METHOD OF MANUFACTURING COLOR PICTURE TUBE

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FIG. 1a

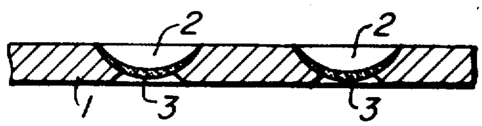


FIG. 1b

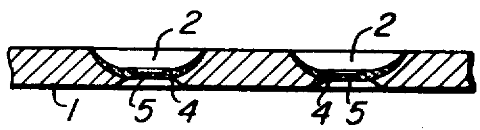


FIG. 2c

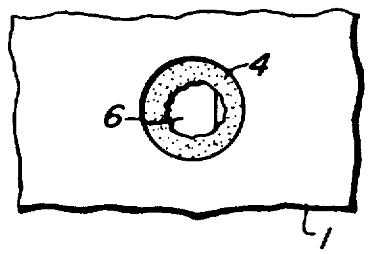


FIG. 2a

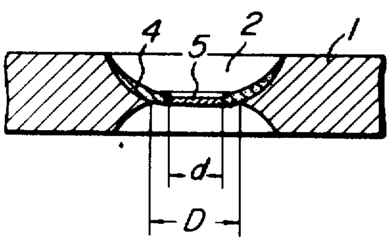


FIG. 3a

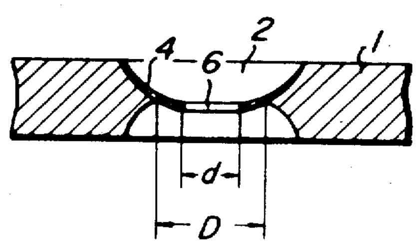


FIG. 2b

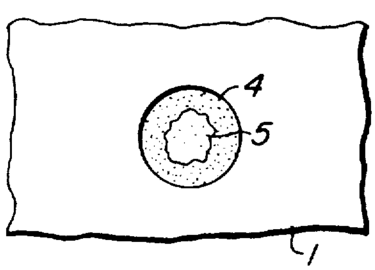
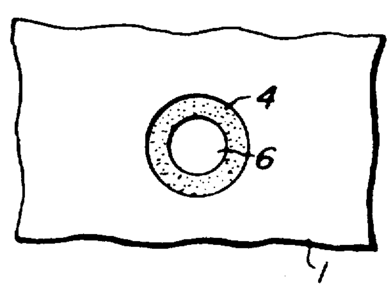


FIG. 3b



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Nov. 21, 1972 TADAO OKABE ET AL 3,703,374

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FIG. 4a

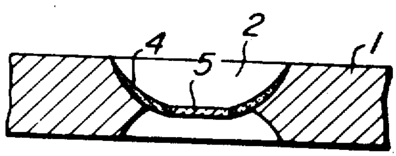


FIG. 4b

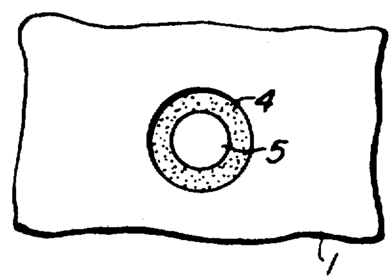


FIG. 5

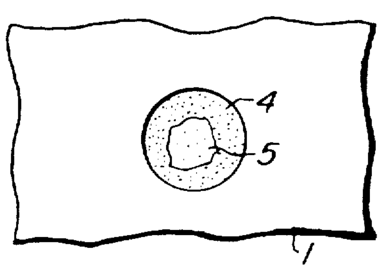
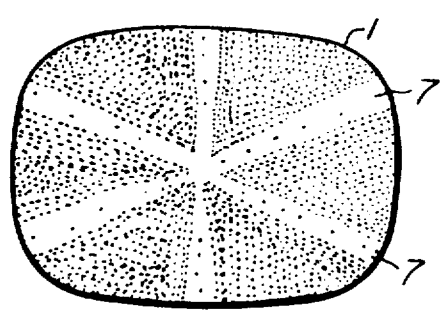


FIG. 6



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METHOD OF MANUFACTURING COLOR PICTURE TUBE

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Int. Cl. G03c *5/00*
U.S. Cl. 96—36.1 14 Claims

