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METHOD OF MANUFACTURING PICKUP TUBES

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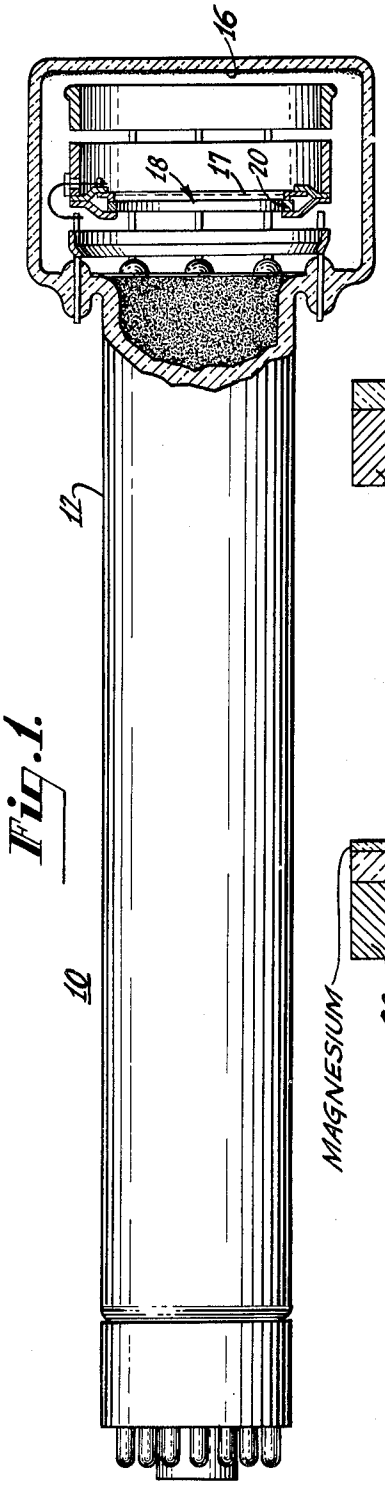


Fig. 1.

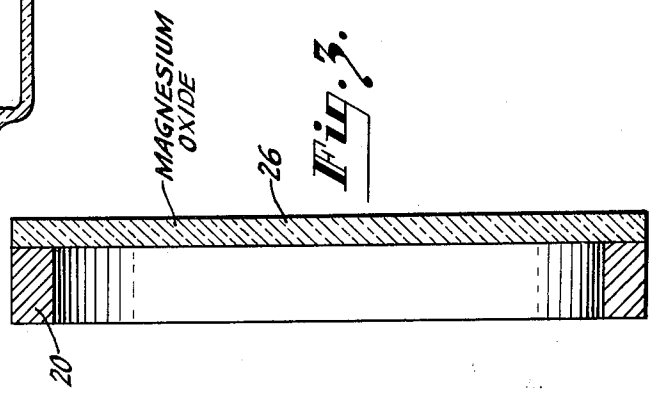


Fig. 3.

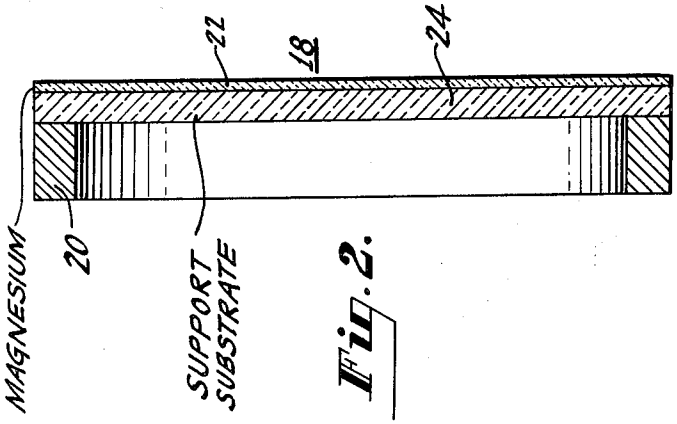


Fig. 2.

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METHOD OF MANUFACTURING PICKUP TUBES

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This invention relates to television pickup or camera tubes. In particular, this invention relates to a novel method of manufacturing an improved target structure for television pickup tubes.

In the prior art, there are several commercially available tube types known as image orthicons. The image orthicon tube generally comprises an envelope having an electron gun in one end thereof. In the opposite end of the envelope is a photocathode. Between the electron gun and the photocathode is at least one mesh screen and a semiconducting storage target electrode.

During operation of the image orthicon tube, an image of a scene to be reproduced is directed onto the photocathode which produces photoelectron emission which in turn provides a charge pattern on one side of the target electrode. The electron beam scans the opposite side of the storage target to read off the charge pattern thereon and produces electrical output signals corresponding to the original input scene.

In the prior art, the storage targets for the image orthicon type of tube have been made of a thin membrane of glass, or of thin semiconducting materials, or of insulating materials with electrically conducting plugs therein. This invention is particularly related to storage targets of the semiconducting type. The semiconducting type storage target generally comprises an annular support ring having a thin membrane of magnesium oxide or aluminum oxide, either of which may include certain impurities, supported across the aperture in the support ring.

