United States Patent

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[73] Assignee **General Electric Company**

[54] **TARGET STRUCTURE FOR CAMERA TUBES CONSISTING OF A MAGNESIUM OXIDE LAYER SUPPORTED ON ONE SIDE OF A METAL MESH**
4 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **313/65,** 313/89, 313/311
[51] **Int. Cl.** **H01j 29/45,** H01j 31/30
[50] **Field of Search** ..... 313/65 T, 65, 68, 89

[56] **References Cited**
UNITED STATES PATENTS

3,441,787	4/1969	Goetze et al.	313/68 X
3,509,414	4/1970	Einstein	313/65 X
2,785,328	3/1957	Kihn	313/68
2,922,906	1/1960	Day, Jr. et al.	313/65 T
3,249,784	5/1966	Burns	313/68
3,319,103	5/1967	Cartwright et al.	313/68

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ABSTRACT: A target structure is disclosed having superior electrical properties and mechanical strength. The target comprises a homogenous magnesium oxide membrane supported by a fine gauge nickel mesh. The target structure can be used in either direct-beam or return-beam-type camera tubes.

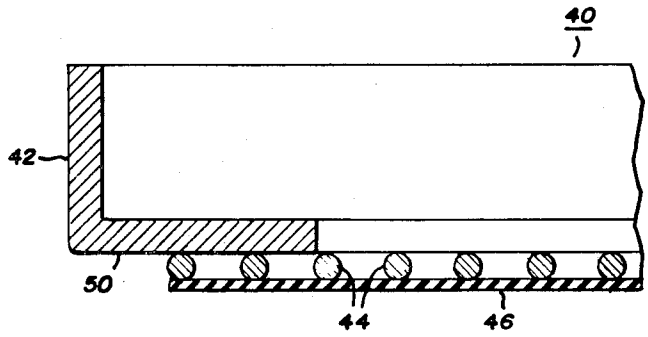


FIG. 1.

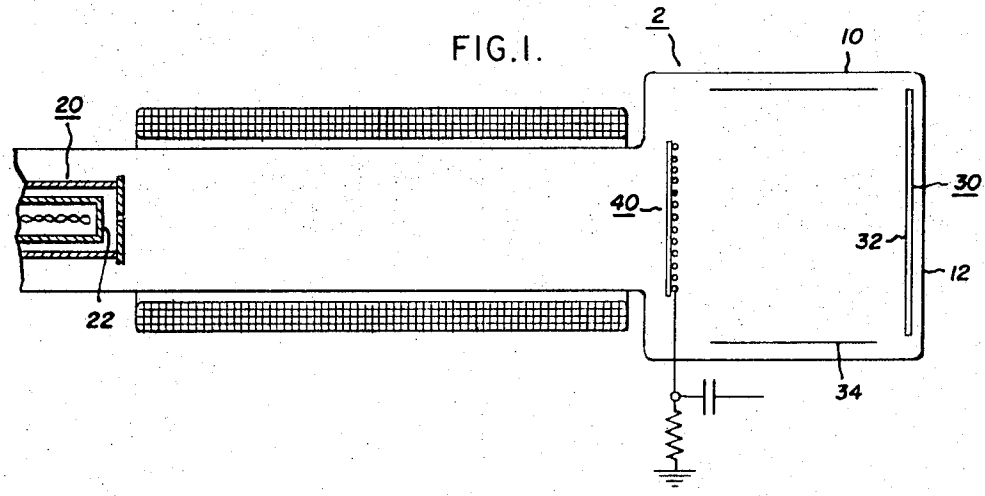


FIG. 2.

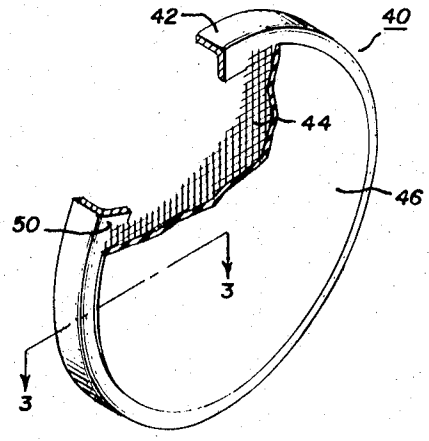
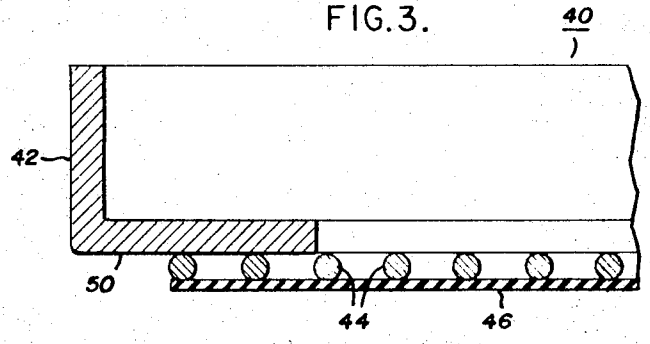


FIG. 3.



