Aug. 26, 1941. D. W. POWER 2,254,090

CATHODE RAY TUBE ENVELOPE

Filed April 30, 1940

Fig. 1

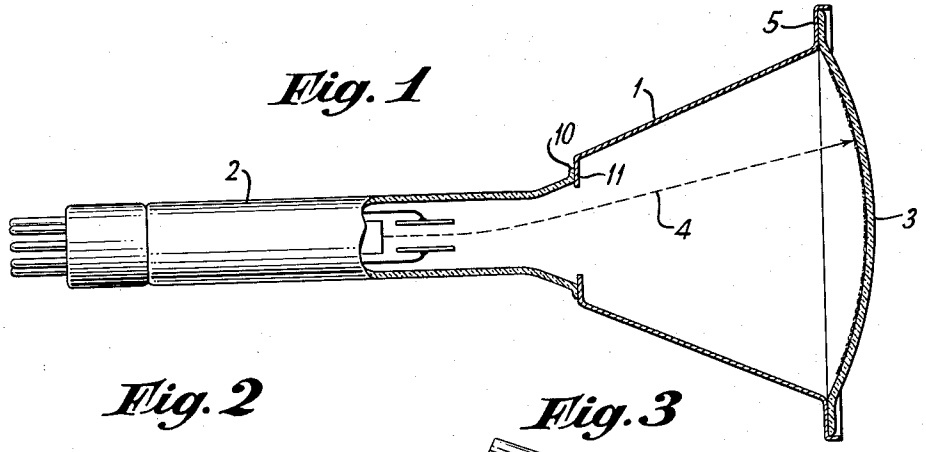


Fig. 2

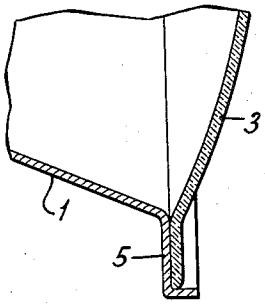


Fig. 3

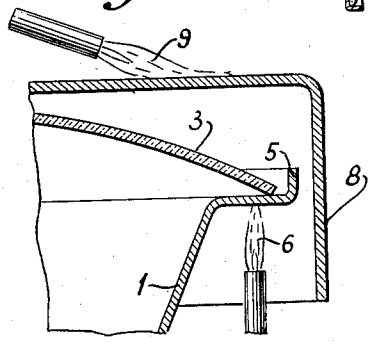


Fig. 4

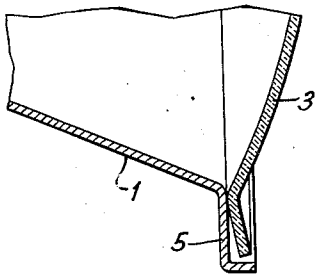
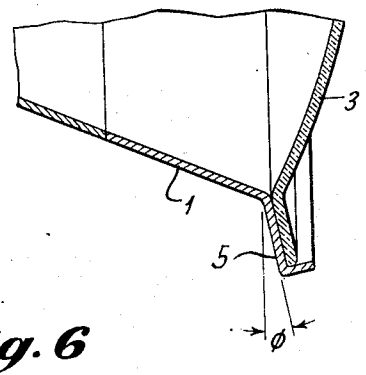


Fig. 5



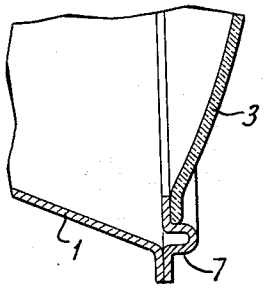


Fig. 6

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CATHODE RAY TUBE ENVELOPE

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Application April 30, 1940, Serial No. 332,537

2 Claims. (Cl. 250—141)

My invention relates to cathode ray tubes, particularly to glass-to-metal seals employed in the fabrication of envelopes for such tubes.

Electron discharge devices of the cathode ray type usually comprise a conical envelope with an electron gun at the small end of the envelope for directing an electron beam onto a round transparent viewing plate or window joined along its rim to the large end of the conical envelope. For best results the window should have a single radius of curvature over its entire viewing area. Since the window must be of glass or similar transparent plastic, it is important that the window be not distorted when it is heated and sealed to the envelope. Further, because of the relatively large area of the window and the considerable pressure on the window, the seal must be especially strong as well as vacuum-tight and the zones of stress must be uniformly distributed and concentric with the window.

An object of my invention is to make an envelope for cathode ray tubes in which the window or viewing plate may be joined to the envelope without distortion of the plate.

Another object of my invention is to make a strong bond between the rim of a cathode ray tube window and the envelope of the tube, said window being in an accurately predetermined position with respect to the beam forming means of the tube.

