United States Patent [19]

Logue

[11] **3,720,345**

[45] **March 13, 1973**

[54] **TELEVISION BULB WITH IMPROVED STRENGTH**

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[73] Assignee: **Owens-Illinois, Inc.**, Toledo, Ohio

[22] Filed: **June 8, 1970**

[21] Appl. No.: **44,016**

[52] **U.S. Cl.** ..... **220/2.1 A**

[51] **Int. Cl.** **H01j 61/30**

[58] **Field of Search** ..... 220/2.1 A, 2.3 A

[56] **References Cited**

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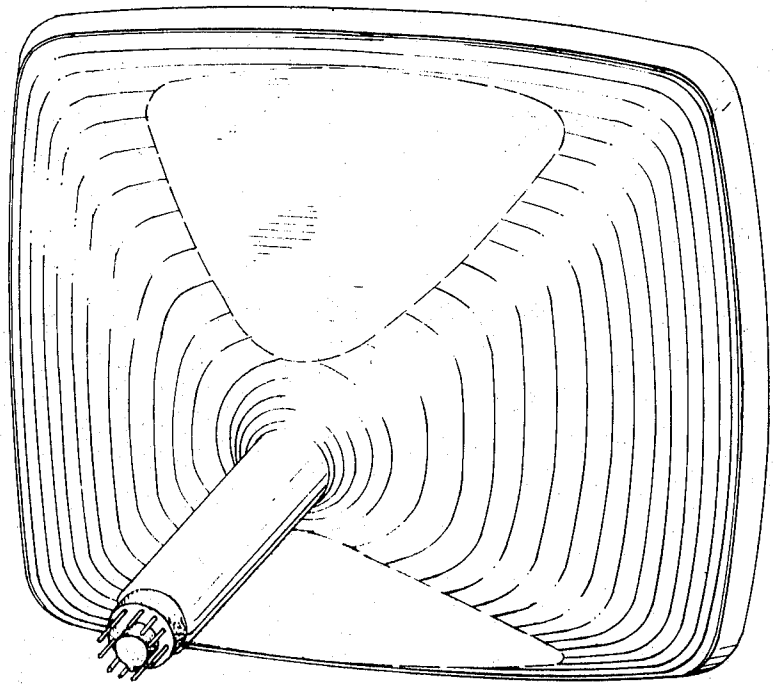
[57] **ABSTRACT**

A wide-angle color television picture bulb comprising a generally rectangular glass faceplate having horizontal and vertical axes, said horizontal axis being longer than the vertical axis, a substantially wide-angle hollow glass funnel having a generally tubular neck at one end, a generally tubular flaring yoke area extending from the said neck, and side walls joined to and diverging from said yoke area to a portion joined to said faceplate. The funnel side walls which extend generally parallel to the horizontal axis of the faceplate have a central portion thereof which is substantially flat in all cross sections thereof and is smoothly interconnected with the remaining portions of said side walls. The funnel side walls which extend generally parallel to the vertical axis of the faceplate have portions thereof which are substantially bowed outwardly relative to the vertical axis and side walls which extend generally parallel to the horizontal axis of the faceplate.

5 Claims, 8 Drawing Figures



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SHEET 1 OF 4

FIG. 1.

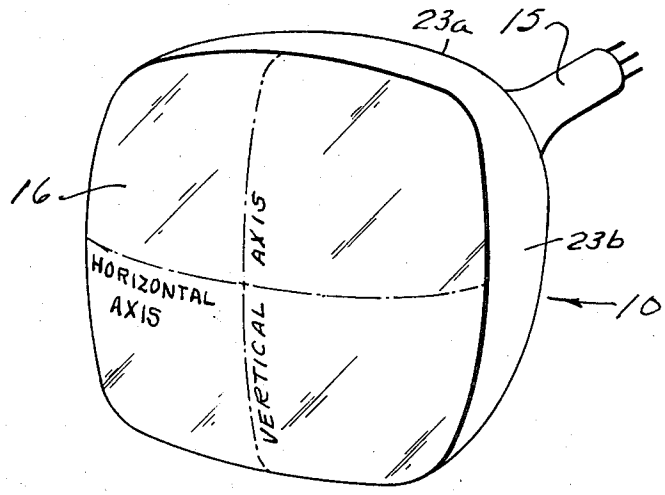

FIG. 2.

