Oct. 31, 1967 R. J. LINDEMAN ET AL 3,350,593

ONE PIECE METAL CONE FOR A CATHODE RAY TUBE

Filed July 31, 1964 2 Sheets-Sheet 1

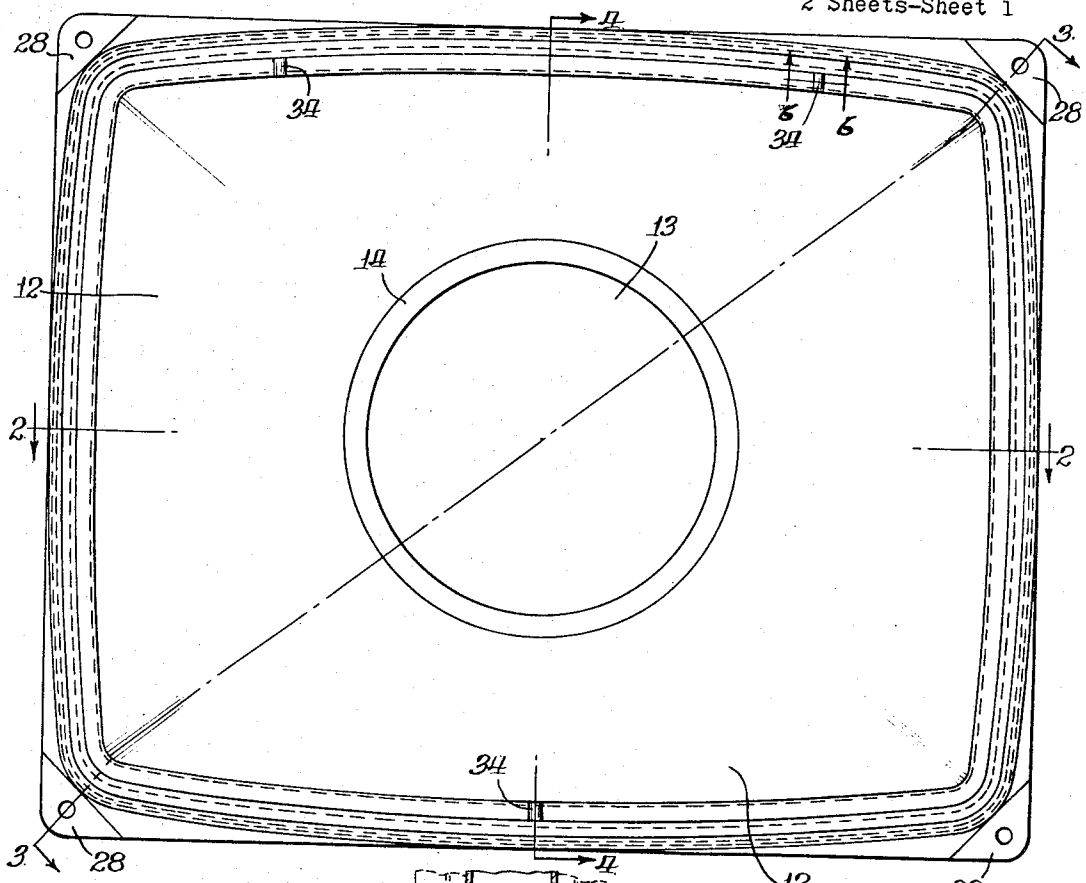

Fig. 1.