A storage target of the magnesium oxide type is difficult to produce. One of the reasons for this difficulty is that the magnesium oxide must be stretched quite taut, across the support ring, to prevent target vibrations. If any mechanical vibrations occur during tube operation these vibrations will produce spurious signals in the output of the tube.

Another problem in manufacturing these targets is that image orthicons having a relatively high signal-to-noise ratio, require close spacing between the target and the mesh screen. In these types, target microphonics are particularly noticeable. Therefore, in these tubes maximum target tension is required.

It is therefore an object of this invention to provide a novel method of manufacturing an improved target electrode structure.

It is another object of this invention to provide a new and improved method of manufacturing targets for use in image orthicon type tubes.

These and other objects are accomplished in accordance with this invention by depositing on a suitable support ring a supporting film of organic material; then metallic magnesium is deposited; and then the organic film is removed just prior to oxidizing the magnesium.

The invention will be more clearly understood by reference to the accompanying single sheet of drawings wherein:

FIG. 1 is a partial sectional view of an image orthicon made in accordance with this invention;

FIG. 2 is an annular sectional view of a storage target in the process of being made, in accordance with the invention; and,

FIG. 3 is an annular sectional view of a completed storage type target in accordance with this invention.

Referring now to FIG. 1, there is shown an image orthicon tube **10**. The tube **10** comprises an evacuated envelope **12** having an electron gun (not shown) positioned in the stem end thereof (to the left as viewed in FIG. 1). Positioned on the inner surface of the face plate, in the opposite end of the envelope, is a photocathode **16**. The photocathode may be of any conventional materials, examples of which are the S–10 photosurface described in U.S. Patent No. 2,682,479 issued to Johnson, or the mult-alkali photosurface described in U.S. Patent No. 2,770,561 issued to Sommer.

In the envelope **12**, spaced from the photocathode **16** toward the electron gun, is a fine mesh screen **17** and a semiconducting type storage target **18**. The storage target **18** comprises an annular metallic support member **20** having a thin film of oxidized metal, e.g. magnesium oxide thereon.

During operation of the image orthicon **10**, light from a scene to be reproduced is directed through the transparent face plate onto the photocathode **16** producing a photo-electron image corresponding to the light from the scene. The photo-electron image is focused, and accelerated, by known techniques e.g. by use of the mesh screen **17**, and lands on one side of the storage target **18** to provide a charge pattern thereon. An electron beam from the electron gun scans the opposite side of the storage target **18** to remove the charge pattern therefrom. The electron beam is reflected back toward the electron gun where it is fed into a conventional electron multiplier which produces electrical output signals from the tube. The output signals correspond to the light from the scene to be reproduced.

In order to manufacture a storage target **18**, shown more clearly in FIG. 2, a thin film of organic material **24** is first deposited onto and across an apertured support member or metallic support ring **20** before one deposits the magnesium metal. The thin organic film **24** may be any of several known materials. Examples of materials which have been found suitable are collodion, nitrocellulose, or isobutyl-methacrylate. The organic film **24** functions as a temporary substrate for metal layer **22**. Onto the organic film **24** there is deposited by any suitable means, for example evaporation in a good vacuum, a film or metal **22** which is to be oxidized. The metal film may be a material such as magnesium and may be approximately 500 to 1,000 angstrom units thick.

In the prior art, the oxidation of the metal film and the removal of the organic substrate **24** were accomplished by baking the target structure **18** in an oven (not shown) having an oxidizing atmosphere. It has been found that, when this prior art method was utilized, the resulting magnesium oxide membrane was not stretched as tautly as desired across the support ring **20**. One of the reasons for this condition is that the support ring is normally made of molybdenum, which has a coefficient of thermal expansion of approximately 5×10^{-6}; the organic film is normally made of collodion, which has a coefficient of thermal expansion of approximately 100×10^{-6}; while magnesium metal has a coefficient of thermal expansion of approximately 25×10^{-6}. Observations of the structure during the baking period reveal that, as the temperature of the oven and therefore the target subassembly is initially increased, the magnesium film remains substantially flat even though both the magnesium and the organic substrate have a higher coefficient of thermal expansion than the support ring **20**. It is assumed that gradual decomposition of the support substrate **24** causes it to shrink. Apparently, the organic film **24** has little sheer strength and the magnesium film expands freely along the surface of the organic layer. When a temperature in the oxidizing atmosphere of the prior art is obtained at which the organic material is removed, e.g. ap-

proximately 200° C., the magnesium film is deposited onto, or becomes supported directly by, the metal support ring **20**. Any further temperature increase causes the magnesium film to wrinkle because the magnesium is expanding faster than the ring **20**. The amount of wrinkling increases until oxidation temperature of the magnesium is attained, approximately 400° C., and the magnesium film is changed into magnesium oxide. Some tightning of the film is observed during the oxidation process. However, this tightning can compensate for only a small amount of the looseness that develops in the magnesium film prior to oxidation. Therefore, it is extremely important that the magnesium film be deposited as a flat film on the support ring at a temperature close to the oxidation temperature of the magnesium. When this is done, the magnesium film loosens very little before oxidation and is stretched tight by the oxidation process.

