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(71) Applicant (for all designated States except US): **THOMSON LICENSING** [FR/FR]; 46, quai A. Le Gallo, F-92100 Boulogne-Billancourt (FR).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **LIANG, Kangning** [US/US]; 5071 French Broad Lane, Bartlett, TN 38135 (US).

(74) Agents: **TRIPOLI, Joseph, S.** et al.; Two Independence Way, Princeton, New Jersey 08540 (US).

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(54) Title: METHOD OF MANUFACTURING A COLOR FILTER ON A CATHODE-RAY TUBE (CRT) PANEL

(57) Abstract: A color filter is formed in one of the plurality of sets of fields. The color filter is formed by applying a photosensitive material layer on the inner surface of the faceplate panel and exposing one of the sets of fields corresponding to the blue region, the red region or the green region, to harden the photosensitive material in such region. A pigment layer, having a color that corresponds to the color of the region of hardened photosensitive material, is then applied over the exposed photosensitive material layer. After the pigment layer is applied, the unhardened photosensitive material layer is removed to form the color filter.



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METHOD OF MANUFACTURING A COLOR FILTER ON A CATHODE-RAY TUBE (CRT) PANEL

5 CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application Serial No. 60/618,772 (Atty. Docket PU040279), entitled "METHOD OF MANUFACTURING A COLOR FILTER ON A CATHODE RAY TUBE (CRT) PANEL" and filed October 14,
10 2004, which is incorporated by reference herein in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

15

The invention relates to a color cathode-ray tube (CRT) and, more particularly to the manufacturing of a luminescent screen assembly having at least one color filter.

20 2. Description of the Background Art

A color cathode-ray tube (CRT) typically includes an electron gun, an aperture mask, and a screen. The aperture mask is interposed between the electron gun and the screen. The screen is located on an inner surface of a faceplate of the CRT tube.
25 The aperture mask functions to direct electron beams generated in the electron gun toward appropriate color-emitting phosphors on the screen of the CRT tube.

The screen may be a luminescent screen. Luminescent screens typically comprise an array of three different color-emitting phosphors (e.g., green, blue and red) formed thereon. Each of the color-emitting phosphors is separated from another
30 by a matrix line. The matrix lines are typically formed of a light-absorbing black, inert material.

In order to enhance the color contrast of the luminescent screen, a pigment layer, or color filter, may be formed between the faceplate panel and the color-emitting phosphor. The color filter typically has a color that corresponds to the color

of the color-emitting phosphor formed thereon (e.g., a red-emitting phosphor is formed on a red pigmented filter). The color filter transmits light that is within the emission spectral region of the phosphor formed thereon and absorbs ambient light in other spectral regions, providing a gain in color contrast.

5 After the application of the color filter, the color-emitting phosphors are typically formed using a subtractive process in which a phosphor layer is deposited on the interior of the faceplate panel, and, in a subsequent development process, select portions of the phosphor layer are removed. Unfortunately, during the phosphor formation process, portions of the phosphor coating may not adhere
10 properly to the color filter layer resulting in lower light output and lower contrast performance for the luminescent screen. In addition, agglomerates may form when the pigment is mixed with the resist, leading to a non-uniform pigment distribution. This process is procedurally complex and time consuming.

 Thus, a need exists for a method of forming a color filter cathode-ray tube
15 (CRT) that overcomes the above drawbacks.

SUMMARY OF THE INVENTION

 The present invention relates to a color filter luminescent screen assembly for
20 a cathode-ray tube (CRT). The luminescent screen assembly is formed on an interior surface of a faceplate panel of the CRT tube. The luminescent screen assembly includes a patterned light-absorbing matrix that defines a plurality of sets of fields corresponding to one of a blue region, a red region and a green region.

 A color filter is formed in one of the plurality of sets of fields. The color filter is
25 formed by applying a photosensitive material layer on the inner surface of the faceplate panel and exposing one of the sets of fields corresponding to the blue region, the red region or the green region, to harden the photosensitive material in such region. A pigment layer, having a color that corresponds to the color of the region of hardened photosensitive material, is then applied over the exposed
30 photosensitive material layer. The pigment layer may be applied from an aqueous suspension comprising pigment, one or more surface-active agents, one or more non-pigmented oxide particles and a gelling agent. The gelling agent prevents hardened photosensitive material from dissolving into the pigment suspension so as to form agglomerates. Furthermore, the gelling agent retains the photosensitive

material layer in unhardened areas preventing deposition of the pigment directly on the surface of the faceplate panel. After the pigment layer is applied, the unhardened photosensitive material layer is removed to form the color filter.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

The invention will now be described in greater detail, with relation to the accompanying drawings, in which:

FIG. 1 is a plan view, partially in axial section, of a color cathode-ray tube
10 (CRT) made according to embodiments of the present invention;

FIG. 2 is a section of the faceplate panel of the CRT of FIG. 1, showing a luminescent screen assembly;

FIG. 3 is a block diagram comprising a flow chart of the manufacturing process for the screen assembly of FIG. 2;

15 FIGS. 4A-4E depict views of the interior surface of the faceplate panel during formation of the luminescent screen assembly; and

FIGS. 5A-5E depict views of the interior surface of the faceplate panel during formation of an exemplary luminescent screen assembly.

