Feb. 15, 1955 H. B. LAW 2,702,274

METHOD OF MAKING AN ELECTRODE SCREEN BY CATHODE SPUTTERING

Filed April 2, 1951 2 Sheets-Sheet 1

Fig. 1.

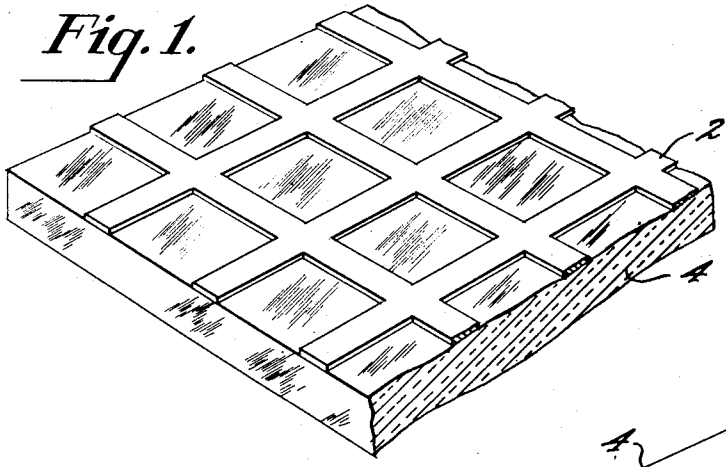
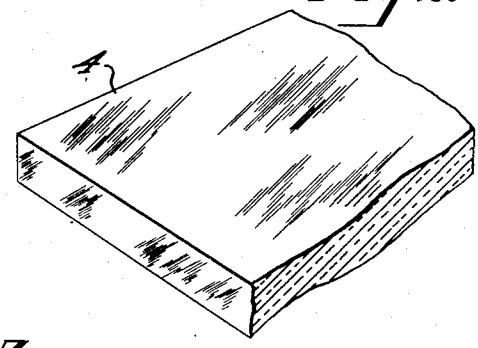


Fig. 2.



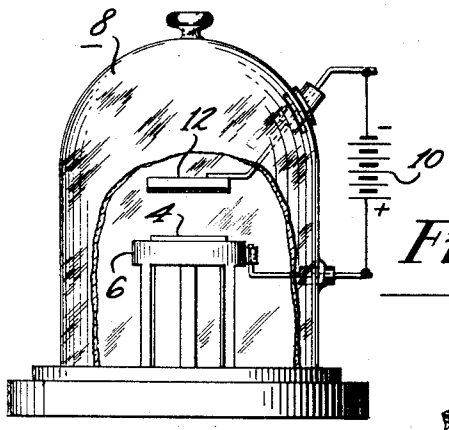
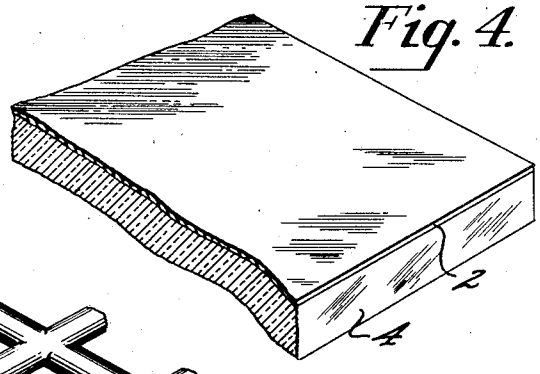


Fig. 3.

Fig. 4.