ABSTRACT OF THE DISCLOSURE

A method of manufacturing color picture tubes utilizing the phenomenon wherein, during hardening of a liquid consisting of a dispersant with fine particles of e.g. carbon mixed therein, the fine particles are forced out of the hardened phase into the unhardened liquid phase to concentrate the latter. In this way a hardened layer of the fine particles is formed in the peripheral portion of each beam-permeating aperture of a shadow mask thereby to temporarily make smaller said shadow mask beam-permeating aperture. This shadow mask is used to provide a phosphor screen formed by phosphors of the three primary colors. Thereafter, the shadow mask has said hardened layer in each beam-permeating aperture removed, and is assembled into the tube.

This invention relates to a method of manufacturing color picture tubes, and more particularly to a method of manufacturing a color picture tube comprising a plurality of three primary-color phosphor dots smaller than the beam-permeating apertures of a shadow mask.

A shadow-mask type color picture tube has been suggested which has a phosphor screen constructed in such a way that phosphor dots of the three primary colors of red (R), green (G) and Blue (B) are applied in a size smaller than that of the electron-beam permeating apertures of the shadow mask and that a non-luminous and light-absorbing material such as carbon is applied in the interstices of the respective adjacent phosphor dots.

It has heretofore been the practice to make the face plate of the tube opaque in order to prevent external light from being reflected on the face panel of the picture tube. Thus, a tube constructed in this manner may shut out the reflection of external light to some extent and may thus increase the transparency of the glass face plate by that amount. As a result, the picture screen may be made brighter. A further advantage of such construction is that since the probability of the respective three electron beams bombarding three-primary-color phosphor dots other than those aimed at becomes very small, the color purity of the picture is enhanced.

However, in view of the fact that the shadow mask is also used for exposure purposes in the step of applying phosphor dots to the screen and that for purposes of precision this mask should be the very same as that used in the finished picture tube, it is extremely difficult to apply phosphor dots smaller than the size of the shadow-mask beam-permeating apertures.

An object of this invention is to provide a method of manufacturing color picture tubes, which makes it possible to easily and inexpensively form phosphor dots smaller than the beam-permeating apertures of a shadow mask.

Another object of this invention is to provide a method of manufacturing color picture tubes, which makes it possible to uniformly form over the entire picture screen, phosphor dots smaller than the beam-permeating apertures of the shadow mask.

In accordance with a method of the invention for accomplishing the above objects, taking advantage of the phenomenon that during hardening of a liquid consisting of a dispersion medium with fine particles of e.g. carbon mixed therein the fine particles are forced out of the hardened phase into the unhardened liquid phase to concentrate the latter, a hardened layer of the fine particles is formed in the peripheral portion of each beam-permeating aperture of a shadow mask thereby to prepare an exposure shadow mask which apparently has light-transmitting apertures smaller than the shadow-mask beam-permeating apertures. Exposing the screen with this shadow mask, a phosphor screen is produced which is provided with phosphor dots smaller than the shadow-mask beam-permeating apertures. Thereafter, the hardened layer in each shadow-mask beam-permeating aperture is removed, and this same mask is assembled into the color picture tube to complete it.

This invention will now be described with reference to the accompanying drawings, in which:

FIGS. 1*a* and 1*b* are views showing an embodiment of the method of manufacturing a shadow mask for exposure as is used in accordance with the invention, respectively;

FIGS. 2*a* to 2*c* show enlarged views of a part of the exposure shadow mask in FIG. 1, respectively;

FIGS. 3*a* and 3*b* are views showing a further embodiment of the method of manufacturing an exposure shadow mask employed in the invention, respectively; and

FIGS. 4*a*, 4*b*, 5 and 6 are views for illustrating still another embodiment of the method of manufacturing an exposure shadow mask employed in the invention, respectively.

