

PATENT SPECIFICATION

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(54) PICTURE DISPLAY TUBE

(71) We, N. V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability Company, organised and established under the laws of the Kingdom of the Netherlands, of Emmasingel 29, Eindhoven, the Netherlands, 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 picture display tube.

A picture display tube is disclosed in our British Patent Specification No. 1,226,728. The tube comprises an envelope including a display screen, an electrode system to generate at least one electron beam directed onto the display screen, an electrically conductive layer which extends at least between the display screen and the electrode system over the inner surface of the envelope and of which at least the part situated near the electrode system consists of an electrical resistive layer, a high voltage contact which is provided in the envelope between the display screen and the electrode system and which is electrically connected to the conductive layer, and a getter which is secured to a connection member projecting internally from the tube wall by means of a resilient metal strip.

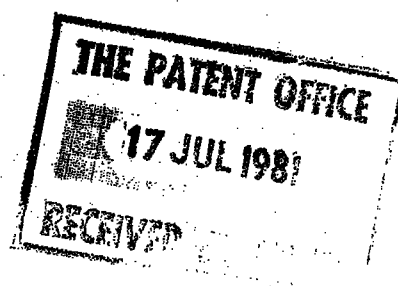
As a result of the large voltage differences between certain electrodes of the electrode system, electrical flash-overs in the tube may occur which are associated with currents rising rapidly in time and reaching high values. As a result of this, damage may be done in particular to semiconductor components in the electronic circuit of the television receiver via inductive or capacitive couplings. A known solution to avoid such damage is to provide an electrical resistive layer on an internal wall portion of the tube envelope near the electrode system. The result of this

solution, however, is that the getter usually connected to the electrode system by means of a metal strip has to be secured in the tube elsewhere, to prevent the gettering material released from the getter by heating from depositing on said resistive layer and hence short-circuiting the resistive layer, or to prevent the layer being short-circuited by the metal strip. Thus the getter should be connected in the tube in a place remote from the electrode system.

In Fig. 3 of the above-mentioned British Patent Specification the getter is secured to the high voltage contact. The connection is carried out prior to securing the glass cone to the glass window of the tube. An advantage of this method is that the getter is assembled in the tube in a phase of the manufacturing process of the tube in which the connection place of the getter is still readily accessible. The detrimental effects of gases and vapours on the getter during subsequent phases in the manufacturing processes of the tube can be avoided by using a protected getter or a chemically resistant getter.

The method according to the above mentioned British Patent Specification is satisfactory in those cases where there is no need at all for the possibility of assembling a getter in the tube after having secured the cone and the window to each other. However, this need does exist for black-and-white display tubes. This need also exists for colour tubes when after securing window and cone together the envelope is stored for some time. In that case it is desirable not yet to provide the envelope with a getter. This need exists furthermore when during a repair, if any, of the tube it has to be provided with a new getter.

According to one aspect of the present invention there is provided a picture display tube comprising an envelope including a display screen, an electrode system for generating at least one electron beam directed onto the display screen, an



electrically conductive layer which extends at least between the display screen and the electrode system over the inner surface of the envelope and of which at least the part situated near the electrode system consists of an electrical resistive layer, a high voltage contact which is provided in the envelope between the display screen and the electrode system and which is electrically connected to the conductive layer, and a getter mounted on a resilient metal connection strip detachably held in the envelope by a pin and slot connection, the pin comprising a connection member projecting internally from the tube wall, the connection member having an enlarged head and a neck portion, and the metal strip having an opening therein, a portion of which opening is a clearance fit on the enlarged head and the remainder of which is a clearance fit on the neck portion but is too small to allow the head to pass therethrough.

The provision of the pin and slot connection enables a getter not only to be secured easily on the connection member but also to be detached easily.

In an embodiment of the present invention the enlarged head of the connection member projecting from the tube wall gradually widens to an end having a largest transverse dimension D and a smallest transverse dimension where the head meets the neck of d and the opening in the metal connection strip has a first aperture the dimensions of which are larger than the said largest transverse dimension D , which first aperture communicates via a passage of width b in a second aperture having dimension A , in such manner that $D > A > b > d$, so that the gradually widening end of the said connection member in cooperation with the said second aperture constitutes a detachable coupling.