20 **DETAILED DESCRIPTION**

FIG. 1 shows a conventional color cathode-ray tube (CRT) 10 having a glass envelope 11 comprising a faceplate panel 12 and a tubular neck 14 connected by a funnel 15. The funnel 15 has an internal conductive coating (not shown) that is in
25 contact with, and extends from, an anode button 16 to the neck 14.

The faceplate panel 12 comprises a viewing surface 18 and a peripheral flange or sidewall 20 that is sealed to the funnel 15 by a glass frit 21. A three-color luminescent phosphor screen 22 is carried on an inner surface of the faceplate panel 12. The screen 22, shown in cross-section in FIG. 2, is a line screen which includes a
30 multiplicity of screen elements comprised of red-emitting, green-emitting and blue-emitting phosphor stripes R, G and B, respectively, arranged in triads, each triad including a phosphor line of each of the three colors. The R, G and B phosphor stripes extend in a direction that is generally normal to the plane in which the electron beams are generated. At least one of the R, G and B phosphor stripes are formed on

color filters 43. The color filters 43 each comprise a pigment that corresponds to the color of the phosphor stripe formed thereon. The color filters 43 are formed on hardened photosensitive material 46.

A light-absorbing matrix 23, shown in FIG. 2, separates each of the phosphor lines. A thin conductive layer 24 (shown in FIG. 1), preferably of aluminum, overlies the screen 22 and provides means for applying a uniform first anode potential to the screen 22, as well as for reflecting light emitted from the phosphor elements, through the viewing surface 18. The screen 22 and the overlying aluminum layer 24 comprise a screen assembly.

A multi-aperture color selection electrode, or shadow mask 25 (shown in FIG. 1) is removably mounted, by conventional means, within the faceplate panel 12, in a predetermined spaced relation to the screen 22.

An electron gun 26, shown schematically by the dashed lines in FIG. 1, is centrally mounted within the neck 14, to generate three inline electron beams 28, a center and two side or outer beams, along convergent paths through the shadow mask 25 to the screen 22. The inline direction of the beams 28 is approximately normal to the plane of the paper.

The CRT of FIG. 1 is designed to be used with an external magnetic deflection yoke, such as a yoke 30, shown in the neighborhood of the funnel-to-neck junction.

When activated, the yoke 30 subjects the three beams 28 to magnetic fields that cause the beams 28 to scan a horizontal and vertical raster across the screen 22.

The screen 22 is manufactured according to the process steps represented schematically in FIG. 3. Initially, the faceplate panel 12 is cleaned, as indicated by reference numeral 300, by washing it with a caustic solution, rinsing it in water, etching it with buffered hydrofluoric acid and rinsing it again with water, as is known in the art.

The interior surface of the faceplate panel 12 is then provided with the light-absorbing matrix 23, as indicated by reference numeral 302, preferably using a wet matrix process in a manner described in U. S. Pat. Nos. 3,558,310 issued January 26, 1971 to Mayaud; 6,013,400 issued January 11, 2000 to LaPeruta et al.; or 6,037,086 issued March 14, 2000 to Gorog et al.

The light-absorbing matrix 23 is uniformly provided over the interior viewing surface of faceplate panel 12. For a faceplate panel 12 having a diagonal dimension of about 68 cm (27 inches), the openings or gaps formed between the lines of the

light-absorbing matrix 23 can have a width in a range of about 0.075 mm to about 0.03 mm. Referring to FIG. 4A, the light-absorbing matrix 23 defines three sets of fields: a first set of fields 40, a second set of fields 42 and a third set of fields 44.

As indicated by reference numeral 304 in FIG. 3, at least one color filter is formed in one or more of the three sets of fields defined by the light-absorbing matrix 23. Referring to FIG. 4B, the at least one color filter may be formed by first depositing a photosensitive layer 46 on interior surfaces of the faceplate panel 12. The photosensitive material layer 46 may comprise, for example, an aqueous solution of sodium dichromate and a polymer such as polyvinyl alcohol (PVA). The photosensitive material layer 46 may be formed on the faceplate panel 12 by spin coating the aqueous solution of the polymer and dichromate thereon. The thickness for the photosensitive material layer 46 should be within a range of about 0.5 micrometers to about 2.0 micrometers.