Referring to FIG. 1*a*, numeral **1** designates an enlarged section of a part of a shadow mask, while numeral **2** represents electron-beam permeating apertures. Shown at **3** are applied films, which are formed in such a way that a liquid consisting of a transparent dispersing agent, e.g. an aqeuous solution of polyvinyl alcohol (PVA) with a fine powder of a "usable material" (hereinafter described) such as titanium dioxide (for example, TiO_2) and carbon (C) incorporated thereinto, is applied on one or both sides of the shadow mask **1** by means of a brush, sprayer, etc. A method for the application includes the step of immersing the shadow mask into the liquid with the fine powder mixed therein, or applying the liquid onto the shadow mask. Thereafter, the shadow mask is rotated to thereby permit application in a uniform thickness. Under such conditions the shadow mask **1** is subjected to drying treatment. Then, as shown in FIG. 1*b*, a hardened layer **4** of fine powder (in this embodiment, a hardened layer of TiO_2 or C) is formed in the peripheral portion of each beam-permeating aperture **2** of the shadow mask **1**, whereas a hardened film **5** of the dispersing medium (in this embodiment, a transparent film of PVA) is formed in the central portion of each aperture. This is believed to be based upon the principle that during hardening of the dispersing agent with the fine powder mixed therein, particles undergoing Brownian movement are forced out of the hardened phase into the unhardened liquid phase to concentrate the latter. For example, in the step of drying the applied film **3**, it has been observed with a microscope that the TiO_2 powder in the applied film **3** is, at first, subjected to a violent Brownian movement when the PVA film begins hardening from the central portion of the aperture in which it is thin, then the white TiO_2 powder gradually moves from that portion towards the peripheral portion of the aperture. Thus, the transparent film **5** of PVA remains in the central portion, while the hardened layer **4** of the TiO_2 powder is formed in the peripheral portion. As a result, each path of light for use in exposure apparently becomes smaller than the aperture **2** of the shadow mask (the transparent portion **5** of the PVA film).

Fine powder exhibiting such phenomenon is not restricted to the powdery titanium oxides or carbon, but may be made of a variety of substances. Therefore, the general term, "fine powder of usable material" is herein given to these substances in powdery form.

The size of the hardened film **5** of the dispersing medium may be suitably varied dependent upon the concentration of the dispersant, the amount of the fine powder of the usable material to be incorporated, the drying speed of the applied liquid, etc. For example, the portion **5** of the hardened dispersant film may be made small with a short drying time, whereas large with a long drying time. Although the portion **5** of the hardened film is sometimes torn to become voided at a low concentration of the dispersing agent or at a high drying rate, the objects of the invention may be accomplished in similar manner to the case of untorn films **5**.

With the exposure mask provided as in the above description, the diameter *d* of the hardened dispersant film is smaller than the diameter D of the electron-beam permeating aperture of the shadow mask, as illustrated in FIG. 2*a*. Accordingly, when the exposure shadow mask is used to form the three-primary-color phosphor dots on the screen by the process of ultraviolet-ray exposure, they will be smaller in size than the beam-permeating apertures of the shadow mask. The process of depositing the three-primary-color phosphor dots by ultraviolet-ray exposure is quite identical to that of the prior art, so description thereof is omitted. The process of applying a non-luminous and light-absorptive material, such as carbon, in the interstices of the three-primary-color phosphor dots has been suggested in various forms. Furthermore, such a process of application is not directly related to the invention, so description thereof is also omitted.

After the three-primary-color phosphor dots smaller than the shadow-mask beam-permeable apertures are applied by ultraviolet-ray exposure as described above, the exposure shadow mask has the portions of the hardened layers of the fine powder as well as the hardened films of the dispersant removed therefrom by means of rinsing, for example. Then, the original shadow mask may be easily recovered. Accordingly, assemblage of this shadow mask in the picture tube with the three-primary-color phosphors deposited on the screen, makes it possible to easily manufacture a color picture tube having a screen on which three-primary-color phosphors smaller than the beam-permeating apertures of the shadow mask are applied.

If the exposure shadow mask prepared as set forth in the foregoing description has exactly circular hardened films of the dispersant formed in the beam-permeable apertures, the three-primary-color phosphor dots provided by use thereby will be in regular form. However, it is found from a detailed observation of the exposure shadow mask provided in accordance with the above method that not only the hardened dispersant film **5** formed by drying has an irregular, complicatedly curved configuration at its periphery, but also some particles of the fine powder of the usable material often remain in the film without being moved to the peripheral edge of the shadow-mask aperture. Furthermore, the dispersant film can be torn due to a tension exerted thereon in the step of drying the film for effecting hardening thereof, whereby an opening **6** of abnormal configuration as shown in FIG. 2*c* appears. In the case where, as described, the hardened dispersant film is not exactly circular, but is irregular in shape, or the fine powder remains in the hardened film of the dispersing medium, a uniform deposition of phosphor dots is not achieved in the step of forming the phosphor dots by means of this shadow mask and according to the ultraviolet-ray exposing process, which is very undesirable.

