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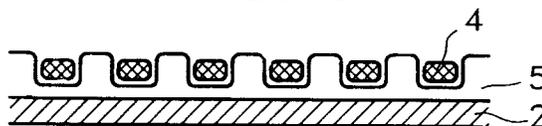
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54 **A coating composition and a cathode ray tube using the same.**

57 The present invention relates to a coating composition comprising alkyl silicate, a conductive material, distilled water and organic solvent, and a cathode ray tube using the same. The coating composition includes chloride salt, nitrate salt and/or acetic acid salt.

FIG. 8



EP 0 574 112 A1

The present invention relates to a coating composition and a cathode ray tube using the same, and particularly to a coating composition comprising a novel metal salt, and to cathode ray tube using the same, having good non-glare characteristics, manufactured by spin coating a coating composition.

Generally, since image display devices, such as cathode ray tubes (CRT) and liquid crystal devices (LCD), etc., employ smooth glass as panels for reproducing the image, letters and figures in the reproduced image are unclear due to external light reflecting from the panel's surface, which results in difficult image distinction. To solve the problem, a method is used which prevents the reflection by manufacturing a concavo-convex pattern on the viewing surface of the display devices such as CRTs, to induce a diffused reflection of the external light incident upon the outer surface of the panel.

Commercially utilized methods for manufacturing the concavo-convex pattern employ etching with hydrofluoric acid, grinding by sand blasting, etc. However, in the etching method, hydrofluoric acid causes contamination and when defective goods result, recovery is difficult. In the grinding method, the produced goods are poor in quality and have a high percentage of defectiveness due to the residue left after grinding. Therefore, recently the application of the above methods in non-glare treatment are significantly reduced.

Therefore, to obviate the problems associated with the above-mentioned methods, a method has been recently suggested which provides for the manufacture of the concavo-convex pattern through coating a soluble silicate on the surface of the panel and adhering the silicon dioxide (SiO_2) layer onto the surface by heating the coating layer.

Japanese Patent Laid-open Publication No. sho 44-11150 discloses a method for manufacturing a non-glare coating layer through coating "water glass" (potassium silicate) on the outer surface of the panel. However, in this method, a white, opaque coating layer appears and results in a great transmittance drop which prohibits practical use.

Further, Japanese Utility Model Laid-open Publication No. sho 50-26277 discloses a method for manufacturing a coating having SiO_2 particles by spray coating hydrolyzed silicon tetrachloride (SiCl_4) on the surface of a panel. However, since the coating solution comes out as a strong acid, this corrodes the apparatus. This method also is not practically applicable.

In order to overcome the above problems, Japanese Patent Laid-open Publication No. sho 61-118931 and sho 61-29051 suggest methods for manufacturing non-glare coating layers manufactured by a method comprising the steps of spray coating hydrolyzed solution of alkyl silicate ($\text{Si}(\text{OR})$ -

4) on the surface of the panel and then hardening the solution at a temperature above 80°C to produce a SiO_2 concavo-convex pattern. This method is practical and is now being applied in actual use. However, the reflectance (gloss value) of the external light ranges from 40 to 70%. Due to certain characteristics of the spray coating, reflectances above 70% are difficult to reproduce. Moreover the coating layer is very weak.

In U.S. Pat. No. 4,563,612, a method for coating a composition prepared by mixing alkyl silicate and a powder of metal compounds on the surface of the panel is disclosed. This method also has the above-desired problem with reflectance of external light.

Meanwhile, Figures 1A and 2A illustrate a spray coating method and a spin coating method (called a clear coating), respectively, for coating a composition onto a cathode ray tube. Figure 1B is an enlarged view of the coating layer obtained by the method of Figure 1A, and Figure 2B is an enlarged view of a coating layer obtained by the method of Figure 2A. Here, since the concavo-convex pattern (3) on the panel (2) as manufactured via spray coating is rougher than that manufactured by the spin coating method, the diffused reflection effect is better in the coating layer according to the spray coating method. However, when applying a coating composition by a spray method, the thickness of the coating layer needs to be adjusted, and due to characteristics of the spray coating method, a compact pattern cannot be manufactured. Thus, a coating layer having high reflectance of the external light is very difficult to obtain. While on the other, the coating layer by a spin coating method has a constant thickness and a high reflectance of external light.