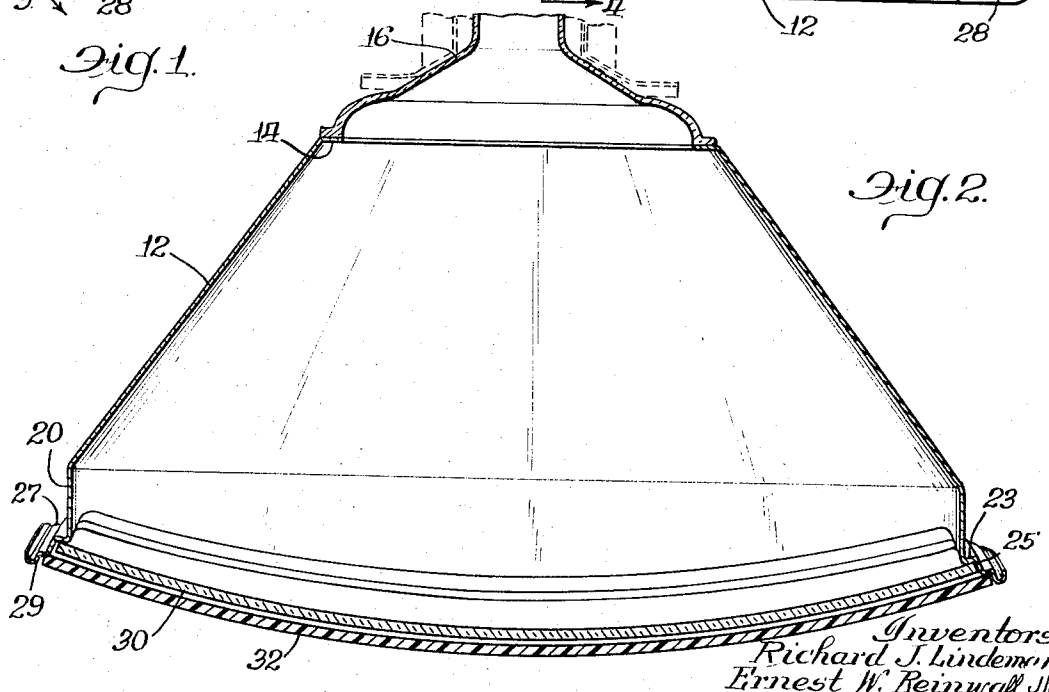

Fig. 2.

Inventors:
Richard J. Lindeman
Ernest W. Reinwall, Jr.
By Mueller & Richele Attys

Oct. 31, 1967 R. J. LINDEMAN ET AL 3,350,593

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Filed July 31, 1964 2 Sheets-Sheet 2

Fig. 6.

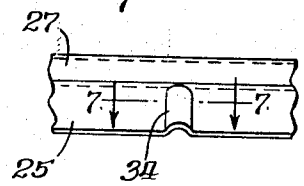

Fig. 7.

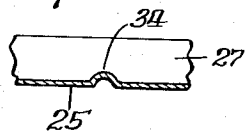

Fig. 3.

Fig. 4.

Fig. 5.

Inventors:
Richard J. Lindeman
Ernest W. Reinwall, Jr.
By: Muller & Richele
Attys

United States Patent Office

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ONE PIECE METAL CONE FOR A CATHODE RAY TUBE

Richard J. Lindeman, Elmwood Park, and Ernest W. Reinwall, Jr., McHenry, Ill., assignors to Motorola, Inc., Franklin Park, Ill., a corporation of Illinois

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ABSTRACT OF THE DISCLOSURE

This cone for a color cathode ray tube envelope comprises a one-piece metal shell that has a main body portion in the shape of a pyramidal frustum. An electron gun assembly is mounted in a generally circular opening at the small end of the body portion. A plurality of side walls define a rectangular opening in the large end of the body portion. The free marginal edges of the side walls are formed into first and second steps to provide inner and outer seating ledges. Three indentations extend from the periphery of a flange portion which cooperates with an extending ledge portion to form the inner seating ledge. The faceplate panel is seated on the inner seating ledge and is indexed to the electron gun assembly by the indentations. A safety panel is set into the outer seating ledge to complete the envelope.

This invention relates generally to cathode ray tubes and more particularly to an improved rectangular metal cone for cathode ray tubes having a composite metal and glass envelope.

The usual cathode ray tube for television receivers includes a large area glass faceplate panel having a fluorescent screen thereon and a relatively small diameter neck containing an electron gun assembly located some distance from the faceplate panel. The faceplate panel and the neck in turn are joined by a cone or funnel of a generally frusto-conical or frusto-pyramidal shape.