Referring now to FIGS. 3*a* and 3*b*, description will be

made of a further embodiment of the invention which eliminates the above-mentioned inconvenience.

When the hardened dispersant film **5** shown in FIGS. 2*a* and 2*b* is dissolved by any suitable solvent, this portion will become a voided portion **6** (shown in FIGS. 3*a* and 3*b*) with no film, and the dissolved matter is absorbed by the hardened film **4** containing a large amount of the fine powder. This is because the hardened film **4** is also dissolved and softened by the solvent.

Accordingly, the irregular bent which existed before the dissolving treatment is smoothed while the dissolved matter is absorbed by the hardened circumferential film **4**, with the result that a regular and circular opening **6** as shown in FIG. 3*b* is obtained. The size of the hardened film **4** containing the fine powder in a large amount is determined by the quantity of and the material for the fine powder incorporated in the dispersing agent, the viscosity of the dispersing agent, the rate of drying the applied film (3 in FIG. 1*a*), etc. Therefore, suitable selection of these factors controls the size of the voids or openings **6** to a desired value, thus making it possible to apply phosphor dots of a desired diameter to the screen.

This embodiment will now be further described by way of a more specific example.

A fine powder of carbon was employed as that of the usable material, and was mixed into an aqueous solution of PVA. The mixed liquid was uniformly applied to at least one side of a shadow mask by means of a brush, sprayer or the like, and was thereafter dried. In this way a transparent PVA film was formed in the central portion of each beam-permeating aperture of the shadow mask, whereas a hardened film containing a large amount of carbon powder was provided in the peripheral edge portion.

Subsequently, to the shadow mask subjected to the above treatment, a solution consisting of water and ethyl alcohol which were mixed in the ratio of 1:9, respectively, was uniformly sprayed by means of a sprayer. Then, the PVA film formed in the center of the beam-permeable aperture was dissolved, and was absorbed by the circumferential film containing a large amount of carbon, whereby regular and smooth circular openings **6** as shown in FIG. 3*b* could be provided.

If water is used alone as the solvent for dissolution of the PVA film, the dissolving speed of the PVA film will be excessive and thereby also uselessly dissolve the film of a high carbon content. On the other hand, if ethyl alcohol is employed alone, the PVA will be hard to dissolve and hence the objects of the invention will not be accomplished. A non-solvent such as ethyl alcohol has the function of suppressing swelling of the PVA film and thus retarding dissolution of the same. While this embodiment has attained the best result with the liquid mixture consisting of water and ethyl alcohol in the ratio of 1:9, respectively, the mixed ratio between water and alcohol may be suitably varied since the dissolution of the PVA film is influenced by the type as well as the amount of the fine powder, the drying speed, or the like film-forming conditions.

Furthermore, the solvent for use in dissolving the hardened dispersant film is not restricted to the liquid mixture consisting of water and ethyl alcohol, but it may be optionally selected from materials capable of dissolving the hardened dispersant film at an appropriate dissolving speed. Still further,the method of applying such solvents is not restricted to one using a brush, sprayer, etc. as in the above embodiment, but a uniform contact of a vapor of the solvent may attain a similar effect.

The hardened film formed in the peripheral portion of each beam-permeating aperture of the shadow mask as described in the foregoing embodiments, is required to shield light for use in exposure. Conversely, any hardened film having such a function may attain the objects of this invention. As a consequence, although the above embodiment has used such light-impermeable substances as titanium oxides and carbon for the usable fine-powder material along with PVA being transparent for the dispersing medium, a light-impermeable dispersant may be employed if the fine powder is made of a light-permeable substance such as glass. The light-impermeable dispersing agent may be obtained by, for example, coloring the transparent PVA with a black dyestuff. It is of course a matter of fact that in case where the hardened dispersant films remain in the shadow-mask apertures, no light-impermeable dispersing medium is employable. In addition, if both the fine powder and the dispersant are light-permeable, the hardened film of these constituents is formed in the peripheral portion of each shadow-mask aperture. Thereafter, a lacquer film, etc. impermeable to light is formed on the surface of the hardened film by means of a sprayer or the like.

