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(54) **Cathode-ray tube screening arrangement**

Abschirmanordnung für Kathodenstrahlröhre

Dispositif de blindage pour tube à rayons cathodiques

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(56) References cited:
FR-A- 2 379 906 **GB-A- 2 255 441**
US-A- 2 545 120 **US-A- 4 392 083**

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Description

Background to the Invention

This invention relates to cathode ray tubes (CRTs) according to the first part of claim 1. The invention is particularly, although not exclusively, concerned with CRTs for use in monitors and display terminals for data processing apparatus.

The problem of electric field emissions from CRTs is of increasing concern, and regulations are being introduced in some countries, specifying the maximum permissible amounts of such emissions.

Electric field emissions from a CRT comprise both DC and AC components.

The DC electric field generated on the surface of a CRT screen is relatively easy to reduce to acceptable levels by the incorporation of a conductive coating, available from all tube manufactures. However, 'normal' conductive coatings are high resistance and cannot cope with high levels of AC field. Very low Ohmic coatings or screens are available but at high cost.

The majority of AC electric field is produced by capacitive coupling between the scan coils (deflection yoke) and the aluminised internal final anode layer of the CRT. (This layer is connected to the Extra High Tension supply, around 10kV to 17kV for normal monochrome tubes). This capacitance is quite significant, being in the order of 100pF for a 14" CRT with a 20mm neck. Scan voltages of several hundred at line rate (30kHz to around 80kHz or more) and tens of volts at frame rate (between 50 and 100Hz) with fast edges during flyback, are capacitively coupled and modulate the aluminised layer inside the tube. This layer, though very thin covers the tube front. As the EHT source impedance is fairly high, substantial AC voltage can be induced at line and frame rate in this layer.

FR-A- 2 379 906 describes a CRT with a guard screen according to the first part of claim 1, comprising a continuous conductive layer on the outside of the CRT envelope. The guard screen extends between a deflection yoke and an internal conductive layer. Such a guard layer would reduce the capacitive coupling between the deflection yoke and the internal conductive layer. However, forming the guard screen as a continuous layer allows eddy currents to be induced in the layer by the deflection yoke, thus giving rise to heat generation.

US-A- 4 392 083 describes a radiation shield for the neck of a CRT. The shield consists of a cylindrical sleeve which fits over the neck of the CRT envelope. The sleeve is formed of thin insulating material with a pattern of parallel conductors on its inner and outer surfaces, the conductors on the two surfaces being offset so as to provide a continuous covering around the sleeve. Such a sleeve is easy to fit on the CRT and reduces the eddy current problem. However, such a cylindrical sleeve can only be used around the neck of the CRT, and is not suitable for use around the flared portion, to provide a screen be-

tween the deflection yoke and the internal conductive layer.

The object of the invention is to provide a way of overcoming all the above problems.

Summary of the Invention

According to the invention there is provided a cathode ray tube (CRT) comprising:

an envelope (10) having a neck portion (12) and a flared portion (14);

an internal conductive anode layer (20) extending over the inside of said flared portion;

a deflection yoke (22) surrounding said envelope; and

a conductive guard screen (24) comprising a cylindrical portion (32) surrounding said neck portion (12) and a flared portion (34) surrounding said flared portion (14) of the envelope, said guard screen extending between said deflection yoke (22) and said internal conductive anode layer (20),

characterised in that

said conductive guard screen (24) is formed from a flexible circuit wrapped around the outside of said envelope, said flexible circuit comprising an insulating substrate (26) with a plurality of conductive tracks, said tracks comprising:

a set of originally parallel conductive tracks (32) which, when the circuit is wrapped around the envelope, form a cylindrical portion of the guard screen around said neck portion of the envelope, and

at least one set of originally concentric, arc-shaped or radially arranged tracks (34) which, when the circuit is wrapped around the envelope, form a flared portion of the guard screen around said flared portion of the envelope.

Brief Description of the Drawings

Figure 1 is a sectional elevational view of a CRT embodying the invention.

Figure 2 is a cross-sectional view showing the guard screen in more detail.

Figure 3 shows a typical conductive pattern on the guard screen.

Description of an Embodiment of the Invention

One CRT in accordance with the invention will now be described by way of example with reference to the

accompanying drawings.

Referring to Figure 1, the CRT comprises an evacuated glass envelope 10 having a cylindrical neck position 12, a flared portion 14 and a face 16. An electron gun 18 is positioned in the neck 12 of the tube, and the face 16 is coated with a phosphor, in the conventional manner.

The envelope 10 has an internal aluminised layer 20 on its inner surface, extending from the end of the neck 12, up the flared portion 14, and over the screen 16.

The CRT has scan coils 22 positioned around the neck 12, for deflecting the electron beam from the electron gun 18.

A conductive guard screen 24 is positioned around the CRT, between the scan coils 22 and the envelope 10. This screen is connected, in use, to ground potential. The guard screen 24 thus prevents or reduces the voltages induced between the coils 22 and the internal layer 20, and hence reduces AC emissions from the face 16 of the CRT. It has been found that a reduction in the order of 90-95% of the AC emissions can be achieved by use of the guard screen.