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TARGET STRUCTURE FOR CAMERA TUBES CONSISTING OF A MAGNESIUM OXIDE LAYER SUPPORTED ON ONE SIDE OF A METAL MESH

BACKGROUND OF THE INVENTION

This invention relates to improvements in target structures for camera tubes. In one aspect the invention relates to a ruggedized target structure. The invention herein described was made in the course of or under a contract or subcontract thereunder with the Department of the Army.

Targets for camera tubes conventionally comprise a thin membranelike layer of active material carried in drum-head fashion on a supporting ring. Due to the delicate physical nature of some active materials a supporting layer may be desirable to physically support the target. The support layer is usually a thin, nonactive material so as to not interfere with the passage of electrons to the active material. However, when the supporting layer is made thick enough to provide the intended physical support for the target, it has been found that the energy requirements to pass an electron beam through the support layer to the active material are greatly increased.

Alternatively the active material can be mounted in unsupported fashion with a target mesh mounted in close proximity providing a baffle to prevent breakage by relative air movement, for example, during pump down. The basic purpose of the mesh in such a case is to function as a collector of secondary electrons from the target. Such a structure is shown in U.S. Pat. No. 2,922,907 assigned to the assignee of this invention.

The resulting target, however, is a delicate structure requiring special mounting particularly if the camera tube is to be exposed to rugged operating conditions wherein vibration of the tube can cause breakage of the target or movement of the target with respect to the mesh causing microphonics.

It has now been discovered that a ruggedized magnesium oxide target can be constructed using support means which still permit the passage of electrons thus mitigating the energy requirements heretofore necessary when solid supports were used.

SUMMARY OF THE INVENTION

In accordance with the invention, a camera tube is provided having an improved target structure wherein support means comprising a finely apertured nickel metal mesh are provided to physically support a continuous membrane or layer of magnesium oxide. In one aspect the invention relates to a ruggedized target structure wherein the magnesium oxide target membrane is directly mounted on a finely apertured metallic mesh.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial view in cross section, schematically representing a camera tube to which the present invention may be applied.

FIG. 2 is an enlarged partially cutaway, isometric view of the invention.

FIG. 3 is an illustration of a cross-sectional segment of the invention.

DETAILED DESCRIPTION

Referring now to FIG. 1, a camera tube is generally indicated at 2 having an outer glass envelope 10, an electron optics section 20, a photocathode 30, and target section 40. Electron optics section 20, comprises a cathode 22 and suitable electrodes and coils for the collimation, acceleration, focus, and deflection of an electron beam emitted from the cathode. Electron optics useful in the practice of the present invention can be found in U.S. Pat. No. 3,319,110, issued May 9, 1967 and assigned to the assignee of this invention. Suitable external circuitry (not shown) controls the scanning or sweeping of the beam.

Photocathode 30 comprises a layer 32 of photoemissive material which can be coated on the innner face of a window 12 formed on the end of envelope 10. Electrons emitted from the photocathode are, in response to light imaged thereon, accelerated by electrode 34 toward target section 40.

Referring now to FIG. 2, in accordance with the invention, target section 40 generally comprises an annular metal support ring 42 upon which is tautly mounted a finely apertured metal mesh 44. Mesh 44 in turn carries, on one side thereof, the magnesium oxide membrane target material.

The MgO membrane is a homogeneous layer about 500 angstroms thick formed by oxidizing a thin layer of magnesium which has been evaporated onto a thin plastic film placed over the mesh and which is later removed. The resulting membrane is planar, apparently having assumed the configuration of the plastic film. By oxidizing the magnesium in situ, rather than using magnesium oxide powder, a structure is apparently formed which is homogeneous and results in a membrane having high lateral resistivity which can be as much as three orders of magnitude higher than the transverse resistivity. While the reasons for this phenomena are not completely understood it it thought that the homogeneous crystal formation of MgO crystals of about 300 angstroms average size which, in a membrane of about 500 angstroms thickness, is of substantially the same order of magnitude as the thickness of the membrane, may result in a grain boundary conductivity through the membrane.

Metal mesh 44 is preferably constructed of nickel which does not chemically react with the magnesium oxide and does not oxidize under conditions used to oxidize the magnesium. Nickel is also preferred because it does not warp under subsequent heating conditions as does, for example, copper which could rupture the magnesium oxide membrane. As will be noted below, the metal mesh when constructed of nickel, can actually be tightened as well as cleaned by baking in a reducing atmosphere subsequent to formation of the target structure. Metal mesh 44 is preferably of 1,000 line per inch or finer gauge with a transverse thickness of about 0.2 mils and a ratio of mesh-to-opening area sufficient to provide about 60 percent transmission of light. It has been found that such meshes provide sufficient area of opening to pass a substantial amount of the photocathode emitted electrons through the mesh to the target membrane. Such meshes are commercially available or can be constructed by electrodeposition of the metal on ruled glass.

