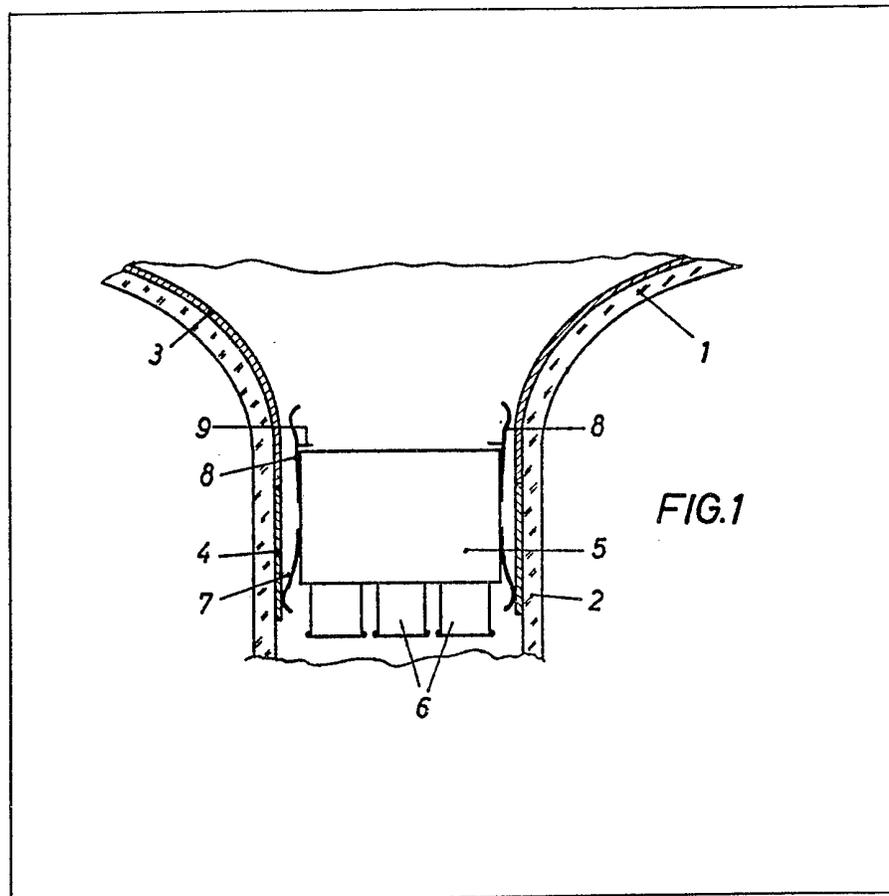


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- (71) Applicants  
Videocolour GmbH,  
Söflinger Strasse 100,  
7900 Ulm, Federal  
Republic of Germany
- (72) Inventor  
Reinhard Srowig
- (74) Agents  
Kilburn & Strobe, 30,  
John Street, London  
WC1N 2DD

(54) **Electrical connections to coatings in display tubes**

(57) In a cathode ray display tube having a funnel conductive layer 3 joined in the tube rack to a resistive layer 4 which is connected to a gun electrode 5 by a spring contact 7, and is of at least 10 times the specific resistance of the layer 3, to reduce peak currents during spark overs, the

resistive layer 4 is short-circuited during production of the tube by a further spring contact 8 which corrects electrode 5 to the conductive layer 3, to permit sufficiently high currents for effective spot-knocking, after which process the further contact 8 is opened (as shown) — e.g. thermally, by the high frequency melting of a solder attachment, or the heating of a thermally deformable material or a bimetal.