The photosensitive material layer 46 should have a viscosity within a range of about 10 centipoise (cps) to about 25 cps. The photosensitive material layer 46 may include sodium dichromate within a range of about 6 weight % to about 12 weight % and the polymer (e.g., PVA) within a range of about 88 weight % to about 94 weight %.

After the photosensitive material layer 46 is deposited on interior surfaces of the faceplate panel 12, portions of the photosensitive material layer 46 may be irradiated using, for example, actinic radiation, through the shadow mask 25 to cross-link the photosensitive material of the photosensitive material layer 46 in the first set of fields 40. Cross-linking the photosensitive material in the photosensitive material layer 46 in the first set of fields 40 hardens the photosensitive material in such fields.

Referring to FIG. 4C, a first color filter layer 60 is applied over the irradiated photosensitive material layer 46. The first color filter layer 60 may be applied from a first aqueous pigment suspension that may comprise, for example, a first pigment, one or more surface active agents, one or more gelling agents and at least one non-pigmented oxide particle.

The first pigment may be, for example, a blue pigment, such as, a daipyroxide blue pigment TM-3490E, commercially available from Daicolor-Pope, Inc. of Paterson, New Jersey. Another suitable blue pigment may include, for example, EX 1041 blue pigment, commercially available from Shepherd Color Co. of Cincinnati, Ohio, among other pigments.

The pigment may be milled using a ball milling process in which the pigment is dispersed along with one or more surfactants in an aqueous suspension. The pigment may be ball milled using for example, 1/16 inch zirconium oxide (ZrO_2) balls for at least about 61 hours to about 90 hours.

5 The one or more surface-active agents may include, for example, organic and polymeric compounds that may optionally adopt an electric charge in aqueous solution. The surface-active agent may comprise anionic, non-ionic, cationic, and/or amphoteric materials. The surface-active agent may be used for various functions such as improving the homogeneity of the pigment suspension and improved wetting
10 of the faceplate panel 12, among other functions. Examples of suitable surface-active agents include various polymeric dispersants such as, for example, DISPEX N-40V polymeric dispersant (commercially available from Ciba Specialty Chemicals of High Point, North Carolina) as well as block copolymer surface active agents such as Pluronic Series (ethoxypropoxy co-polymers) L-62 (commercially available from
15 Hampshire Chemical Company of Nashua, New Hampshire) and carboxymethyl cellulose (CMC) (commercially available from Yixing Tongda Chemical Co. of China).

The one or more gelling agents may include, for example, organic and inorganic compounds that form gels with the polymer used in the photosensitive material layer 46. The gelling agent in the aqueous pigment suspension gels the
20 polymer on the surface of the hardened portion of the photosensitive material layer 46. Gelling the surface of the hardened photosensitive blocking layer 46 prevents dissolution of the polymer therein into the pigment suspension preventing the agglomeration of the pigment particles. Examples of suitable gelling agents for polyvinyl alcohol (PVA) include inorganic compounds such as, for example, boric acid
25 (H_3BO_3), borax, ammonium vanadate and copper salts, among others, as well as organic compounds such as, for example, Congo Red, resorcinol and salicylanilide, among others. Preferably, boric acid is used as the gelling agent.

The at least one non-pigmented oxide particle may comprise a white or clear oxide material, such as, for example, silica, alumina, or combinations thereof. The at
30 least one non-pigmented oxide particle should have a size less than that of the pigment. Preferably, the average size of the at least one non-pigmented oxide particle should be less than about 50 nanometers. The at least one non-pigmented oxide particle is believed to enhance the adhesion of the pigment on the irradiated photosensitive material layer 46. The at least one non-pigmented oxide particle may

be present in a concentration of about 5 weight to about 10 weight % with respect to the concentration of the pigment.

The first aqueous pigment suspension should include pigment within a range of about 5 weight % to about 17 weight %. Additionally, the first aqueous pigment suspension should include the gelling agent within a range of about 1 weight % to about 5 weight %.

The first aqueous pigment suspension may be applied to the faceplate panel 12 by, for example, spin coating in order to form a first color filter layer 60 on the irradiated photosensitive material layer 46. After spin coating, the first color filter layer 60 may be heated to a temperature in a range from about 55 °C to about 90 °C to provide increased adhesion of the first color filter 60 to the hardened photosensitive material 46 in the first set of fields 40 of the faceplate panel 12.

