United States Patent [19]

Katayama

[11] **3,887,827**

[45] **June 3, 1975**

[54] **TARGET ASSEMBLY OF IMAGE PICK-UP TUBE**

[75] Inventor: **Mitsumasa Katayama,** Kadoma, Japan

[73] Assignee: **Matsushita Electronics Corporation,** Osaka, Japan

[22] Filed: **Oct. 23, 1973**

[21] Appl. No.: **408,531**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 181,310, Sept. 17, 1971, abandoned.

[30] **Foreign Application Priority Data**

Sept. 19, 1970 Japan 45-93354

[52] **U.S. Cl.** **313/390;** 313/366

[51] **Int. Cl.** **H01j 29/02;** H01j 31/38

[58] **Field of Search** .. 313/65 R, 65 T, 65 A, 65 AB, 313/66, 94

[56] **References Cited**

UNITED STATES PATENTS

2,730,638	1/1956	Cashman	313/65 A
3,360,671	12/1967	Salgo et al.	313/65 A
3,569,758	3/1971	Horiuchi et al.	313/66
3,688,143	8/1972	Lieb et al.	313/67
3,714,488	1/1973	Kato	313/65 R
3,725,711	4/1973	Sadler	313/66

Primary Examiner—Robert Segal

Attorney, Agent, or Firm—Depaoli & O'Brien

[57] **ABSTRACT**

A target assembly of an image pick-up tube is provided which includes a stepped annular support member for a target substrate secured between a face plate and a front end portion of a tubular envelope of the image pick-up tube. The target substrate is affixed within the outwardly offset portion of the support member. The support member enables a fabrication sequence to be used which obviates exposure of the target substrate to mechanical or thermal shock during manufacture, permits the affixing material to be out of the field of view in a straight-sides image pick-up tube, and furnishes automatically accurate centering of the target substrate. In combination with a soft-metal sealing ring having an annular width extending from the inwardly offset portion of the support member to the inner side of a signal ring capping the face plate and the envelope, the support member also insulates the target substrate from mechanical shock during use of the image pick-up tube.

3 Claims, 5 Drawing Figures

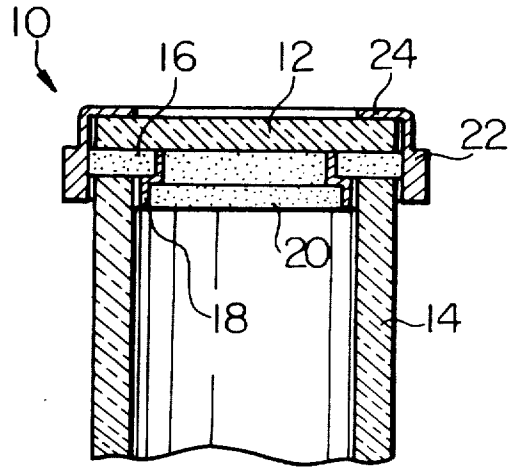


Fig. 1

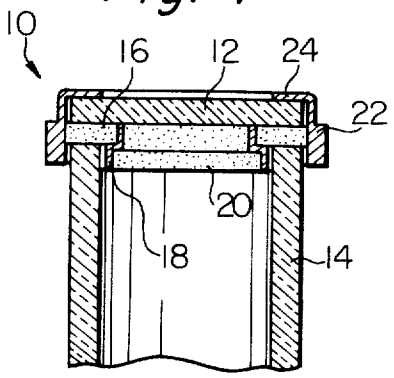


Fig. 2

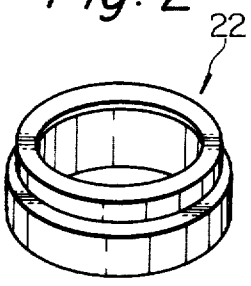


Fig. 3

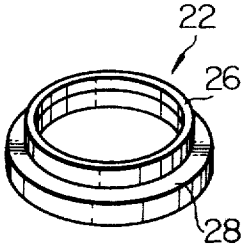


Fig. 4

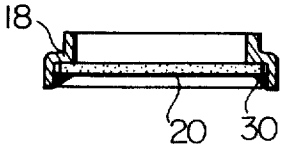
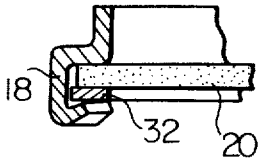