In this embodiment of a picture tube in accordance with the present invention, securing the getter is carried out by inserting the enlarged or widening end of the connection member through the first aperture in the connection strip and then moving the connection strip in its longitudinal direction in such manner that the second aperture in the connection strip is made to cooperate with the enlarged or widening end of the connection member. The coupling thus produced is locked in that the connection strip bears on the tube wall on either side of the second aperture and, as a result of the resilience in the strip, the strip is pressed against the enlarged or widening end of the connection member at the area of the second aperture. It has been found that a good coupling between the connection member and the connection

strip is obtained with low resilience of the strip. Hence no large resilient forces need be overcome for producing the coupling. As a result of this, a fitting tool for positioning the getter in its place can be given an extremely simple construction and the possibility of damage of the tube during the fitting of the getter can be minimised. The removal of the getter in possible repair of the tube can also be carried out extremely simply and without exerting great forces with the coupling mechanism described.

The gradually widening end of the connection member may have several shapes, for example a spherical, a conical or a pyramidal shape. In a further embodiment of a picture display tube in accordance with the invention the connection strip has a deepened portion or recess at the area of the second aperture so that an extra locking of the coupling is obtained. The shape of the deepened portion may correspond substantially to the shape of the gradually widening end of the connection member.

In this latter case and with a connection member widening in the form of a pyramid, the strip may also be locked against rotation with respect to the connection member. Locking against rotation is alternatively possible by providing the widening end of the connection member with at least one flattening which cooperates with a straight edge of the second aperture.

The connection member is preferably secured to the high voltage contact provided in the tube wall so that with the insertion of the high voltage contact the connection member for the getter is also obtained. If desired the connection member with the high voltage contact may constitute one assembly of sheet material.

According to a second aspect of the present invention there is provided a tool for positioning a getter in a picture display tube in which the getter is inserted via the tube neck and is secured so as to be detachable to a connection member projecting internally from the tube wall by means of a resilient connection strip, wherein the device comprises a strip of resilient material which at one end is secured to a rigid member and at the other end has a holder on which a number of studs are present between which the connection strip of the getter can be detachably held and which holder comprises means to detach the connection strip from the holder, an abutment on the rigid member for limiting the depth of insertion of the strip in the tube and a cable which is guided along the strip and is secured adjacent the holder to bend the

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THE PATENT OFFICE
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strip and thus to transport the getter which is detachably held by the holder towards the connection member projecting internally from the tube wall.

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

10 Figure 1 is a sectional view of a colour television display tube in accordance with the present invention,

15 Figure 2 shows on an enlarged scale the manner in which a getter is releasably secured in the display tube shown in Figure 1,

Figures 3, 3a and 3b are sectional views of embodiments of a connection member secured to a high voltage contact,

20 Figure 4 is a plan view of a getter having a connection strip,

Figure 5 is a sectional view of another embodiment of a connection construction,

25 Figure 6 is a sectional view of a connection member forming one assembly with the high voltage contact, and

Figures 7, 7a and 7b show an auxiliary tool for securing a getter in a tube in accordance with the invention.

30 The tube shown in Figure 1 is a vertical sectional view and comprises a glass envelope having a display window 1, a cone 2 and a neck 3. An electrode system 4 for generating three electron beams 5, 6 and 7 is present in the neck 3. The electron beams 35 5, 6 and 7 are generated in one plane, in this case normal to the plane of the drawing, and are directed onto a display screen 8 provided internally on the display window 1 and consisting of a large number of phosphor strips luminescing in red, green and blue and the longitudinal direction of which is parallel to the plane of the drawing. On their way to the display screen 8 the electron beams 5, 6 and 7 are deflected over the display screen 8 by means of a number of deflection coils 9 arranged coaxially around the tube axis and pass through a colour selection electrode 10 consisting of a metal plate having elongate apertures 11 the longitudinal direction of which is also parallel to the plane of the drawing. The three electron beams 5, 6 and 7 pass through the apertures 11 at a small angle to each other and consequently each impinge only upon phosphor strips of one colour. The tube furthermore comprises an inner screening cone 12 with which the electron beams 5, 6 and 7 are screened from the earth's magnetic field. The inner wall of the tube is coated with an electrically conductive layer 13 of which at least the part 14 extending from the neck-cone transition into the neck 3 consists of an electrically resistive material which is composed of a mixture of approximately 6

parts by weight of ferric oxide and 1 part by weight of graphite and 2.5 parts by weight of potassium silicate. The layer 13 which may alternatively consist of an electrically resistive layer is connected to a high voltage contact 15 provided in the tube wall and is further connected, via contact springs 16, to the colour selection electrode 10 and the display screen 8, and via contact springs 17, is connected to the last electrode of the electrode system 4.

