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[54] **CATHODE-RAY TUBE INCLUDING A GLASS ENVELOPE WITH TWO SPACED EXTERNAL CONDUCTIVE COATING AND A CONNECTING STRIP OF A THIRD EXTERNAL CONDUCTIVE COATING THEREON**

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[51] **Int. Cl.** **H01j 29/00**, H01j 31/00

[58] **Field of Search** ..... 313/82 R, 85 R

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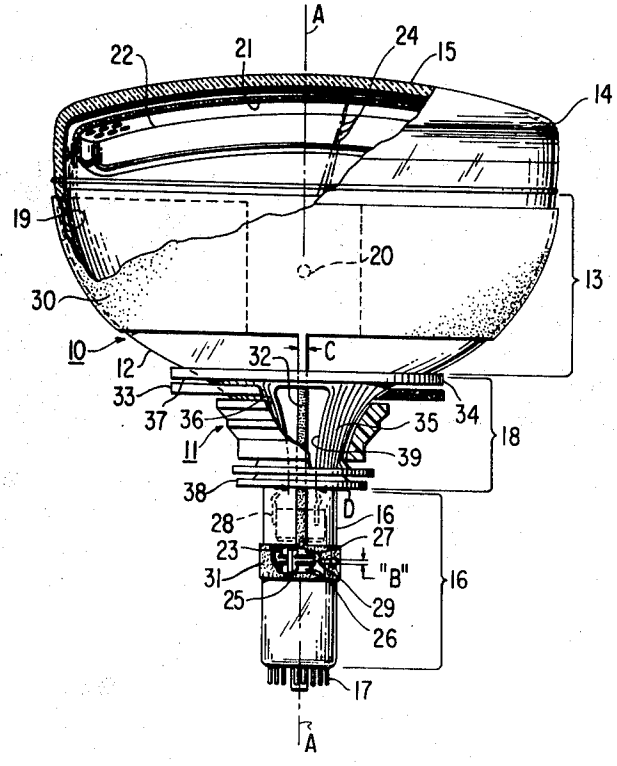
Primary Examiner—Robert Segal

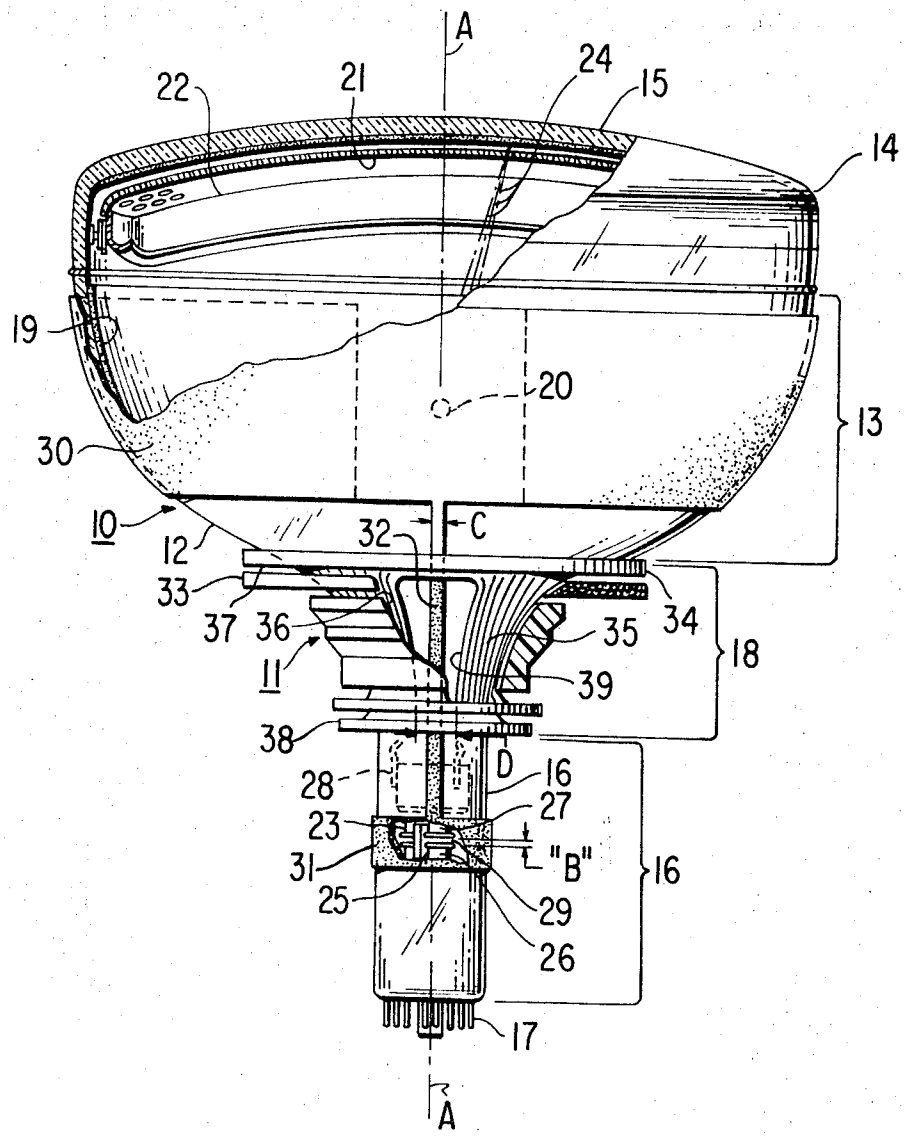
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[57] **ABSTRACT**