Fig. 5



TARGET ASSEMBLY OF IMAGE PICK-UP TUBE

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of copending application Ser. No. 181,310, filed Sept. 17, 1971, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an image pick-up tube and more particularly to a target assembly of an image pick-up tube. The invention specifically relates to a fabrication sequence for the target assembly that obviates exposure of its target substrate to mechanical or thermal shock during such fabrication and further relates to means for insulating the target substrate of the target assembly from mechanical shock during use of the image pick-up tube.

2. Review of the Prior Art

The art of manufacturing image pick-up tubes has progressed to the point that many devices and techniques are known for positioning, attaching, and sealing the parts of a target assembly thereof. A need nevertheless exists for devices and fabrication methods that can provide more accurate, simpler, and more automatic positioning, more reliable shock protection during fabrication and during use, and more efficient sealing of the target substrate within a target assembly.

U.S. Pat. No. 2,730,638 discloses, for example, a pair of seam-welded Kovar rings, the inner being stepped and sealed to the perimeter of a glass plate coated with a layer of photoconductive material, and the outer being sealed to an end of the tubular envelope. However, the pair of Kovar rings exert no inwardly directed bonding pressure; moreover, stepped surfaces of the inner ring are parallel to the glass plate, and the inner shock-transmitting wider step of the ring is annularly co-linear with the glass plate so that mechanical shock is directly and linearly transmittable to the glass plate.

As another example, U.S. Pat. No. 3,271,608 shows a copper layer used as a substrate for layers of other metals and sealed into and stretched taut between a pair of supporting rings which are in turn sealed to the underside of a Kovar ring which is attached to a glass envelope by means of an elongated Kovar ring, but this patent does not teach the protection of the substrate from shock during manufacture or during use of the target assembly.

The photosensitive target of U.S. Pat. No. 3,569,758 is adhesively secured to the surface of a conductive layer attached to a glass substrate and is centrally disposed thereon in spatial separation from an annular indium seal at the end of a vacuum vessel. The indium seal is not interrelated with the conductive layer; it has a sealing function only. Moreover, although the target is itself separated from edgewise-exerted pressure, it is susceptible to any damge occuring to the unprotected glass substrate, it does not appear to possess a means for accurate centering, and it does not cover the entire interior of the vacuum tube.

U.S. Pat. No. 3,688,143 likewise has a multi-diode target disc which is supported by an inner ring within an outer stepped ring which is positioned within the expanded end of a camera tube, thereby apparently providing accurate centering of the target disc. There is no means for shock absorption during use, such as an intervening soft-metal layer, however.

Although each of these structures provides one or more parts of use for shock insulation or assembly efficiency, none offers a well-designed combination of features which are specifically intended for such purposes.

SUMMARY OF THE INVENTION

An object of this invention is to provide a means for preventing damage to a target substrate while manufacturing a target assembly and attaching it within a straight-sided image pick-up tube.

Another object is to provide a means for accurately, simply, and quickly centering a target substrate within an image pick-up tube.

An additional object is to provide a means for efficiently protecting the target substrate from damage by mechanical shock during use of the image pick-up tube.

In satisfaction of these objects and in accordance with the purposes of this invention, a stepped, annular metallic support member is herein provided which has an outwardly offset portion, an inwardly offset portion, and a step portion therebetween, the offset portions being disposed in parallel to the tubular envelope of an image pick-up tube when mounted therewithin and the step portion being disposed radially to the tube. The outwardly offset portion is spaced from the inner sides of the tube. The support member is a part of a target assembly which further comprises a face plate which is hermetically secured on one open end of a tubular envelope of an image pick-up tube, a signal ring which caps the face plate and the envelope, a target substrate which fits closely within and is attached to the outwardly offset portion while positioned against the step portion, and a sealing ring of a soft metal which joins the inwardly offset portion to the face plate and to the envelope and has sufficient annular width to extend from the inwardly offset portion to the signal ring so that the signal ring is spaced from the envelopes. The invention particularly provides a fabrication sequence for affixing these parts of the target assembly so that the target substrate is mounted after all other parts of the target assembly have been attached and is thereby protected from mechanical and thermal shock during manufacture of the target assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

