

Dec. 20, 1955

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2,728,009

CATHODE-RAY TUBE WITH TARGET SUPPORT

Filed Nov. 14, 1950

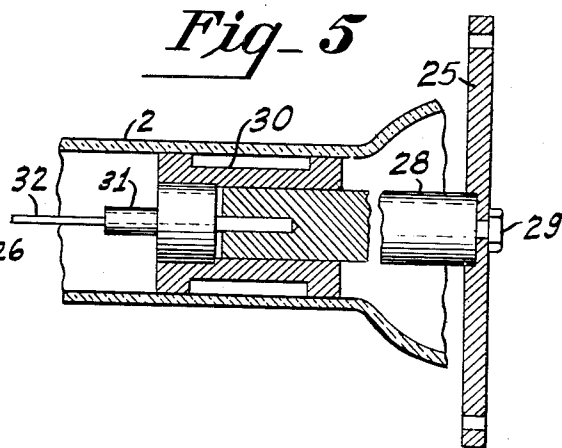
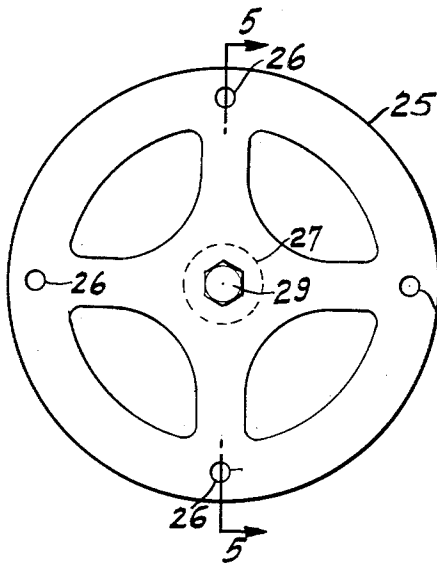
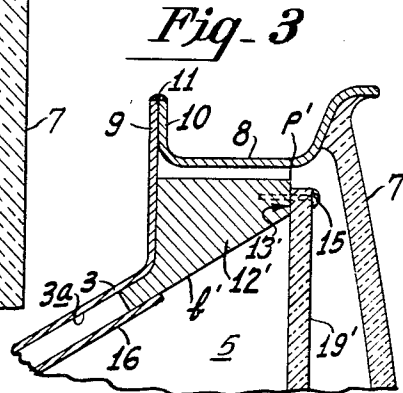
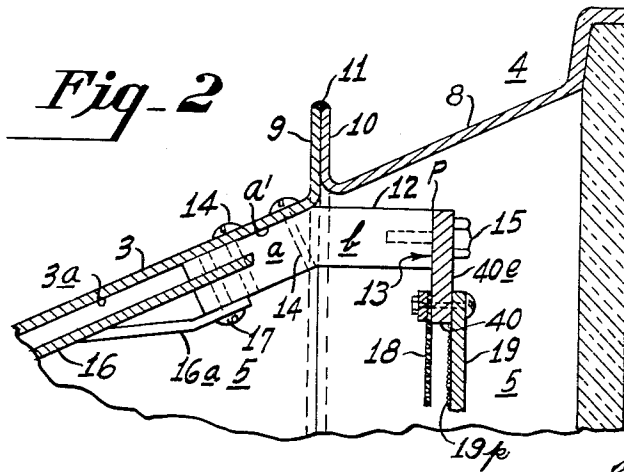
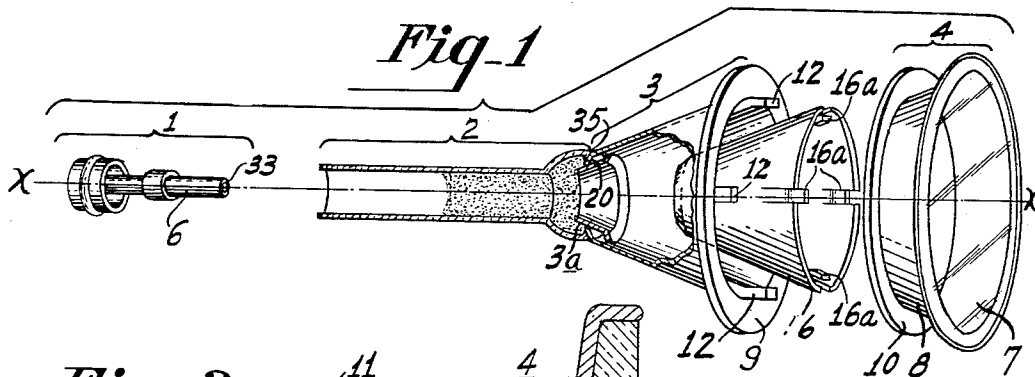