Accordingly, in order to adjust the reflectance of the external light within the 40-90% range, equipment for both spray coating and spin coating are needed. This complicates the manufacturing process and increased tooling costs.

Considering the above-mentioned disadvantages, the object of the present invention is to provide a coating composition which gives a coating layer having a wide range of reflectance of the external light and enhances the strength of the layer though manufacturing the layer through spin coating.

Another object of the present invention is to provide a cathode ray tube having good antistatic and non-glare characteristics, manufactured by employing the above coating composition.

According to one aspect of the present invention, there is provided a coating composition comprising alkyl silicate, a conductive material, distilled water and organic solvent, characterized in that the coating composition further comprises at least one

metal salt selected from the group consisting of chloride salt, nitrate salt and acetic acid salt, and the amount of the metal salt is 0.01 to 2 weight percent based on the composition.

According to another aspect of the present invention, there is provided a cathode ray tube having an antistatic and non-glare coating layer on the outer surface of a panel, comprising silicon dioxide and a conductive material. The coating layer further comprises at least one metal salt selected from a chloride salt, a nitrate salt and an acetic acid salt, preferably using a spin coating method to coat a coating composition on the surface of the panel. The composition is then dried.

A preferred metal salt is at least one selected from potassium chloride (KCl), sodium chloride (NaCl), ammonium chloride (NH₄Cl), potassium nitrate (KNO₃), sodium nitrate (NaNO₃), ammonium nitrate (NH₄NO₃), potassium acetate (CH₃COOK), sodium acetate (CH₃COONa) and ammonium acetate (CH₃COONH₄).

Also, as the conductive material generally added to impart conductivity to the coating layer, tin (Sn) compound, antimony (Sb) compound, platinum (Pt) compound, gold (Au) compound, indium (In) compound or zirconium (Zr) compound can be employed.

Embodiments of the present invention will now be described by way of example, with reference to the accompanying drawings, in which:

Figure 1A and 1B illustrate a spray coating method and an enlarged view of the coating layer obtained by this method,

Figure 2A and 2B illustrate a spin coating method and an enlarged view of the coating layer obtained by this method,

Figure 3 is an enlarged photograph (400 times) of a coating layer manufactured by the coating method of Figure 1A, using the coating composition obtained through example 1,

Figure 4 to 6 are enlarged photographs (400 times) of coating layers manufactured by the coating method of Figure 2A, using the coating compositions obtained through examples 1, 2 and 3,

Figure 7 is an enlarged photograph (400 times) of a coating layer manufactured by the coating method of Figure 2, while blowing dry air on the surface of the panel, and using the coating composition obtained through example 1,

Figure 8 is a cross-sectional view of a coating layer as illustrated in any of Figures 3 to 6

Figure 9 is a cross-sectional view of the coating layer illustrated in Figure 7,

Figure 10 is an enlarged view of a coating layer as illustrated in any of Figures 4 to 6; and

Figure 11 is a graph showing the reflectance of the external light according to the amount of the

metal salt added to the coating composition of the present invention.

First, the metal salts added to the coating composition of the present invention exist in an aqueous solution state. After coating the composition on the outer surface of a panel, the composition is heated and dried. As the water and organic solvent vaporize from the surface, the metal salt dissolved in the solution precipitates as a crystal. The separation of the metal salt from the continuous silicate structure produces the concavo-convex pattern. The coating composition of the present invention gives a concavo-convex pattern which provides a good non-glare effect in the coating layer even when using the spin coating method.

The amount added of the metal salt ranges from 0.01 to 2 weight percent based on the total amount of the composition. If the amount added of the metal salt is less than 0.01 weight percent, the reflectance of the external light of the manufactured cathode ray tube is too high, and if the amount added of the metal salt is more than 2 weight percent, the reflectance of the external light is too low. The preferred amount added of the metal salt is about 1 weight percent.

A coating composition according to the present invention is manufactured as follows. First, tetraethyl orthosilicate, organic solvent, conductive material and distilled water are mixed and the mixture is matured in an approximately 60 °C water bath for about 6 days. Metal salt is dissolved in distilled water, this solution is added to the above matured mixture and the thus-obtained mixture is stirred for about 2 hours. The mixture is spin coated on the outer surface of the panel at the speed of 50 to 100 rpm, for 5 to 20 seconds. Drying the coated composition at the temperature ranging from 80 to 200 °C for 0.5 to 2 hours gives a coating layer manufactured by the use of a coating composition accordingly to the present invention.

