharges into a collector reservoir 113. An air venting means 115 is located relative to the panel holding means 90, and movable therewith, in a manner that the inner end 117 thereof is oriented within the panel. This vent facilitates the desired level of the suspension in the upper peripheral region of the panel, in the region whereat air is trapped by the edge of the panel as the tilted panel is immersed into the suspension.

In the first embodiment of the apparatus, operation is accomplished by positioning the panel and contained electrode on the insulative panel supportive means 83 and then simultaneously immersing the panel 15 and associated electrode member 71, in the aforescribed tilted manner, into the electrophoretic suspension 75. The immersion movement is effected by activation of movement means 89 through control means 82. Motion is initiated within the suspension in the container 91 by activation of the agitation means 109. The D.C. power supply 97 is then activated to apply an electrical potential of, for example, in the order of 80 to 200 volts to establish a coating application current of a sufficiency to effect superposed electrophoretic deposition of the particulate solids on the first apertured conductive webbing 47. At a constant coating potential, the current density varies in accordance with the inter-electrode spacing. It has been found that the deposition of the electrophoretic coating is substantially consummated in the region of the suspension whereat the gradient of electrical potential (volts/cm.) is strongest. In the coating means illustrated in FIG. 3, the coating deposition is most efficiently effected in

substantially the top portion of the suspension at a band or region substantially 2 to 3 inches in depth, such being the region of strongest potential and referenced as "r." Therefore, the activation period of the applied electrical potential is in keeping with the process and the coating thickness desired. For example, to effect a coating thickness in the order of 1.0 to 2.0 mils by a D.C. potential of approximately 120 volts, the immersed panel and associated electrode, being in an initial stationary position within the suspension, are subjected to electrical activation for a time period such as 20 seconds to effect coating deposition in the top portion of the suspension; whereupon, electrical activation is continued and withdrawal of the panel and electrode is initiated at a speed of about 4 in./min. to sequentially coat the remainder of the first webbing 47. The disposed coating produces the inner defining edge of each window encompassment 61 of the second apertured webbing 53, and, being substantially contiguous to the glass surface of the viewing panel, reduces the size of the first webbing apertures 31 by, for example, 1.0 to 4.0 mils. If desired, a second or repeat electrophoretic application can be made to achieve a required coating buildup to further reduce the final dimensioning of each window area.

Upon simultaneous withdrawal of the panel and electrode assembly from the electrophoretic bath 75, the electrode member 71 is removed therefrom, and the coated panel is rinsed and flushed with water. The duo-webbing is then dried preparatory to subsequent screening of the pattern of phosphor elements thereon.

In a second embodiment of the coating apparatus 119, as shown in FIGS. 5 and 6, the electrode member 121 is removed from the panel 15 and stationarily positioned in the top region of the electrophoretic suspension, in substantially the aforementioned region "r." In this instance, the electrode 121 is formed of a different shape being a substantially flat elongated perforated member oriented at a location, for example, between the instanding ledges 123 and 125 of the inclined insulative parallel panel slides 127 and 129, whereat the panel 15 can be moved thereacross in a lateral manner adjacent thereto with the plane of the sealing edge 16 being substantially parallel therewith during immersion and withdrawal from the coating suspension. Since the position of the electrode member is fixed within the coating bath 75 and the panel 15, during the withdrawal coating step, is moved thereacross in a plane adjacent thereto, there is need to compensate for the distance differential between the electrode member and the first apertured webbing 47 on the interior surface of the domed portion of the panel. The compensation for this differential spacing is accomplished by a change in D.C. potential or by a variation in panel withdrawal speed or a combination of both. Such compensation is adequately handled by modification of the control means 82.

In a third embodiment of the coating apparatus 133 as illustrated in FIGS. 7 and 8, both the electrode member 135 and the tilted panel 15 are separately movable in a parallel manner on separate adjacent slideways relative to one another. The panel per se is placed on insulative parallel slides 137 and 139 for immersion into and withdrawal from the suspension 75, and the separate substantially flat longitudinal foraminous electrode member 135 is moved thereacross during coating application in close adjacent thereto in a plane substantially parallel with the plane of the panel sealing edge 16. Separate movement of the electrode member is facilitated by insulative parallel slideways 141 and 143, which may be contiguous to panel slides 137 and 139. Movement of the electrode member is effected by movement means 145 which is comprised, for example, of a rack 147 and pinion 149 arrangement. The rack portion is attached to an insulating member 151 which supports the electrode member 135. The mating pinion element 149 is attached to a submersible type of motor means 153 which is located in the coating bath 75 and connected to the ex-

ternal control means 82. An expandable insulated electrical conductor 95' facilitates connection for electrical activation of the electrode member as it is moved across the open face of the panel 15. In this apparatus embodiment, the coating deposition region "r," which is the region of strongest potential, moves with the electrode member 135. As in the previous process embodiment spacing differentials between the electrode and the first apertured webbing on the viewing curvature of the panel are compensated for by modification of the speed of the moving electrode or change in D.C. potential. After the activated electrode member 135 has been predeterminedately moved across the panel, which consummates the coating step, the panel is removed, rinsed and dried.