To construct target section 40, metallic mesh 44 is peripherally welded to edge 50 of support ring 42. A thin film of a removable material is then applied to the outer face of the mesh. This can be accomplished, for example, by dropping onto the surface of a pan of water, a small quantity of nitrocellulose dissolve in an organic solvent such as amyl acetate. This solution spreads out into a thin film because of the surface tension and the solvent evaporates, leaving a plastic film. The mesh, which is placed in the water either prior to formation of the film or which is immersed into the water around the outside of the film is then raised gently to pick up the film on the top surface of the mesh.

After the film has dried completely, the mesh is placed in an evaporator and a thin coating of magnesium is evaporated onto the film. The amount of evaporated material is determined by the desired electrical characteristics of the final target assembly. In one embodiment of the invention, sufficient magnesium is evaporated onto the film to provide a 400–600 angstrom layer, preferably about 500 angstroms, of magnesium oxide upon subsequent oxidation of the magnesium.

The resulting layer or membrane, as best seen in FIG. 3, is a relatively flat layer making only line contact with the supporting mesh, probably due to the inherent planar shape of the plastic film. The area of contact between the MgO membrane and the metal mesh is thus small in comparison with the total area of the MgO membrane surface. The MgO membrane has a high lateral resistivity relative to its transverse resistivity and thus the small area of contact between the membrane and the mesh does not discharge the charge pattern on the membrane.

The target structure is then baked in an oxidizing atmosphere at a temperature of at least 400° C. for about 5 hours to vaporize the plastic film and to oxidize the magnesium, converting it to magnesium oxide. Finally the target assembly is baked in a reducing atmosphere at about 800° C. which tightens and cleans the nickel metal mesh to provide a rigid structure. It should be noted that this final step is very important to insure a rigid, well supported, target structure. Constructing the mesh target support of nickel metal mesh enables one to first secure the perimeter by welding to a support ring and then to tighten the mesh by subjecting the metal mesh to a reducing atmosphere.

After assembly, the target structure can be mounted in camera tube **2** in conventional manner such as shown, for example, in Hannam U.S. Pat. No. 2,922,907 assigned to the assignee of this invention or it can be mounted in a ruggedized-type camera tube using vibration isolating means such as shown, for example, in Ney et al. U.S. Pat. No. 3,137,803, also assigned to the assignee of this invention. However, as stated earlier, the inherent ruggedness and unitary construction of the structure of the invention will make it unnecessary to use vibration isolation means to prevent microphonics.

Camera tube **2**, having the novel target mounted therein, can be operated in a direct beam vidicon mode. Electrons emitted from photocathode **30** in response to a pattern of light imaged thereon, pass through mesh **44** striking MgO layer **46** causing secondary emission of electrons which are then collected by mesh **44** leaving a corresponding positive charge pattern on the beam side of the target. The electron beam, which arrives at the target at the same potential as mesh **44** (about 7–8 volts positive), restores the negative charge, thereby discharging the target sector. The signal is fed from mesh **44** through appropriate external circuitry (not shown).

The novel target when used in a direct beam vidicon mode camera tube exhibited no lag and good antihalation properties as well as high gain.

Thus the invention provides a novel target structure having superior electrical and mechanical properties. The novel target structure can be used in a return beam-type camera tube as well as a direct beam-type camera tube. When used in a return beam camera tube the novel target structure exhibits excellent antihalation properties. The conductive mesh provides a high transparency to electrons traveling toward the target from the photocathode. The mesh also imparts enhanced mechanical strength to the target resulting in a much more rugged structure than heretofore. Minor modifications and improvements of the invention will be apparent to those skilled in the art and are deemed to be within the scope of the invention found in the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A target structure for a scanning beam electronic device comprising a metallic support frame member, a finely apertured nickel metal mesh rigidly positioned across said frame member, and a homogeneous magnesium oxide target comprising a continuous layer of about 400–600 angstrom thickness supported directly on one side of said metal mesh, one surface of said layer being in line contact with said one side of the metal mesh.

2. The target structure of claim **1** wherein said finely apertured nickel metal mesh has a gauge of about 1,000 lines per inch and has a ratio of mesh-to-opening area sufficient to provide about 60 percent transmission of light therethrough.

3. A rugged target structure for a scanning beam electronic device comprising a metallic support frame member, a finely apertured metal mesh rigidly positioned across said frame member, and a homogeneous, thin, magnesium oxide target comprising a continuous layer of about 400–600 angstrom thickness supported directly on one side of said metal mesh, one surface of said layer being in line contact with said one side of said metal mesh.

4. The target structure of claim **3** wherein said target layer comprises an oxidized layer of magnesium metal.