Preferred embodiments of the present invention will be described in detail below.

EXAMPLE 1

tetraethyl orthosilicate (TEOS) --- 3 wt%
methyl alcohol --- 83 wt%
distilled water --- 10 wt%
tin chloride (SnCl₄·nH₂O) --- 3 wt%
potassium chloride --- 1 wt%

All of the above compounds except the potassium chloride are mixed together and matured in a 60 °C water bath for 72 hours. A 10 weight/vol% aqueous potassium chloride solution is added to the matured mixture and stirred for 2 hours to give a coating composition according to the present invention. The composition is spin coated on the surface of a panel at a speed of 150 rpm for 2

minutes. Then, the coated panel is baked at 170 °C for 0.5 hours.

EXAMPLE 2

tetraethyl orthosilicate (TEOS) --- 3 wt%
 methyl alcohol --- 83 wt%
 distilled water --- 10 wt%
 tin chloride ($\text{SnCl}_4 \cdot n\text{H}_2\text{O}$) --- 3 wt%
 Sodium nitrate --- 1 wt%

A coating composition according to the present invention is obtained here by the same procedure as example 1, except that sodium nitrate is employed in lieu of the potassium chloride. Coating this composition on the outer surface of a panel and drying by heating gives a non-glare cathode ray tube according to the present invention.

EXAMPLE 3

tetraethyl orthosilicate (TEOS) --- 3 wt%
 methyl alcohol --- 83 wt%
 distilled water --- 10 wt%
 tin chloride ($\text{SnCl}_4 \cdot n\text{H}_2\text{O}$) --- 3 wt%
 Ammonium acetate --- 1 wt%

A coating composition according to the present invention is obtained here by the same procedure as example 1, except that ammonium acetate is employed in lieu of the potassium chloride. Coating this composition on the outer surface of a panel and drying by heating gives a non-glare cathode ray tube according to the present invention.

Figure 3 is an enlarged photograph (400 times) of the coating layer manufactured by the coating method of Figure 1A, using the coating composition obtained through example 1. Figures 4 to 6 are enlarged photographs (400 times) of the coating layers manufactured by the coating method of Figure 2A, using the coating compositions obtained through examples 1, 2 and 3. As confirmed by the photographs, the coating layer obtained using the spin coating method also has the deep and clear pattern as obtained via the spray coating method.

After coating a coating composition according to the present invention onto the surface of the panel, acceleration of the drying speed by blowing hot air or dry air onto the panel, or by rapid revolving the panel, gives a coating layer in which the metal salt is not yet separated from the silicate layer and is precipitated in the silicate layer.

Figure 7 is an enlarged photograph (400 times) of the coating layer manufactured by the coating method of Figure 2, while blowing dry air on the surface of the panel, and using the coating composition obtained through example 1. This photograph confirms that the concavo-convex shape is not deep.

Figure 8 is a cross-sectional view of coating layers such as those illustrated in Figures 3 to 6, and Figure 9 is a cross-sectional view of a coating layer such as that illustrated in Figure 7. The metal salt (4) in the coating layer is manufactured by the common spray or spin coating method, and is precipitated on the upper surface of the silicate layer (5). However, the metal salt (4) in the coating layer manufactured by blowing dry air during coating, is not completely separated from the silicate layer (5) and gives a coating layer on the panel (2) having a shallow concavo-convex shape.

Figure 10 is an enlarged view of coating layers, such as those illustrated in Figures 4 to 6, which shows the reaction principal of the coating composition on the panel. The metal salts exposed to the air in the silicate layer absorb a small amount of unvaporized moisture and solvent remaining after drying and baking process from the network-type silicate layer, and vaporize them into the air to provide a solid coating layer. In Figure 10, the arrows indicate the proceeding direction of the solvent (6) and the vaporized solvent (6').

