

- [54] PROCESS FOR FABRICATING A CATHODE RAY TUBE SCREEN STRUCTURE

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- [22] Filed: May 15, 1974

- [21] Appl. No.: 470,212

Related U.S. Application Data

- [62] Division of Ser. No. 357,942, May 7, 1973, Pat. No. 3,858,083.

- [52] U.S. Cl. 204/181
[51] Int. Cl. B01k 5/02
[58] Field of Search 204/181

References Cited

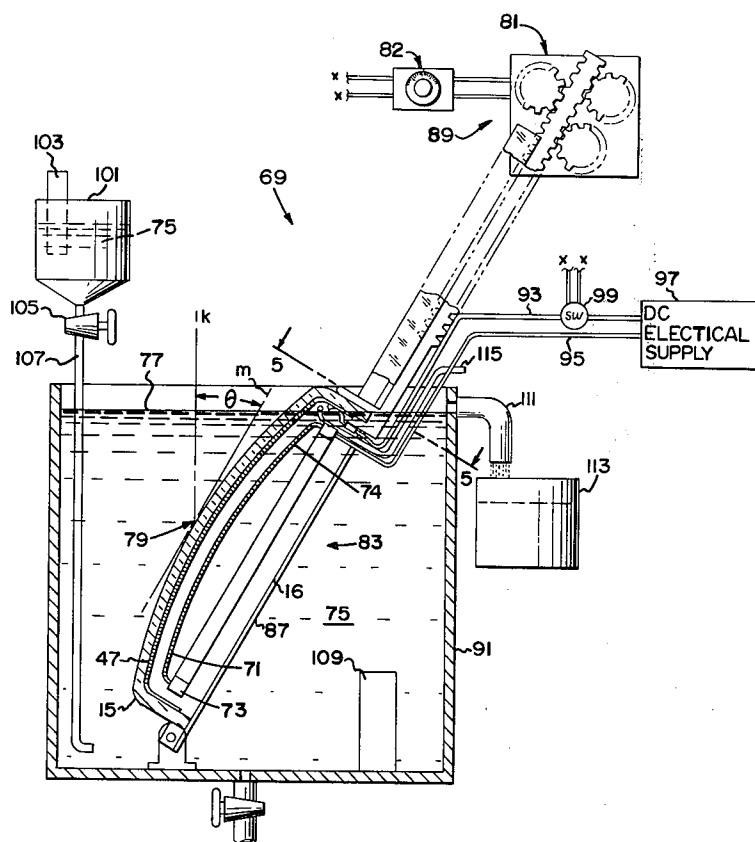
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| [56] | References Cited | |
| | UNITED STATES PATENTS | |
| 3,808,048 | 4/1974 Strik | 204/181 |

Primary Examiner—Howard S. Williams
Attorney, Agent, or Firm—Norman J. O'Malley;
Frederick H. Rinn; Robert T. Orner

[57] **ABSTRACT**

A process is provided for fabricating a multiplex screen structure for a color cathode ray tube whereof the window areas of a webbing structure are smaller than the apertures of a spatially related pattern member. The screen structure comprises a first apertured webbing of an opaque electrical conductive material formed by photo-processing on the inner surface of the tube viewing panel. A second apertured webbing of a substantially opaque material is electrophoretically superposed over the first webbing to provide a duo-webbing whereof the apertures are in alignment. The electrophoretic deposition of the second webbing produces a narrow mat-like encompassment within the perimeter of each aperture in the first webbing to effect a reduced-in-size second webbing aperture or window. An array of phosphor elements are formed to overlay the window areas, whereupon a reflective metallic backing is applied.