Still another embodiment of the invention will now be described.

As already explained in connection with the foregoing embodiments, it is found from detailed observation of the manufactured shadow masks that not only the hardened dispersant film **5** formed by drying has an irregular, complicatedly bent configuration at its periphery, but also some particles of the fine powder often remain in the dispersant film without being moved to the peripheral edge portion. In addition to these inconviences, in some sorts of usable materials, the applied film bursts so as to become scattered and a hardened film is not formed at all (hereinbelow, this phenomenon is termed" burst"). Or, in case of applying the mixed liquid consisting of the fine powder and the dispersant to the shadow mask by rotational application, radial portions **7** in which the fine powder is not sufficiently applied (hereinafter, such portions are called "spokes"), appears on the shadow mask **1** as is shown in FIG. 6. Since the portions formed by the spokes have an insufficient amount of the fine powder, the concentration of the fine powder is low in these areas. As a result, the diameter d of the hardened dispersant film (represented in FIG. 2a) becomes larger than in portions where no spoke occurs, thereby lowering the reduction percentage of the beam-permeating aperture.

When a shadow mask with the film burst, spokes or the like thus produced is used to form phosphor dots according to the ultraviolet-ray exposure process, such inconveniences will be involved that the phosphor dots are not uniformly produced and that the configurations or the sizes of the respective phosphor dots are not identical.

This embodiment has been suggested in order to eliminate such inconveniences. It employs as the usable material a combination between a substance which has a relatively high cohesiveness and a substance which has a relatively high dispersibility, thereby to manufacture an exposure shadow mask having substantially uniform light-transmitting apertures. With this shadow mask, phosphor dots are deposited by the ultraviolet-ray exposure process.

Hereinbelow will be explained an example in which an aqueous solution of PVA was employed as the dispersing medium, activated carbon as the substance constituting the usable material which is relatively high in cohesiveness, and graphite as the substance which is relatively high in dispersibility.

Using a liquid consisting of an aqueous solution of PVA with the fine powder of graphite incorporated therein, a hardened film was formed in each beam-permeating aperture of a shadow mask. Then, since graphite has a small surface area and is easily dispersed, the fine graphite powder was rapidly concentrated into the peripheral edge portion of the beam-transmitting aperture **2** during drying. Thus, as shown in FIGS. 4a and 4b, a hardened film **4** which is high in its graphite content was formed, along with a hardened PVA film **5** having a good regular circular shape and being composed of a very small residual amount of graphite. Even when the above liquid mixture is applied onto a shadow mask according to the method of rotational application, graphite will be uniformly distributed without any local settling, due to its high dispersibility. In addition, graphite is well dispersed in the aqueous solution of PVA and hence it is not washed away by the flow of a solvent, so that there is no fear of causing any spokes.

However, when graphite is used alone as the fine powder, the film obtained will very easily tend to burst, resulting in formation of a number of beam-permeating apertures which are not reduced in size. Accordingly, it becomes difficult to produce phosphor dots each being smaller than the beam-permeating aperture.

On the other hand, if activated carbon is employed alone as the usable material, it will be once dispersed in the aqueous solution of PVA but will form a net-like structure to provide a flocculated state with a lapse of time, due to it being very large in surface area and very high in its adsorption power for various substances and ions. For this reason, the movement of the activated carbon towards the circumferential portion of the beam-permeating aperture in the step of drying the applied film to harden it, tends to become insufficient. As a result, as shown in FIG. 5, not only an excessive amount of activated carbon remains in the hardened PVA film **4** (of a high fine-power content), but also the configuration of the hardened PVA film **5** becomes irregular. In addition, in case of the rotational application, activated carbon is caused to locally flow in the liquid and is not uniformly applied to thereby easily bring about the spokes **7** as shown in FIG. 6, due to the tendency towards flocculation and towards formation of a net-like structure. However, the applied film formed by activated carbon hardly exhibits the film burst in contrast to the case of using graphite. This fact is very advantageous in practical use.