In accordance with this invention it has been found that when an inert gas atmosphere is utilized, examples of which are helium and argon, during the initial temperature increase, this inert atmosphere prevents oxidation of the organic, or support substrate, **24** and permits the substrate to function as a support for the magnesium metal layer up to the oxidation temperature of the magnesium. In practice it has been found preferable to switch the atmosphere in the oven to an oxidizing atmosphere just below the oxidation temperature of the magnesium to insure complete removal of the organic substrate prior to the oxidation of the magnesium.

It has been found that taut targets of magnesium oxide **26** are provided when the inert atmosphere is changed to an oxygen atmosphere within the range of temperatures of about 325° C. to about 400° C. Within this range a temperature of approximately 340° C. is preferable.

When practicing this invention it has been found that, at about 200° C. while still in the inert atmosphere, a black or dark brown color appears on the ring **20** side of the aluminum **22**. This deposit is probably a partial decomposition of the organic film **24**.

Thus, the conventional support ring with a conventional organic film **24** thereon and a conventional layer of magnesium metal **22** may be manufactured into a quite taut target electrode by raising the temperature in the oxidizing furnace while the furnace is filled with an inert atmosphere. When the temperature is just below that at which the magnesium oxidizes (400° C.), the inert atmosphere is exhausted and the furnace is filled with oxygen so that the support substrate oxidizes and is removed and the magnesium drops onto the support ring and is oxidized, giving a taut, physically strong magnesium oxide target as shown in FIG. 3.

What is claimed is:

1. The method of manufacturing a target electrode assembly for use in a television pickup tube, said method comprising forming a subassembly, said subassembly including an apertured support member having a temporary supporting film thereon and a layer of metal on said supporting film, said method comprising raising the temperature of said subassembly to a temperature below the oxidizing temperature of said metal while said subassembly is in a non-oxidizing atmosphere, changing to an oxidizing atmosphere, and then raising the temperature of said subassembly to a temperature above the oxidizing temperature of said metal.

2. The method of manufacturing a target electrode structure of the type comprising a film of oxidized metal stretched taut across an apertured support member, said method comprising the steps of providing a temporary organic support film on said apertured support member, providing a layer of metal to be oxidized on said support film, providing an inert atmosphere around the elements including said support member, said organic support film and said metal, raising the temperature of said elements

to a temperature not greater than the oxidizing temperature of said metal, changing said atmosphere to an oxidizing atmosphere, and raising the temperature of said elements to a temperature above the oxidizing temperature of said metal.

3. The method of manufacturing a target electrode structure for use in a television pickup tube, said target structure comprising a thin membrane of oxidized material supported upon an apertured support member, said method comprising depositing a temporary support means across the aperture in said apertured support member, depositing the material to be oxidized onto said temporary support means, providing an inert atmosphere around the elements including said support member, said temporary support means and said material to be oxidized, raising the temperature of said elements to a temperature of approximately 325° C. while said elements are in said inert atmosphere, changing said atmosphere to oxygen while within the temperature range of approximately 325° C. to approximately 400° C., and raising the temperature of said elements to a temperature above the oxidizing temperature of said material to be oxidized.

4. The method of manufacturing a target electrode of the type comprising a support ring which supports a film of oxidized material, said method comprising the steps of depositing an organic temporary support member on said support ring, said support member oxidizes if subjected to a temperature above 200° C. in an oxidizing atmosphere, depositing a material to be oxidized on said organic temporary support member, raising the temperature of said elements including said support ring, said organic temporary support member and said material to be oxidized to a temperature of about 325° C. while subjecting said elements to an inert atmosphere and subjecting said elements to an oxidizing atmosphere while raising said temperature from about 325° C. to about 400° C.

5. The method of manufacturing a target electrode of the type comprising a film of magnesium oxide supported tautly across the aperture in a molybdenum support ring, said method comprising the steps of depositing an organic film on said support ring, said organic film being decomposable at a temperature of about 200° C. in an oxygen atmosphere, depositing magnesium metal on said organic film, raising the temperature of the elements including said support ring, said organic film and said magnesium metal to a temperature of approximately 325° C. while said elements are in an inert atmosphere, raising the temperature of said elements through the range of approximately 325° C. to approximately 400° C., subjecting said elements to an oxidizing atmosphere at a predetermined temperature within said range, and raising the temperature above said range to oxidize said magnesium metal.

6. The method of manufacturing a target electrode as in claim **5** wherein said predetermined temperature is approximately 340° C.

7. The method of manufacturing an assembly comprising the steps of depositing an organic material onto a support member, depositing a ray sensitive means onto said organic material, raising the temperature of the elements recited to a temperature above that which would destroy said organic material in an oxidizing atmosphere, and maintaining said organic material as a support member during said temperature rise by subjecting said elements to an inert atmosphere.

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