Referring to Figure 2, the guard screen 24 is formed from a flexible printed circuit, wrapped around the envelope 10. The flexible printed circuit comprises a flexible insulating substrate 26, having first and second conductive patterns 28, 30 on opposite sides of the substrate. The substrate 26 may comprise a polyimide film such as for example KAPTON®, having a thickness of 50 microns. Alternatively, the substrate may comprise a KAPTON base with insulating coating layers, with a total thickness of 150 microns.

Each of the conductive patterns comprises a set of parallel fingers, the fingers of the two patterns being interdigitate so that, the fingers of one set are positioned over the gaps between the fingers of the other set. Thus, between them, the two sets of fingers provide complete screening, without any gaps.

The reason why the screen is formed in this way, rather than as a continuous conductive layer, is to prevent or reduce eddy currents in the screen, induced from the scan coils, which would generate excessive heat and cause potential failure of the scan circuits and associated components.

Referring now to Figure 3, this shows a typical conductive pattern on one side of the substrate. The pattern on the other side is similar, but has its conductors offset to produce the interdigitated arrangement.

As can be seen in Figure 3, each pattern includes a set of parallel fingers 32, which, when the flexible printed circuit is wrapped around the CRT, form a cylindrical portion of the guard screen around the neck of the envelope. Each pattern also includes two sets of concentric, arc-shaped fingers 34 which, when the guard screen is in position, form a conical portion, around the flare of the envelope.

Other patterns are possible. For example, the arc-shaped fingers may be replaced by radial fingers.

The width of each finger preferably does not exceed approximately twice the line frequency AC signal penetration depth, otherwise the scan energy will be dissipated in heat generated from eddy current loss. The finger width in millimetres may be calculated from :-

$$W = 2kf^{-1/2}$$

Where

W = Maximum finger width.

k = Constant for material, for copper k = 72 @ 70°C, 75 @ 100°C.

f = Maximum operating frequency.

Typically, the maximum finger width lies in the range 0.5mm to 0.8mm.

The fingers do not have to be copper (ie standard PCB conductive coating), but could be formed in a conductive ink from a screen printing technique. Using this method a very thin, flexible guard screen could be manufactured in quantity and at competitive cost. The screen must be thin in order to fit between the scan coils and CRT neck, and flexible to form a cone around the CRT flare.

A further advantage of fitting a screen between the tube and scan coils is the improved immunity to the scan circuitry to tube 'flash over'. This occurs when the EHT in the tube final anode flashes across to other tube electrodes (a well known phenomenon). Capacitive coupling to the scan coils can cause failure of the electronic drive circuitry but with a screen fitted as described above, this problem would be vastly reduced.

Claims

1. A cathode ray tube (CRT) comprising:

an envelope (10) having a neck portion (12) and a flared portion (14);

an internal conductive anode layer (20) extending over the inside of said flared portion;

a deflection yoke (22) surrounding said envelope; and

a conductive guard screen (24) comprising a cylindrical portion (32) surrounding said neck portion (12) and a flared portion (34) surrounding said flared portion (14) of the envelope, said guard screen extending between said deflection yoke (22) and said internal conductive anode layer (20),

characterised in that

said conductive guard screen (24) is formed from a flexible circuit wrapped around the outside of said envelope, said flexible circuit comprising an insulating substrate (26) with a plurality of conductive tracks, said tracks comprising:

a set of originally parallel conductive tracks (32) which, when the circuit is wrapped around the envelope, form a cylindrical portion of the guard screen around said neck portion of the envelope, and

at least one set of originally concentric, arc-shaped or radially arranged tracks (34) which, when the circuit is wrapped around the envelope, form a flared portion of the guard screen around said flared portion of the envelope.

2. A CRT according to Claim 1 wherein said conductive tracks are disposed on both sides of said insulating substrate (26), the tracks (28) on one side of the substrate being interdigitated with the tracks (30) on the other side of the substrate.

Patentansprüche

1. Kathodenstrahlröhre (CRT) mit

einem Röhrenkolben (10), einem Halsteil (12) und einem sich nach außen erweiternden Röhrenteil (14),

einer inneren leitenden Anodenschicht (20), die sich über die Innenseite des sich nach außen erweiternden Röhrenteils erstreckt, ein Ablenkjoch (22), das das Gehäuse umgibt, und

einen stromleitenden Schutzschirm (24), der einen den Halsteil (12) umgebenden zylindrischen Teil (32) und einen sich nach außen erweiternden, den Teil (14) des Röhrenkolbens umschließenden Teil (34) aufweist, wobei der Schutzschirm sich zwischen dem Ablenkjoch (22) und der inneren stromleitenden Anodenschicht (20) erstreckt,

dadurch gekennzeichnet,

daß der stromleitende Schutzschirm (24) aus einer flexiblen Schaltung gebildet ist, die um die Außenseite des Röhrenkolbens herum angeordnet ist und eine isolierende Unterlage (26) mit einer Vielzahl von stromleitenden Bahnen aufweist, wobei die Bahnen aufweisen:

einen Satz von ursprünglich parallelen stromleitenden Bahnen (32), die, wenn die Schaltung um den Röhrenkolben herum angeordnet wird, einen zylindrischen Teil des Schutzschirmes um

den Halsteil des Gehäuses bilden, und mindestens einen Satz von ursprünglich konzentrischen, bogenförmig oder radial angeordneten Bahnen (34), die, wenn die Schaltung um den Röhrenkolben herum angeordnet wird, einen sich nach außen erweiternden Teil des Schutzschirmes um den sich nach außen erweiternden Teil des Röhrenkolbens bilden.

