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DEVICE PROVIDED WITH A CATHODE-RAY TUBE
PROTECTION CIRCUIT FOR CRT
ACTIVATED BY POWER SWITCH
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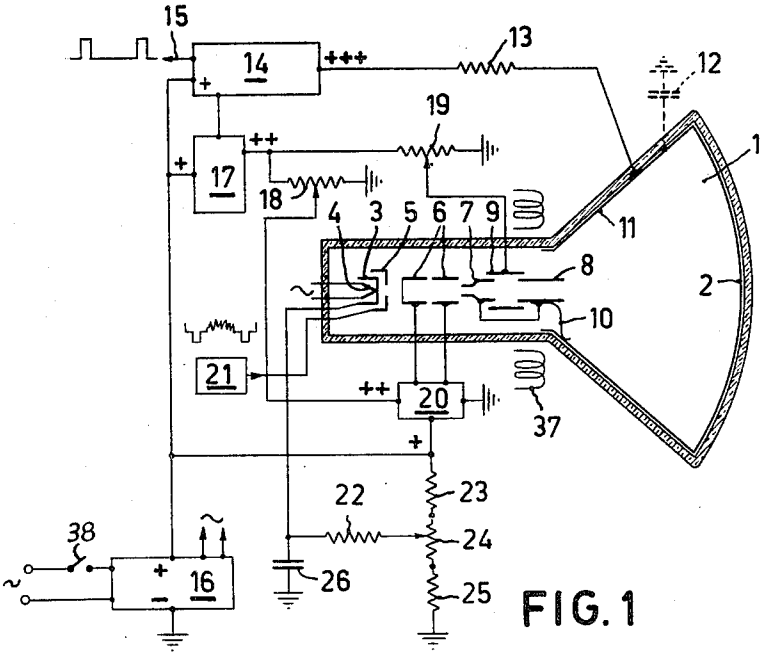

FIG. 1

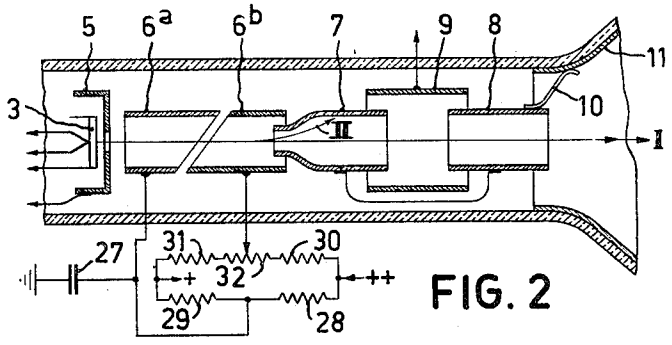

FIG. 2

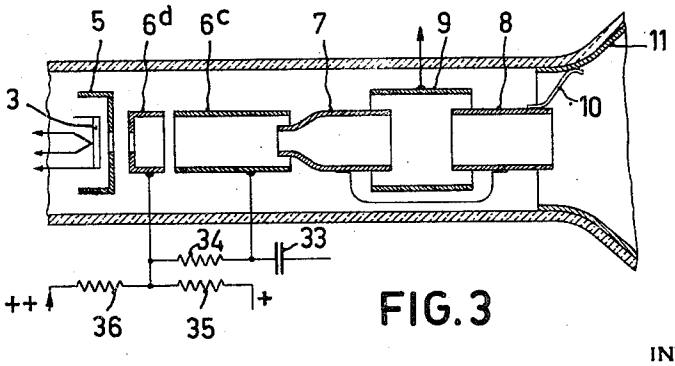

FIG. 3

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DEVICE PROVIDED WITH A CATHODE-RAY TUBE PROTECTION CIRCUIT FOR CRT ACTIVATED BY POWER SWITCH

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10 Claims. (Cl. 315—20)

This invention relates to cathode ray tube devices and more particularly to a television receiver including means for preventing damage to the sensitive viewing screen when the receiver is turned off or in the event of a power failure.

The invention relates to a device provided with a cathode-ray tube comprising an electron gun which at least consists of a cathode, a control electrode, a first anode and a second anode. The invention further relates to a circuit arrangement for energizing the first anode.