Most present day cathode ray tubes that are made on a commercial basis use a glass cone, resulting in a unitary glass envelope. In the instance of black and white tubes the faceplate panel and the cone are joined by the glass manufacturer to form a single structure. However, it has been recognized that a sheet metal cone, with the faceplate panel and the neck sealed to the ends, may be lighter in weight than an all-glass structure of equal size and strength. This is particularly so with larger tubes having a rectangular faceplate panel and wide deflection angles. A metal cone can further offer improved X-ray radiation protection.

There has also been an increasing effort to produce color cathode ray tubes of the aperture mask type having a rectangular viewing screen. The envelope of such tubes requires stringent dimensional tolerances, and the alignment of internal components is more critical than in black and white tubes, adding to the difficulties in fabricating a tube with a glass envelope. An all-glass envelope having a frusto-pyramidal funnel is further susceptible to distortions arising from elevated temperature during processing of the tube and as a result of atmospheric pressure subsequent to evacuation of the tube. Consequently glass of greater thickness and hardness than that usually required for black and white tubes is often used, adding to the size and complexity of color tubes.

In addition, in the usual color cathode ray tube an apertured shadow mask (or a switching grid) must be positioned in close proximity to the fluorescent screen on the inside surface of the faceplate panel. As a result, it is necessary to accurately position and seal the faceplate

panel to the wide end of the cone in a separate operation subsequent to mounting of the apertured shadow mask structure rather than providing a unitary glass envelope, as in the instance of black and white cathode ray tubes. In assembling the shadow mask, for example, a frame is provided for the shadow mask, and the frame in turn is secured to mounting studs which have been embedded in the side walls of the faceplate panel prior to sealing to the cone. For these and other reasons the economies that have been achieved in the manufacture of black and white cathode ray tubes by using a unitary glass envelope cannot be realized in the manufacture of color cathode ray tubes, and the attending advantages of a metal cone or funnel becomes more attractive when considered in conjunction with the manufacture of color cathode ray tubes.

For both black and white and color television receivers, but particularly in the instance of color television receivers in which the cathode ray tube is large and the associated circuitry complex, it is desirable to reduce cabinet space and supply simplified mounting for the tube in the cabinet. It is the usual practice, for example, to provide a safety window to protect the viewer from flying glass in the event of an implosion. Also, some provision must be made so that the tube can be firmly mounted in the cabinet, and in the instance of an all-glass envelope, this usually requires a band or strap around the funnel, with suitable brackets or guide wires to urge the faceplate panel of the tube against the bezel in the front of the receiver.

It is, therefore, an object of the invention to provide an improved metal cone for cathode ray tube envelopes.

Another object of the invention is to provide an improved metal cone particularly suitable for rectangular color cathode ray tubes of the shadow mask type.

A further object of the invention is to provide an improved cathode ray tube having a metal cone with provision for the mounting of a safety window on the cone.

Still another object of the invention is the provision of an improved cathode ray tube with a rectangular metal cone and having integral mounting brackets for mounting in the cabinet of a television receiver.

A still further object of the invention is to provide an improved color cathode ray tube having a metal cone and a simplified aperture mask structure.

Another object of the invention is to provide a metal cone for color cathode ray tube having a seating ledge with indexing points so that the faceplate panel may be accurately positioned and sealed thereto.

Other objects, as well as the features and attending advantages of the invention will become apparent from the following description when taken in conjunction with the following drawings, in which:

FIG. 1 is a top plane view illustrating the pyramidal frustum metal cone for a cathode ray tube embodying the present invention;

FIG. 2 is a sectional view in elevation of the cone, taken along lines 2—2 of FIG. 1;

FIG. 3 is a sectional view in elevation of the cone, taken along lines 3—3 of FIG. 1;

FIG. 4 is a sectional view in elevation of the cone, taken along lines 4—4 of FIG. 1;

FIG. 5 is an enlarged partial section illustrating the manner in which an aperture mask is positioned in the cone;

FIG. 6 is a sectional view taken along lines 6—6 of the cone of FIG. 1; and

FIG. 7 is a sectional view taken along lines 7—7 of FIG. 6.