It has been found beneficial to apply a protective medium over the duo-webbing on the panel, such as an impregnating coating of a binder solution to guard against accidental abrasion of the webbed structure during subsequent screen forming steps. A suitable example of a compatible protective coating is polyvinyl alcohol in a methanol and water vehicle. Such coating is applicable by dipping, flowing or spraying and is subsequently removed from the multiplex screen during subsequent heat processing of the finished screen. Upon drying, the webbed panel is ready for deposition of the respective phosphor elements comprising the repetitive screen pattern.

Thus, several apparatus embodiments are provided for fabricating the apertured webbing portion of a color CRT screen structure, wherein the window areas are dimensioned substantially equal to or smaller than the apertures in the related pattern mask member without affecting in any manner the initially formed openings in the mask or the mask material per se.

Additionally, the disclosed apparatus embodiments provide a broader concept for applying a coating to a previously applied first patterned coating disposed on a CRT viewing panel to provide additional advantages to the first coating and the ensuing tube per se.

While there has been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. Apparatus for superposing an electrophoretic coating on a priorly applied electrically conductive apertured first webbing disposed on the inner surface of a color cathode ray tube viewing panel, said apparatus comprising:
 - a non-conductive liquid-holding container adapted to hold an electrophoretic coating suspension therein, said container comprising a bottom portion with an encompassing side formation and an open top;
 - inclined panel supportive means located within said container and extending through the open top thereof, said supportive means having provisions to accommodate the movement of said panel placed thereon in a manner whereof the panel opening and the panel inner surface are oriented in a slanted downward direction;
 - an electrode member formed for positioning relative to the opening in said panel in spatial relationship to the inner surface thereof and said apertured first webbing thereon;
 - means for moving said panel along said inclined supportive means to effect the immersion and removal of said panel from said electrophoretic suspension;
 - a direct current voltage source connected to supply an electrical coating potential between said electrode member and said apertured first webbing, said coating potential being applied between the immersed electrode and immersed panel portion; and

agitation means positioned in said electrophoretic suspension to provide homogeneity therein and circulation thereof in said container and through said foraminous electrode member.

2. The electrophoretic coating apparatus according to Claim 1 wherein said electrode member is positioned within said panel, and whereof the area of said electrode member is substantially equal to that of the first webbing to be coated, and whereof said panel and associated electrode member are moved simultaneously into and out of said coating suspension.

3. The electrophoretic coating apparatus according to Claim 1 wherein said electrode member is positioned so as to be within said coating suspension and said panel is moved relative thereto.

4. The electrophoretic coating apparatus according to Claim 3 wherein said electrode is a substantially elongated perforated member stationarily located so as to be near the top of said coating suspension, and wherein said panel is moved thereacross to sequentially dispose the electrophoretic coating on said first webbing, said coating potential being supplied during the movement of said panel.

5. The electrophoretic coating apparatus according to Claim 4 further comprising means to supply said coating potential during the removal movement of said panel.

6. The electrophoretic coating apparatus according to Claim 1 wherein said electrode member is a substantially elongated perforated member oriented for movement within said coating suspension in a manner independent of the moving means for said panel.

7. The electrophoretic coating apparatus according to Claim 6 further comprising a coordinated control means wherein the activation of said voltage source, said electrode movement means and said panel movement means are controlled by said coordinated control means.

8. The electrophoretic coating apparatus according to Claim 1 further comprising a coordinated control means wherein the activation of said voltage source and said panel movement means are controlled by said coordinated control means.

9. The electrophoretic coating apparatus according to Claim 1 wherein said panel supportive means are slanted from the vertical by an angular inclination within the range of substantially 20 to 35 degrees.

10. The electrophoretic coating apparatus according to Claim 1 wherein a venting means is oriented within the panel to facilitate the desired suspension level in the upper peripheral region of said inclined panel.

11. The electrophoretic coating apparatus according to Claim 1 wherein said electrode member is formed to effect a predetermined differential spacing between areas of the electrode and the first conductive webbing to provide the provision for selectively treating discrete portions of the pattern to provide a predetermined graded sizing of the reduced aperture areas in said webbing.

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JOHN H. MACK, Primary Examiner

A. C. PRESCOTT, Assistant Examiner

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