7 Claims, 5 Drawing Figures



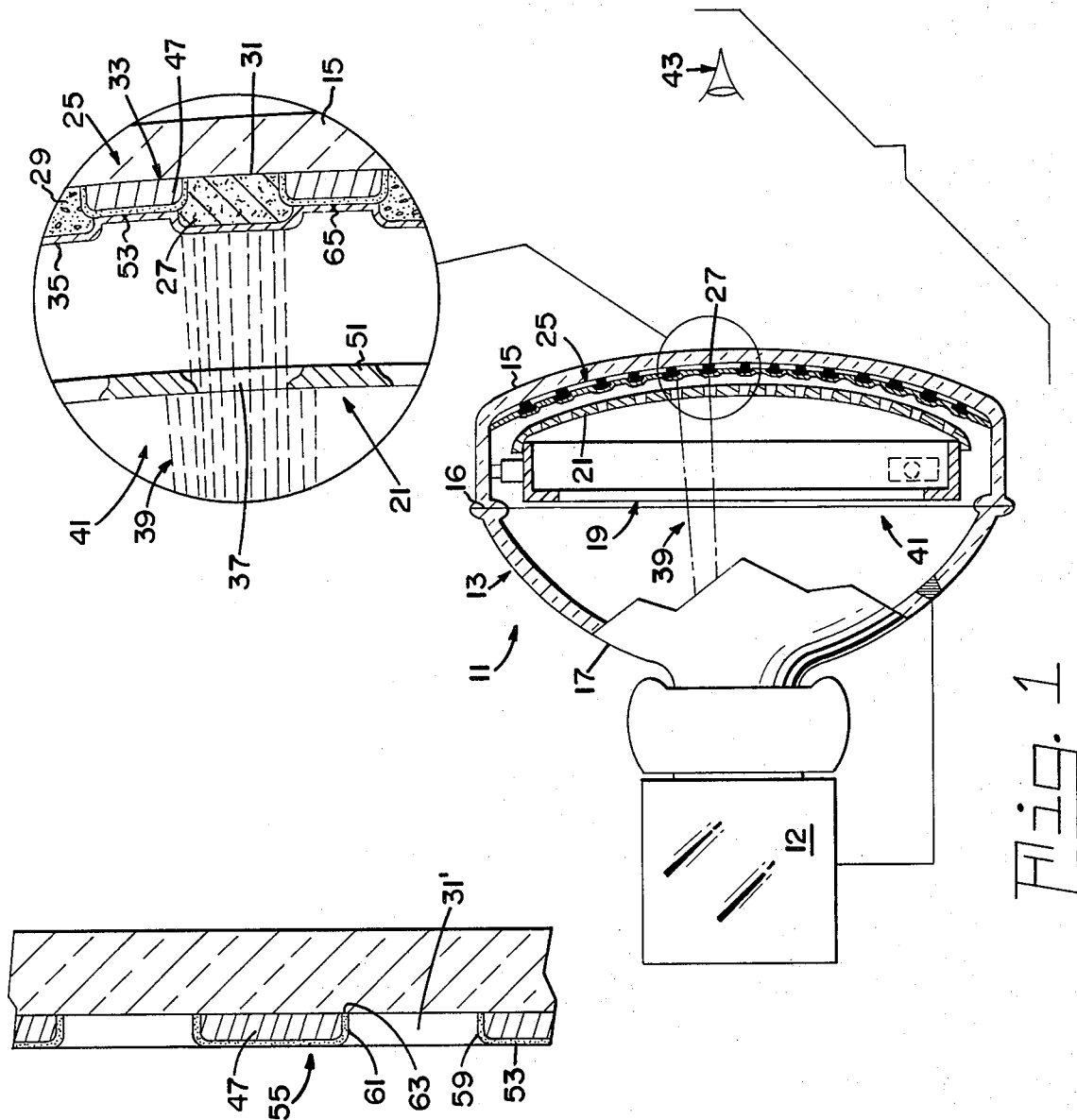


Fig. 1

Fig. 3

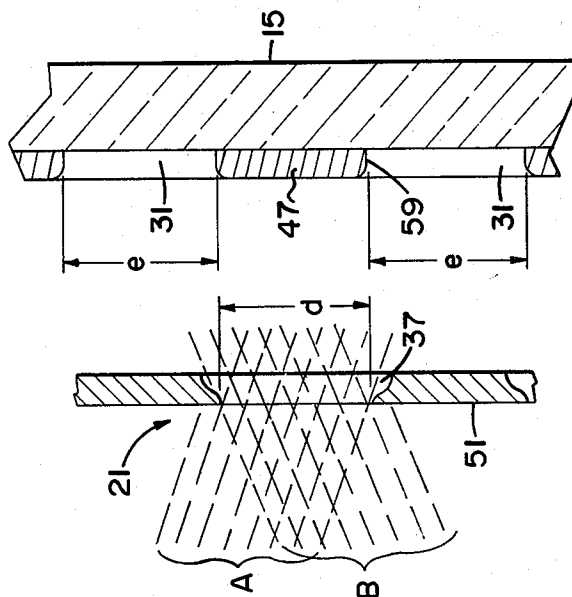


Fig. 2

PROCESS FOR FABRICATING A CATHODE RAY TUBE SCREEN STRUCTURE

CROSS-REFERENCE TO RELATED APPLICATION

This application is a divisional application of Ser. No. 357,942, filed May 7, 1973, now U.S. Pat. No. 3,858,083, which is assigned to the assignee of the present invention.

This divisional application contains matter disclosed but not claimed in two related United States patent applications which were filed concurrently with the parent application and assigned to the assignee of the present invention. These related applications are: Ser. No. 357,931, now U.S. Pat. No. 3,858,081, and Ser. No. 357,941, now U.S. Pat. No. 3,830,722.

BACKGROUND OF THE INVENTION

This invention relates to a color cathode ray tube and more particularly to a process for fabricating a 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 a non-light-transmissive or 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 then surrounded or 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. While such web-like screen structures have been fabricated, either before or after phosphor screening, it has proven to be expeditious to form the windowed webbing prior to the deposition of the respective phosphor multi-elements of the screen. Such web-like structures have been fabricated by sev-

eral processes wherein photo-deposition techniques constitute a fundamental part. An example of one type of web-forming procedure for defining windows in the screen structure 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 substantially equal to or slightly smaller than the apertures in the related pattern member. This aperture-to-window relationship is commonly referred 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 wherein the window openings in the opaque interstitial webbing are of dimensions smaller than the spatially associated apertures in the pattern member which is subsequently utilized in the finished operable tube.

By one 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 aforescribed 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.

In another procedure, the mask member is treated after the dot-initiated windows and the overlaying phosphor elements are formed by a separate series of photo exposures through the initially apertured mask. This process involves subjecting the mask to a chemical etching solution whereby the sizes of the mask apertures are enlarged thereby effecting a dimensional differential between the final-sized apertures and the formed windows in the opaque interstitial webbing.

While, this too, is a production procedure, the aperture etching requires additional closely controlled processing steps. In addition, as a result of this 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.

OBJECTS AND SUMMARY OF THE INVENTION