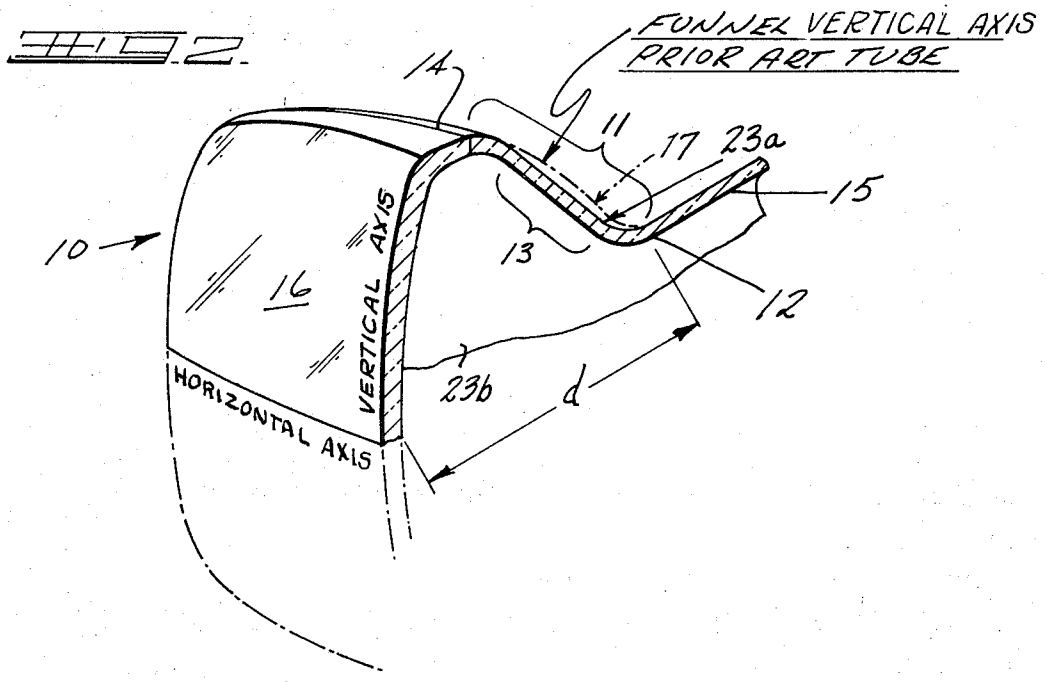

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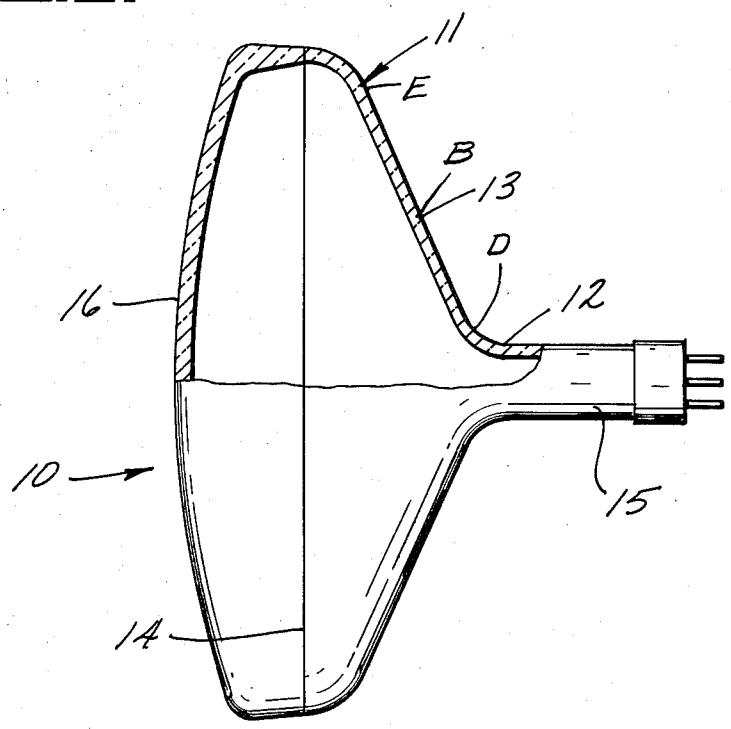
FIG. 2.