The specific structure of this invention will be understood when the detailed description is read in conjunction with the drawings wherein:

FIG. 1 is a sectional view of a target assembly according to this invention;

FIG. 2 is a signal ring covering the assembly;

FIG. 3 is a perspective view of an annular metallic support member included in the target assembly of FIG. 1;

FIG. 4 is a sectional view of one form of the annular metallic support member; and

FIG. 5 is a partial sectional view of another form of the annular metallic support member.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, a target assembly 10 comprises a transparent face plate 12 which is hermetically secured on one open end of a tubular envelope 14 of

an image pick-up tube, a target substrate **20**, an annular metallic support member **18** for supporting therein the target substrate **20**, a signal ring **22** which caps the face plate **12** and the envelope **14**, and an annular binding and sealing ring **16** interposed between the envelope **14** and the face plate **12**. The support member **18** may be attached to the back surface of the face plate **12** so as to provide mechanical robustness or may be separated therefrom so as to provide enhanced shock insulation.

As shown in FIG. **3**, the support member **18** comprises an inwardly offset portion **26**, an outwardly offset portion **28**, and a step portion therebetween which is radially disposed when the support member **18** is mounted within the envelope **14**. The concentrically disposed annular bends between these three portions of the support member **18** serve to distribute and absorb any radially directed stresses that are transmitted through the soft-metal ring **16** which itself has a shock-wave dampening effect.

The signal ring **22** of FIG. **2** partially caps the face plate **12** and partially extends over the envelope **14** in such a manner as shown in FIG. **1**, so that robust construction and fine configuration of the target assembly **10** is accomplished. The signal ring **22** may be fastened to the envelope **14** by means of pressure welded indium or an adhesive agent at the same time that the target assembly is fabricated through pressure welding, or after the support member **18** is secured at the end portion of the envelope **14**. The signal ring **22** preferably has a masking portion **24** attached to the edge portion of the face plate **12** but may be otherwise simply cylindrical. The signal **22** is composed of an electrically conductive substance, and its inner surface is in contact with the outer surface of the binding ring **16** so as to serve as an output terminal for the electric image signal produced in the target substrate **20**.

As shown in FIG. **4**, the target substrate **20**, which is formed of, for example, monocrystalline silicon, is seated on the step portion of the support member **18** and is secured by means of adhesive agent or solder **30** having a low melting temperature, such as indium or tin, which is affixed to the outwardly offset portion **28**, so that the adhesive agent or solder **30** is beyond the field of view defined by the inwardly offset portion **26** of the support member **18**.

As shown in FIG. **5**, the target substrate **20** is otherwise seated on the step portion, but is, in this case, secured by means of a washer **32** pressed by an inwardly bent end portion **34** of the support member **18**. The washer **32** preferably has such a wavy construction as to provide a spring action.

In order to achieve the object of providing efficient protection to the target substrate **20** from mechanical shock damage while the image pick-up tube is in use, the outer edge of the outwardly offset portion **28** is also spaced radially from the inner surface of the envelope **14**, and the inner surface of the signal ring **22** is additionally spaced radially from the outer surface of the envelope **14**. These relationships are effected by constructing the radially wide ring **16** with an outer diameter which is greater than the outer diameter of the envelope **14** and with an inner diameter which is less than the inner diameter of the envelope **14** minus the radially measured width of the step portion of the support member **18**. The ring **16** thus has sufficient annular width to extend from the inwardly offset portion **26** to the signal ring **22** so that the signal ring **22** is spaced from the envelope **14** and the outwardly offset portion **28** is also spaced from the envelope **14**. The ring **16** additionally applies strong inward pressure on the inwardly offset portion **26** of the annular support member **18**, thereby providing a strong structure against external shock, which is created when the sealing pressure compresses the soft-metal ring **16**.