It is an object of the invention to reduce the aforementioned disadvantages by providing a process 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 to provide a process for fabricating the apertured webbing portion of the screen structure having window areas smaller than the related apertures in the spatially associated pattern member.

These and other objects and advantages are achieved in one aspect of the invention by the provision of a process for fabricating a color cathode ray tube multiplex screen structure spatially associated with an apertured pattern member and comprising a first apertured webbing of an opaque electrically conductive material formed by photo-processing on the inner surface of the tube viewing panel. A second apertured webbing of a substantially opaque material is electrophoretically superposed on the first webbing to provide a duo-webbing structure with the apertures thereof being in alignment. The electrophoretic deposition of the second webbing effects a narrow matlike encompassment within the delineating perimeter of each of the first webbing apertures thereby producing a smaller second webbing aperture or window, the defining encompassment being substantially perimetricaly contiguous with the glass surface of the viewing panel within the aperture area of the first webbing. The windowed structure thus formed provides window areas smaller than the apertures in the spatially related pattern member. A patterned screen, comprising a spaced-apart multitude of at least two repetitive phosphor elements, is formed atop the second apertured webbing whereof an individual phosphor element is disposed over each of the reduced-in-size windows in the webbing structure. The screen structure is completed by the application of a metallic reflecting film over the spaced-apart phosphor elements of the screen pattern.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustration of a color cathode ray tube 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;

FIGS. 2 and 3 are enlarged sections of fragments of the screen structure illustrating stages of screen fabrication;

FIG. 4 is a sectional view showing a means for disposing the second webbing on the panel; and

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

FIG. 4 showing additional detail of the coating means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For a better understanding of the present invention, together with other and further objects, advantages and capabilities thereof, reference is made to the following specification and appended claims in connection with the aforescribed 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 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 present invention relates to the apertured opaque webbing 33 of the structure, which in this instance is a duo-layered formation, and to the process for fabricating the same.