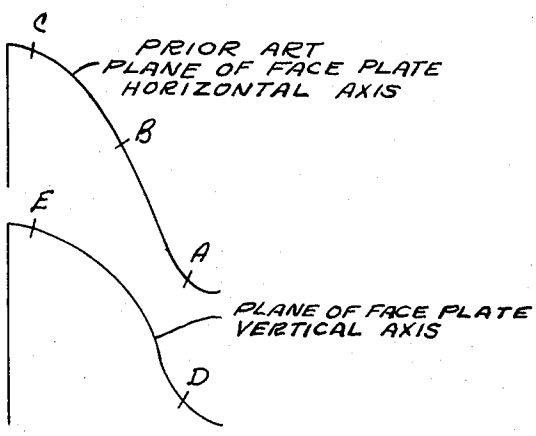


FIG. 6.

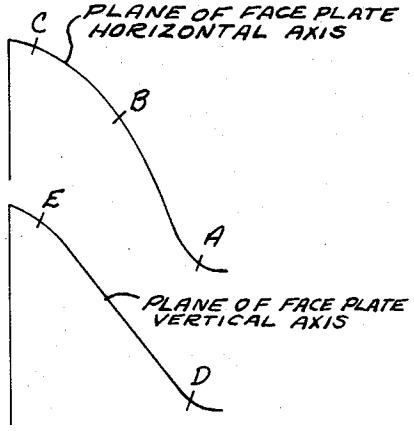


FIG. 7.

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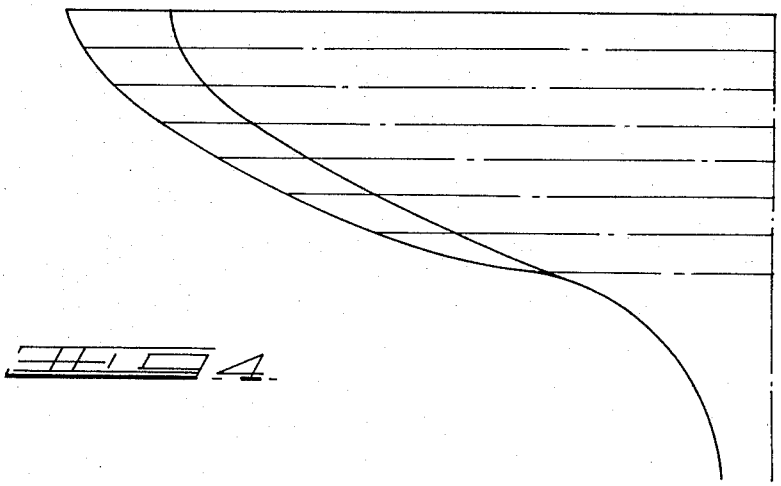