As is known, after evacuating the tube a layer of gettering material of, for example, barium, strontium, calcium or magnesium is deposited on the tube wall so as to getter the residual gases remaining in the tube. In the conventional display tubes such as those disclosed in British Patent Specification No. 1,226,728 the gettering device from which the gettering material is released by heating, is connected to the electrode system either directly or by means of a metal strip. As already stated, this conventional way of connecting cannot be used in a display tube having a resistive layer. As shown in Figure 1, a getter 18 is connected in the tube by means of a connection strip 19 in a place remote from the electrode system 4. The getter is secured to a connection member welded to the high voltage contact 15 so as to be detachable by using a pin and slot connection construction as will be described hereinafter with reference to Figure 2. This Figure shows the wall portion of the cone 2 in which the high voltage contact 15 is sealed. The high voltage contact 15 has a connection member which extends into the tube cavity and which is in the form of a pin 20 which at its free end widens to form an enlarged head in the shape of a cone and has a largest transverse dimension D and a smallest transverse dimension d , as is shown in Figure 3. As shown in Figure 2 the getter 18 comprises a metal holder 21 which is welded to the metal connection strip 19. The strip 19 has a first aperture 22 whose dimensions are larger than the transverse dimension D . The aperture 22 communicates via a passage 23 with a second aperture 24 which is smaller than the transverse dimension D but is larger than the transverse dimension d of the neck of the connection member. The width of the passage 23 is slightly larger than the dimension d but is smaller than the aperture 24. This is illustrated in the plan view in Figure 4 of a getter 28 and a connection strip 29. The strip has a first aperture 32, a passage 33 of width b and a second aperture 34 of diameter or maximum dimension A . Due to the resilience of the connection strip 19 which is pre-bent according to the broken lines 25 (shown in Figure 2), the

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17 JUL 1981
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strip 19 presses against the conically widening end of the pin 20 at the area of the second aperture 24 with which the coupling of the strip 19 and the pin 20 is produced.

5 Possible rotation of the strip 19 about the pin 20 can be prevented, for example, by providing the widening or diverging end of the pin 20 with at least one flattening as is shown in Figure 3 by the broken line 26 and

10 providing the second aperture 24 with a straight edge cooperating with said flattening.

Instead of a conically widening end, other shapes are also possible, for example,

15 the spherically widening end 27 of the connection member shown in Figure 3a, or the end 30 widening in the form of a pyramid as shown in Figure 3b. Furthermore, it is not necessary to secure the connection member to the high voltage

20 contact. The connection member may also be inserted independently in the tube wall.

Figure 5 shows a getter structure in which the connection strip 39 has a

25 deepened or recessed portion 40 at the area of the second aperture 44. As a result of this the coupling between the connection strip 39 and the connection member 41 is additionally locked. Otherwise, the strip 39 again comprises a first aperture 42 which

30 communicates via a passage 43 into the second aperture 44, analogously to the construction shown in Figure 4.

Figure 6 shows a high voltage contact 50 having a connection member 51 formed

35 integral therewith. The assembly is manufactured from sheet material and obtained by deep drawing. This construction which has been manufactured from one piece has the advantage that no

40 welding operation need be carried out which might damage the high voltage contact.

Figure 7 shows an embodiment of a

45 fitting tool with which the getter can be positioned in place via the neck of the tube. The device comprises a resilient metal strip 60 which at one end has a metal holder 61 in which an elongate aperture 62 is provided.

50 The other end of the strip 60 is secured to a rigid tube 63 having a handle 64. A pull cable 65 connected at one end to the holder 61 is guided along the strip 60 by means of

55 cable guides 66 and at the other end is secured to a handle 67 secured to the tube 63 so as to be rotatable. By tensioning the cable 65 by means of the handle 67, the resilient strip 60 is bent. In the aperture 62 of the holder 61 a stud 68 is arranged about

60 a shaft 69 so as to be rotatable. A second pullcable 70 which is also guided along the strip 60 with a small amount of play is secured at one end to a second handle 71 connected to the tube 63 so as to be

65 rotatable and is secured to the stud 68 at its

other end. By tensioning the pullcable 70 by means of the handle 71, the stud 68 rotates about the shaft 69 so that a getter secured to the holder 61 is released.

