

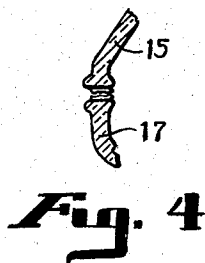
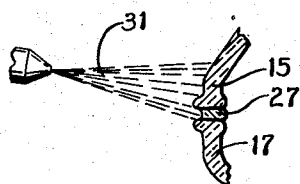
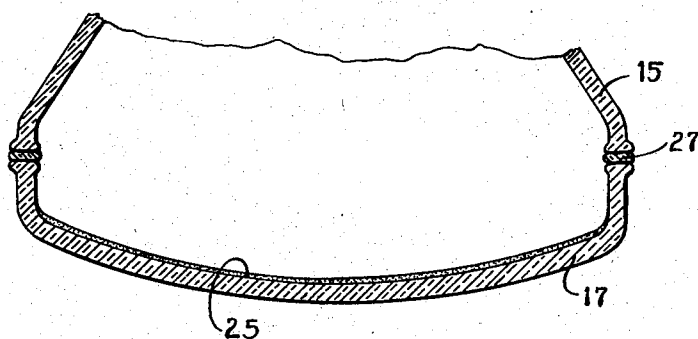
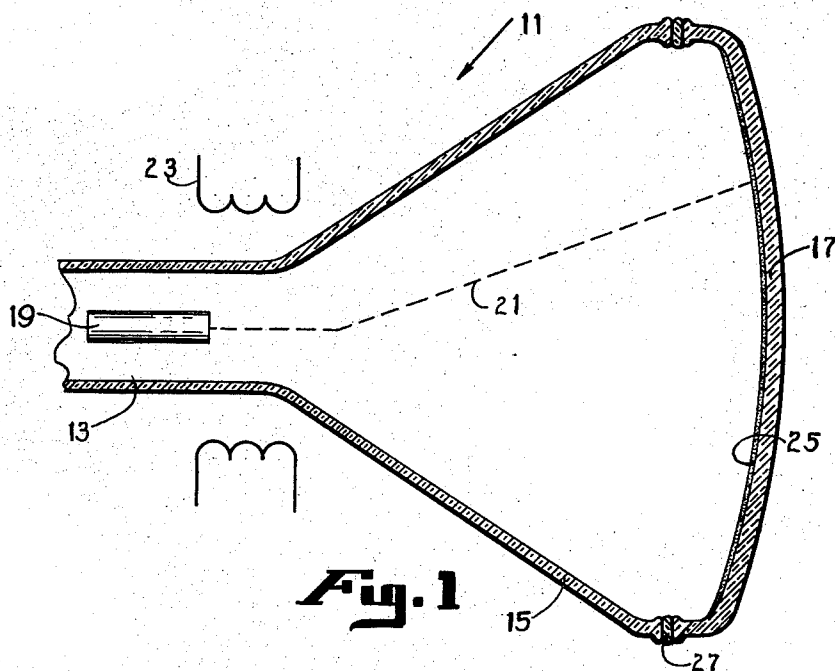
April 28, 1959

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2,884,312

ELECTRON DISCHARGE DEVICE MANUFACTURE

Filed Sept. 3, 1957



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ELECTRON DISCHARGE DEVICE MANUFACTURE

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Application September 3, 1957, Serial No. 681,671

7 Claims. (Cl. 41—42)

This invention relates to electron discharge devices and bore particularly to a process for salvaging the envelopes or closure members of such devices.

Electron discharge devices such as cathode ray tubes of the type adapted for use in television apparatus may have an all-glass envelope which includes a cone portion and a face panel sealed to one another by a glass frit. Since these envelope parts are expansive, it is desirable from a cost standpoint to dis-assemble and re-use them if the finished tube is found to be defective.

One process for separating frit-sealed glass closure members utilizes an extended heating cycle to weaken the seal followed by the application of air into the envelope to create a pressure which tends to blow the envelope apart at the seal. This process is slow and costly, and the scrap resulting therefrom is high due primarily to cracking of the cone and panel, and chipping of the hot frit onto the glass face panel surface.

Accordingly, an object of the invention is to reduce the aforementioned disadvantages and to efficiently and inexpensively separate glass closure members of the type used in electrical devices.

A further object is to reduce glass envelope salvage scrap.

The foregoing objects are achieved in one aspect of the invention by the provision of a process for separating a frit-sealed cone and face panel assembly by etching the seal and subsequently causing one of these components to expand or contract relative to the other to cause a cracking of the seal.

For a better understanding of the invention, reference is made to the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a plan view of a cathode ray tube;

Fig. 2 is a sectional view of one portion of a cathode ray tube utilizing a frit seal between the cone of the tube and the face panel; and

Figs. 3 and 4 illustrate two steps utilized in the process of breaking the seal to facilitate separation of the envelope components from one another.