A cathode-ray tube including a glass envelope having a forward portion terminating in a viewing screen, a center portion, and a rear portion including an electron-gun assembly having at least one focusing lens therein. A first external conductive coating is on the forward portion of the envelope, and a second conductive coating spaced from the first conductive coating is on the rear portion of the envelope at least over the focusing lens. A longitudinal strip of a third external conductive coating on the center portion of the envelope connects the first and second conductive coatings.

1 Claim, 1 Drawing Figure





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CATHODE-RAY TUBE INCLUDING A GLASS ENVELOPE WITH TWO SPACED EXTERNAL CONDUCTIVE COATING AND A CONNECTING STRIP OF A THIRD EXTERNAL CONDUCTIVE COATING THEREON

BACKGROUND OF THE INVENTION

The invention relates to a novel cathode-ray tube, for example, to a color television picture tube, including a glass envelope with two spaced external conductive coatings and a connecting strip of a third conductive coating thereon.

One type of cathode-ray tube conventionally comprises a glass envelope having a forward portion terminating in a vewing window with a luminescent viewing screen thereon and a rear portion including bipotential electron-gun assembly having at least one electron gun with focusing lens. Each electron gun projects one electron beam towards the window to excite the screen to luminescence. A deflection yoke mounted on the envelope includes magnetic field producing coils positioned adjacent the envelope to provide for deflection of the electron beams.

The tube includes a first external conductive coating on the forward portion of the envelope or funnel between the yoke and the viewing screen and a second conductive coating, spaced from the first conductive coating, on the rear portion of the envelope or neck at least over the focusing lenses of the electron gun. The second conductive coating is spaced from the first coating to permit mounting of the yoke on an uncoated portion of the envelope. If the yoke were mounted on a conductive coating, it may accidentally become grounded to the coating. In the operation of the tube, the second coating is connected to a ground potential with a spring clip clamped against the coating, which is in turn connected with a ground wire to a convenient ground potential. By grounding the second coating in this manner, a special clip with ground wire is necessary, which increases the cost of equipment necessary for tube operation. In addition, the clip with ground wire results in an increased number of separate external components necessary for tube operation. Furthermore, the ground clip may become easily disconnected or may be improperly connected, resulting in decreased operating performance of the tube.

SUMMARY OF THE INVENTION

As in the prior art, the novel cathode-ray tube includes an evacuated glass envelope having a forward portion or funnel terminating in a viewing screen, a center portion, and a rear portion or neck including an electron gun therein. The forward portion includes a first external conductive coating, and the rear portion includes a second external conductive coating, spaced from the first external conductive coating, at least around the envelope over the focusing lens of the electron gun. Unlike the prior art, the center portion includes a longitudinal strip of a third external conductive coating connecting the first and second coatings.

In operation, a deflection yoke having two pair of magnetic field producing coils, each coil having a window, is mounted on the center portion of the novel tube. The yoke is positioned over the center portion with at least one of the windows formed by the inner pair of coils positioned over the strip. The novel tube eliminates the clip with ground wire and utilizes an external strip of conductive coating to connect the second coating to the first coating. The connecting strip connects the second coating to ground potential since the first coating is normally connected to a ground potential during the use of the tube. Since the first, second and connecting strip of a third conductive coating can be simultaneously applied using existing processes at a cost substantially equal to the cost of only the additional coating material, and the clip with ground wire is eliminated, an economy results in the manufacture and use of the novel tube. In addition, the elimination of the clip with ground wire reduces the number of separate external components required for the operation of the tube. Furthermore, replacing the separate mechanical ground connection with an integral ground connection in the form of a strip of conductive coating provides more assurance that the second coating is always connected to ground potential during the operation of the tube. Also, the novel tube can be installed in equipment not previously provided with a mechanical ground, thereby resulting in increased tube-operating performance without requiring a receiver modification.