The characteristic features of my invention are defined in the appended claims and preferred embodiments are described in the following specification and shown in the accompanying drawing in which Figure 1 is a sectioned elevational view of a cathode ray tube made according to my invention, Figure 2 shows a detailed sectional view of my improved window seal, Figure 3 shows a detail view of the window and envelope in position for sealing according to my invention, Figure 4 shows an alternative form of the window, and Figures 5 and 6 show in detail other seals embodying my invention.

The cathode ray tube as illustrated in Figure 1 comprises the usual conical envelope 1 joined at its small end to a cylindrical portion 2 enclosing the electron gun and sealed along its outer rim to the edge of a concaved window or plate of glass 3. The window is sealed to the envelope with the plane through the rim of the window normal to and coaxial with the center line of the electron gun. If this symmetrical position of the window is not established in manufacture, the electron beam can only be focused on part of the window. The window 3, further, must be homogeneous in composition and uniform in thickness. It has been found particularly difficult in manufacture to prevent waves of varying thickness in the window during high temperature sealing operations and to bring the window to the desired positional relation with respect to the electron gun.

The conical envelope 1, is, in the tube shown, made of sheet metal and is provided along its outer rim with a drawn flange 5 joined to the rim of the glass window. As shown in greater detail in Figure 2, the rim of the window is fitted to the envelope flange and is hermetically joined to the flange over a considerable area of contact. The window has a fixed radius of curvature over its entire area and up to the rim of the cone, which affords maximum usable scanning and viewing area on the window. In the manufacture of an envelope according to my invention, it is easy to heat the window to annealing temperature and yet maintain the window below deformation temperature while the rim of the window is sealed to the flange. The cone is preferably held with its axis vertical, as shown in Figure 3, and the window is placed on the cone with the rim of the window in contact with the flange. A metal hood 8 is placed over the screen and flood fires 9 played on the hood until the window, heated by radiation, is raised to annealing temperature, and sharp pointed gas flames 6 are directed at the rim and flange of the metal cone. For uniformity of heating, the envelope flange may be rotated over a series of spaced gas flames. As the glass at the point of contact softens and seals, the flames may be moved radially inward, the progress of the inward travel of the flame being slow enough to permit the glass to settle uniformly along the rim and seal to the flange and to expel air from between the glass and metal as the seal moves inwardly toward the rim of the cone. When the window has settled the desired distance, the flames 6 are removed and the sealing glass hardens and immediately stops the window.

An up-turned flange as shown in Figure 4 may be press-molded on the rim of the window, and the sealing started at the rim of the cone and moved outwardly.

To strengthen the seal it has been found desirable to incline the flange 5 of the cone to the plane of the base of the cone as shown in Figure 5. The degree of inclination ϕ, sufficient to give the conical section of the flange strength against deflection by blows delivered to the outer

edge of the flange, may vary between 5 and 30 degrees, 15 degrees being preferred.

If it is not desired to make the entire envelope cone of the metal selected for sealing to the glass plate, the flange ring 7, Figure 6, of the selected metal may be separately formed and welded to the end of the cone. The ring may be channeled as shown to cushion the seal against shock. Alternatively, the body of the cone, of iron or steel, may be lap or butt welded or brazed to a chrome-iron ring carrying the flange 5, as shown in Figure 5. A chrome-iron flange may be sealed to commercial lime window plate glass of the type known as "Libby-Owens-Ford" window glass. This plate glass may easily be heated and pressed to the desired shape.

My novel method of sealing may advantageously be employed in joining the cylinder 2 to the small end of the metal cone. As shown in Figure 1, the cylinder 2 is formed with an outwardly extending flange 10 sealed to an inwardly extending flange 11 on the metal cone. In manufacture, the flange 10 is slightly conical and contacts the metal near the junction of the cone and flange 11. As the glass flange is softened, the cylinder is slowly pushed forward to flatten the softened flange against the metal. As the glass-to-metal area of contact expands, air is squeezed from the seal and the final seal is free of bubbles and air pockets.

My novel method of making cathode ray tubes and of joining the window to the envelope provides a simple, strong structure that is easily made in manufacture and leaves the viewing plate without distortions.

I claim:

1. An electron discharge device comprising a cone-shaped sheet metal envelope, a radial flange integral with and drawn from the rim of the large end of the cone, an electron gun at the small end of the cone for directing a beam axially of the cone, a window concaved outwardly joined along its edge to one surface of said flange, said flange being conical, with said surface inclined to the plane through said edge of the window.

2. A composite metal and glass envelope comprising a metal shell with a flange extending radially outward from the rim of the shell, said flange being conical, of uniform thickness, and inclined to the plane of the rim of the shell, a glass plate across the large end of the metal shell with an integral flange along the rim of the plate fitted to and joined gas-tight to the surface of the metal flange.

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