Referring to FIG. 4D, the first color filter layer 60 and underlying unhardened portions of the irradiated photosensitive material layer 46 are developed using, for example, deionized water. During development, the unhardened portions of the photosensitive material layer 46 as well as the color filter layer 60 over the second set of fields 42 and the third set of fields 44 are removed, leaving the first color filter 60 and underlying hardened portions of the photosensitive material layer 46 remaining in the first set of fields 40.

After the first color filter layer 60 and the irradiated photosensitive material layer 46 are developed, the faceplate panel 12 is heated. The faceplate panel 12 may be heated to a temperature of about 50 °C to about 100 °C and then cooled to a temperature of about 40 °C. The color filter formation process described above with reference to FIGS. 4B-4D, may then be repeated to form a second color filter in the second set of fields 42 or a third color filter in the third set of fields 44.

The faceplate panel 12 may then be screened with non-pigmented green phosphors 72 non-pigmented blue phosphors 74 and non-pigmented red phosphors 76, as indicated by reference numeral 306 in FIG. 3 and depicted in FIG 4E, preferably using a screening process in a manner known in the art.

In an exemplary luminescent screen assembly fabrication process, a 27 inch faceplate panel 12 having matrix lines 23 formed thereon was used as shown in FIG. 5A.

In such an example, a solution of 1000 grams of deionized water, 320 grams of 10 % polyvinyl alcohol and 42 grams of 10 % sodium dichromate having a viscosity

of 12.5 cp (centipoises) was applied to the faceplate panel. The solution was applied to the faceplate panel using a spin-coating technique. The faceplate panel was dried up to 52.5 °C and then cooled to 40 °C to form a photosensitive material layer 46 thereon as shown in FIG. 5B.

5 The coated faceplate panel 12 was irradiated using actinic radiation having an intensity of about 4.0 W/m². The faceplate panel 12 was exposed on the blue fields 40 at two different source positions (e.g., 30 seconds at -0.130 and 30 seconds at -0.174) to cross-link the photosensitive material and obtain the desired width of hardened lines.

10 A blue pigment solution comprising 50 grams of TM-3490E Diapyroxide blue pigment (commercially available from Diacolor-Pope, Inc. of Paterson, New Jersey, in 200 grams of water was mixed with 3.0 grams of DISPEX N-40V in a ball mill containing 2 mm glass bead media. The pigment solution was ball milled for about 66 hours.

15 The blue pigment recovered from the ball mill was then diluted with enough water to yield an aqueous blue pigment suspension having about 14 weight % pigment. Boric acid was added to the diluted blue pigment suspension to have a concentration of 2 weight % boric acid in the suspension. The blue pigment suspension was then ball milled for at least one hour.

20 The blue pigment suspension was applied to the faceplate panel using a spin-coating technique. The faceplate panel was dried up to 51.5 °C and then cooled to 40 °C to form a blue color filter layer 60 on the irradiated photosensitive material layer 46, as shown in FIG. 5C.

25 The blue color filter layer 60 and underlying unhardened portions of the irradiated photosensitive material layer 46 were developed by spraying the faceplate panel with deionized water for 30 seconds at 30 psi (pounds/inch²). The faceplate panel 12 was dried at a temperature of about 50 °C and then cooled to a temperature of about 40 °C. This development step removed the photosensitive material layer 46 and blue pigment layer 60 from both the red fields 42 and the green fields 44, leaving
30 a blue color filter 60 on the hardened photosensitive material 46 in the blue fields 42, as shown in FIG. 5D.

 The color filter formation process described above with reference to FIGS. 5B-5D, may then be repeated to form a red color filter in the red set of fields 42 or a green color filter in the green set of fields 44.

The faceplate panel 12 may then be screened with non-pigmented green phosphors 72 non-pigmented blue phosphors 74 and non-pigmented red phosphors 76, depicted in FIG 5E.

Although an exemplary faceplate panel for a color cathode-ray tube (CRT)
5 which incorporates the teachings of the present invention has been shown and described in detail herein, those skilled in the art can readily devise many other varied embodiments that still incorporate these teachings, such as, for example field emission displays (FEDs).