Known devices often have a limitation in that burning-in of the fluorescent screen occurs, for example, when the device is switched off. This is particularly true in the case of devices for reproducing television images.

The electrode to which the fluorescent screen of the cathode-ray tube is connected usually consists of a conductive layer provided on the inner side of the bulb. This electrode generally has a comparatively high capacitance with respect to "ground," and consequently a considerable charge, since this electrode is connected to a very high voltage. After the device has been switched off, this high voltage charge may be retained for a comparatively long time.

If, after the device has been switched off, the voltage of the first anode decreases rapidly, the cathode ray is usually suppressed only in part. Consequently, part of the electrons still emanating from the glowing cathode may flow to the fluorescent screen then still strongly positive, and impinge thereon with a high velocity, as a result of which a burn may occur, since the electric charge on the screen and the electrodes connected therewith are neutralized only slowly. If, however, the ray could pass at its full strength, the screen could be discharged before the deflection voltages have disappeared completely.

According to a known solution, it has been suggested to disconnect the first anode from the supply source simultaneously with the interruption of the A.C. supply. Since the first anode is connected to a comparatively large capacitor to eliminate the consequences of any flash-over from an electrode applied to a high voltage, the positive voltage of this anode is maintained for a comparatively long time after the interruption, so that the ray can pass at its full strength until the screen has been discharged.

However, this solution is not effective when the device is switched off by pulling the plug out of the socket, or because of the disappearance of the supply voltage.

According to the invention, the burning-in of the screen after switching off such a device is avoided by providing a first anode which consists of two parts to which approximately equal potentials are supplied by means of switching circuits having different discharge times in a manner such that if the potential of one of the anode parts drops below that of the other part, the cathode ray no longer impinges upon the screen. It is then possible to suppress the ray completely, but the ray is preferably deflected so that it strikes the second anode and discharges it. Since the second anode is also connected to the electrode which is provided on the inner wall of the bulb, this electrode, and consequently also the screen, are discharged. In the case where the ray is completely suppressed, these electrodes remain charged, which may be unpleasant upon touching.

The invention will now be described more fully with reference to the accompanying drawing in which:

FIG. 1 shows diagrammatically a circuit arrangement of a device in accordance with the invention, and

FIGS. 2 and 3 show in greater detail two embodiments in accordance with the invention.

Referring now to FIG. 1, reference numeral **1** denotes a cathode-ray tube comprising a fluorescent screen **2** and an electron gun consisting of a cathode **3** heated by a heating member **4**, a control electrode **5** with which the intensity of the cathode ray can be controlled, a first anode **6** consisting of two parts, a second anode **7**, **8** and a focusing electrode **9**. The parts **7** and **8** of the second anode are electrically connected together in the tube and the part **8** is connected electrically by means of a spring **10** to the conductive coating **11** on the inner wall of the tube **1**. The electrodes **7**, **8** and **11** have a capacitance with respect to "ground" which is represented diagrammatically by the capacitor **12**. The electrode **11** comes also into contact with the fluorescent screen **2**. Through a resistor **13**, the electrode **11** is connected to a source of high voltage **14** (16 kv.) which derives its voltage from the horizontal deflection circuit. High voltage source **14** is connected at **15** to the synchronisation separating circuit (not shown) and further to the positive terminal of the power supply apparatus **16**. Deflection coils **37** are arranged around the neck of the cathode-ray tube in normal manner.

The efficiency diode circuit **17** of the deflection circuit **14** supplies the positive voltage for the parts of the first anode **6** and the focussing electrode **9** through potentiometers **18** and **19**, respectively. The two parts of the first anode **6** are connected to the circuit arrangement **20**, two embodiments of which are shown in FIGS. 2 and 3. In this case, the control electrode **5** is connected to a video amplifier **21** and the cathode **3** to the brightness control consisting of resistors **22**, **23**, **24**, **25** and a capacitor **26**. Alternatively, the control voltages may also be supplied to the cathode **3**, in which case the electrode **5** is connected to the brightness control. A switch **38** controls the supply of power to the system.