The basic or first apertured webbing 47 as illustrated in FIGS. 1, 2, and 3 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. Pat. 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. As shown in FIG. 2, the apertures 31 in the first webbing, which are the basic window areas in the screen structure, are related to the apertures 37 in the spatially associated pattern member 21.

Each of the pattern mask apertures 37 is common to at least two basic window areas 31 in the first webbing 47 during both photo-fabrication of the screen and subsequent tube operation since the respective utilized energies are beamed from predeterminedly offset and spatially positioned sources such as indicated at "A" and "B" in FIG. 2. The window-defining light absorbing interstitial portion of the first webbing 47 is a related counterpart of the solid interstitial portion 51 of the apertured portion 21 of the metallic pattern member 19. Since the pattern apertures 37 are employed to form the basic window areas 31 of the first webbing 47, there is an interrelationship between the pattern aperture dimensioning d and the basic window dimensioning e as referenced in FIG. 2.

It is the purpose of the invention to expeditiously achieve a window-limited screen structure, wherein the windows in the multiplex screen are 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. 3, to reduce the size of the window areas 31 of the first webbing, a second apertured webbing 53 of a non-light-transmissive material is superposed on the first webbing by electrophoretic means 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-size windows 31' in the duo-webbing structure 55 that are in the order of 1.0 to 4.0 mils smaller than the first

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

The light absorbing or opaque 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. Therefore, the examples herein presented are not to be considered limiting. A suitable substantially opaque substance may be one that is dark in color such as gray ferrous oxide, manganese dioxide, 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 the 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 elements 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 facilitated by an improved electrophoretic coating procedure. To describe the process, reference is directed to FIGS. 4 and 5 wherein one embodiment of an electrophoretic coating apparatus 69 is illustrated. A 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 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. The functioning area of the electrode member 71 at least equals 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 electrophoretic coating suspension to permit 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. Pat. Application Ser. No. 310,706, now U.S. Pat. No. 3,863,086 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:

a C ₁ - C ₂ monohydric alcohol	c.c.	100-800
a C ₃ - C ₅ monohydric alcohol	c.c.	200-900
water	c.c.	10-80
suspended solids	gr.	5-20
aluminum nitrate	gr.	0.1-0.2

A preferential electrophoretic formulation comprises per liter, for example:

methanol	c.c.	310-330
2-propanol	c.c.	650-670
water	c.c.	10-20
suspended solids	gr.	5-8
Al(NO ₃) ₃ · 9H ₂ O	gr.	0.1 to 0.2

To effect the coating procedure, the angular placement of the panel is such that the panel opening and the panel inner surface are oriented in a slanted downward direction in a tilted manner to provide for upward deposition of the electrophoretic coating on the conductive webbing 47 and 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 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. 4, the angular orientation θ 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 θ is influenced by the curvature of the viewing panel and the webbing area to be coated. Nominally the value of the angle of tilt is in the order of 20 to 35 degrees. Panel supportive means 83 is, for example, in the form of two slanted parallel slides 85 and 87 upon which the panel 15 and electrode member 71 are 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 movement means 89, the panel being temporarily clamped thereto by means 90. The coating suspension 75 is held by a non-conductive liquid-holding container 91 having sufficient depth to accommodate the panel and associated electrode. Insulated electrical connections 93 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 maintains the 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 an ultrasonic or fluid vibrator, which is operated to maintain the suspension and expedite flow of the suspended particles through 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. A venting means 115 is oriented within the panel to facilitate the desired suspension level in the upper peripheral region of the tilted panel.

One embodiment of the process is accomplished by simultaneously immersing the panel 15 and associated electrode member 71 in the aforescribed tilted manner into the electrophoretic suspension 75. Movement is initiated within the suspension 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. 4, the coating deposition is effected in substantially the top portion of the suspension at a band or region substantially 2 to 3 inches in depth whereat the deposition potential is greatest. 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 electrode being in an initial stationary position 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. Since the amount of coating deposition is directly related to the inter-electrode spacing, a graded sizing of the final window areas of the second coating can be produced by a discrete shaping of the

electrode member. Graded sizing is also achievable by the combination of inter-electrode spacing with variations in withdrawal timing and applied potential.