Figure 11 is a graph showing the reflectance of the external light according to the amount of the metal salt added in the coating composition of the present invention. For this graph, the coating layers were manufactured through the procedure in example 1 while changing the added amount of the potassium chloride (based on the total weight of the coating composition), and the reflectance of the external light for each coating layer was detected and plotted. The reflectance of the external light is the percentage of the reflected light from a glass regarded as 100% when the incidence angle of the external light is 60°, and is detected by means of a GM-060 detector manufactured by Minolta Co. In the graph, as the added amount of the metal salt increases, the reflectance decreases greatly. The reflectance of the cathode ray tube employing a coating composition according to the present invention is easily adjustable by adjusting the amount of the metal salt added in the coating composition.

From the graph, it can be seen that the reflectance of the external light varies from 40% to 90% in accordance with the added amount of the metal salt which is given to be in the range of from 0.01 to 2 weight percent. The amount of additional metal salt is limited to this range so that the reflectance of the external light of the manufactured cathode ray tube lies between 40% to 90%. Here, if the reflectance is lower than 40%, the resolution of the cathode ray tube deteriorates and the quality of the reproduce image also deteriorates due to the sparkling and if the reflectance is higher than 90%, the panel begins to bear similar effects as the common glass. A preferred value of the reflectance

ranges from 50% to 60%. Also if the added amount of the metal salt is 1 weight percent as in the example illustrated, the reflectance of the cathode ray tube is about 55%. That is to say, the reflectance of the external light can be controlled by adjusting the amount of added metal salt.

The present invention provides a coating composition which enables easy adjustment of the reflectance of the external light through varying the amount of the metal salt added, and forms a coating layer having a wide range of reflectance through a spin coating without special processing or separate equipment for spray coating. When the added metal salt is dried and precipitated, the metal salt absorbs a small amount of solvent contained in the network of silicate layer and evaporates the solvent into the air to give a cathode ray tube having a solid coating layer. Moreover, practically speaking, the equipment (and thus, the equipment cost) is greatly reduced.

Claims

1. A coating composition comprising an alkyl silicate, a conductive material, distilled water and organic solvent,

characterized in that said coating composition further comprises at least one metal salt selected from a chloride salt, a nitrate salt and an acetic acid salt, and the amount of said metal salt is 0.01 to 2 weight percent based on said composition.

2. A coating composition as claimed in claim 1, wherein said metal salt is at least one selected from potassium chloride (KCl), sodium chloride (NaCl), ammonium chloride (NH₄Cl), potassium nitrate (KNO₃), sodium nitrate (NaNO₃), ammonium nitrate (NH₄NO₃), potassium acetate (CH₃COOK), sodium acetate (CH₃COONa) and ammonium acetate (CH₃COONH₄).

3. A cathode ray tube comprising an antistatic and non-glare coating layer on the outer surface of a panel (2), said layer comprising silicon dioxide and a conductive material,

characterized in that said coating layer further comprises at least one metal salt (4) selected from a chloride salt, a nitrate salt and an acetic acid salt.

4. A cathode ray tube as claimed in claim 3, wherein said metal salt (4) is at least one selected from potassium chloride (KCl), sodium chloride (NaCl), ammonium chloride (NH₄Cl) potassium nitrate (KNO₃), sodium nitrate (NaNO₃), ammonium nitrate (NH₄NO₃), potassium acetate (CH₃COOK), sodium ace-

tate (CH₃COONa) and ammonium acetate (CH₃COONH₄).

5. A cathode ray tube as claimed in claim 3, wherein the reflectance of said coating layer is in the range of 40 to 100%.

6. A cathode ray tube having an antistatic and non-glare coating layer on the outer surface of a panel (2) said layer comprising silicon dioxide and a conductive material,

characterized in that said coating layer comprises metal salt (4) by manufacturing said layer through spin coating a coating composition at least one metal salt (4) selected from a chloride salt, a nitrate salt and an acetate, and the amount of said metal salt (4) is 0.01 to 2 weight percent based on said composition on the outer surface of a panel (2), and then drying said composition.

7. A method of providing an antistatic and non-glare layer on the outer surface of a panel which comprises spin coating a coating composition comprising silicon dioxide, a conductive material and at least one metal salt selected from a chloride, a nitrate and an acetate in an amount of 0.01 to 2 weight percent based on said composition, and drying said composition.