FIG 4

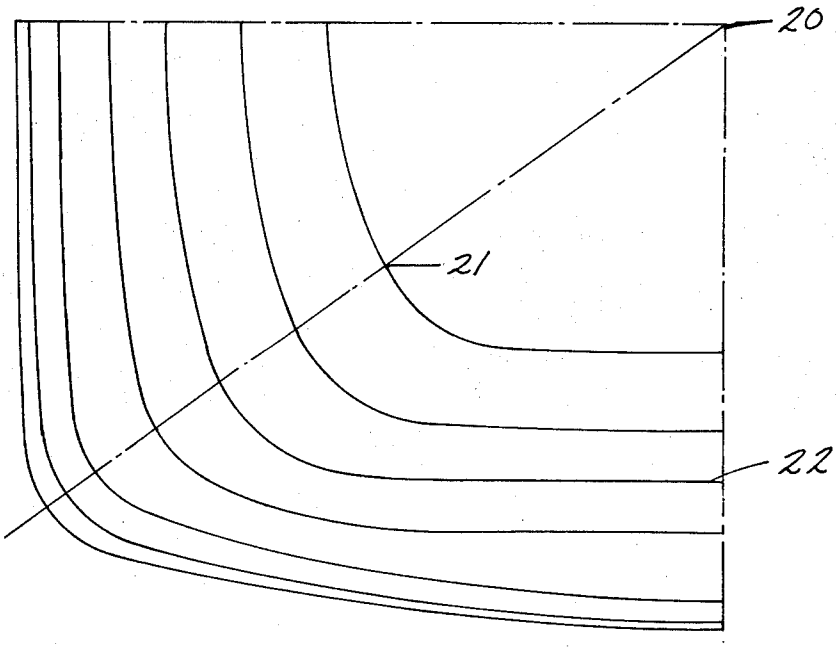

FIG 5

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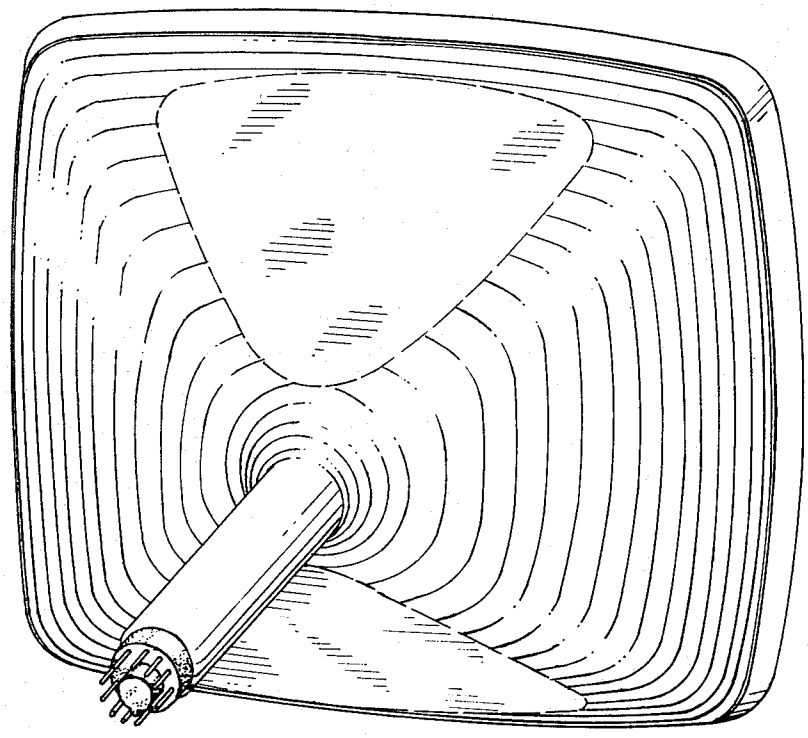

FIG. 8

TELEVISION BULB WITH IMPROVED STRENGTH

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an improved television picture tube bulb having a wide angle of divergence for displaying a picture on a coated surface thereof known as a faceplate. The funnel of the tube has two pair of diverging walls. One pair of walls are generally triangular shaped geometrically similar planar sidewalls on the diametrically disposed sides which are generally parallel to the horizontal axis of the faceplate. The invention is of utility when applied to cathode-ray television picture tubes and in funnel bodies or funnels which form a part of such television picture tubes. Such tubes, when made of glass, are commonly molded in separate parts including a funnel body or funnel having a yoke area, a faceplate and a neck tube extending from the neck end of the funnel body, said parts being sealed together during the process of manufacturing the picture tube. The funnel or body comprises walls which are flared, divergent from the smaller or neck end towards the larger, faceplate end to which the faceplate is united. The faceplate has a long or horizontal axis and a short or vertical axis and the funnel has sides which are generally parallel to the horizontal and vertical axes of the faceplate.

