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J. GALLUP

2,162,808

ELECTRODE STRUCTURE FOR TELEVISION TRANSMITTING TUBES

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Fig. 1

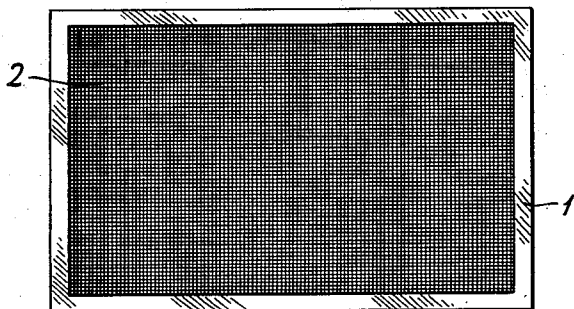


Fig. 2

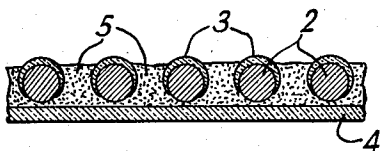


Fig. 3

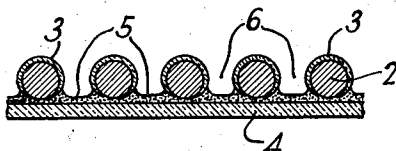


Fig. 4

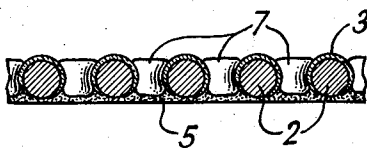
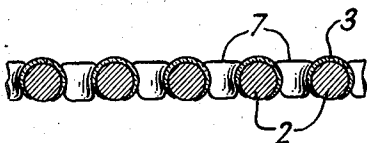


Fig. 5



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2,162,808

ELECTRODE STRUCTURE FOR TELEVISION TRANSMITTING TUBES

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Application November 30, 1937, Serial No. 177,251

8 Claims. (Cl. 250—27.5)

My invention relates to double-sided mosaic electrodes of the barrier grid type for television transmitting tubes, and particularly to a method of manufacturing such electrodes.

Television transmitting tubes, such as shown by Hickok U. S. Patent 2,047,369, are known in which an optical image is projected upon one side of a mosaic electrode of the double-sided wire mesh type, the opposite side being scanned with a cathode ray beam. It has been proposed to provide barrier grid action by coating the walls of the interstices and one side of the wire mesh foundation screen with insulation leaving the screen exposed on the opposite or scanned side, the exposed metal acting as a barrier grid to prevent re-distribution of secondary electrons over areas of the electrode other than the area being scanned. It is difficult to make a satisfactory barrier grid mosaic electrode of this kind by the usual methods.

One of the objects of my invention is to provide an improved method of manufacturing double-sided mosaic electrodes of the barrier grid type, and particularly of the type where the metal of the foundation is exposed and serves as the barrier grid portion of the electrode.

Another object of my invention is to provide such a mosaic electrode which is uniformly responsive over its active surface, and in which the individual photoelectric elements are adequately insulated one from another and from the metallic foundation.

Other objects, features and advantages of my invention will appear from the following description taken in connection with the accompanying drawing in which,

Figure 1 is a plan view of one form of an electrode foundation member suitable for use in practicing my invention, and

Figures 2, 3, 4 and 5 are greatly enlarged crosssectional views of a portion of the electrode shown in Figure 1 illustrating four steps in the manufacturing process.

Referring to Fig. 1 the foundation for the mosaic electrode preferably consists of a fine mesh nickel wire screen, although a perforated metal sheet may be used. The foundation is coated on one side only with an enamel or other vitreous material having high electrical resistance. The usual enamels for ferrous metals may be used although for use with a nickel wire mesh screen I have found advantageous a vitreous enamel in which the percentages of alkali and silica are considerably higher and the percentage of boric anhydrid is lower than in the usual

enamels. Such an enamel as described in my copending application, Serial No. 115,192 filed September 10, 1936 is particularly advantageous because it is a poor solvent of metals and has high electrical resistivity.