CLAIMS

1. A method of manufacturing a color filter on a luminescent screen of a display,
5 comprising:
 providing a faceplate panel having a patterned light-absorbing matrix
 thereon defining a first set of fields, a second set of fields and a third set of fields;
 forming a photosensitive layer on the patterned light-absorbing matrix;
 exposing the photosensitive layer to form hardened regions thereof over
10 one of the first set of fields, the second set of fields and the third set of fields;
 forming a first pigment layer on the exposed photosensitive layer; and
 forming a first color filter by retaining the first pigment layer on the
 hardened regions of the photosensitive layer formed over the one of the first set of
 fields, the second set of fields and the third set of fields.
- 15 2. The method of claim 1 wherein the first pigment layer is selected from the
group consisting of a red pigment layer and a blue pigment layer.
3. The method of claim 1 wherein the first pigment layer includes a gelling agent.
- 20 4. The method of claim 3 wherein the gelling agent is selected from the group
consisting of resorcinol, salicyclanilide, borax, ammonium vanadate, copper salts and
boric acid.
- 25 5. A method of manufacturing a color filter on a luminescent screen assembly of
a color cathode-ray tube (CRT), comprising:
 providing a faceplate panel having a patterned light-absorbing matrix
 thereon defining a first set of fields, a second set of fields and a third set of fields;
 forming a photosensitive layer on the patterned light-absorbing matrix;
30 exposing the photosensitive layer to form hardened regions thereof over
one of the first set of fields, the second set of fields and the third set of fields;
 forming a first pigment layer on the exposed photosensitive layer; and

forming a first color filter by retaining the first pigment layer on the hardened regions of the photosensitive layer formed over the one of the first set of fields, the second set of fields and the third set of fields.

- 5 6. The method of claim 5 wherein the first pigment layer is selected from the group consisting of a red pigment layer and a blue pigment layer.
7. The method of claim 5 wherein the first pigment layer includes a gelling agent.
- 10 8. The method of claim 7 wherein the gelling agent is selected from the group consisting of resorcinol, salicyclanilide, borax, ammonium vanadate, copper salts and boric acid.
9. A display, comprising:
- 15 a faceplate panel having a patterned light-absorbing matrix thereon defining a first set of fields, a second set of fields and a third set of fields; hardened regions of photosensitive material formed over one of the first set of fields, the second set of fields and the third set of fields defined by the light-absorbing matrix; and
- 20 a first color filter disposed on the hardened regions of photosensitive material.
10. The display of claim 9 wherein the first color filter is selected from the group consisting of a red color filter and a blue color filter.
- 25 11. The display of claim 9 wherein the first color filter includes a gelling agent.
12. The display of claim 11 wherein the gelling agent is selected from the group consisting of resorcinol, salicyclanilide, borax, ammonium vanadate, copper salts and
- 30 boric acid.
13. A luminescent screen assembly of a color cathode-ray tube (CRT), comprising:

a faceplate panel having a patterned light-absorbing matrix thereon defining a first set of fields, a second set of fields and a third set of fields;

hardened regions of photosensitive material formed over one of the first set of fields, the second set of fields and the third set of fields defined by the light-

5 absorbing matrix; and

a first color filter disposed on the hardened regions of photosensitive material.

10 14. The luminescent screen assembly of claim 13 wherein the first color filter is selected from the group consisting of a red color filter and a blue color filter.

15. The luminescent screen assembly of claim 13 wherein the first color filter includes a gelling agent.

15 16. The luminescent screen assembly of claim 15 wherein the gelling agent is selected from the group consisting of resorcinol, salicyclanilide, borax, ammonium vanadate, copper salts and boric acid.

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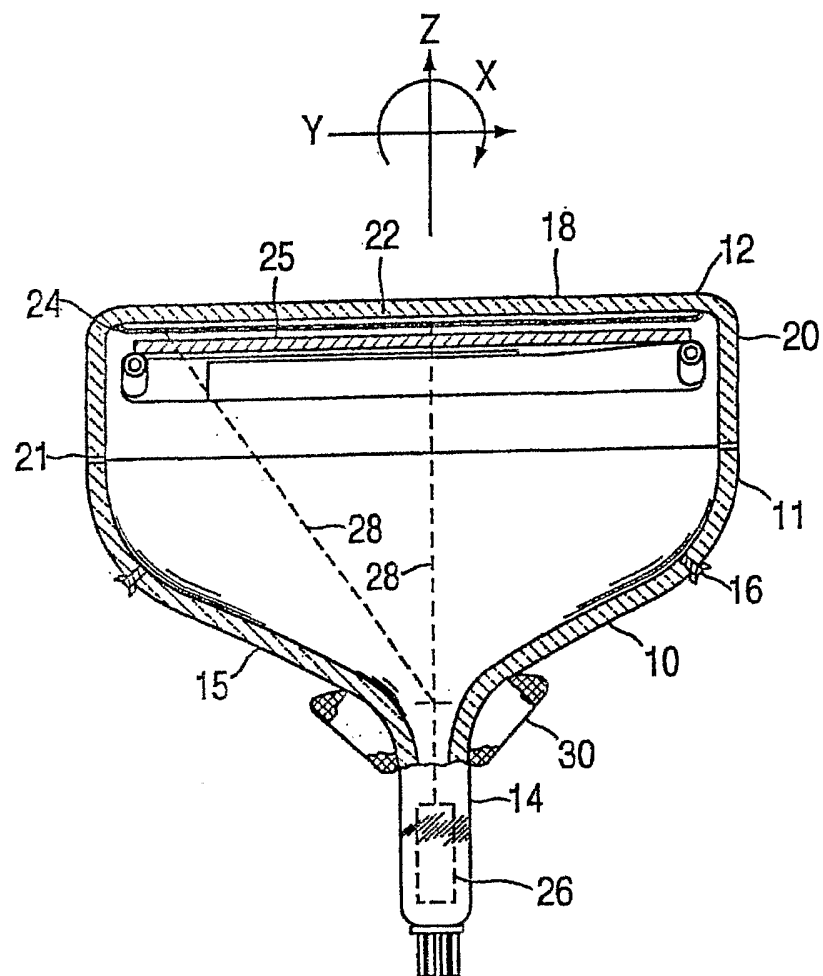