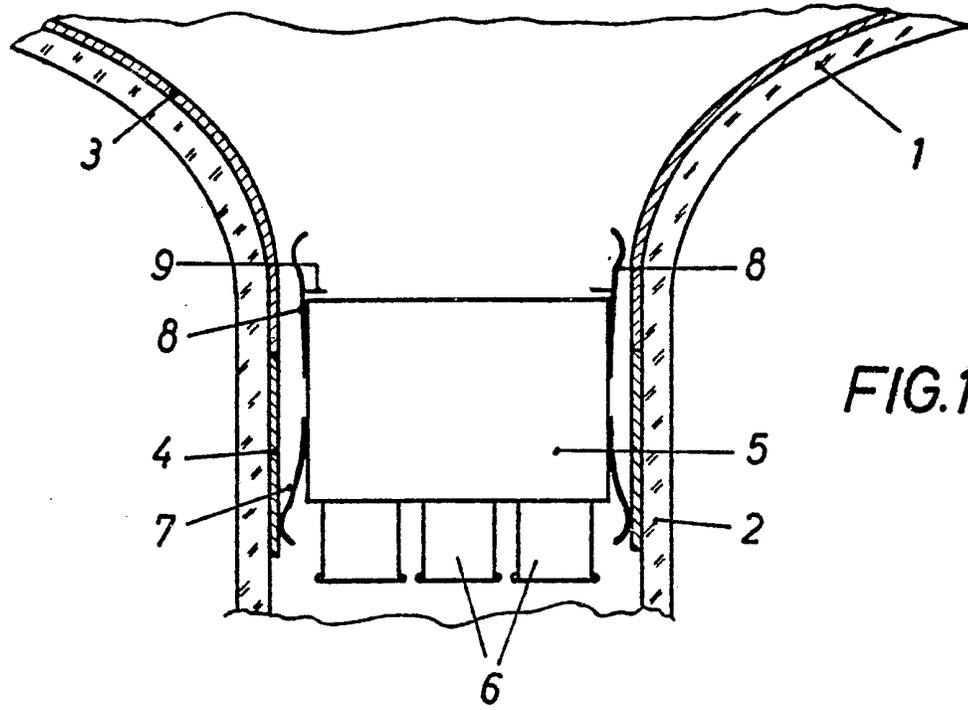


FIG. 1

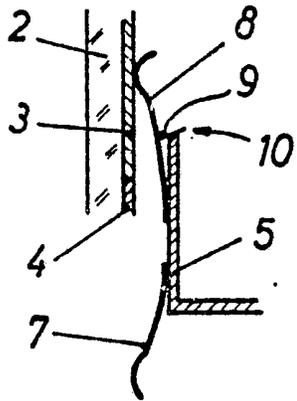


FIG. 2

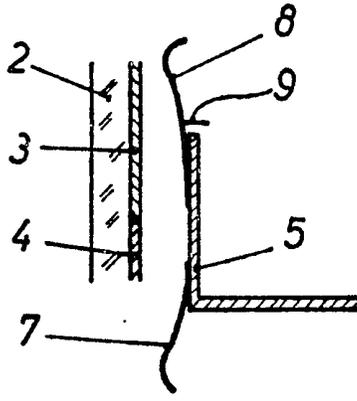


FIG. 3

**SPECIFICATION**  
**Cathode-ray tube**

The present invention relates to a cathode-ray tube having a fluorescent screen whose vacuum envelope comprises a glass funnel-shaped portion and an adjoining neck portion, having an electrically conductive layer which is disposed on the inner wall surface of the funnel portion and extends into the neck portion and is adjoined on the tube-neck side by an electrical resistance layer whose specific resistance is at least ten times that of the conductive layer of the funnel portion, and having an electron-beam generating means which is disposed in the tube neck and the screen-side electrode (or electrodes) of which has (or have) at least one contact spring which effects an electrically conductive connection to the resistance layer.

German Patent Specification O.S. 2,712,711 discloses a colour picture cathode-ray tube which comprises on the inner wall surface of the tube cone an electrically conductive layer which is adjoined on the neck side by a highly resistant layer whose specific resistance is at least ten times the specific resistance of the electrically conductive layer. In this known arrangement the contacting with the electron-beam generating system is via springs which contact the electrically conductive coating.

It is further known that when operating cathode-ray tubes working with very high voltages, for example 20 to 30 kV, spark-overs can occur, very high spark-over current arising. Such current occurring on high-voltage spark-overs can easily be from 600 to 1,000 A, which are dangerous for the circuits of the equipment.

It is further known in cathode-ray tubes to reduce the conductivity of the conductive coating on the inner wall surface which makes it possible to reduce the peak currents in spark-overs to, for example 50 to 100 A. Since, however, currents of this order of magnitude still require protective measures for the circuits, it is desired to reduce still further the peak currents which occur on inevitable voltage spark-overs. This could be done, for example, by increasing the resistance of the conductive layer in the interior of the tube. This has, however, the disadvantage that it becomes practically impossible in the production of the tube to remove impurities in the electron-beam generating system by so called burning-off. Burning-off is the term used for the step of deliberately producing in the tube under vacuum high-voltage spark-overs whereby burrs and impurities on the electrodes are burnt-off. This burning-off is a step carried out during the production of the tubes.

The present invention is based on the problem of providing a cathode-ray tube which in production permits burning-off but which on high voltage spark-overs during the actual operation permits only reduced peak currents.

This problem is solved according to the invention in that the screen-side electrode (or

65 electrodes) comprises (or comprise) at least one further contact spring which, to effect an electrical bridging of the resistance layer bears on the conductive layer in an electrically contacting manner only during certain production steps but in the operating condition of the tube has no electrical contact with the conductive layer.

Such a cathode-ray tube described makes it possible in a simple manner to permit, during the production of the tube, adequately high peak currents for the burning off to be applied, but ensures during operation that, due to the interposed high-resistance layer, during high-voltage spark-overs the peak currents occurring are reduced to such an extent that extensive protection measures are no longer necessary.

Some embodiment of the invention will be described hereinafter by way of example, with reference to FIGURES 1—3 of the accompanying drawings.