Upon simultaneous withdrawal of the panel and electrode assembly from the electrophoretic bath 75, the electrode member 71 is removed therefrom and the 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 another embodiment of the coating process, the electrode member is removed from the panel and stationarily positioned in the top region of the electrophoretic suspension. In this instance the electrode, formed as a substantially flat elongated perforated member, having a width in the order of two to three inches, is oriented at a location whereat the tilted panel 15 can be moved in a lateral manner adjacent thereto with the plane of the sealing edge 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 and the panel, 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 on the domed portion of the panel. The compensation for this differential spacing is effected by a change in d.c. potential or by a change in panel withdrawal speed or a combination of both.

In still another embodiment of the coating process, both the electrode member and the tilted panel are separately movable in a parallel manner relative to one another. The panel per se is immersed into the suspension 75 and a separate substantially flat foraminous electrode member is moved thereacross during coating application in close adjacency thereto in a plane substantially parallel with the plane of the panel sealing edge 16. 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 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, an expeditious process is provided for fabricating an apertured webbing in a color CRT screen structure having window areas that are 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.

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. In a color cathode ray tube viewing panel having a first apertured substantially opaque electrically conductive webbing formed on the inner surface of the viewing area of the panel, a process for disposing a second apertured webbing of a second opaque material in a contiguous superposed manner on the first webbing, said process comprising the steps of:
 - positioning an electrode member relative to said panel in spatial relationship to the inner surface thereof and said first apertured conductive webbing thereon;
 - placing said panel in supportive means in a tilted manner to orient the panel opening and the panel inner surface in a slanted downward direction;
 - immersing said panel and electrode into an electrophoretic bath in a manner that said bath makes contact with said conductive webbing and said electrode member, said bath including a suspension of particulate solids;
 - initiating movement of said electrophoretic bath to maintain a uniformity of suspension and effect movement of said suspension relative to said conductive webbing and said electrode;
 - applying an electrical potential between said conductive webbing and said electrode member for a time period to effect electrophoretic deposition of said particulate solids on said first apertured conductive webbing to provide a duo-webbing comprising a second apertured webbing contiguously superposed on said first webbing, the inner defining edge of each window encompassment of said second webbing being substantially contiguous with the glass surface of said viewing panel effects a reducing of the size of said first webbing apertures;
 - removing said panel from said electrophoretic suspension; rinsing said panel; and
 - drying said coated webbing preparatory to the subsequent screening of phosphor elements thereon.
2. The process for electrophoretically disposing a second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein an impregnating coating of a binder solution is applied to the formed duo-webbing to provide a protective medium thereto which is removed therefrom during subsequent heat processing of the finished screen structure.
3. The process for electrophoretically disposing a second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein there is movement of said electrode relative to said panel and wherein said electrophoretic deposition of the particulate solids is substantially effected during movement of the panel in the suspension prior to complete removal of the panel therefrom.
4. The process for electrophoretically disposing a second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein said panel is immersed in said suspension at an angular orientation to prevent settling of the suspended particulate material on the inner surface thereof.
5. The process for electrophoretically disposing a second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein said panel and said electrode member are immersed simulta-

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neously into said suspension and removed simultaneously therefrom.

6. The process for electrophoretically disposing a second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein said electrode member is positioned in said suspension and wherein there is relative movement between said panel and said electrode during immersion and removal of said panel into and from said suspension.

7. The process for electrophoretically disposing a 10

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second apertured webbing on said cathode ray tube viewing panel according to claim 1 wherein said electrode member is formed to effect a differential spatial relationship between areas of the electrode and the first apertured conductive webbing to provide the provision for selectively treating discrete portions of the pattern to provide a predetermined graded sizing of the reduced apertures in the duo-webbing.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,898,146

DATED : August 5, 1975

INVENTOR(S) : Charles H. Rehkopf and Kenneth Speigel

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 7, line 47: " θ " should read --- $\angle \theta$ "

Col. 7, line 52: " θ " should read --- $\angle \theta$ "

Signed and Sealed this

eighteenth Day of November 1975

[SEAL]

Attest:

RUTH C. MASON

Attesting Officer

C. MARSHALL DANN

Commissioner of Patents and Trademarks