FIG. 1

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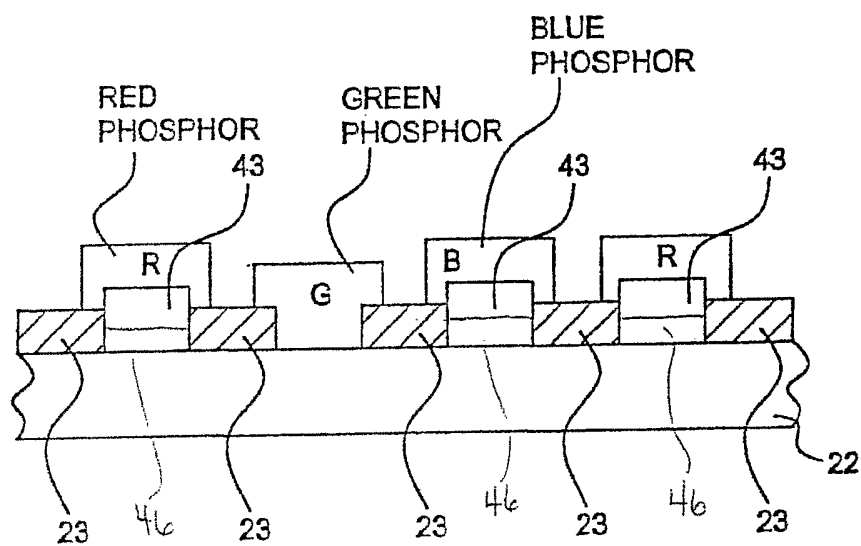


FIG. 2

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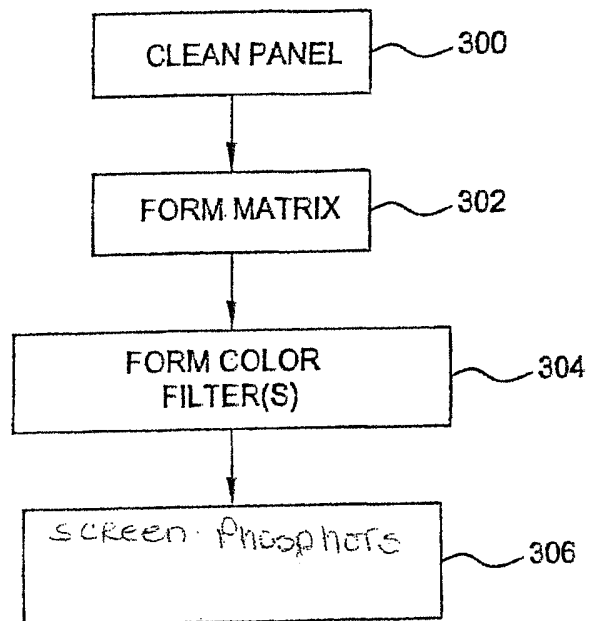


FIG. 3

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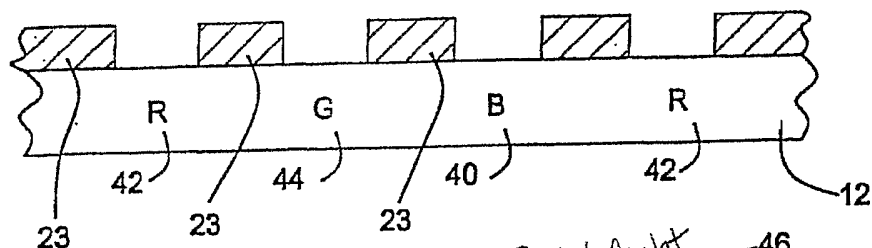