Figure 7a shows the getter 28 of Figure 4 with connection strip 29 in a position in which it is mounted on the holder 61. The connection strip 29 has four abutment edges 35 with which the strip 29 can be tensioned between four studs 72 present on the holder 61. In the position shown in Figure 7a the getter 28 can be positioned in its place via the still open neck 3 of the tube shown in Figure 1. This is done as follows. The resilient strip 60 of the getter fitting tool shown in Figure 7 is inserted into the neck 3 of the tube over such a distance that the abutment member 73 bears against the open end of the neck 3 of the tube. The pullcable 65 is then tensioned so that the strip 60 bends and the holder 61 is moved towards the high voltage contact 15 with the connection member 20. The access to the high voltage contact is provided via a slot 80 present in the magnetic screening cone 12 as shown in Figure 1. The place of the abutment member 73 on the fitting tool is such that in the bent condition of the strip 60 the aperture 32 provided in the connection strip 29 corresponds to the place of the connection member 20 so that when the strip 60 is bent, the connection strip 29 slides over the enlarged or widening end of the connection member 20. The strip 29 is then moved in its longitudinal direction until the second aperture 34 coincides with the connection member 20. In this phase of the method the connection strip 29 is detached from the holder 61 by tensioning the cable 70 so that the stud 68 rotates and the connection strip 29 is pressed away between the studs 72. Due to the resilience of the connection strip 29, the strip presses against the gradually widening end of the connection member 20 at the area of the aperture 34. Thus the coupling of the strip 29 and the connection member 20 is produced in the manner as shown in Figure 2 or Figure 5.

The principle of inserting and securing a getter in the tube has been explained with reference to a manually operated apparatus. Of course, the operation of the apparatus can simply be mechanised. Detaching the connection strip of the getter from the holder can furthermore be realised in manners differing from that with the stud 68. For example, as shown in Figure 7b, the holder 90 may consist of two portions 91 and 92 pivoting about a shaft 93. For detaching the connection strip of the getter the part 92 of the holder 90 is tilted in the direction of the arrow 94. According to another possibility, the holder can be made

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THE PATENT OFFICE
17 JUL 1981
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detachable by a construction in which the parts 91 and 92 are drawn apart in the longitudinal direction of the holder.

WHAT WE CLAIM IS:—

1. A picture display tube comprising an envelope including a display screen, an electrode system for generating at least one electron beam directed onto the display screen, an electrically conductive layer which extends at least between the display screen and the electrode system over the inner surface of the envelope and of which at least the part situated near the electrode system consists of an electrical resistive layer, a high voltage contact which is provided in the envelope between the display screen and the electrode system and which is electrically connected to the conductive layer, and a getter mounted on a resilient metal connection strip detachably held in the envelope by a pin and slot connection, the pin comprising a connection member projecting internally from the tube wall, the connection member having an enlarged head and a neck portion, and the metal strip having an opening therein, a portion of which opening is a clearance fit on the enlarged head and the remainder of which is a clearance fit on the neck portion but is too small to allow the head to pass therethrough.

2. A picture display tube as claimed in Claim 1, wherein the enlarged head of the connection member projecting from the tube wall gradually widens to an end with a largest transverse dimension D and a smallest transverse dimension where the head meets the neck of d and the opening in the metal connection strip comprises a first aperture whose dimensions are larger than the said largest transverse dimension D , which first aperture communicates *via* a passage having a width b into a second aperture having dimensions A , in such manner that $D > A > b > d$, so that the gradually widening end of the said connection member in cooperation with the said second aperture constitutes a detachable coupling.

3. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens conically from the neck.

4. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens spherically from the neck.

5. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens in the form of a pyramid from the neck.

6. A picture display tube as claimed in any one of Claims 2 to 5, wherein the metal

strip of the getter is recessed at the area of the second aperture.

7. A picture display tube as claimed in Claim 6, wherein the shape of the recessed portion is substantially in the form of the gradually widening end of the connection member.

8. A picture display tube as claimed in any one of Claims 1 to 7, wherein the connection strip is locked against rotation with respect to the connection member.

9. A picture display tube as claimed in any one of the preceding claims, wherein the connection member is secured to the high voltage contact.

10. A picture display tube as claimed in Claim 9, wherein the connection member with the high voltage contact constitutes one assembly manufactured integrally from sheet material.

11. A picture display tube substantially as hereinbefore described with reference to and as shown in Figures 1, 2 and 3 of the accompanying drawings.

12. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figures 3a and 5 of the accompanying drawings.

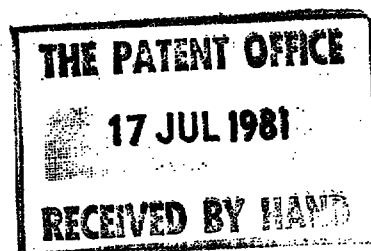
13. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 3b of the accompanying drawings.

14. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 4 of the accompanying drawings.

15. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 6 of the accompanying drawings.