According to the present invention there is provided a metal shell having a main body in the shape of a pyramidal frustum. The smaller end of the main body has a circular opening surrounded by a flange that is sealed to

a glass chamber containing an electron gun structure. The larger end of the main body is open and includes a side wall defining a substantially rectangular opening. When used in conjunction with a color tube of the shadow mask type, an aperture mask may be secured directly to the side wall. The free marginal edges of the side wall is formed into steps which provide inner and outer seating ledges that are continuous with one another. The inner seating ledge has a smaller periphery than the outer seating ledge. A glass faceplate panel is positioned by and sealed to the inner seating ledge to complete the tube envelope. The outer seating ledge is adapted to receive a safety window to provide protection against implosion. The side walls around the peripheral edge of the inner sealing ledge are provided with several standoff indentations which provide indexing points for the faceplate panel to reduce the effects of the dimensional tolerances which arise in fabricating the metal shell. The four corners of the rectangular configuration defined by the outer sealing ledge also includes outwardly extending ears to thereby provide brackets for mounting the tube to the cabinet of a television receiver.

As illustrated in FIGS. 1–5, the metal cone for cathode ray tube **10** comprises a main body portion **12** in the shape of a pyramidal frustum. The smaller end of body portion **12** has a generally cylindrical opening **13** therein. The flange **14** rims opening **13** and provides an annular surface to which a flared glass neck **16** (shown in assembled condition in FIGS. 2 and 3) is sealed.

The larger end of body portion **12** includes a side wall (or an intermediate portion) **20** to define a substantially rectangular opening. The marginal edge of side walls **20** is formed into first and second steps to provide inner seating ledge **22** and outer seating ledge **24**. Inner seating ledge **22** includes an outwardly extending ledge portion **23** and an upwardly extending flange portion **25**. Outer seating ledge **24** includes an outwardly extending ledge portion **27** and an upwardly extending flange portion **29**. Four additional flanges (or ears) extend outwardly from the corners of the rectangular opening defined by flange **29** to thereby provide mounting brackets **28** so that tube **10** may be mounted to the front of the cabinet of a television receiver.

Faceplate panel **30** (shown in assembled condition in FIG. 2) is sealed to inner seating ledge **22** to complete the tube envelope which is to be evacuated. A safety window **32** is fastened in outer seating ledge **24** to provide a transparent protective screen over faceplate panel **30**.

Faceplate panel **30** is a generally rectangular outwardly convexly curved glass panel having a suitable fluorescent screen (which may include a plurality of phosphor dot triads in the instance of a color tube) on the inner surfaces thereof. Safety window **32**, having the same general configuration as faceplate panel **30**, may also be glass, or a suitable plastic material, and serves to protect the viewer from flying glass in the event of an implosion.

Upwardly extending flange **25**, which forms a side wall around the peripheral edge of inner seating step **22**, is provided with a plurality of indentations **34**. As can be seen in FIGS. 6 and 7, these indentations are rounded with a slight radius so that they extend inwardly towards the axial center of the tube, thereby providing a plurality of indexing points for positioning and alignment of the faceplate panel **30**. For example, three such indentations **34** may be provided, as shown in FIG. 1 to coincide with a three-point indexing used in exposing the phosphor dot pattern on faceplate panel **30** in a lighthouse, or by similar known techniques. These indexing points, in turn, provide for alignment of faceplate panel **30** with the axis of the electron gun assembly in the tube.

As mentioned, metal cone **10** may be used with either black and white or color cathode ray tubes, and is particularly adapted to provide simplicity and economy in the production of color cathode ray tubes. In this instance an aperture mask (or beam switching grid) **40** is positioned behind and in close proximity to faceplate panel **30**. As best seen in FIGS. 3 and 5, aperture mask **40** may be a one-piece structure which includes a major surface **41**, having the same general contour as faceplate panel **30**, and an annular flange portion **43** which extends longitudinally along side wall **20**. Flange portion **43** may be secured to side wall **20** by a plurality of weld joints around its periphery. In addition to eliminating the frame structure commonly provided for the aperture mask assembly used with an all-glass envelope, this also eliminates the necessity of providing side flanges on the faceplate panel with mounting studs inserted therein for support of the aperture mask frame structure.