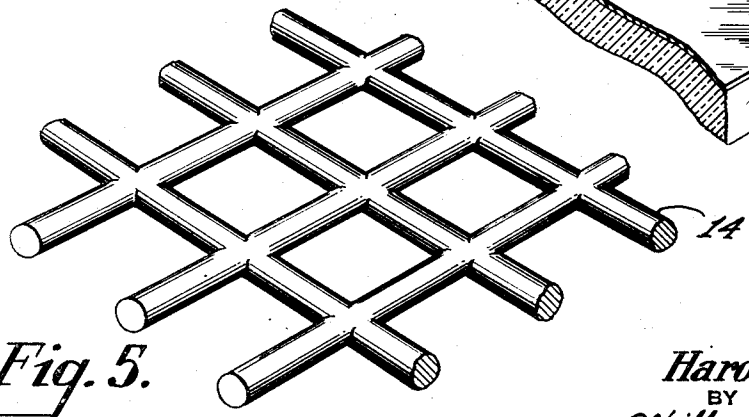


Fig. 5.

INVENTOR
Harold B. Law
BY
William A. Zalesk
ATTORNEY

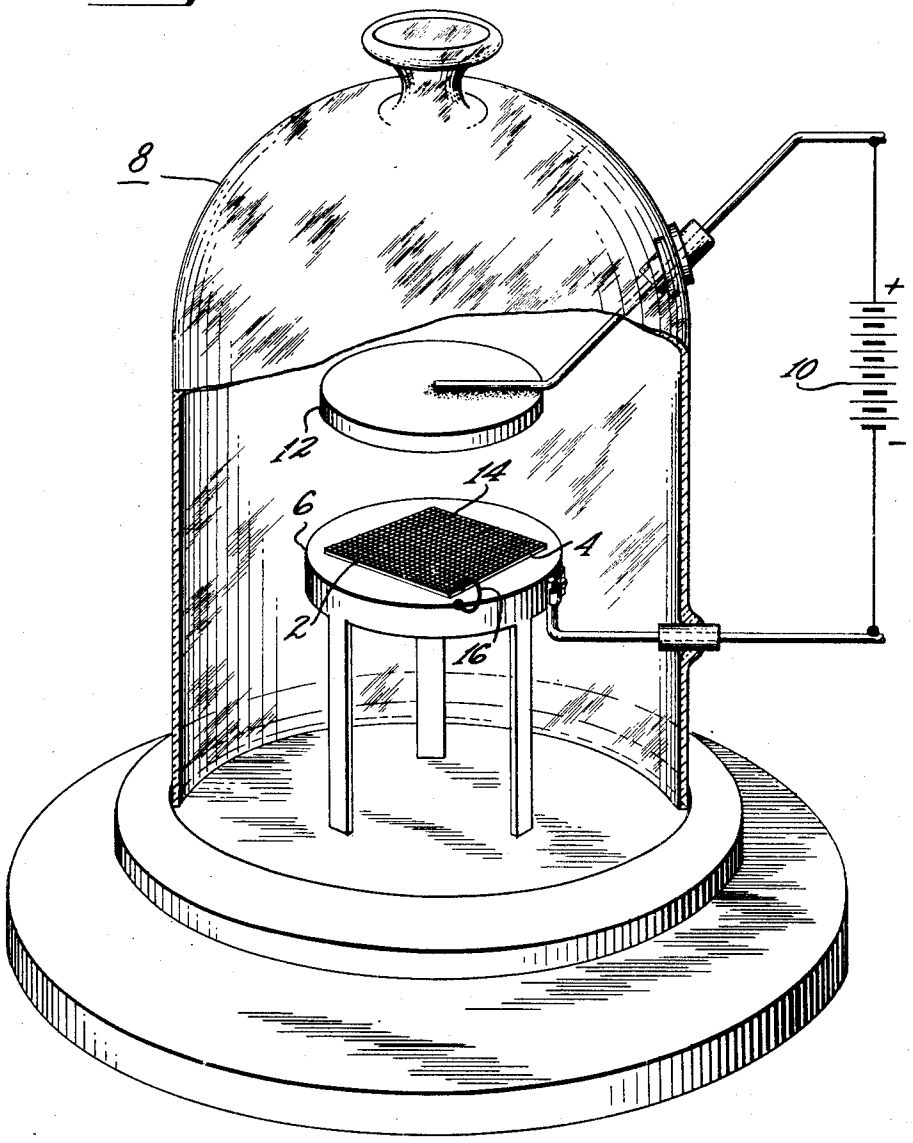
Feb. 15, 1955 H. B. LAW 2,702,274

METHOD OF MAKING AN ELECTRODE SCREEN BY CATHODE SPUTTERING

Filed April 2, 1951

2 Sheets-Sheet 2

Fig. 6.