In order to effect the object of simple, quick, and accurate centering of the target substrate **20**, it is necessary that the inner diameter of the ring **16** be only slightly greater than the outer diameter of the inwardly offset portion **26** and that the inner diameter of the outwardly offset portion **28** be only slightly greater than the diameter of the target substrate **20**. When the target substrate **20** is placed within the outwardly offset portion **28**, it is thereby centered automatically and can be soldered into place without delay.

The target substrate **20** is preferably positioned substantially perpendicularly to the central axis of the envelope **14**, which has its other end (not shown) hermetically sealed so as to make a chamber to be evacuated for permitting an electron beam to freely pass therethrough, and has one surface exposed to any optical image passed through the face plate **12**. The opposite surface of the target substrate **20** is, in operation, scanned by an electron beam emitted from an electron gun (not shown) whereby an image signal is produced therein which is picked up by a suitable external device through the binding member **16**. It should be noted that the peripheral wall of the support member **18** may be plated with a suitable soft metal such as indium, tin, and an alloy thereof so as to provide a robust welded connection between the peripheral wall and the binding member **16**.

In furtherance of the object of providing a means for preventing damage to a target substrate **20** while manufacturing a target assembly of this invention and attaching it to an image pick-up tube, a specific fabrication sequence must be used; viz, the support member **18** is first combined with both the tubular envelope **14** and the face plate **12** by means of a soft-metal binder ring **16** having the appropriate annular dimensions, using, for example, a pressure welding technique. Secondly, the signal ring **22** is attached, by pressure welding or by adhesives, to the face plate **12** and the envelope **14**. Thirdly, after all stress-creating activities have been completed, the target substrate **20** is added, being automatically centered upon the stepped portion of the support member **18**, and is secured by adhesives or solder **30** to the outwardly offset portion **28** so that no stresses are created. This fabrication sequence also reduces possibilities of sealing material, such as indium, sticking onto the target substrate **20**, so that manufacturing defects therefrom are minimized.

Thereafter, when the image pick-up tube is in use, any mechanical shock, such as that created by toppling an upright tube or dropping a tube upon the floor, tends to become partially dampened while passing through the soft-metal ring **16**, is then diminished by circumferential distribution through the inwardly offset portion **26**, and is further decreased by transmittal through the bend between the inwardly offset portion **26** and the step portion so that the relatively fragile target substrate **20** is well protected from damage.

It should be understood that this invention can be modified in various ways without departing from the spirit thereof and consequently should be interpreted

only in light of the following claims when broadly construed.

What is claimed is:

1. A target assembly of an image pick-up tube including a tubular envelope, comprising:

a transparent face plate having the diameter of said tubular envelope;

an annular, stepped metallic support member comprising an inwardly offset portion adjacent said face plate, an outwardly offset portion, and a step portion therebetween, said offset portions being parallel to said tubular envelope and said step portion being perpendicular thereto;

an annular, electrically conductive signal ring of cylindrical shape which is disposed along the rim of said face plate;

an annular binding and sealing ring of soft metal which is sealingly and bindingly interposed between and welded to said face plate and said tubular envelope, has an outer diameter which is greater than the outer diameter of said tubular envelope, and has an inner diameter which is less than the inner diameter of said tubular envelope minus the radially measured width of said step portion, said binding and sealing ring being additionally welded to said inwardly offset portion along said inner diameter, whereby said binding and sealing ring has sufficient annular width to extend from said inwardly offset portion to said signal ring, said signal ring is annularly spaced from the exterior of said tubular envelope, and said outwardly offset portion is annularly spaced from the interior of said tubular envelope so that damage from mechanical shock while said image pick-up tube is in use is minimized.

2. The target assembly of claim 1 wherein said binding and sealing ring exerts a strong inward pressure upon said inwardly offset portion when sealing pressure is applied to compress the soft metal thereof while said binding and sealing ring is being welded, thereby providing a strong structure against external shock.

3. The target assembly of claim 1 which further comprises a target substrate fitting closely within said outwardly offset portion and affixed thereto while seated on said step portion, whereby the field of view defined by said inwardly offset portion is unobstructed.

* * * * *