Fig-4

Fig-5

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CATHODE-RAY TUBE WITH TARGET SUPPORT

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Application November 14, 1950, Serial No. 195,588

16 Claims. (Cl. 313—89)

This invention relates to improvements in cathode-ray tubes and to improvements in the art of manufacturing the same.

The principal object of the invention is to provide a tube structure which shall lend itself readily for use in the manufacture of color kinescopes and other beam tubes of the kind where optimum performance can be achieved only when the gun elements and the target or screen elements are mounted in substantially perfect alignment.

Another object of the invention is to provide a metal tube-envelope having a main chamber capable of accommodating a thin-metal target or other easily distortable electrode structure, and of a construction calculated to protect said electrode structure from warping due to the high temperatures normally employed in forming a hermetic seal between the separable metal parts of the envelope.

Another and specific object of the invention is to provide an improved method of and apparatus for aligning an electron gun, or a battery of guns, with respect to a screen-assembly of the "masked-target" variety.

Stated generally, the foregoing and other objects are achieved, in accordance with the invention, by the provision of a metal envelope having a face plate or "window" which is open during the assembly and alignment of the electrode elements of the device, and by the provision on the inner wall of the envelope of mounting brackets or lugs which serve, during the electrode assembly-operation, to support a jig for aligning the gun structure of the device with respect to the plane ultimately occupied by the target or screen assembly. The face plate of the tube comprises the base of a bowl-shape closure member, within which the screen assembly is received. The closure member is provided with an outwardly extending flange which, when placed in juxtaposition with a complementary flange on the outer surface of the envelope, may be welded in place without risk of overheating any part of the screen assembly. Whenever it is necessary or expedient to provide a metal shell within the envelope, for the purpose of protecting the beam from the disturbing effects of stray magnetic fields, the metal shell or shield may conveniently be supported upon the same mounting lugs that support the target or screen assembly.

The invention is described in greater detail in connection with the accompanying single sheet of drawings, wherein:

Fig. 1 is an exploded view, partly in section, of a cathode ray tube embodying the invention,

Fig. 2 is a fragmentary sectional view of one corner of the main chamber of the tube of Fig. 1, subsequent to its assembly, and showing the manner in which the target or screen assembly and the window or face plate of the tube are mounted.

Fig. 3 is a view similar to Fig. 2, showing an alternative form of mounting lug support for supporting the target or screen,

Fig. 4 is a rear elevation of a jig employed during the assembly operation for aligning the neck and the gun

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structure of the tube with respect to the plane of the target or screen, and,

Fig. 5 is a broken sectional view of the neck of the tube with the centering portion or mandrel of the jig positioned therein during the assembly operation.

As shown in the exploded view (Fig. 1) the envelope of the cathode-ray tube of the invention consists, essentially, of four discrete parts, 1 to 4 inclusive. The main chamber 5 (Fig. 2) of the envelope comprises (a) the hollow metal frustum 3 of a cone, pyramid or similar body and (b) the bowl-shape closure member 4 for the large open end or base of the frustum. The other two parts of the envelope comprise an elongated cylindrical glass neck 2 which can be hermetically sealed to the edge of the narrow end of the frustum 3, and a glass closure element or stem 1 for the free open-end of the neck. As will hereinafter more fully appear, the stem 1 also serves as a support for an electron gun 6, the barrel of which is accommodated within the neck 2.