INVENTOR
Harold B. Law
BY
William A. Zalesak
ATTORNEY

United States Patent Office 2,702,274 Patented Feb. 15, 1955

2,702,274

METHOD OF MAKING AN ELECTRODE SCREEN BY CATHODE SPUTTERING

Harold B. Law, Princeton, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application April 2, 1951, Serial No. 218,797

4 Claims. (Cl. 204—192)

This invention relates to a method of making electrodes and more particularly to a method of making target electrodes for television pick up tubes.

In a number of instances it has been found desirable to provide, in certain types of television camera tubes, a target electrode which consists of a thin sheet of insulating material such as glass or mica having a metallic grid work or screen adhering to the surface thereof. One type of television pick up tube is that having a mica or an insulating target sheet coated on one side by a conductive film or signal plate and on the other side with a photo-emissive mosaic. An optical image focussed on the mosaic will establish a pattern of charges on the mosaic due to photo-emission from the mosaic elements in an amount proportional to the light falling on each element. The mosaic elements are discharged successively by an electron beam scanning over the mosaic surface. The discharge of each element produces a pulse in the circuit of the signal plate to produce the output signal of the tube. As disclosed in U. S. Patent 2,324,504, a metallic grid on the mosaic surface of the target will provide a more satisfactory tube operation.

It is an object of this invention to provide an improved method of making electrodes of the type wherein a metallic grid is formed on the thin sheet of insulating material.

It is another object of this invention to provide an improved method of making electrodes of the type wherein a sheet of insulating material is covered by a thin layer of metal having a desired configuration.

In accomplishing these and other objects there is provided, in accordance with the present invention, a method of producing such an electrode which, considered broadly, consists of the steps of sputtering a layer of metal on the surface on a thin sheet of glass or other insulating material in a conventional sputtering chamber. The metalized surface is then masked with a member having substantially the configuration of the ultimate electrode and then bombarded with positive ions. The bombarding ions strike the metalized layer where the mask does not protect it and sputtering away the metal from those areas. When the process has been completed, the mask may be removed leaving an image of the mask as the remains of the layer of metal on the surface of the glass sheet.

A better understanding of this invention may be had from the following detailed description when read in connection with the accompanying drawing in which,

Figure 1 is a greatly enlarged, partly sectional, perspective view of an electrode made in accordance with this invention,

Figure 2 is a view similar to Figure 1 and showing a portion of a sheet of insulating material,

Figure 3 is a view of a typical sputtering chamber,

Figure 4 is a view similar to that shown in Figure 2 of the sheet of insulating material with one surface coated with a metallic material,

Figure 5 is a greatly enlarged, perspective view of a portion of a fine mesh screen which may be used as a mask in accordance with the present invention,

Figure 6 is a perspective view partially cut away of the chamber shown in Figure 3 but with the polarity of the electrodes reversed.

Referring now to the drawings in more particularity, there is shown in Figure 1 an enlarged view of an electrode structure of the type adapted to be made in accordance with the present invention in which a fine mesh metal screen **2** is formed on the surface of a thin sheet of insulating material **4**.