BRIEF DESCRIPTION OF THE DRAWING

The sole FIGURE is a partially broken away top elevational view of the novel color television picture tube and associated magnetic deflection yoke illustrating the external strip of conducting coating thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The novel color television picture tube **10** with an electromagnetic deflection yoke **11** positioned thereon is illustrated in the sole FIGURE. The tube **10** comprises a glass envelope **12** including a forward portion or funnel **13** terminating in a panel **14** having a viewing window **15**, a rear portion or neck **16** terminating in a stem assembly **17**, and a flared center portion **18** connecting between the funnel **13** and neck **16**. The inside surface of the funnl **13** includes an internal conductive coating **19**. An anode connection **20** is provided through the funnel **13** for connecting a high voltage to the internal coating **19**. A luminescent viewing screen **21** comprised of a multiplicity of phosphor dots is supported on the inside surface of the viewing window **15**, and an aperture-mask assembly **22** is positioned in the envelope in front of the screen **21**. An electron-gun assembly **23** is positioned in the neck **16** for projecting three electron beams **24** red (r), blue (b), and green (g) towards the aperture-mask assembly **22** and the screen **21**.

The electron-gun assembly **23** includes three electron guns **25** (only one of which is partially shown in the sole FIGURE). The electron-gun assembly **23** includes a first grid G-1 (not shown), a second grid G-2 (not shown), a third or focusing grid G-3 designated **26**, and a fourth grid or anode G-4 designated **27**. A convergence assembly **28** is coupled to the three electron guns **25**. A spacing "B" exists between the third and fourth grids **26** and **27**. The third grid **26** is at approximately 5,500 volts, and the fourth grid **27** is at approximately 25,000 volts. The spacing "B" and potential difference produce a lens-like configuration of equipotential field lines resulting in the formation of one of the three electron beams **24**. The lens-like configuration having the spacing "B" is therefore generally

designated a focusing lens of one of the three electron guns **25**. For an electron-gun assembly **23** comprising three electron guns **25**, there are three focusing lenses **29** in substantial alignment.

The tube **10** includes a first external conductive coating **30** on the external surface of the funnel **13**. The first external coating **30** covers substantially the entire external surface of the funnel **13** except for an area surrounding the anode connection **20**. This is to prevent current leakage from the anode connection **20** to the first external coating **30**. The internal conductive coating **19**, the glass funnel **13**, and the first external conductive coating **30** in combination provide voltage regulation in the operation of a color television receiver, as is known.

The tube **10** also includes a second external conductive coating **31** on the neck **16**. In the preferred embodiment, the second external coating **31** comprises a band around the neck **16** positioned substantially centered over the focusing lenses **29** of the electron-gun assembly **23**. The second external coating **31** is believed to equally distribute electrical charges accumulating on the inner surface of the neck **16** over the focusing lenses **29**, thereby reducing convergence shift of the electron beams **24** caused by the prior nonuniform charge distribution. Referring to the sole FIGURE, it is preferred the the band of second external coating **31** is approximately 0.75-inch wide.

A longitudinal strip of a third external conductive coating **32** on the center portion **18** of the envelope **12** parallel to the axis A-A of the tube **10** connects the first and second external coatings **30** and **31** respectively. In the preferred embodiment, the third external coating **32** is a longitudinal strip on the top of the surface of the envelope **12** approximately 0.25-inch wide. In this description, the top of the envelope **12** is defined to be that portion of the envelope which is uppermost when positioned in a television receiver.

In the opeation of the novel tube **10**, an electromagnetic deflection yoke **11** of the well-known saddle type is positioned on the envelope **12** adjacent the center portion **18** of the envelope **12**. The yoke **11** is conventionally positioned on the envelope to produce a deflection field for deflecting the electron beams **24** from the electron-gun assembly **23** to horizontally and vertically sweep the screen **21** scanning a rectangular raster at the screen **21** in a known manner. The yoke **11** includes a set of saddle-type vertical deflection coils **33** and a set of saddle-type horizontal deflection coils **34**. The usual convention is to position the horizontal deflection coils **34** inside the vertical deflection coils **33** and in close proximity to the envelope **12**.

The horizontal coils **34** each have two spaced groups of active side conductors **35** and **36** extending generally along the longitudinal axis A-A of the tube **10** (only one coil is shown in the sole FIGURE) and spaced from one another circumferentially of the tube **10**. The spaced groups of side conductors **35** and **36** are joined at their ends by groups of connecting front and rear end conductors **37** and **38** respectively extending traversely of the tube **10**. The groups of side conductors **35** and **36** follow the contour of the envelope **12** on the center portion **18**, flaring up at their ends to join the groups of front and rear end conductors **37** and **38**, which are spaced from the tube **10**. The groups of front and rear end conductors **37** and **38** are usually flared up and spaced from the envelope **12** to prevent their generating a field which interacts with the desired deflection field. The open center space between the two spaced groups of side conductors **35** and **36** and the connecting groups of front and rear end conductors **37** and **38** is generally defined to be a "window" **39**.