As described above, each process using graphite or activated carbon alone as the usable material has its own advantages as well as disadvantages. The disadvantges, however, may be eliminated when, for use, both the substances are mixed in an appropriate ratio and dispersed in the aqueous solution of PVA. It is therefore possible to provide a shadow mask for the ultraviolet-ray exposure process which has hardened PVA films each being reduced in the spokes and/or the burst to the utmost, having a good circular shape and containing an extremely small amount of residual light-impermeable substances.

A further explanation will be made of specific examples of the present invention.

Activated carbon and graphite both ranging in particle size from 1μ to 5μ were mixed in a variety of proportions and were added to an aqueous solution of PVA, thereby preparing a liquid which contained a mixture of 2% (by weight). Subsequently, this liquid was used to form hardened films on an ultraviolet-ray exposure shadow mask by the above process. Characteristics of the hardened films obtained were compared.

As a result, it was found as given in the following table that the hardened films formed on the ultraviolet-ray exposure shadow mask exhibit different characteristics dependent upon the mixed ratio between activated carbon and graphite. In addition, an appropriate selection of the value of the mixed ratio between the two substances removes the disadvantages of activated carbon and graphite as occurring when they are respectively used alone. Hardened films of good characteristics are then attainable. In this embodiment, the mixed ratio between activated carbon and graphite of approximately 1:20 may provide hardened PVA films which are good in configuration and which are small in any amounts of the residual carbon in said films, the burst and the spokes.

TABLE

Mixed ratio (activated carbon:graphite)	Amount of residual carbon in hardened PVA film	Configuration of hardened PVA film	Burst	Spokes
0:1	Very small	Good	Much	No.
1:30	do	do	Rather much.	Very little.
1:20	Small	do	Little	Little.
1:10	Rather large	Rather bad	do	Rather much.
1:0	Large	Bad	do	Much.

While this embodiment has been described as using activated carbon for the substance of a relatively high cohesiveness and graphite for the substance of a relatively high dispersibility, the usable material employed in the invention, of course, is not restricted to the combination of the two substances but the constituents may be suitably selected from substances which are relatively high in cohesive and dispersive properties, respectively.

Furthermore, also possible in this embodiment is the process wherein after the applied films are drying-treated to be hardened, only the hardened dispersant films **5** are dissolved and removed with a suitable solvent, e.g. the liquid mixture consisting of water and alcohol as in the foregoing embodiments. This enables, owing to the removal of the hardened dispersant films, a very efficient application of phosphor dots.

It is to be understood that those among the exposure masks provided by the above embodiments in which the hardened layers of the usable material are left in the peripheral portions of shadow-mask apertures but the hardened dispersant films are removed, may be utilized not only for the ultraviolet-ray exposure process but also for the well-known process of applying phosphor dots with an electron beam.

What is claimed is:

1. In that method of manufacturing a color phosphor screen made up of a plurality of phosphor dots of the three primary colors on a target surface for use in a cathode ray tube of the shadow mask type which comprises the steps of forming a shadow mask provided with apertures of the ultimate size and pattern of distribution required by the normal operating parameters of said cathode ray tube, forming in the annular peripheral portion of each of said apertures an opaque substance to temporarily reduce the size of the apertures, disposing a radiation sensitive phosphor layer on said target surface, exposing said phosphor layer to radiation through the mask formed by the shadow mask having the opaque substance in the peripheral portions of each aperture, removing the opaque portions from the shadow mask, and assembling said shadow mask into said cathode ray tube to serve as the electron-optical element of said tube; the improvement characterized in that said opaque substance is formed in the peripehal portion of each aperture in the shadow mask by the steps of applying onto at least one side of the shadow mask a slurry containing a film forming dispersing agent and a fine powder material so as to form a slurry film covering the whole of each aperture and drying said slurry film to form a hardened film within each aperture having opaque peripheral portions in each aperture.

2. A method according to claim **1**, wherein said hardened film is so formed as to have at least a part of a hardened dispersant film in a central portion thereof containing said dispersing agent but little of said fine powder material, said method further comprising, before the step of exposing said phosphor layer, the step of removing only said hardened dispersant film with a solution capable of dissolving said dispersant film.