The base of the bowl-shape closure element 4 is constituted of glass and comprises the face plate or window 7 of the tube. The sides of the bowl 4 comprise a metal window-frame 8 which, when joined to the frustum 3, defines a part of the main chamber 5 of the tube. The large open end of the frustum 3 terminates in an outwardly extending peripheral flange 9. The metal window frame 8 terminates at its inner or open end in a similar outwardly extending peripheral flange 10 which, when placed in juxtaposition with the first flange 9, can be hermetically sealed thereto as by a weld 11 (Fig. 2).

In accordance with the invention, the main chamber 5 of the envelope is provided with three or more mounting brackets or lugs 12 which are disposed in equally spaced circumferential array on the inner surface 3a of the frustum adjacent to its large open-end or base. These lugs 12 are preferably constituted of metal and may be welded to the inner surface 3a of the frustum, with or without the use of rivets 14 (Fig. 2).

The lug 12 shown in Fig. 2 comprises a straight arm a and an integral angularly extending arm b. The inner arm a preferably has an outer surface a' of the same curvature or contour as that of the surface 3a to which it is affixed. The angular arm b extends into the "bowl" or closure member 4 along a line parallel to the central axis x-x of the envelope. A somewhat more economical use of the space within the front closure 4 of the envelope can be achieved when the lugs are of the wedge-shape contour shown at 12' in Fig. 3. Here it will be observed that the slanting face b' of the wedge extends parallel to the inclined surface of the metal frustum 3. Thus, the presence of the lugs 12' does not limit the useful area of the window 7, or of the screen-area scanned by the beam from the gun 6 (Fig. 1). In both cases, however, the lugs 12 (Fig. 2) or 12' (Fig. 3) extend forwardly well beyond the plane of the flange 9 on the rim of the frustum and terminate in locating surfaces (13, Fig. 2; 13', Fig. 3) lying in a common plane P (Fig. 2, P', Fig. 3) normal to the tube axis x-x, Fig. 1, in the space normally defined by the window 7 and frame 8 of the bowl-shaped closure 4. The free end of each lug contains a threaded hole for receiving a complementarily threaded mounting screw 15.

When it is necessary or expedient to shield the main chamber of the tube against stray-magnetic fields the lugs 12 may be employed as combined spacers and supports for the shield 16. When the lugs 12' are of the wedge-shape contour shown in Fig. 3, the part of each lug that lies adjacent to the slanting face 3a of the envelope may be made just thick enough to establish a desired spacing between the envelope and the shell-like shield 16. In this case, the outer end of the shell is simply fitted over

the adjacent end of the lugs 12' and secured to the inclined surface *b'* thereof.

Referring to Fig. 2: In the interest of rigidity, the lugs 12 may be made of a thickness dimension greater than the desired envelope-to-shell spacing. In this case, the shielding shell 16 may be supported by means of tongues 16*a* (one for each lug) struck-out from the edge of the shell and fixed to the exposed surface of the adjacent lug 12 by means of a rivet 17, or by welding.

As previously mentioned, the lugs 12 terminate in a common plane P and are each provided with a threaded hole for receiving the shank of a screw 15. The lugs 12 and screws 15 serve two functions: (i) as a support for the base 25 of a removable jig which is used in the alignment and assembly of the several parts of the tube and (ii) they serve, when the jig is removed through the open end of the frustum, as a permanent support for the screen or target assembly 18, 19 (later described).

Prior to mounting the base 25 of the jig within the envelope the magnetic shield or shell 16 is entered into the frustum 3 and secured near its larger end to the lugs 12, and near its other end to a suitable metal seat or throat 20 (Fig. 1), provided for the purpose, on the inner surface of the narrow end of the frustum.