16. A tool for positioning a getter in a picture display tube in which the getter is inserted *via* the tube neck and is secured so as to be detachable to a connection member projecting internally from the tube wall by means of a resilient connection strip, wherein the device comprises a strip of resilient material which at one end is secured to a rigid member and at the other end has a holder on which a number of studs are present between which the connection strip of the getter can be detachably held and which holder comprises means to detach the connection strip from the holder, an abutment on the rigid member for limiting the depth of insertion of the strip of resilient material in the tube and a cable which is guided along the strip of resilient material and is secured adjacent the holder to bend the strip of resilient material and thus to transport the

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detachable by a construction in which the parts 91 and 92 are drawn apart in the longitudinal direction of the holder.

WHAT WE CLAIM IS:—

5 1. A picture display tube comprising an envelope including a display screen, an electrode system for generating at least one electron beam directed onto the display screen, an electrically conductive layer
10 which extends at least between the display screen and the electrode system over the inner surface of the envelope and of which at least the part situated near the electrode system consists of an electrical resistive layer, a high voltage contact which is
15 provided in the envelope between the display screen and the electrode system and which is electrically connected to the conductive layer, and a getter mounted on
20 a resilient metal connection strip detachably held in the envelope by a pin and slot connection, the pin comprising a connection member projecting internally from the tube wall, the connection member
25 having an enlarged head and a neck portion, and the metal strip having an opening therein, a portion of which opening is a clearance fit on the enlarged head and the remainder of which is a clearance fit on
30 the neck portion but is too small to allow the head to pass therethrough.

2. A picture display tube as claimed in Claim 1, wherein the enlarged head of the connection member projecting from the tube wall gradually widens to an end with a largest transverse dimension D and a smallest transverse dimension where the head meets the neck of d and the opening in the metal connection strip comprises a first aperture whose dimensions are larger than the said largest transverse dimension D , which first aperture communicates via a passage having a width b into a second aperture having dimensions A , in such
35 manner that $D > A > b > d$, so that the gradually widening end of the said connection member in cooperation with the said second aperture constitutes a detachable coupling.

3. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens conically from the neck.

4. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens spherically from the neck.

5. A picture display tube as claimed in Claim 2, wherein the part of the connection member projecting from the tube wall widens in the form of a pyramid from the neck.

6. A picture display tube as claimed in any one of Claims 2 to 5, wherein the metal

strip of the getter is recessed at the area of the second aperture. 65

7. A picture display tube as claimed in Claim 6, wherein the shape of the recessed portion is substantially in the form of the gradually widening end of the connection member. 70

8. A picture display tube as claimed in any one of Claims 1 to 7, wherein the connection strip is locked against rotation with respect to the connection member. 75

9. A picture display tube as claimed in any one of the preceding claims, wherein the connection member is secured to the high voltage contact.

10. A picture display tube as claimed in Claim 9, wherein the connection member with the high voltage contact constitutes one assembly manufactured integrally from sheet material. 80

11. A picture display tube substantially as hereinbefore described with reference to and as shown in Figures 1, 2 and 3 of the accompanying drawings. 85

12. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figures 3a and 5 of the accompanying drawings. 90

13. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 3b of the accompanying drawings. 95

14. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 4 of the accompanying drawings. 100

15. A picture display tube as claimed in Claim 11, modified substantially as hereinbefore described with reference to and as shown in Figure 6 of the accompanying drawings. 105

16. A tool for positioning a getter in a picture display tube in which the getter is inserted via the tube neck and is secured so as to be detachable to a connection member projecting internally from the tube wall by means of a resilient connection strip, wherein the device comprises a strip of resilient material which at one end is secured to a rigid member and at the other end has a holder on which a number of studs are present between which the connection strip of the getter can be detachably held and which holder comprises means to detach the connection strip from the holder, an abutment on the rigid member for limiting the depth of insertion of the strip of resilient material in the tube and a cable which is guided along the strip of resilient material and is secured adjacent the holder to bend the strip of resilient material and thus to transport the 115

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getter which is detachably held by the holder towards the connection member projecting internally from the tube wall.

- 5 17. A tool according to Claim 16, wherein the means to detach the connection strip from the holder comprises a pivotally mounted stud disposed in an aperture in the holder.

- 10 18. A tool according to Claim 16, wherein the holder comprises two parts which can pivot relative to each other to detach the connection strip from the holder.

19. A tool according to Claim 16, wherein the holder comprises two parts which are

linearly separable to detach the connection strip from the holder. 15

20. A tool for positioning a getter in a picture tube, substantially as hereinbefore described with reference to and as shown in Figures 7, 7a and 7b of the accompanying drawings. 20

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18

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