As shown in FIG. 2, the first anode **6** is divided into two parts by a diagonal cut, so that parts *6a* and *6b* are formed, which are separated along a plane which is at a sharp angle to the axis of the parts. The part *6a* of the first anode is connected to the capacitor **27** and its potential is supplied through resistors **28**, **29** which constitute a voltage divider. The part *6b* of the first anode **6** is connected to a potentiometer **32**, the ends of which are connected to resistors **30** and **31**. The potentiometer **32** renders it possible to make the voltage of the part *6b* exactly equal to that of the part *6a*. The electron beam passes in the direction I. Since the circuit branch **30**, **31**, **32** does not include a capacitor, its R.C. time constant is very short. If the device is switched off, the voltage of *6b* will decrease much more rapidly than that of *6a*, as a result of which due to the diagonal cut, the part *6b* causes a deflection of the ray in the direction II, so that this ray impinges on the second anode **7** and discharges the electrodes **7**, **8** and **11** before the deflection due to the voltage difference between electrodes *6a* and *6b* has decreased to zero.

The circuit arrangement may also be simplified, as shown in FIG. 3, in which at the same time another embodiment of the first anode is illustrated. The part *6c* is then connected to a capacitor **33** and through a resistor **34** of high value to the anode part *6d* and the common point of a voltage divider constituted by resistors **35** and **36**.

The voltages of the parts *6c* and *6d* will then always

become equal. After the receiver is switched off, the voltage of 6*d* will decrease more rapidly than that of 6*c*. Since 6*d* has a small aperture through which the ray passes the control effect of 6*d* is so great that the ray is suppressed completely. As has been indicated already, the disadvantage of this arrangement is that the electrodes **7**, **8** and **11** remain at a high voltage, which may be unpleasant if the device is opened, for example, for checking, adjusting or repairing purposes. The embodiment of the first anode of FIG. 2 is consequently preferred. It should be noted that the circuit arrangement of FIG. 3 may also be used with the construction of the anode parts 6*a* and 6*b* shown in FIG. 2, and conversely.

The invention is of particular importance for tubes without an ion trap, and especially if the deflection voltages are produced by means of transistors, since in this case, after the device has been switched off, they drop to zero substantially immediately, because there are no tubes with afterglowing cathodes present.

The invention will now be described more fully with reference to an example.

The voltage of the supply apparatus **16** designated in the drawing by + is, for example, 200 v. The high voltage +++ supplied by the circuit arrangement **14** is 16 kv. and the voltage ++ supplied by the efficiency diode circuit to the focusing electrode **9** and the circuit arrangement **20** is approximately 800 v.

The resistors and capacitors shown in the drawing may have, for example, the following values.

Resistor **13**	MΩ 1
Resistor **18**	MΩ 1.5
Resistor **19**	MΩ 1.5
Resistor **22**	Ω 47,000
Resistor **23**	Ω 2,200
Resistor **24**	Ω 6,000
Resistor **25**	Ω 21,300
Resistors **28, 29, 30, 31**, each	MΩ 4.7
Resistor **32**	MΩ 1
Resistor **34**	MΩ 10
Resistors **35, 36**, each	MΩ 2.7
Capacitor **12**	pF 1,500
Capacitor **26**	pF 80,000
Capacitors **27, 33**, each	pF 68,000

Although only two embodiments of circuit arrangements and constructions of the first anode have been described, it is obvious that various changes and modifications of the invention may be made without departing from the scope of the invention.

What is claimed is:

1. A cathode ray tube arrangement comprising a cathode, a first anode comprising first and second sections insulated from one another, a second anode, a source of anode voltage, first and second circuit means for coupling said voltage source to said first and second sections, respectively, said first and second circuit means having different discharge time constants, and means for effectively removing said voltage source from said first and second sections thereby to diminish the anode voltages of said first and second sections in accordance with the said respective time constants of said first and second circuit means.

2. A cathode ray tube arrangement comprising a fluorescent screen, an electron gun for directing an electron beam to said screen, said electron gun comprising a cathode, a first anode and a second anode, said first anode comprising first and second sections insulated from one another, a source of anode voltage, first and second circuit means for coupling said voltage source to said first and second sections, respectively, to provide approximately equal potentials thereto, said first and second circuit means having different discharge time constants, and means for effectively removing said voltage source from said first and second sections thereby to diminish the anode voltages of said first and second sections in accordance with the said respective time constants of said first and second circuit means, said first and second sections being arranged within said tube so as to deflect the electron beam away from said screen at a given inequality of the anode potentials of said first and second sections.