FIG. 4A

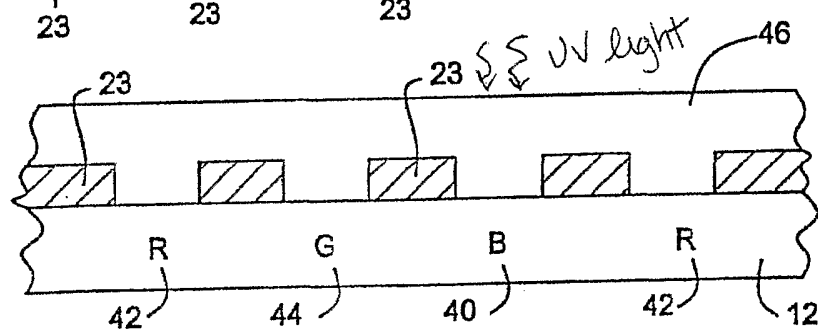


FIG. 4B

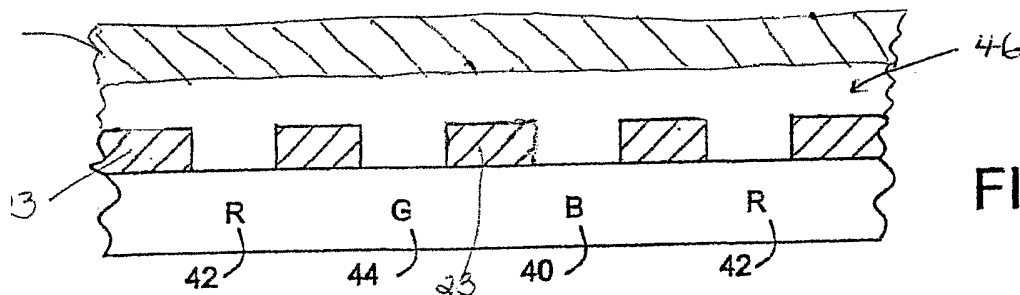


FIG. 4C

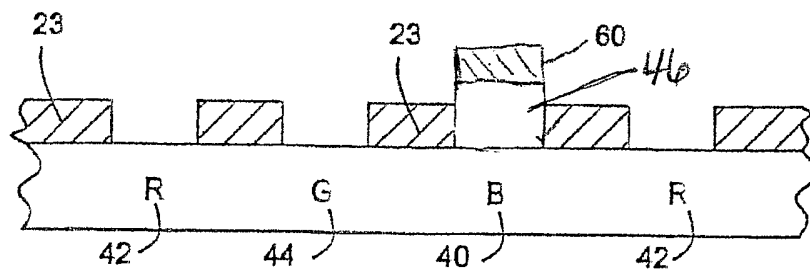


FIG. 4D

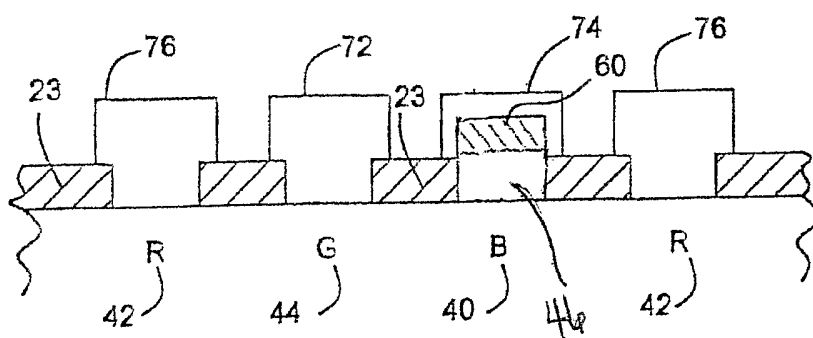


FIG. 4E

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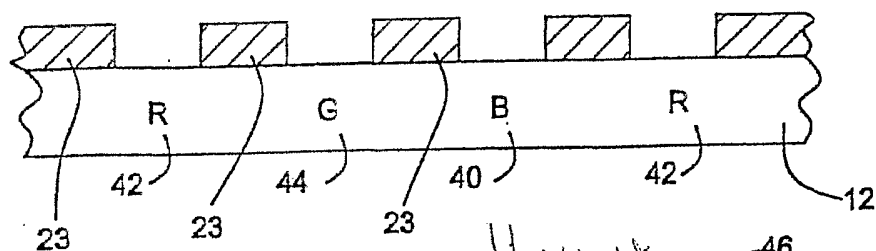