In making these electrodes, one surface of a thin sheet of insulating material is first substantially covered with a thin coating of metal. This may be accomplished by a sputtering process more fully described in U. S. Patent 2,529,086 to the present inventor, in which case the sheet of insulating material **4** is placed on one of the electrodes **6** of a sputtering chamber **8**. This electrode is electrically connected to a source of energy **10** in such a way that it becomes an anode. The other electrode **12** of the sputtering apparatus is connected to the source of electrical energy **10** in such a way that it becomes a cathode. The cathode is coated with whatever material is to be sputtered onto the sheet of insulating material. A material which has been found to be suitable for this sputtering operation is a suspension of metals in volatile oils and known as "Liquid Bright Palladium" No. 62 which, when dried on the cathode, comprises principally the metals bismuth, palladium and gold in the ratio of approximately one part bismuth, seven parts palladium and twenty-five parts gold. When the sheet of insulating material has thus been coated in the sputtering chamber, it is removed from the chamber and a mask member **14** is placed over the metalized surface. The mask member should be substantially the same size and configuration as the portion of the target electrode which is ultimately to have the surface remain metalized. To produce one form of an electrode, the mask may be a fine mesh metal screen produced according to the method described in the aforesaid Patent 2,529,086 and as represented in Figure 5 of the drawings.

The coated sheet of insulating material with the masking member positioned thereon is then returned to the sputtering chamber. This time, however, the metallic surface and the masking member are electrically connected to become the cathode in the chamber. In Figure 6, an electrically conductive member **16** connects the coating and the mask to the lower chamber-electrode **6**. For convenience, the polarity of the electrical energy supplied to the electrodes of the sputtering chamber may be reversed from that utilized during the sputtering process.

When the structure is thus placed in the sputtering chamber and the electrical energy from a source **10** is applied to the electrodes thereof, an electrical field is set up between the two electrodes which ionizes gas particles remaining in the chamber. The positive ions thus formed are attracted toward the cathode, bombarding the surface of the mask and the electrode. At those areas where the mask does not cover the metalized surface on the sheet of insulation, the bombarding ions dislodge particles of the metal layer which are diffused into the chamber. The mask serves to protect those areas of the metalized surface lying under it from being sputtered away by the bombardment of the ions.

When the mask is placed over the metalized surface, it may be placed in physical contact with that surface or spaced a short distance therefrom. So long as the spacing between the metalized surface and the mask is small as compared with the mean free path of the ions, the image formed on the electrode will be sharp and clear. Therefore when the process has been run to completion, the mask may be removed and the metalized surface on the sheet of insulating material is now in the form of an image of the mask. Those areas which were protected by the mask member retain the metal layer that was put on by the coating process, while the areas which were not protected have had the metal coating substantially entirely removed by the sputtering process.

Thus there has been described a simple, effective, and efficient method of producing electrodes of the type wherein one surface of a thin sheet of insulating material is partially covered by a very thin metal coating having a desired configuration.

What is claimed is:

1. A method of making an electrode in the form of a fine mesh metal screen supported on a thin sheet of

insulating material, said method comprising, depositing a metallic layer on the surface of the insulating material by the process of cathode sputtering, masking a portion of said metallic layer with a masking member having substantially the configuration of the ultimate electrode, cathode sputtering away the metal from those areas of said sheet not masked by said member, and removing said masking member from said metallic layer.

2. The method as set forth in claim 1 wherein said metallic layer consists essentially of one part bismuth, seven parts palladium, and twenty-five parts gold.

3. The method as set forth in claim 1 wherein said insulating material is glass.

4. The method as set forth in claim 1 wherein said insulating material is mica.

References Cited in the file of this patent

UNITED STATES PATENTS

395,963	Edison	Jan. 8, 1889
1,750,418	McFarland	Mar. 11, 1930
1,994,483	Ott	Mar. 19, 1935
2,267,714	Borries	Dec. 30, 1941
2,267,752	Ruska	Dec. 30, 1941
2,456,795	Samuelson	Dec. 21, 1948
2,467,953	Bancroft	Apr. 19, 1949
2,558,504	Aller	June 24, 1951
2,582,685	Eisler	Jan. 15, 1952
2,677,071	Carne	Apr. 27, 1954

OTHER REFERENCES

Smith: "Engineering," vol. 124, September 23, 1927, page 110.