

## PATENT SPECIFICATION

(11) 1 355 148

1 355 148

- (21) Application No. 45102/72 (22) Filed 29 Sept. 1972  
 (31) Convention Application No. 7 113 565  
 (32) Filed 2 Oct. 1971 in  
 (33) Netherlands (NL)  
 (44) Complete Specification published 30 May 1974  
 (51) International Classification H01J 9/20  
 (52) Index at acceptance  
 H1D 4A4 4A7 4F2B 4F2E 4F2Y 4H1 4HY 4K4 4K7Y



## (54) LUMINESCENT SCREEN /

(71) We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, of Abacus House, 33 Gutter Lane, London E.C.2., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The invention relates to a method of metallizing a luminescent screen having a luminescent layer, comprising the provision of a film that can be removed by volatilization, the metallization of said film and the firing of said film. The invention furthermore relates to a cathode-ray tube having a luminescent screen metallized by such a method.

A luminescent screen having a luminescent layer is used, for example, in a television picture display tube. The luminescent screen in such a tube is made using a glass face-plate. On this face-plate is provided on the inside of the tube a luminescent layer which is scanned by one or more electron beams. The luminescent material emits light under the influence of the electron beam(s) and in this manner picture display is obtained in a universally known manner. The picture is monochromatic when a homogeneous layer of one type of luminescent material is provided on the face-plate. The picture is coloured when a luminescent layer is provided which consists of discrete regions of, for example, luminescent materials luminescing in three primary colours by means of which a naturally coloured picture can be displayed which is built up from three primary colours. In television picture display tubes and also in other types of cathode-ray tubes, the luminescent layer is generally provided with a metallization. This metallization consists of a very thin metal layer which is permeable to the electrons of the electron beam(s) and which reflects light. Said metallization has several func-

tions, the most important of which are the supply of a given electric voltage to the luminescent layer and the reflection of light irradiated by the luminescent layer in directions away from the viewer, as a result of which the light intensity of the observed picture is increased. The latter function requires a smooth surface of the metallization on the side of the viewer.

A method of providing such a metallization with a smooth surface is known from the United States patent specification no. 2,751,515. In this method, a film that can be removed by volatilization is first provided on the luminescent layer so as to fill most irregularities of the luminescent screen. The metallization is then vapour-deposited on the smooth surface of said film. The film is then fired which means that a thermal treatment is used by which the film volatilizes and escapes in a gaseous form through small apertures in the metallization. Said small apertures have been formed during the vapour-deposition of the metallization as a result of irregularities of the luminescent layer which have not been filled by the film. The film should therefore be provided with a thickness which is sufficient to obtain a smooth metallization but is not so large that an entirely closed non-porous metallization is obtained since in that case the film could not escape during the firing as a result of which blisters are formed in the metallization. However, it cannot be prevented that a part of the film is provided on parts of the screen which are not covered with a luminescent layer and that said parts of the film are also metallized. Since said parts of the film are very smooth owing to the lack of an underlying luminescent layer, a non-porous metallization is formed in those places. During firing, blisters and chips are formed in those places, which presents the danger of loose particles occurring in the tube and moreover an ugly appearance of the tube because said blisters and chips are

[Price 25p]

visible for the viewer. This latter is the case in particular in the modern picture tubes in which the edge of the picture screen projects from the anti-implosion means. For that purpose the above-mentioned United States patent specification indicates as an improvement the provision of a layer of porous material on the relevant parts of the picture screen. This porous material may consist in particular of the same material as the luminescent layer. Apart from the fact that this means a complication in the manufacture of the tube, said improvement is substantially impossible in colour television display tubes since in these tubes the luminescent material is provided by means of a photochemical method in which luminescent material is provided only in those places where it is necessary for displaying the picture. It is therefore usual in practice to polish the film away manually in those places where it projects beyond the luminescent layer prior to metallizing the skin. In connection with the complicated shape of the edge of the luminescent layer, said cleaning away is difficult to mechanize since said edge has to be followed exactly and the luminescent layer may not be damaged. Removing the excess parts of the film by washing with a suitable solvent, as is proposed in United Kingdom patent specification 1,158,487 has the same drawbacks.