3. A method according to claim **1**, wherein said dispersing agent is polyvinyl alcohol and said fine powder material is selected from the group consisting of carbon and titanium dioxide.

4. A method according to claim **2**, wherein said solution for dissolving said hardened dispersant film is a liquid mixture consisting of a first liquid capable of dissolving said hardened dispersant film and a second liquid incapable of dissolving said hardened dispersant film.

5. A method according to claim **4**, wherein said dispersing agent is polyvinyl alcohol, said first liquid is water, and said second liquid is alcohol.

6. A method according to claim **1**, wherein said fine powder material is powder formed of a light-impermeable substance.

7. A method according to claim **6**, wherein said light-impermeable substance is selected from the group consisting of carbon and titanium oxides.

8. A method according to claim **1**, wherein said fine powder material is a powdery mixture consisting of powder of a light-impermeable substance which has a high cohesiveness and that of a further light-impermeable substance which has a high dispersibility.

9. A method according to claim **8**, wherein said cohesive light-impermeable substance is activated carbon while said dispersive light-impermeable substance is graphite.

10. A method according to claim **9**, wherein the mixed ratio between activated carbon and graphite is substantially 1:20.

11. A method of preparing an exposure mask usable for forming a phosphor screen having phosphor dots of the three primary colors on the inner surface of the face panel of a color picture tube, said dots being formed by exposure of a phosphor layer disposed on the inner surface of the face panel to a selected radiation, said method comprising the steps of:

(a) applying onto at least one side of a shadow mask to be incorporated into said tube having beam-permeating apertures a slurry layer comprising at least a solution of a film forming dispersing agent and a fine powder material so as to cover therewith at least all of the beam-permeating apertures, said dispersing agent having the property of dispersing said fine powder in said slurry layer and of forcing said fine powder material out of a hardened phase into an unhardened phase of said slurry layer, and

(b) subjecting the thus treated shadow mask to a drying treatment to cause the slurry layer in each beam-permeating aperture to be hardened from the center to the peripheral portion thereof, so that said fine powder material is substantially exclusively contained in the peripheral portion of said slurry layer in the beam-permeating apertures, to thereby obtain a hardened peripheral portion of the slurry layer which extends inwardly from the periphery of the beam-permeating apertures of the shadow mask and contains the fine powder material in a concentrated state therein, said hardened peripheral portion being thus impermeable to the radiation usable for formation of said phosphor screen.

12. A method of preparing an exposure mask according to claim **11**, wherein said hardened slurry layer in each beam-permeating aperture is so formed as to have at least a part of a hardened dispersant film in a central portion thereof containing said dispersing agent but little of said fine powder material, said method further comprises, after the step of the drying treatment, the step of removing said hardened dispersant film by a solution capable of dissolving said dispersant film.

13. An exposure mask usable for forming a phosphor screen having phosphor dots of three primary colors formed by exposure of a phosphor layer disposed on the inner surface of the face panel of a color picture tube to a selected radiation, comprising:

a shadow mask having beam-permeating apertures which is to be incorporated as an electron-optical element into said tube; and

a hardened film formed entirely over each of said beam-permeating apertures, said hardened film having a center portion permeable with respect to a selected radiation which is usable for formation of said phosphor screen and an annular peripheral portion substantially impermeable to said radiation, said peripheral portion of said hardened film being extended inwardly from the periphery of the aperture of said shadow mask and serving as means for reducing the aperture size of said shadow mask with respect to said radiation.

14. An exposure mask according to claim 13, wherein said hardened film is of a hardened dispersing agent, said peripheral portion of said hardened film contains fine

powder material in a concentrated state, and said central portion of said hardened film contains little of said fine powder material, said dispersing agent having a property of dispersing said fine powder when contained in a solution thereof and having a high permeability with respect to said radiation, said fine powder material having a relatively low permeability to said radiation.

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U.S. Cl. X.R.

96—44

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,703,374 Dated November 21, 1972

Inventor(s) Tadao Okabe, et al

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

Column 1, priority data, which reads "Nov. 9, 1969"

should read: --Oct. 9, 1969--.

Signed and sealed this 12th day of June 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents