# United States Patent [19]

**Bongenaar**

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[54] **CATHODE-RAY TUBE WITH IMPLOSION SAFETY**


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[30] **Foreign Application Priority Data**

Feb. 12, 1973 Netherlands ..... 7301933

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[51] **Int. Cl.**[2] ..... **H01J 29/02**

[58] **Field of Search** ..... 178/7.8, 7.82; 220/2.1 A, 220/2.3 A



[56] **References Cited**

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| | | | |
|---|---|---|---|
| 3,146,305 | 8/1964 | Monaco et al. | 178/7.82 |
| 3,166,211 | 1/1965 | Stel et al. | 178/7.82 |
| 3,490,636 | 1/1970 | Nienhuis et al. | 178/7.82 |
| 3,818,557 | 6/1974 | Eisses et al. | 178/7.82 |



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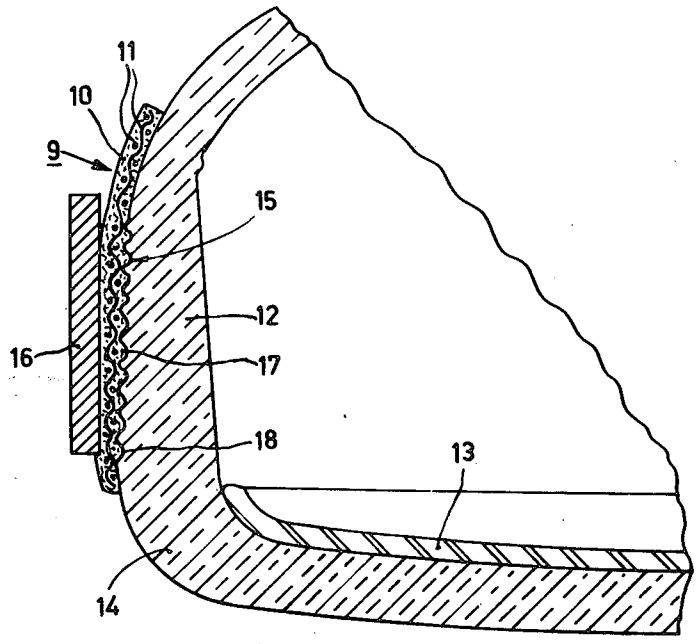
[57] **ABSTRACT**

A cathode ray tube comprising implosion safety means having a fabric reinforced adhesive tape arranged around the tube and a clamping band on the tape. One of the surfaces adjoining the tape is roughened so as to receive the adhesive forced out of the tape during its compression by the band, and the reinforcement fabric is in contact with the roughened surface.


**3 Claims, 3 Drawing Figures**



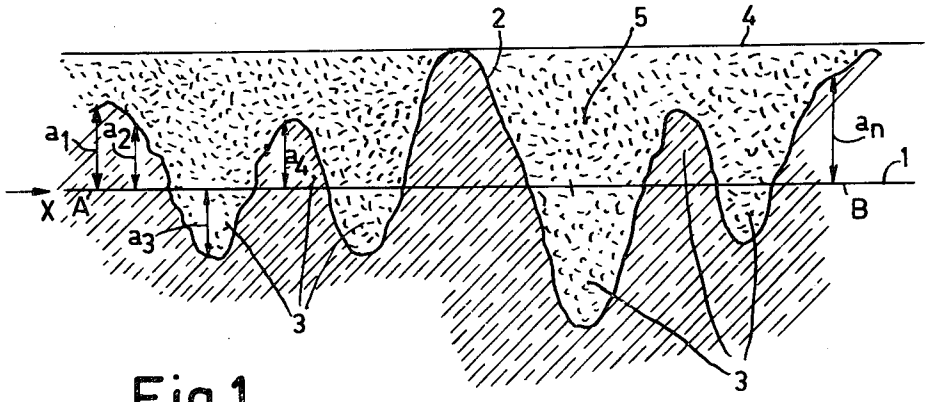



Fig.1

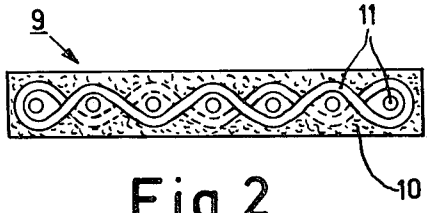



Fig.2

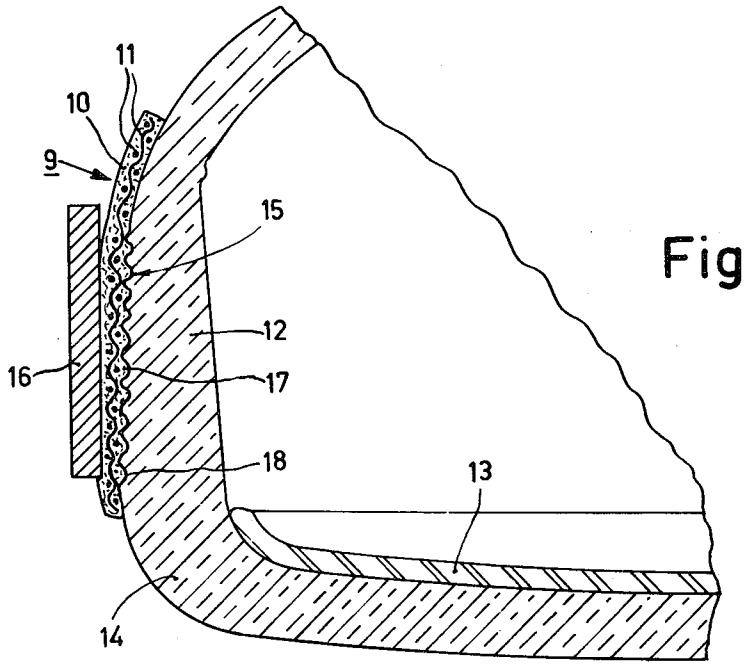



Fig.3

# CATHODE-RAY TUBE WITH IMPLOSION SAFETY

The invention relates to a cathode-ray tube for picture display having an implosion safety provided around the widest part of the tube, said implosion safety consisting of a fabric-reinforced adhesive tape which comprises a layer of adhesive, and at least one clamping band arranged over said adhesive tape.

A cathode-ray tube having such an implosion safety is known from the published Dutch Patent application 7,100,273. The adhesive tape which is reinforced by means of a fabric, for example a glass fibre fabric, inter alia has the advantage of a large friction between the fabric and the glass envelope on the one hand and the fabric and the clamping band on the other hand. As stated in the said patent application, said friction is sufficiently large to prevent the sliding off of the clamping band from the slightly conical surface of the tube. A surface roughening on the outside of the envelope and the inside of the clamping band would therefor no longer be necessary.

In spite of this, the evil of the sliding off of the clamping band has proved to be insufficiently cured also when using a fabric-reinforced adhesive tape between the envelope of the tube and the clamping band. Said sliding off of the clamping band occurs in particular when an adhesive tape is used which contains as an adhesive a synthetic material which consists of a comparatively viscous material. It has furthermore been found that the clamping band starts sliding in those places where it exerts the largest forces on the envelope, while one might expect a good contact between the fabric in the adhesive tape and the surfaces enclosing said adhesive tape just in those places.

It is the object of the invention to provide a cathode-ray tube of the type mentioned in the first paragraph in which the sliding off of the clamping band from the envelope is avoided in a simple manner.

For that purpose, a cathode-ray tube according to the invention is characterized in that at least one of the surface enclosing the adhesive tape on either side has a surface unevenness in which the adhesive forced out of the adhesive tape upon providing the clamping band is received entirely or at least substantially entirely.

The invention is based on the recognition resulting from investigations that at the area where the clamping band exerts a large pressure on the adhesive tape the fabric present in said adhesive tape is compressed and the adhesive is forced out of the adhesive tape so that at that area an excess of adhesive is formed. Due to the presence of the fabric, it is difficult for said excess of adhesive to find an outlet in the lateral direction. A good contact of the fabric with the surfaces present on either side thereof is thus prevented, as a result of which the clamping band aided by the adhesive which now serves as a lubricant, slides off from the envelope.

It is to be noted that it is known from the U.S. Pat. No. 3,708,369 to roughen the inside of the clamping band. In this case it does not concern a fabric-reinforced adhesive tape, but a synthetic material which hardens during the shrinkage of the clamping band around the envelope. With a view to obtaining a better adhesion of the synthetic material to the clamping band, the inside of the clamping band is roughened. It appears from the text of said application that in this case a very superficial roughening is meant since otherwise the clamping band contacts the glass surface, which is just to be avoided. However, such an extent of roughness is insufficient to receive the excess of adhesive which is formed during the shrinkage process or the mechanic tightening of the clamping band. The end in view cannot be achieved. On the contrary, too small an extent of roughness has just an opposite effect since it more impedes the lateral movement of the quantity of adhesive not taken up.



It is irrelevant for the invention as such whether the surface unevenness is present on the inside of the clamping band or on the outside of the envelope, or on both. The choice of the surface to be roughened is determined by the way in which said surface unevenness can be realized with the minimum cost. This appears to be the case when simultaneously with the moulding of the display screen the required surface unevenness is also moulded in the outer surface of the upright edge of the display screen. This requires only a simple processing of the matrix by giving the surface thereof the required surface unevenness by slightly hammering in those places where this is desired.

In the case of a substantially rectangular display screen, the largest pressure forces are exerted by the clamping band on the corners of the upright edge of the display screen. Therefore, according to the invention a surface unevenness is preferably provided on the corners of the said upright edge.

The extent of surface unevenness depends upon the quantity of adhesive present in the adhesive tape per surface unit. When an average thickness is considered of the layer of adhesive present in the adhesive tape, the extent of the surface unevenness must be such that the adhesive forced out of said adhesive tape during providing the clamping band around the envelope is fully received by said surface unevenness. According to the invention this can be realized if the surface unevenness corresponds to an average roughness value which is at least equal to half the thickness of the layer of adhesive.

The maximum extent of the surface unevenness is determined by the way in which it is provided in the upright edge of the display screen. When the said unevenness is moulded in the upright edge, a certain value thereof should not be exceeded since otherwise the display screen can no longer be detached from the mould. The conditions with respect to minimum and maximum surface unevenness can be satisfied, if, according to the invention, the surface unevenness corresponds to an average roughness value of 50 $\mu$m to 500 $\mu$m.

It is to be noted that a cathode-ray tube is known from the U.S. Pat. No. 3,490,636 the upright edge of the display screen of which tube comprises at the corners thickened shoulders having grooves which extend in parallel to the tube axis and which, after providing the clamping band in the cold condition, are filled with an adhesive. In this case, no fabric-reinforced adhesive tape is used. In this case it concerns grooves of comparatively coarse dimensions, as also shown in the drawing, so as to enable the filling thereof with adhesive and to obtain a large contact area of adhesive and clamping band. The provision of such grooves requires either an expensive machining of the glass surface, or an expensive machining of the mould with the additional possibility of a larger reject percentage.

Furthermore it is to be noted that a cathode-ray tube is known from the U.S. Pat. No. 3,264,080 the upright edge of the display screen of which tube has ribs on the

straight sides. In this case no clamping band is used and the ribs serve only to avoid the occurrence of scratches and other damage on the straight sides of the rectangular window.

The adhesive in the fabric-reinforced adhesive tape may consist of a synthetic material which softens at low temperature, for example, a rubber-containing synthetic material or a synthetic material which softens at high temperatures, for example, an acrylate-containing synthetic material. In a cathode-ray tube according to the invention the clamping band may be tightened around the envelope both in the cold condition and by means of a shrinkage process. In this latter method the clamping band is first heated to a temperature of 400° to 450°C and then slid around the upright edge of the display screen. Upon cooling of the clamping band, shrinkage forces arise which, after cooling, provide the required stress in the clamping band.

Because in a cathode-ray tube according to the invention, the choice with respect to the viscosity of the adhesive present in the adhesive tape hardly plays a part, an economic advantage may be obtained with respect to the cost-price of such an adhesive tape in addition to the advantages already mentioned.

The invention will be described in greater detail with reference to a drawing, in which

FIG. **1** is a cross-sectional view of a surface unevenness on a considerably exaggerated scale.

FIG. **2** is a cross-sectional view of a fabric-reinforced adhesive tape, and

FIG. **3** is a cross-sectional view of a part of a cathode-ray tube according to the invention.

In the cross-sectional view of the surface shown in FIG. **1**, the center line **1** having the roughness profile **2** encloses surfaces **3** the overall area of which on one side of the line **1** is equal to the overall area of the other side of the line **1**. The value of the average roughness $R_a$ is equal to the average distance $a$ of the roughness profile **2** to the center line **1** related on the base length $L$ between the points A and B. So

$$R_a = \frac{a_1+a_2+a_3 \ldots . +a_n}{n} = \frac{1}{L}\int_{x=0}^{x=L} |\, a_i \,|\, dx.$$

In the spaces present between the effective profile **2** and the reference profile **4** the excessive adhesive **5** forced out of the adhesive tape by the clamping band is fully received (clamping band and adhesive tape are not shown for clarity).

In FIG. **2**, the adhesive tape consists of a non-hardened adhesive **10** and a glass fibre fabric **11**. As shown in FIG. **3**, this tape is provided around the edge **12** of the display screen **14** which is covered on the inside with a phosphor screen **13**. At the corners of the upright edge **12** the surface has a surface unevenness **15** in which the adhesive **17** forced out of the adhesive tape **9** by the clamping band **16** is accommodated. The average roughness value of the surface unevenness **15** is 100 $\mu$m and is equal to half the thickness of the adhesive tape **9** which has a width of 19 mm. Since the excess of adhesive which mainly consists of acrylate resin is fully received by the surface unevenness **15**, the glass fibre fabric **11** readily contacts both the clamping band **16** and the glass surface **18**. The large friction between the clamping band and the glass fibre now fully prevents the sliding off of the clamping band.

What is claimed is:

**1.** A cathode ray tube for picture display having implosion safety means, comprising a fabric reinforced adhesive tape provided around the widest part of the tube, a clamping band arranged on the upper surface of said tape, at least one of surfaces adjoining the tape on either side thereof being produced to an average roughness value of 50 $\mu$m to 500 $\mu$m and the reinforcement fabric of said tape being in contact with the projecting areas of said roughened surface, whereby the recessed areas of said roughened surface being filled up by adhesive forced out of the tape during its clamping by the band.

**2.** A cathode-ray tube as claimed in claim **1**, wherein the surface unevenness is present on the outer surface of the upright edge of the display screen.

**3.** A cathode-ray tube as claimed in claim **2** comprising a mainly rectangular display screen and wherein the surface unevenness is present at the corners of the upright edge of the display screen.

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