The present invention provides a method of metallizing a luminescent screen having a luminescent layer, comprising the steps of applying a film which can be removed by volatilization to the screen over the luminescent layer, roughening parts of the film which extend beyond the luminescent layer by blasting the film with a fine-granular material, then metallizing the film and subsequently heating the metallized luminescent screen so as to volatilize the film. By roughening the film, a slightly porous metallisation is obtained as a result of which no blisters are formed upon firing. Blasting is not critical since the edge of the luminescent layer need not be followed accurately. It has been found that if parts of the film which do cover the luminescent layer are also blasted, the metallization at that area at most becomes slightly more porous but not less suitable for reflecting light.

Residues, if any, of the fine-granular material which remain behind can be blown away. By a suitable choice of the fine-granular material, said residues can also be removed by means of a thermal treatment.

A cathode-ray tube may comprise a glass face-plate having a metallized luminescent layer, metallization on an edge of the face-plate being present directly on the glass in the tube, the film on which the metal was

deposited having been removed by volatilization.

The invention will be described in greater detail with reference to the accompanying drawing which shows a face-plate of a colour television display tube during the manufacture.

The face-plate 1 comprises an upright edge 2. The surface 3 of the edge 2 is accurately flat and in a later stage of the manufacture it is adhered to the cone of the tube. The face-plate 1 supports a luminescent layer 4 which consists of triplets of phosphor dots which luminesce in three primary colours under the influence of the electron beams in the operating tube. The luminescent layer 4 is provided by means of a known photochemical method. A film 5 is provided across the luminescent layer by spraying with an organic lacquer. The film 5 also covers the upright edge 2 in the places denoted by 6 and 7. The metallization is afterwards vapour-deposited on the film 5 and in the stage of the manufacture shown in the drawing it is not yet present. In order to prevent the metallization from forming a homogeneous non-porous layer at 6 and 7, as a result of which the film upon subsequent firing would produce blisters and chips in the metallization, the upright edge 2 is blasted on the inside with a fine-granular material. For that purpose the nozzle 8 is used. The face plate is for that purpose arranged so as to be rotatable about an axis normal to the centre of the face-plate. The distance from the orifice of the nozzle 8 to the inside of the edge 2 is maintained approximately constant. However, this distance is not critical because the circumference 9 of the luminescent layer 4 need not be followed accurately. Many kinds of material may be used for the fine-granular material. Good results have been obtained *inter alia* with powdered ammonium bicarbonate, as well as with ammonium carbonate, a methacrylate resin and polyvinyl alcohol.

#### WHAT WE CLAIM IS:—

1. A method of metallizing a luminescent screen having a luminescent layer, comprising the steps of applying a film which can be removed by volatilization to the screen over the luminescent layer, roughening parts of the film which extend beyond the luminescent layer by blasting the film with a fine-granular material, then metallizing the film and subsequently heating the metallized luminescent screen so as to volatilize the film.

2. A method as claimed in Claim 1, wherein residues of fine-granular material are removed by means of a thermal treatment.

3. A method of metallizing a luminescent screen, substantially as herein described

visible for the viewer. This latter is the case in particular in the modern picture tubes in which the edge of the picture screen projects from the anti-implosion means. For that purpose the above-mentioned United States patent specification indicates as an improvement the provision of a layer of porous material on the relevant parts of the picture screen. This porous material may consist in particular of the same material as the luminescent layer. Apart from the fact that this means a complication in the manufacture of the tube, said improvement is substantially impossible in colour television display tubes since in these tubes the luminescent material is provided by means of a photochemical method in which luminescent material is provided only in those places where it is necessary for displaying the picture. It is therefore usual in practice to polish the film away manually in those places where it projects beyond the luminescent layer prior to metallizing the skin. In connection with the complicated shape of the edge of the luminescent layer, said cleaning away is difficult to mechanize since said edge has to be followed exactly and the luminescent layer may not be damaged. Removing the excess parts of the film by washing with a suitable solvent, as is proposed in United Kingdom patent specification 1,158,487 has the same drawbacks.