Preferably, although not limiting, cone **10** may be fabricated from .050–.060 inch thick steel by known spinning and/or drawing techniques to provide an essentially uniform thickness throughout its cross-section. Neck **16** and faceplate panel **30** may be sealed to flange **14** and to inner seating ledge **22**, respectively, by known glass-to-metal sealing techniques, commonly known as frit sealing. Safety window **32** may be secured in seating ledge **24** by a suitable cement or epoxy resin.

The invention provides, therefore, an improved cathode ray tube with a composite metal and glass envelope, and is particularly adapted to provide simplicity and economy of assembly for shadow mask-type color cathode ray tubes having a generally rectangular viewing screen. While a preferred embodiment has been shown with particularity, it is to be understood that modifications thereof will be apparent to those skilled in the art without departing from the scope of the invention as set forth in the appended claims.

We claim:

1. A shadow mask type color cathode ray tube including in combination, a one-piece metal shell having a main body portion in the shape of a pyramidal frustum, the smaller end of said body portion having a generally circular opening therein, an annular flange around said circular opening, a generally cylindrical glass electron gun chamber having a flange portion sealed to said annular flange, the larger end of said body portion being opened and having a side wall defining a substantially rectangular opening, the free marginal edge of said side wall being formed into first and second steps to provide inner and outer seating ledges substantially rectangular in configuration, said inner seating ledge being continuous with the marginal edge of said side wall and including a first outwardly extending ledge portion and a first upwardly extending flange portion, said outer seating ledge being continuous with said first upwardly extending flange portion and including a second outwardly extending ledge portion and a second upwardly extending flange portion, the periphery of said outer seating ledge being greater than the periphery of said inner seating ledge, a generally rectangular outwardly curved glass faceplate panel seated on and sealed directly to said inner seating ledge, a transparent safety window having the same general contour as said faceplate panel secured in said outer seating ledge, and a plurality of inwardly extending indentations disposed around the periphery of said upwardly extending flange portion of said inner seating ledge for aligning said faceplate panel with the axis of said electron gun chamber with said panel being seated on said inner seating ledge.

2. The combination of claim **1** wherein the shadow mask is a one-piece structure disposed behind said faceplate panel, said shadow mask structure having a major surface of the same general contour as said faceplate panel, and having an integral annular flange portion ringing said major surface, with said annular flange portion extending longitudinally along said side wall, and there being a plurality of fastening joints between said annular flange portion and said side wall.

3. A cone for a shadow mask type color cathode ray tube envelope having an electron gun assembly for illumi-

nating a plurality of phosphor dot triads on a faceplate panel, and having a safety window, the cone comprising a metal shell having a main body portion in the shape of a pyramidal frustum, the small end of said body portion having a generally circular opening therein, the larger end of said body portion being opened and having a side wall defining a substantially rectangular opening, the free marginal edge of said side wall being formed into first and second steps to provide inner and outer seating ledges substantially rectangular in configuration, said inner seating ledge being continuous with the marginal edge of said side wall and including a first outwardly extending ledge portion and a first upwardly extending flange portion forming a seat for directly receiving a faceplate panel, said first upwardly extending flange portion having a plurality of inwardly extending indentations disposed around the periphery for indexing the faceplate panel to the electron gun assembly, said second seating ledge being

continuous with said first upwardly extending flange portion and including a second outwardly extending ledge portion and a second upwardly extending flange portion forming a seat for receiving the safety window.

References Cited

UNITED STATES PATENTS

2,761,990	9/1956	Amdursky et al.	313—92
2,829,291	4/1958	Sanford	313—92
3,219,225	11/1965	Nempel	220—2.3
3,243,072	3/1966	Day	220—2.3

FOREIGN PATENTS

707,994	7/1941	Germany.
1,279,314	11/1963	France.

JAMES W. LAWRENCE, *Primary Examiner.*

V. LAFRANCHI, *Assistant Examiner.*