The figures show diagrammatically fragments of a cathode ray tube which is preferably a colour picture cathode-ray tube.

The vacuum housing of the tube comprises a funnel-shaped portion 1 which merges into the tube-neck 2. These portions consist in the usual manner of glass and have on their inner wall surface an electrically conductive coating 3 which extends into the neck portion and the resistance of which is chosen so that on high-voltage spark-overs the peak currents are reduced, for example, to about 50 to 100 A. This electrically conductive layer 3 adjoins a further electrical resistance layer 4 whose specific resistance is at least ten times the specific resistance of the electrically conductive layer 3. Preferably, the specific resistance of this further layer 4 is 100 to 1,000 times higher than the specific resistance of the coating 3. The two coatings 3 and 4 are in electrical contact with each other. The screen-side electrode arrangement 5 of the electron-beam generating system receives its voltage via these electrically conductive coatings, in that on the pot-shaped electrode 5 on which the three anodes 6 of the three beam generators of the colour picture tube are mounted contact springs 7 are secured which bear resiliently on the resistance coating 4. The high voltage is applied in known manner to the funnel-shaped portion 1 via a plug-type contact of the conductive layer 3.

115 According to the present invention, on the pot-electrode 5 at least one further spring 8 is provided which can be brought controllably into and out of contact with the conductive layer 3. In FIGURE 1, the springs 8 are shown in the operative condition of the tube, i.e. they are not in contact with the electrically conductive layer. The electrodes 5 and 6 therefore draw their voltage via the contact springs 7 which bear against the highly resistant coating 4. Now, if a high-voltage spark-over occurs during operation, the spark-over current flows through the coatings 3 and 4 in series and in particular due to the high resistance of the coating 4 the peak current occurring is reduced to a desirably low value, for example, to a

value below 1 A.

FIGURES 2 and 3 illustrate a preferred embodiment in which the further contact springs 8 are held by an additional solder connection 10 in an extended position. For this purpose the further contact springs 8 have extensions 9 which are soldered, for example, to the upper edge of the pot-shaped electrode 5. As is apparent from FIGURE 2, the further contact springs 8 when in this extended condition contact the electrically conductive layer 3 whereby the highly resistant layer 4 is electrically short circuited. In this condition, the electrode 5 receives its high voltage via the springs 8 which are in contact with the conductive layer 3. Since the resistance of this layer 3 is less than that of the layer 4, on high-voltage spark-overs within the electron-beam generating system high peak currents occur as is desired in the production of the tube for effecting the burning-off.

After completion of the tube, the solder connections 10 are then melted, for example by a high-frequency field, so that the springs 8 moves into the condition illustrated in FIGURE 3 and FIGURE 1. This means that the springs 8 moves out of contact with the electrically conductive layer and bear on the electrode 5. This ensures that for operation of the tube the highly resistant layer 4 is interposed and on high-voltage spark-overs the peak currents occurring are reduced.

In another embodiment, the springs 8 are made of a metal alloy which has been altered in shape by cold deformation and which on being heated reverts to its previously given form.

In a further embodiment the springs 8 are made from a bi-metal. In such a case it is convenient for the springs 8 not to contact the conductive layer 3 in the inoperative condition. During the burning-off in the production of the tube these springs are exposed to thermal radiation which causes them to bend and contact the coating 3 and thus electrically bridge the resistance layer 4.

## CLAIMS

1. A cathode-ray tube having a fluorescent screen whose vacuum envelope comprises a glass funnel-shaped portion and an adjoining neck portion, having an electrically conductive layer which is disposed on the inner wall surface of the funnel portion and extends into the neck portion and is adjoined on the tube-neck side by an electrical resistance layer whose specific resistance is at least ten times that of the conductive layer of the funnel portion, and having an electron-beam generating means which is disposed in the tube neck and the screen-side electrode (or electrodes) of which has (or have), at least one contact spring which effects an electrically conductive connection to the resistance layer, and in which the screen-side electrode (or electrodes) comprises (or comprise) at least one further contact spring which, to effect an electrical bridging of the resistance layer, bears on the conductive layer in an electrically contacting manner only during certain production steps but in the operating condition of the tube has no electrical contact with the conductive layer.
2. A cathode-ray tube according to Claim 1, in which the further contact spring is held during said production steps by means of a thermally-detachable holding in such a position that it contacts the electrically conductive layer and the thermally detachable holding is subsequently detached by the action of heat.
3. A cathode-ray tube according to Claim 2 in which the thermally-conductive holding is a solder connection.
4. A cathode-ray tube according to any of Claims 1—3 in which the further contact spring comprises a thermally deformable material.
5. A cathode-ray tube according to any of Claims 1—4 in which the further contact spring comprises a permanently thermally deformable material.
6. A cathode-ray tube according to any of Claims 1—5 in which the further contact spring comprises a bimetal.