As shown in Figs. 4 and 5 the base of the jig comprises a rigid metal plate 25 having holes 26, one for each of the mounting screws 15, about its circumference, and a centrally located countersunk hole 27 in which one end of a rod-like pedestal portion 28 (Fig. 5) of the jig is secured, as by a nut 29. The length of the rod 28 is determined by the desired spacing of the electron-gun 6 (Fig. 1) or other beam-source, with respect to the reference plane P (Fig. 2) of the viewing screen 19 or its mask 18. The rod 28 is provided, adjacent to its free end, with a mandrel 30 (Fig. 5) over which the glass neck 2 of the envelope is fitted for the purpose of aligning the neck and maintaining it in its aligned position while forming an appropriate glass-to-metal seal 35 (Fig. 1) between the inner end of the neck 2 and the adjacent narrow end of the metal frustum 3.

As shown in Fig. 5, the outer end of the mandrel 30 is provided with a cylindrical protuberance or riser 31 which is dimensioned to fit snugly within the end of the barrel of the electron gun 6 when the stem or closure element 1 (Fig. 1) is placed on the end of the glass neck 2. The riser 31, in turn, is provided with a rod-like extension 32 which fits into the central apertures in the beam forming-lens elements or diaphragms 33 (Fig. 1) within the gun.

The entire jig is constituted of metal and its several parts are machined and constructed with a fine degree of accuracy. It is thus apparent that it is possible to ensure very accurate spacing of the gun 6 with respect to the reference plane P of the target assembly 18-19 (Fig. 2), and very accurate alignment of the gun with respect to said plane. The gun-centering elements 31, 32 and other parts (25, 28 and 30) of the jig may remain in their described positions while forming a glass-to-glass seal (not shown) between the glass stem 1 and the otherwise open end of the neck 2.

When the seal that joins the stem 1 to the end of the neck 2 of the tube has hardened, the screws 15 that hold the base 25 of the jig to the lugs 12 are removed and the entire jig is withdrawn through the still open front-end of the cone or frustum 3. The same screws 15 that held the base 25 of the jig to the lugs 12 may then be employed in securing the screen or target assembly 18-19 (Fig. 2) to said lugs.

When the screen toward which the electrons are directed is of the "masked target" variety, the correct spacing between the apertured thin-metal mask 18 and the alignment of its apertures with respect to the phosphor elements 19*p* of its viewing screen 19 (Fig. 2) may be fixed by a suitable frame or other spacing element 40 during the manufacture of this sub-assembly, for example,

in the manner taught by H. B. Law in copending application Serial No. 158,901 filed April 28, 1950 (now U. S. Patent 2,625,734, granted January 20, 1953).

As illustrated in Fig. 2, the frame or spacing element 40 is provided with an ear 40*e* at each corner of the assembly for engaging the locating surface 13 of one of the lugs or brackets 12. Each ear contains a hole through which one of the mounting screws 15 passes in securing the target assembly to the several lugs 12. As shown in Fig. 3, when the tube employs a single screen or target element 19', said element may be secured directly to the lugs 12.

When the screen or target assembly has been secured to the brackets or lugs 12 the bowl-shape closure element 4 is placed over the open end of the frustum 3. The outwardly extending peripheral flanges 9 and 10 on said tube parts are then placed in juxtaposition, where they may be held by a suitable clamp (not shown) during the formation of the weld 11 at the outer extremities of said flanges.

The weld 11 is preferably, but not necessarily, made in an inert gaseous atmosphere. The heat applied during the welding operation is dissipated, to a substantial degree, in the flanges 9 and 10 (which may be said to operate as "heat-radiating fins") and in the adjacent thin metal parts of the envelope 3 and window frame 8. In one practical embodiment of the invention the glass window 7 was found to be fully protected from the heat of the weld when the envelope 3 and window-frame 8 were made of steel 0.06 of an inch thick and the axial length of the window frame was about two inches. Any heat that may be transferred by conduction through the metal envelope is barred by the length and mass of the lugs 12, from reaching the easily warped thin metal mask 18 and the temperature sensitive phosphor elements 19*p* of the target assembly.