The yoke area of the funnel is a transition area between the funnel walls and the neck and is the means for positioning for an electronic device known as a "yoke" which serves to direct the dispersion of an electron beam which strikes a phosphorescent material and reproduces a picture on the faceplate.

In order to avoid excessive weight and undue length of the tube as measured between the ends thereof, the side walls are flared at as wide an angle of divergence as is practical. A divergence angle greater than 90°, the tube is called a "wide angle" tube. The tubes are always vacuumized and thereby subjected to an unbalanced atmospheric pressure which places a strain on the tube and tends to break the tube at the yoke area of the funnel.

2. Prior Art

In television picture tubes with a deflection of greater than 90°, the walls of the funnel have an increased angle of divergence to insure an obstruction-free path for an electron beam to scan the inner surface of the faceplate. The conventional design of a funnel is such that the walls of the vertical axis are round or bowed and then approach the face-funnel seal edge in an angle tending toward the perpendicular angle. Prior art practices have been to increase the bowing of the funnel in order to strengthen it.

Prior art attempts to overcome this structural defect have also included the strengthening of the tube with flanges built into the structure of the tube. Such a flange structure is described in U.S. Pat. No. 2,969,162 to Stutske, issued Jan. 24, 1961. The means used to strengthen the areas adjacent to the neck end of the tube are described in the patent in Col. 1, lines 43 through 51, the means is an annular rib about the neck, an annular rib about the face plate periphery, and a plurality of radial ribs joined at their respective end to the top and bottom annular ribs. The tube bulbs manufactured in this construction is a bulky heavy object and also expensive in both terms of material and processing costs. U.S. Pat. No. 2,969,162, Col. 2 indicates that any tube having a divergence angle of more than 90° is referred to as a "wide angle" tube. The patent, Col. 2, lines 12 through 16, states that the walls when approximately flat cannot stand such high pressure as when the walls are more curved or bowed outwardly as they may be in a tube in which the diversion angle is not as great as 90°. The walls are curved outwardly convex when compared with radial lines extending from the yoke area to a periphery of the funnel at the seal line between the funnel and the face plate.

The picture tube of this invention provides a wide angle tube of more than 90° in divergence having increased strength by flattening the funnel walls and so distributing stresses within the glass funnel as to increase the strength of the yoke area.

SUMMARY OF THE INVENTION

The new design concept is a television picture tube funnel having relatively flat walls in profile along the sides which are generally parallel to the horizontal axis of the faceplate. The funnel comprising a section of an assembled tube has generally triangular shaped geometrically similar sidewalls on these diametrically disposed sides. This improved design provides a television picture tube having substantially lower tensile stresses in the yoke area when the bulb is later evacuated.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the television bulb of this invention.

FIG. 2 is a perspective section view of the television bulb of FIG. 1.

FIG. 3 is a cross sectional view of the bulb of FIG. 1 in a plane through and containing the vertical axis of the faceplate.

FIG. 4 is a view showing contour profiles at intervals around the walls of the funnel.

FIG. 5 is a rear view of the funnel of FIG. 3 showing contour lines of the funnel.

FIG. 6 is a view showing profiles of sections containing the horizontal and vertical axes of a conventional funnel outline.

FIG. 7 is a view showing profiles of sections containing the horizontal and vertical axes of an improved funnel embodying the invention.

FIG. 8 is an overall perspective view taken from the end of the bulb opposite to that of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

This invention relates to an improved television bulb having a funnel with a pair of substantially flat triangular shaped planar sidewalls along the sides of the funnel which are generally parallel to the horizontal axis of the faceplate.