FIG. 5A

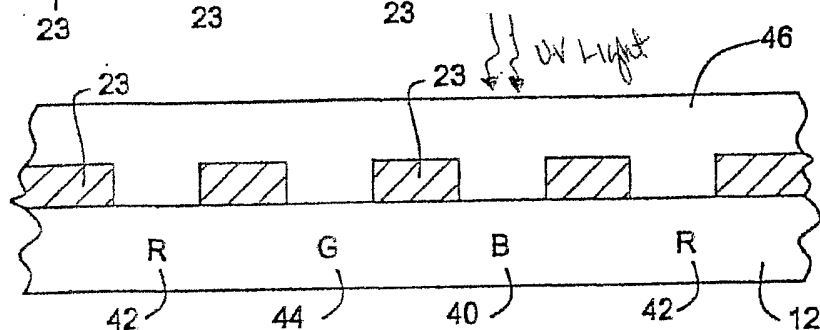


FIG. 5B

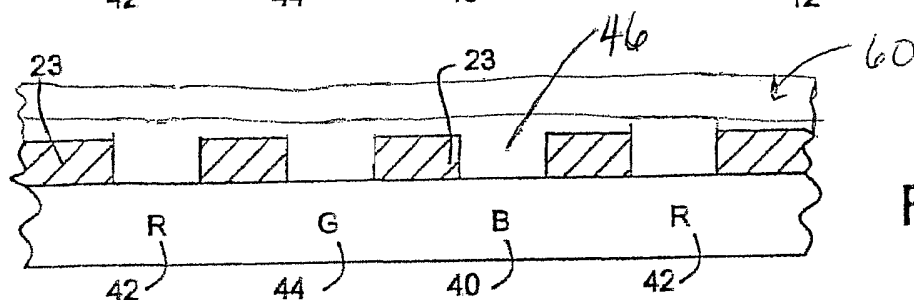


FIG. 5C

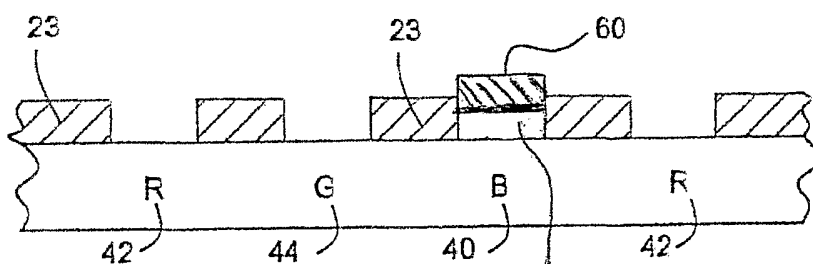


FIG. 5D

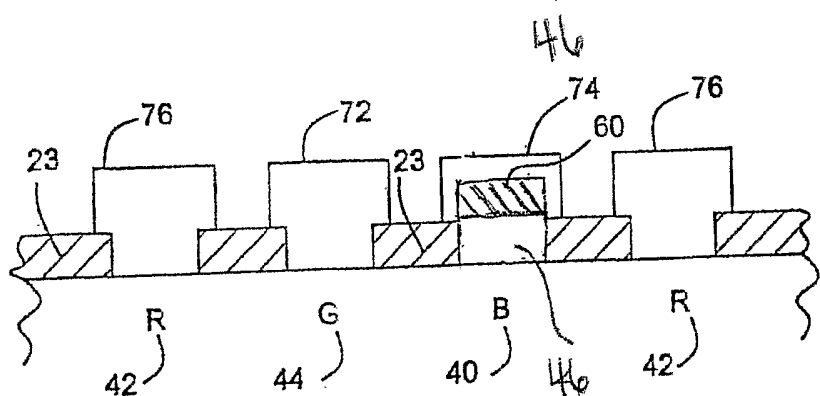


FIG. 5E

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2005/036401

A. CLASSIFICATION OF SUBJECT MATTER
H01J9/227

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHEDMinimum documentation searched (classification system followed by classification symbols)
H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal; INSPEC; PAJ; WPI-Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2002/094486 A1 (PATEL HIMANSHU- MUKUNDRAY ET AL) 18 July 2002 (2002-07-18) paragraphs '0016! - '0018!; claims 1-12; figures 1-3 paragraphs '0022! - '0026! paragraphs '0032! - '0036!	1-16
A	US 6 531 252 B1 (LIANG KANGNING ET AL) 11 March 2003 (2003-03-11) columns 3-6; claims 1-12; figures 1,2,4,5	1-16



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

21 February 2006

Date of mailing of the international search report

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Wengeler, H

INTERNATIONAL SEARCH REPORT

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2002094486 A1	18-07-2002	CN 1486501 A	31-03-2004
		DE 60204115 D1	16-06-2005
		EP 1356493 A2	29-10-2003
		JP 2004519076 T	24-06-2004
		MX PA03006240 A	22-09-2003
		WO 02061788 A2	08-08-2002
US 6531252 B1	11-03-2003	CN 1495829 A	12-05-2004