From the foregoing it will be apparent that the present invention provides an improved cathode-ray tube structure and one which may be used for color-kinescopes and other "precision-built" tubes, including those containing thin-metal or other easily distortable temperature sensitive electrode elements.

What is claimed is:

1. A cathode-ray tube comprising an envelope having a central axis and an inner surface surrounding said axis and defining a boundary of the main chamber of said tube, a plurality of brackets mounted in circumferentially spaced array on said inner surface of said envelope and terminating within said chamber in a common plane normal to said axis, and means for securing a target electrode to said brackets adjacent to said common plane.

2. The invention as set forth in claim 1 and wherein said inner surface of said envelope is inclined with respect to said axis and said brackets extend along said axis in a direction substantially parallel to said inclined inner surface of said envelope.

3. The invention as set forth in claim 1 and wherein said inner surface of said envelope is inclined with respect to said axis and said brackets project forwardly from said inclined surface in a direction substantially parallel to said axis.

4. The invention as set forth in claim 1 and wherein said envelope and said brackets are constituted of metal.

5. In a cathode-ray tube assembly, an inner metal shell having an open end and a plurality of lugs mounted in circumferentially spaced array on the outer surface of said shell adjacent to said open end, an outer envelope secured to said lugs, said lugs extending beyond said open-end of said shell and terminating in a common plane within said envelope, and means for securing a target electrode to said lugs in said common plane.

6. A cathode-ray tube assembly comprising an envelope having an open-end terminating in an outwardly extending peripheral flange, a plurality of lugs mounted

in spaced array on the inner surface of said envelope adjacent to said open end, said lugs extending outwardly beyond said open end of said envelope and terminating in a common plane remote from said flange, means for securing a target electrode to said lugs in said common plane, and a closure element for said open-end of said envelope, said closure element comprising a window having a vacuum-tight window frame of a diameter sufficiently large to receive said target electrode and terminating at its rim in an outwardly extending metal flange disposed in juxtaposition with respect to said first mentioned flange and hermetically sealed thereto.

7. A cathode-ray tube comprising an envelope including a wall in the form of a frustrum having a smaller and a larger end and intervening between a neck portion and an end portion of the tube, a plurality of brackets mounted in circumferentially spaced array on the inner surface of said wall adjacent to its larger end and a target assembly mounted on said brackets and comprising a plate having a ray-sensitive coating thereon and a foraminous electrode mounted adjacent to said coated plate on the side facing the neck portion of the tube.

8. A cathode-ray tube comprising an envelope including a wall in the form of a frustrum having a smaller and a larger end and intervening between a neck portion and an end portion of the tube, a plurality of brackets mounted in circumferentially spaced array on said wall adjacent to its larger end, a target assembly mounted on said brackets and comprising a plate having a ray-sensitive coating thereon and an apertured electrode mounted adjacent to the ray-sensitive coated plate on the side facing the neck portion of the tube, and a metallic shield extending along the inner surface of said wall and mounted at one of its ends on said brackets.

9. A cathode-ray tube comprising an envelope having a substantially frusto-conical wall intervening between a neck portion and an end portion of the tube, a plurality of brackets secured to the wall adjacent to its larger end, a target assembly mounted on said brackets and comprising a plate having a ray-sensitive coating thereon and an apertured electrode mounted adjacent to the phosphor coated plate on the side facing the neck portion of the tube, a metallic shield extending along the inner surface of said wall having tongues cut therefrom to provide slots interfitting with the brackets and means for securing the tongues to the brackets to secure the shield to the wall.