A cathode ray tube 11 is shown in Fig. 1 comprising a glass envelope having a neck portion 13 and a cone 15 and face panel 17 which are frit-sealed to one another in a manner to be hereafter described. Positioned within neck 13 is a gun structure 19 for providing the source, acceleration and focusing of the electron beam or beams 21, which are deflected by coils 23 to provide scanning of the fluorescent screen 25.

Fig. 2 shows the hermetic seal between cone 15 and face panel 17 of the cathode ray tube. During construction of the tube, which may be of the type utilized in color television apparatus, screen 25 is formed on panel 17, and cone 15 is subsequently connected thereto by frit-seal 27. This seal is accomplished by positioning a frit-ring around panel 17, placing cone 15 thereon, and subsequently heating the frit and the seal areas of the cone and panel to a fusion temperature. The frit ring

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may comprise any glass composition which is calcined or partially fused by heat at a temperature below the temperature necessary to provide vitrification.

When a cathode ray tube is found to be defective after construction and testing, it is advantageous from a cost standpoint to dis-assemble and re-use the envelope. To accomplish this objective, cone 15 may be separated from panel 17 by a process wherein frit-seal 27 is initially etched to weaken the seal, and the lateral dimensions of the cone or panel are altered relative to one another by expansion or contraction to provide a shear stress on seal 27 to cause cracking thereof.

In this process, the tube may be immersed face down in an etching fluid such as nitric or hydrofluoric acid preferably to a depth sufficient to allow the acid to extend a short distance above seal 27. The tube may be kept in this position for a period of time, e.g. 10 minutes for a 1.8 normality solution of nitric acid, to allow etching of seal 27 as illustrated in Fig. 3. In order to condition the seal area around frit 27 for the shearing action, the acid is preferably maintained at a temperature above 100 degrees Fahrenheit. After the etching operation has been completed, a cooling medium such as the water spray 31, which may be at a temperature below 80 degrees Fahrenheit, is applied to the seal area so that it strikes the cone 15 near the seal and causes contraction thereof. Since the temperature of the cone is lower than that of the panel, a stress due to the cone contraction causes frit-seal 27 to shear, thereby facilitating separation of the cone from panel 17 as illustrated in Fig. 4. It is to be understood that although a water spray has been illustrated as the cooling medium, other devices capable of selectively cooling portions of the glass envelope may also be used. After the remaining frit has been removed from closure members 15 and 17, they are in condition to be re-used in the fabrication of a new tube.

It has been found that the shearing action on seal 27 may be accomplished by causing either closure member, i.e. the panel or cone, to move relative to one another after the seal has been weakened. Therefore, application of a cooling medium to panel 17 would also cause the seal to shear. In addition, the acid may be deposited into the envelope to cause etching of the frit at its internally disposed edge so that the seal may be weakened to allow shearing thereof with the application of heat to either one of the closure members 15 and 17. It has been found that excellent results may be obtained when the expansion or contraction of one of these members is such that the lateral movement of the one member relative to the other is in the direction of the etched or re-entrant surface of seal 27.

Although several embodiments of the invention have been shown and described, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. A method of separating first and second electrical device glass closure members having given lateral dimensions which are frit-sealed to one another comprising the steps of etching the frit and subsequently altering the lateral dimension of said first closure member to provide shearing of the seal.

2. A method of separating first and second glass closure members of an electron discharge device which are frit-sealed to one another comprising the steps of etching the frit and subsequently cooling the seal area of said first closure member to a temperature below the temperature of said second closure member to provide shearing of the seal.

3. A method of separating first and second glass clo-

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sure members of an electron discharge device which are frit-sealed to one another comprising the steps of etching the frit and subsequently heating the seal area of said first closure member to a temperature above the temperature of said second closure member to provide shearing of the seal.

4. A method of separating first and second glass closure members of an electron discharge device which are frit-sealed to one another comprising the steps of etching the external portion of the frit and subsequently cooling the seal area of said first closure member to a temperature below the temperature of said second closure member to provide shearing of the seal.

5. A method of separating first and second glass closure members of an electron discharge device which are frit-sealed to one another comprising the steps of etching the external portion of the frit and subsequently externally applying a fluid at a temperature below the temperature of said second closure member to the seal area of said first closure member to provide shearing of the seal.

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6. A method of separating first and second glass closure members of an electron discharge device which are frit-sealed to one another comprising the steps of etching the internal portion of the frit and subsequently applying a fluid at a temperature above the temperature of said second closure member to the seal area of said first closure member to provide shearing of the seal.

7. A method of separating first and second glass closure members of an electron discharge device which are frit-sealed to one another comprising the steps of applying an etching acid to the frit at a temperature above 100 degrees Fahrenheit and subsequently cooling the seal area of said first closure member to a temperature below 80 degrees Fahrenheit to provide shearing of the seal.

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