8. A method according to claim 7 wherein the panel is part of a cathode ray tube.

FIG. 1A

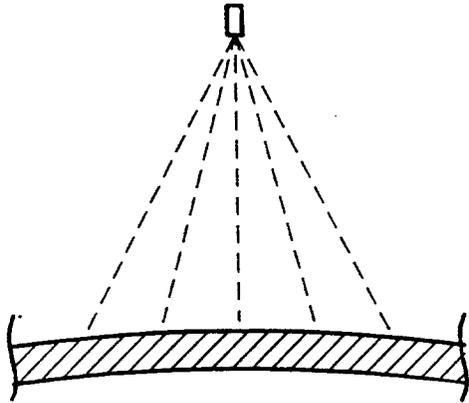


FIG. 1B

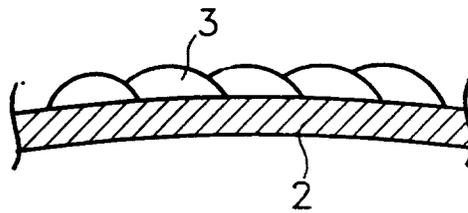


FIG. 2A

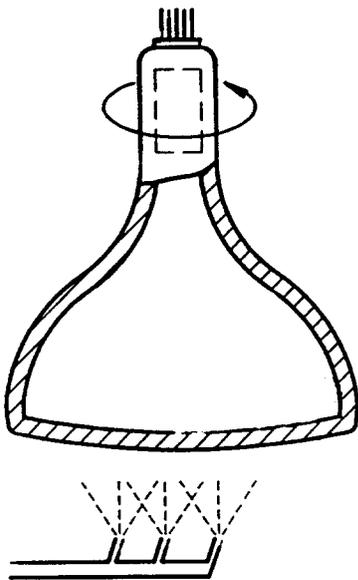


FIG. 2B

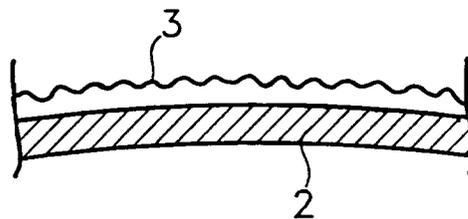


FIG. 3



FIG. 4

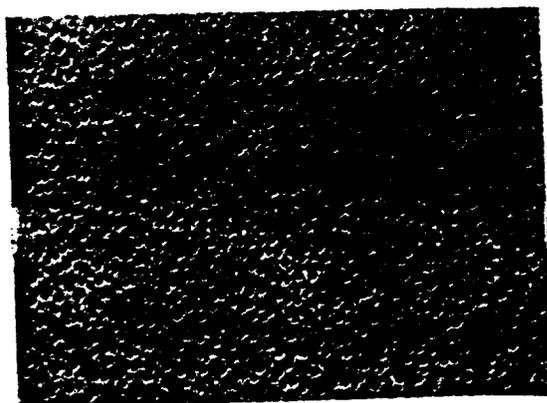


FIG. 5



FIG. 6



FIG. 7

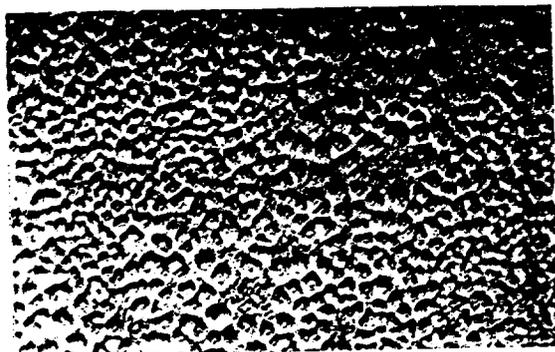


FIG. 8

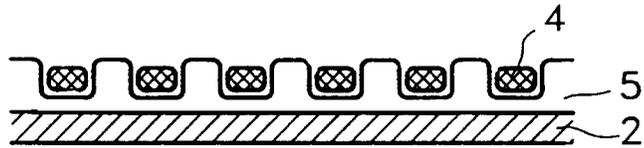


FIG. 9

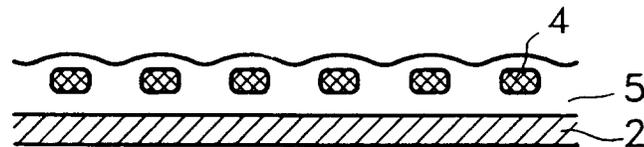


FIG. 10

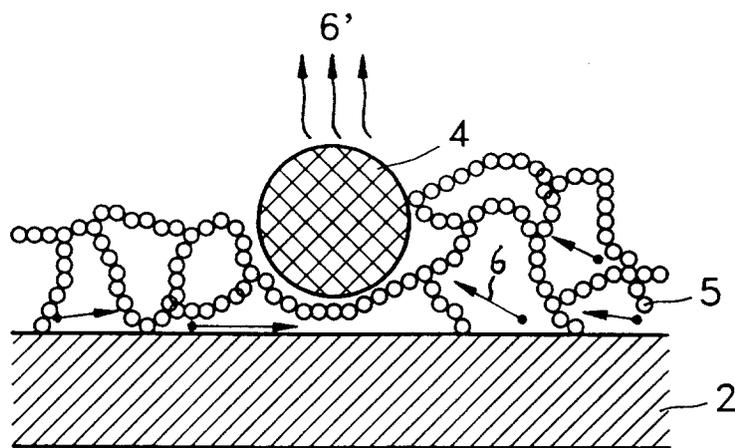
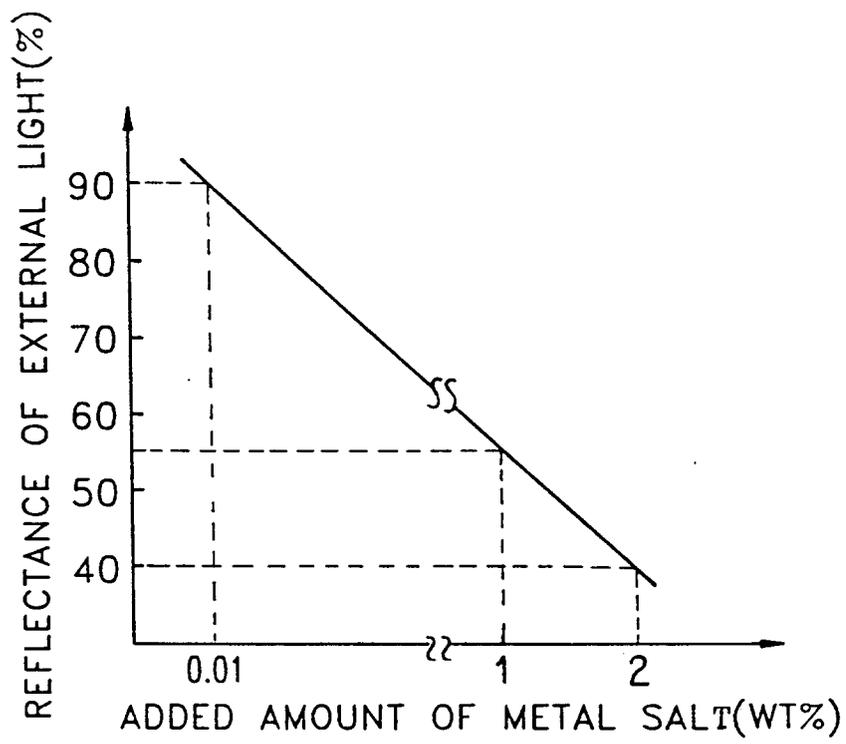


FIG. 11





European Patent
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EUROPEAN SEARCH REPORT

Application Number

EP 93 30 2158

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int. Cl.5) |
| X | EP-A-0 288 982 (TOSHIBA) * the whole document * --- | 1-8 | H01J29/89 H01J29/86 |
| A | DE-A-3 918 744 (MITSUBISHI) * claims 1-8 * --- | 1-8 | |
| A | GB-A-1 136 977 (ACHESON INDUSTRIES) * page 1, right column, line 45 - page 5, line 51 * --- | 1-8 | |
| A | EP-A-0 450 134 (SAMSUNG) * column 2, line 51 - column 4, line 20 * ----- | 1-8 | |
| | | | TECHNICAL FIELDS SEARCHED (Int. Cl.5) |
| | | | H01J |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 02 SEPTEMBER 1993 | Examiner DAMAN M.A. |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p> | | | |

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