10. A cathode-ray tube comprising an envelope having a neck portion, an end portion, and an intervening portion, the intervening portion having a smaller end toward the neck portion and a larger end toward the end portion of the tube, a plurality of brackets mounted in circumferentially spaced array on the larger end of the intervening portion, and a target assembly mounted on said brackets and comprising a plate having a phosphor coating thereon and a foraminous electrode mounted adjacent to the phosphor coated plate on the side facing the neck portion of the tube.

11. A cathode-ray tube comprising an envelope having a neck portion, an end portion, and an intervening portion having a smaller end toward the neck portion and a larger end toward the end portion of the tube, a plurality of brackets mounted adjacent to the larger end of the intervening portion, a target mounted on said brackets, and a metallic shield extending along the inner surface of said intervening portion and mounted at one of its ends on said brackets, the inner surfaces of the brackets extending between the shield and the target substantially in line with the surface of the shield.

12. A cathode-ray tube comprising an envelope having a neck-portion adapted to accommodate a source of electrons, a bowl-like end-portion adapted to accommodate a target for electrons from said source, and an intermediate hollow portion through the interior of which electrons pass in their transit from said source to said tar-

get; said intermediate portion having a small end toward said neck-portion and a larger end toward said bowl-like portion, said bowl-like end-portion and said larger end of said intermediate-portion having complementary circumferentially extending flange means hermetically sealed about the periphery thereof, and means supported by said flange-means for supporting a target electrode in a position to be scanned by electrons from said source.

13. A cathode-ray tube comprising an envelope having a neck-portion adapted to accommodate a source of electrons, a bowl-like end-portion adapted to accommodate a target including at least one element to be scanned by electrons from said source, and an intermediate hollow portion through the interior of which electrons normally pass in their transit from said source to said target, said intermediate portion having a small end toward said neck-portion and a larger end toward said bowl-like portion, said bowl-like end-portion and said larger end of said intermediate-portion having outwardly extending circumferentially disposed flanges arranged thereon in juxtaposition and hermetically sealed together adjacent to their outer extremities, and means supported in contact with the flange on said intermediate portion of said envelope for supporting said target-element in a position to be scanned by electrons from said source.

14. A cathode-ray tube including an envelope having a neck-portion for receiving a source of electrons, a bowl-like end-portion for accommodating a target element toward which electrons from said source are directed, and an intermediate envelope portion through which electrons pass to said target element, said intermediate portion increasing in transverse section from said neck-portion to said end-portion, the larger end of said intermediate portion and said bowl-like portion having flange means the outer peripheries of which are in registry and sealed together, and lug-like supports mounted on the flange means of said intermediate envelope-portion and supporting said target element transversely of said envelope in the path of said electrons.

15. A cathode ray tube comprising an envelope having a neck-portion adapted to accommodate a beam-source of electrons, a bowl-like end-portion adapted to accommodate a target including an electrode to be scanned by beam-electrons from said source, and an intermediate hollow envelope-portion through the interior of which said beam-electrons pass in their transit to said target electrode, said intermediate envelope-portion increasing in its transverse dimensions from said neck-portion to said bowl-like end-portion, the larger end of said intermediate portion and the adjacent end of said bowl-like portion terminating in hermetically sealed metal flanges, and a plurality of metal supporting elements secured in spaced-apart relationship to the metal flange of said intermediate envelope-portion and terminating in a common plane for supporting said target electrode in a position to be scanned by said beam-electrons.

16. A cathode-ray tube comprising an envelope having a central axis and an inner surface surrounding said axis and defining a boundary of the main chamber of said tube, a target electrode having an apertured central portion and a peripheral supporting portion, and means for supporting said target electrode in a predetermined position in said envelope comprising at least three supporting elements mounted in circumferentially-spaced array on said inner surface of said envelope and having locating surfaces lying substantially in a common plane normal to said axis, said peripheral supporting portion of said target electrode including a surface abutting each of the locating surfaces of said supporting elements, and means for maintaining said surfaces in said abutting relation.

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