In television tubes having a deflection angle over about 90°, a high stress concentration and an associated weakness has been found in the yoke area on the horizontal axis. This invention provides a funnel design which improves the strength to an acceptable, commercial level. The conventional funnel is rounded or bowed along the sides which are generally parallel to

the horizontal and vertical axes of the faceplate and the funnel walls approach the funnel seal-face edge at an angle tending to be perpendicular to the seal edge. In the conventional design of the funnel, it was noted that compression rather than the expected tension stresses was present in the sides parallel to the horizontal axis near the seal edge. In this improved tube the stress pattern is modified within the funnel by depressing the walls which are generally parallel to the horizontal axis of the faceplate so that the surface of these walls from the yoke area to the funnel seal edge is relatively flat in profile without the usual bulging and forms generally triangular shaped planar portions of the sidewalls on the funnel which extend generally parallel to the horizontal axis of the faceplate as shown in FIG. **8**.

Television tubes currently are fabricated in several parts, including a funnel having a tubular yoke area, and a neck which extends from the yoke area end of the funnel body and a faceplate. The parts when assembled constitute a television picture bulb which is subsequently evacuated and sealed during manufacture to provide a large hollow glass envelope having a high vacuum within and subject to atmospheric pressures.

The funnel is described as that section of the bulb between the faceplate sealing edge and the neck. The yoke area of the funnel is by definition that portion which supports an electronic collar known as a "yoke." The yoke directs the electronic beam within the bulb.

The neck is a hollow tubular part which is sealed to the funnel at the yoke area. The electron gun and associated parts are positional in the neck and partially within the funnel. The open end of the tubular neck is sealed about the electron gun.

FIG. **2** shows a color television bulb **10**; a funnel **11** has a section thereof known as a yoke area **12**, funnel walls **23***a* generally parallel to the horizontal axis and funnel walls **23***b* generally parallel to the vertical axis, a peripheral edge known as the seal edge **14**, and a neck **15**; and a faceplate **16** sealed to one end of the funnel **11**. The length of the tube *d* from the faceplate to the edge of the funnel neck has been shortened considerably over the bulbs of the prior art to provide the least commercially practical dimension. To provide this shorter bulb length, the funnel walls **23***a*, **23***b* are sharply divergent resulting in a tube with a wide angle of divergence and the funnel **11** has substantially flat central portions **13** in side walls **23***a* which extend generally parallel to the horizontal axis of the faceplate. Portions **13** are substantially flat in all cross sections and smoothly interconnect with the remainder of the side walls, the yoke area and the sealing portion **14** as shown in FIGS. **2** and **3**. A side wall profile is shown in detail in FIG. **2**; the phantom line **17** depicts the profile of a prior art funnel and bulb.

A comparison of the profile of the improved tube design with the prior art design is made by referring to FIGS. **6** and **7**.

FIG. **4** is a side view of a funnel showing contour lines at intervals about the funnel. FIG. **5** is a rear view illustrating a generally triangular shaped substantially planar area on a portion of each side wall, an apex **20** and sides formed by a line of intersection with the bulbous portions **21**, and a contour line **22**. These triangular areas are substantially planar and substantially flat in profile.

STRESS PATTERN ANALYSIS

Conventionally shaped wide angle television bulbs have been evacuated and the stresses generated have been analyzed by means of strain gauges placed at positions designated in the profiles as A, B, C, D and E, as shown in FIG. **6**. The results of this test indicate very high tensile stresses in the portion of the yoke area which is generally parallel to the horizontal axis of the faceplate.

A bulb made in accordance with the invention has relatively flat planar wall portions **13** on the sides which are generally parallel to the horizontal axis of the faceplate and which results in a decrease in tension in portions of the yoke area and a decrease in compression on the walls of the funnel to a more desirable level.

Example I is a chart indicating the stress pattern as redistributed in comparison with the patterns of the prior art wide-angle television tubes having the typical convex outward curve in profile as illustrated in broken lines in FIG. **2**, using glass test bulbs.