It is preferred that the longitudinal strip of a third external coating **32** which is positioned on the center portion **18** of the envelope **12** not contact or be positioned under the two spaced groups of side conductors **35** and **36** of the horizontal coils **34** to prevent grounding of the third external coating **32** by the shorting of the insulation on the coils.

In the preferred embodiment, the third external coating **32** is on the tube **10** substantially centered under one window **39** between the two spaced groups of side conductors **35** and **36** (shown in the sole FIGURE) when the yoke **11** is positioned on the tube **10**. The width C of the strip of third external coating **32** should not exceed the width of the narrowest portion of the window **39**. If the width C of the strip of third external coating **32** is greater than the narrowest width D of the window, it would be under and in contact with the horizontal coil **34**, which as previously described, is not desirable.

In the operation of the tube **10** with yoke **11**, one window **39** formed by one of the horizontal coils **34** is centered over the top of the envelope **12**, and the other window (not shown) formed by the other horizontal coil (not shown) is positioned opposed from the first window **39** centered over the bottom of the envelope **12**. In a 25VABP22 color television picture tube, the anode connection **20** is located on the bottom of the funnel **13**. Since the third external coating **32** does not extend near the anode connection **20** as previously described, a longitudinal strip of a third external coating **32** would not directly connect with the first external coating **30**. It is therefore preferred that the third external conductive coating **32** be positioned under the window **39** on the top of the envelope **12** as previously described.

The first, second and third external coatings **30**, **31** and **32** respectively are deposited from a colloidal graphite suspension such as, for example, "Aquadag." It is preferred that the dry coatings are about 0.001-inch thick and have a low resistance such as, for example, 150 ohms per linear inch. It is preferred that the coatings are applied as one continuous layer of suspension, rather than as separate abutting or overlapping layers, to provide uniform thickness and resistance. The coatings are preferably applied by spraying, which is well known.

In the preferred method of applying the coatings, a spray shield (not shown) is positioned over the envelope **12**. The shield closely fits against and substantially conforms to the contour of the envelope **12**. The shield has cutouts or openings over the portions of the envelope **12** corresponding to the desired position of the coatings **30**, **31** and **32** on the envelope **12**. The coatings are then applied by spraying onto the unshielded portions of the envelope **12**.

Although, in the preferred embodiment, the third external coating **32** is a strip about 0.25 inch wide, the coating width may be narrower since there is substantially no current flow in the coating. The only requirement is that the coating width be sufficient to maintain the second coating **31** at ground potential.

Although the third external coating **32** is described as a strip of a uniform width, it may be of varying width limited only by the width of the window **39** as previously described.

Although particular shapes for the first and second coatings **30** and **31** respectively are described in the preferred embodiment, other shapes can be used such as, for example, the second coating may cover the entire surface of the neck **16.**

Although it is described that the horizontal coils **34** are positioned in contact with the envelope **12** and contain a window **39** under which the third conductive coating **32** can be positioned without contacting the spaced groups of side conductors **34** and **36,** the vertical coils **33** may alternatively be positioned in contact with the envelope **12.** The vertical coils **33** are similar to the horizontal coils **34** and similarly contain a window which would be positioned over the sides of the tube **10** and under which the third conductive coating **32** can be positioned without contacting spaced groups of side conductors of the vertical coils **33.**

I claim:

1. In combination, a cathode-ray tube including a glass envelope having a forward conical portion terminating in a viewing window, a center yoke receiving portion, and a rear neck portion having therein a plurality of electron guns in a delta array, each of said guns having a focusing lens, said tube comprising

a. a first conductive coating substantially covering the external surface of said conical portion, except for a portion surrounding the anode connection,

b. a second circumferential band of conductive coating on the external surface of said neck portion substantially centered over said focusing lenses of said electron guns, and

c. a longitudinal strip of a third conductive coating on the external surface of said yoke receiving portion of said envelope connecting said first coating and said second coating; and a saddle yoke comprising at least two inner opposed magnetic field producing coils, each coil having a window which is formed by two spaced groups of side conductors and two connecting groups of end conductors, said yoke being positioned over said yoke receiving portion, with at least one of the windows formed by the inner pair of coils positioned over said strip, said longitudinal strip being of a width less than the space between the two spaced groups of side conductors forming one of said two windows and capable of maintaining said first and said second conductive coatings at the same potential.

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