The present invention provides a method of metallizing a luminescent screen having a luminescent layer, comprising the steps of applying a film which can be removed by volatilization to the screen over the luminescent layer, roughening parts of the film which extend beyond the luminescent layer by blasting the film with a fine-granular material, then metallizing the film and subsequently heating the metallized luminescent screen so as to volatilize the film. By roughening the film, a slightly porous metallisation is obtained as a result of which no blisters are formed upon firing. Blasting is not critical since the edge of the luminescent layer need not be followed accurately. It has been found that if parts of the film which do cover the luminescent layer are also blasted, the metallization at that area at most becomes slightly more porous but not less suitable for reflecting light.

Residues, if any, of the fine-granular material which remain behind can be blown away. By a suitable choice of the fine-granular material, said residues can also be removed by means of a thermal treatment.

A cathode-ray tube may comprise a glass face-plate having a metallized luminescent layer, metallization on an edge of the face-plate being present directly on the glass in the tube, the film on which the metal was

deposited having been removed by volatilization.

The invention will be described in greater detail with reference to the accompanying drawing which shows a face-plate of a colour television display tube during the manufacture.

The face-plate 1 comprises an upright edge 2. The surface 3 of the edge 2 is accurately flat and in a later stage of the manufacture it is adhered to the cone of the tube. The face-plate 1 supports a luminescent layer 4 which consists of triplets of phosphor dots which luminesce in three primary colours under the influence of the electron beams in the operating tube. The luminescent layer 4 is provided by means of a known photochemical method. A film 5 is provided across the luminescent layer by spraying with an organic lacquer. The film 5 also covers the upright edge 2 in the places denoted by 6 and 7. The metallization is afterwards vapour-deposited on the film 5 and in the stage of the manufacture shown in the drawing it is not yet present. In order to prevent the metallization from forming a homogeneous non-porous layer at 6 and 7, as a result of which the film upon subsequent firing would produce blisters and chips in the metallization, the upright edge 2 is blasted on the inside with a fine-granular material. For that purpose the nozzle 8 is used. The face plate is for that purpose arranged so as to be rotatable about an axis normal to the centre of the face-plate. The distance from the orifice of the nozzle 8 to the inside of the edge 2 is maintained approximately constant. However, this distance is not critical because the circumference 9 of the luminescent layer 4 need not be followed accurately. Many kinds of material may be used for the fine-granular material. Good results have been obtained *inter alia* with powdered ammonium bicarbonate, as well as with ammonium carbonate, a methacrylate resin and polyvinyl alcohol.

#### WHAT WE CLAIM IS:—

1. A method of metallizing a luminescent screen having a luminescent layer, comprising the steps of applying a film which can be removed by volatilization to the screen over the luminescent layer, roughening parts of the film which extend beyond the luminescent layer by blasting the film with a fine-granular material, then metallizing the film and subsequently heating the metallized luminescent screen so as to volatilize the film.

2. A method as claimed in Claim 1, wherein residues of fine-granular material are removed by means of a thermal treatment.

3. A method of metallizing a luminescent screen, substantially as herein described



with reference to the accompanying drawing.

4. A luminescent screen metallized by the method as claimed in any of Claims 1 to 3.

5. A cathode-ray tube having a luminescent screen as claimed in Claim 4.

C. A. CLARK,  
Chartered Patent Agent,  
Century House,  
Shaftesbury Avenue,  
London, WC2,  
Agent for the Applicants.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1974.  
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from  
which copies may be obtained.



\* C L M S \*