EXAMPLE I

STRESSES IN EVACUATED BULBS

	Conventional Bowel Tube Glass	Triangular Planar Design Glass
A	+1680 p.s.i.	+290 p.s.i.
B	−1300 p.s.i.	−1150 p.s.i.
C	−1600 p.s.i.	− 960 p.s.i.
D	−1490 p.s.i.	− 250 p.s.i.
E	− 130 p.s.i.	+ 690 p.s.i.
	(+) = Tension	(−) = Compression

Analysis of the stress pattern of conventional bowed tubes, when evacuated, indicates that the load is such that high compression stresses were developed at a point on the yoke marked D in FIG. **6** in the sides generally parallel to the horizontal axis. Compression stresses were also developed at point E near the face funnel seal. The stress condition results in the high compression stresses at point B in the wall and high tension at point A in the portion of the yoke extending generally parallel to the short axis of the faceplate.

The novel design reduces compression stress in the yoke area at point D and in the seal edge at point E to either a reduced compression and/or a low tension stress. This is accomplished by providing the planar areas on the funnel walls as described.

The test tubes show that the tensile strength in an area in which breakage in the prior art has occurred at point A, have been reduced by a factor of about **6**; that is, plus 1680 to plus 290 at point A′ (FIG. **7**). High compressive stresses at point D in the neck area were reduced by a factor of **6**, that is (−1490) to (−250) at point D′ (FIG. **7**). In addition, tension is present at point E′ on the modified design, rather than compression at point E as in the prior art bulb.

The application of a brittle coating to the surface of a bulb model of the prior art indicated that stresses in the yoke area were highly concentrated and the maximum stress was probably higher even than indicated in contrast to the stress distribution of the improved design having flat walls.

The improved strength of the new design was demonstrated in another way by pressure testing of completed bulbs. This is a standardized procedure for evaluating strength of TV bulbs, in which the bulb is placed in a chamber and hydrostatic pressure slowly applied until failure occurs have been made. When abraded under

prescribed conditions, an arbitrary level of 40 p.s.i. has been chosen as the minimum average strength level for routine production. Samples of 110° wide angle bulbs, with conventional bulbous funnels, when tested in this manner, failed in the yoke area at an average of 22 p.s.i.; however, bulbs made to the improved design withstood pressures in excess of 60 p.s.i. without any failure in the critical yoke area. When failures occurred, they were in non-critical area at strength levels which are considered satisfactory.

What is claimed is:

1. A wide-angle color television picture bulb comprising

a generally rectangular glass faceplate having horizontal and vertical axes, said horizontal axis being longer than the vertical axis,

a substantially wide-angle hollow glass funnel,

said funnel having a generally tubular neck at one end,

said funnel having a generally tubular flaring yoke area extending from the said neck,

said funnel having side walls joined to and diverging from said yoke area to an edge portion joined to said faceplate,

said funnel side walls which extend generally parallel to the horizontal axis of the faceplate having a central portion thereof which is substantially flat in all cross sections thereof and is smoothly interconnected with the remaining portions of said side walls,

said funnel side walls which extend generally parallel to the vertical axis of the faceplate having portions thereof which are substantially bowed outwardly relative to said vertical axis and the side walls which extend generally parallel to the horizontal axis of the faceplate.

2. The combination set forth in claim 1 wherein each said substantially flat wall portion is generally triangular shaped.

3. The combination set forth in claim 2 wherein said faceplate has a peripheral sealing edge and said edge portion of said funnel is joined to said faceplate by sealing.

4. For use in a wide-angle color television picture bulb having a generally rectangular glass faceplate having horizontal and vertical axes, said horizontal axis being longer than said vertical axis,

a substantially wide-angle hollow glass funnel,

said funnel having a generally tubular neck at one end,

said funnel having a generally tubular flaring yoke area extending from the said neck,

said funnel having side walls joined to and diverging from said yoke area to a portion adapted to be joined to said faceplate,

said funnel side walls which are adapted to extend generally parallel to the horizontal axis of the faceplate having a central portion thereof which is substantially flat in all cross sections thereof and is smoothly interconnected with the remaining portions of said side walls,

said funnel side walls which are adapted to extend generally parallel to the vertical axis of the faceplate having portions thereof which are substantially bowed outwardly relative to said vertical axis and the side walls which are adapted to extend generally parallel to the horizontal axis of the faceplate.

5. The combination set forth in claim 4 wherein each said substantially flat wall portion is generally triangular shaped.

* * * * *