2. CRT-Röhre nach Anspruch 1, bei der die stromleitenden Bahnen auf beiden Seiten der isolierenden Unterlage (26) ausgebildet sind, wobei die Bahnen (28) auf einer Seite der Unterlage mit den Bahnen (30) auf der anderen Seite der Unterlage ineinandergreifend angeordnet sind.

Revendications

1. Tube cathodique (CRT) comprenant :

une enveloppe (10) possédant une partie col (12) et une partie évasée (14);

une couche d'anode conductrice interne (20) s'étendant sur l'intérieur de ladite partie évasée ;

un bloc de déviation (22) entourant ladite enveloppe ; et

un écran de garde conducteur (24) comprenant une partie cylindrique (32) qui entoure ladite partie col (12) et une partie évasée (34) qui entoure ladite partie évasée (14) de l'enveloppe, ledit écran de garde s'étendant entre ledit bloc de déviation (22) et ladite couche d'anode conductrice interne (20),

caractérisé en ce que :

ledit écran de garde conducteur (24) est formé à partir d'un circuit souple enroulé autour de l'extérieur de ladite enveloppe, ledit circuit souple comprenant un substrat isolant (26) doté d'une pluralité de pistes conductrices, lesdites pistes comprenant :

un groupe de pistes conductrices initialement parallèles (32) qui, lorsque le circuit est enroulé autour de l'enveloppe, forment une partie cylindrique de l'écran de garde autour de ladite partie col de l'enveloppe, et

au moins un groupe de pistes initialement concentriques, en forme d'arcs ou radialement disposées, (34) qui, lorsque le circuit est enroulé autour de l'enveloppe, forment une partie évasée de l'écran de garde autour de ladite partie évasée de l'enveloppe.

2. Tube cathodique selon la revendication 1, où lesdites pistes conductrices sont disposées sur les deux côtés dudit substrat isolant (26), les pistes (28) qui se trouvent d'un côté du substrat étant en position

interdigitée par rapport aux pistes (30) se trouvant sur l'autre côté du substrat.

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Fig. 1.

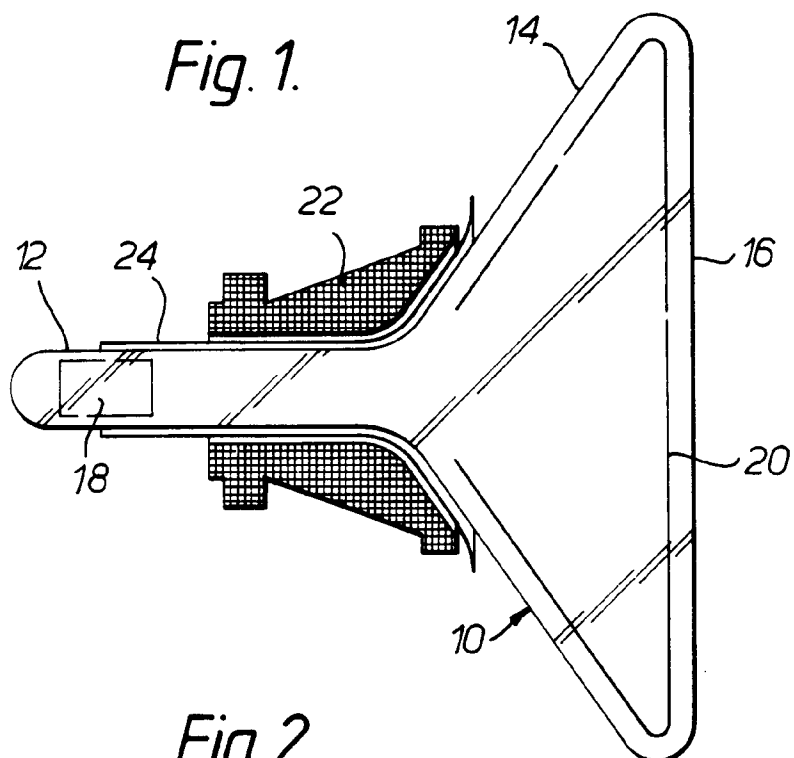


Fig. 2.

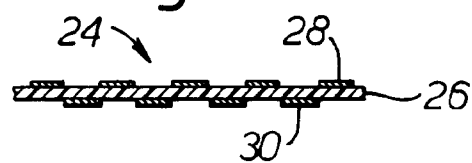


Fig. 3.