3. Apparatus as described in claim **2** wherein each of said first and second sections comprises a truncated right circular cylinder longitudinally displaced from one another along the axis of said cathode ray tube so as to produce a deflection field during the decay of said anode potentials having a transverse component which directs said beam to said second anode.

4. A cathode ray tube arrangement comprising a cathode, a first anode comprising first and second spaced apart truncated cylindrical sections, each of said sections having a matching truncated surface separated from each other by a diagonal cut along a plane which forms an acute angle with the longitudinal axis of said cylindrical sections, a second anode, a source of anode voltage, first and second circuit means for coupling said voltage source to said first and second sections, respectively, said first and second circuit means having different discharge time constants, and means for deenergizing said voltage source thereby to diminish the anode voltages of said first and second sections in accordance with the said respective time constants of said first and second circuit means.

5. A cathode ray tube arrangement comprising a fluorescent screen, an electron gun for directing an electron beam to said screen, said electron gun comprising a cathode, a first anode and a second anode, said first anode comprising first and second spaced truncated cylindrical sections separated from one another by a plane which forms an acute angle with the longitudinal axes of said cylindrical sections, said first and second sections being electrically insulated from one another, a source of anode voltage, first circuit means comprising a resistance-capacitance network for coupling said first section to said voltage source, second circuit means coupling said second section to said voltage source, said first circuit means having a longer discharge time constant than said second circuit means, said first and second circuit means being arranged to supply approximately equal anode potentials to said first and second sections, and means for effectively decoupling said voltage source from said first and second sections thereby to diminish the anode voltage of said first and second sections in accordance with the said respective time constants of said first and second circuit means whereby said electron beam is deflected away from said screen and onto said second anode.

6. A cathode, ray tube arrangement comprising a cathode a first anode comprising a cylinder longitudinally positioned within said tube and divided into two sections along its longitudinal axis, a second anode, a source of anode voltage, first circuit means for coupling said voltage source to one of said cylindrical sections, second circuit means for coupling said voltage source to the other one of said two sections, and first and second circuit means having different discharge time constants, and means for deenergizing said voltage source thereby to initiate a decay in the anode voltages of said one and said other cylindrical sections in accordance with the said respective time constants of said first and second circuit means.

7. Apparatus as described in claim **6** wherein said first anode cylinder is divided into two separate sections each of which comprises a truncated right circular cylinder, said two sections being electrically insulated from one another and said first and second circuit means being arranged to supply approximately equal potentials to said first and second sections.

8. A cathode ray tube arrangement comprising a fluorescent screen, an electron gun for directing an electron beam to said screen, said electron gun comprising a cathode, a first anode and a second anode, said first anode comprising first and second spaced sections insulated from one another, said first section comprising a substantially disc-shaped member having an aperture for passage therethrough of said electron beam and said second section comprising a cylindrical member, a source of anode voltage, first and second circuit means for coupling said voltage source to said first and second sections, respectively, said first and second circuit means having different discharge time constants, means for effectively removing said voltage source from said first and second sections thereby to diminish the anode voltage of said first and second sections in accordance with the said respective time constants of said first and second circuit means.

9. Apparatus as claimed in claim 8 wherein said second circuit means comprises a resistance-capacitance network having a substantially longer discharge time constant than said first circuit means.

10. A cathode ray tube arrangement comprising a fluorescent screen, an electron gun for directing an electron beam to said screen along a given path, said electron gun comprising a cathode, a first anode and a second anode, said first anode comprising first and second longitudinally spaced sections insulated from one another, a source of anode voltage, first circuit means for coupling said voltage source to said first section to supply a given potential thereto, second circuit means for coupling said voltage source to said second section to supply a potential thereto having a predetermined relationship to the potential of said first section thereby to direct said electron beam to said screen, and means for effectively removing said voltage source from said first and second sections, said first and second circuit means having different discharge time constants whereby a deflection field is produced by the decay in anode potential of said first and second sections, said field having a component transverse to said given path upon a given variation in said predetermined anode potential relationship whereby said electron beam is deflected away from said screen.

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