The particular electrode shown comprises a frame 1 on which the nickel screen 2, insulated or enameled on one side, is held under slight tension. As best shown in Fig. 2, all of the wire of the nickel mesh screen on one side is covered with the enamel 3, leaving the wire of the screen exposed on the opposite side.

The closely woven nickel wire mesh screen forms a nickel mesh foundation and when designed for use in television transmitting tubes, may to advantage have 150-200 or more wires per linear inch if the tube is to be suitable for reproducing a television image in good detail. The nickel screen 2 may to advantage be rolled and treated with acid to increase the area of the holes or interstices as described by Hickok in the above-mentioned patent. Prior to enameling the nickel mesh on one side, I find it advantageous to clean the nickel thoroughly, then oxidize it slightly by heating in air until it assumes a greenish color probably due to a film of nickel monoxide, NiO. I then spray the mesh from one side only with the enamel ground to a particle size under two microns and held in suspension in either water or alcohol. Care should be taken that the enamel does not flow through the interstices to the opposite side of the screen. I therefore prefer to do this spraying with the screen horizontal and the spray gun below the screen, so that the enamel is prevented by gravitation from overflowing the upper surface of the nickel mesh. The uncoated side of the screen should be wiped clean with a dry cloth to remove any particles of the enamel which may have fallen back on this surface. The sprayed screen is then fired in a furnace at about 900° C. in air to fuse the enamel into a smooth glassy coating. I prefer to build the enamel coating up to a thickness of approximately 3 mils on the surface of the electrode and to a thickness of ½-1 mil on the walls of the holes in the electrode by applying the enamel in several thin coats and firing the screen after each coat is applied. I find that in this way a screen electrode well-insulated on one side and highly suitable for the production of mosaic electrodes of the barrier grid type for television transmitting tubes can be made with such a wire woven screen.

Following the formation of the insulating coating on the walls of the interstices and one side of

the mesh foundation, which will hereinafter be referred to as the front side, I place on the uninsulated side or rear surface of the foundation a suitable base 4, as best shown in Fig. 2, which is such that it may later be removed without disturbing the material with which the interstices of the screen are filled. Paper or Cellophane is very suitable for providing the base member 4. The interstices of the mesh are then filled with a semi-fluid or viscous substance 5 capable of being removed by dissolving in a solvent which is inert to the enamel and the metal of the foundation or by heating, and which when dried contracts and solidifies to form what might be termed a false bottom adjacent to the base member 4, as best shown in Fig. 3. The substance 5 while still in the semi-fluid state flows between the base 4 and the uninsulated surface of the foundation and prevents electrical contact between the screen 2 and the metal powder with which the interstices are subsequently filled. The insulated foundation is heated to a temperature of approximately 110° C. for about one half hour to dry the semi-fluid or viscous substance 5 which dries down to form cup-like recesses 6 which are then filled with metal powder to form the individual mutually-separated metal plugs 7, (Fig. 4). The substance 5 may be a material soluble in all proportions in the liquid with which it is mixed and capable of large contraction upon drying without cracking or disintegrating as the solvent vaporizes. For this purpose I have found that a viscous syrup of granulated sugar in water is particularly suitable, although other substances preferably of an organic nature and having the desired properties may be used.

A metal powder such as silver powder suitable for the purpose of filling the interstices of the prepared insulated foundation is available on the market and is commercially known as "325 Mesh Silver Powder". This powder is sifted through a 400 mesh screen to remove any particles larger than 25 microns, the powder then being mixed with melted paraffine to make a semi-liquid paste which is brushed into the screen with a camel's hair brush until the cup-like recesses 6 are completely filled, thereby forming the metal plugs 7 as shown in Fig. 4. The front surface of the electrode may be cleaned by removing any excess of the metal powder and paraffine binder with a cloth while the assembly is heated to a temperature somewhat below the melting point of the paraffine binder. The entire assembly is immersed in water or other suitable solvent to dissolve the substance 5 and remove the base 4 which is composed of paper or Cellophane. The prepared screen is then baked in air for a period of approximately 15 minutes at 200-300° C. to volatilize the paraffine, followed by another baking in air from one half to one hour at 400-600° C. to sinter the metal powder and form coherent masses of metal in the interstices of the mesh. The sintering of the metal powder provides a mosaic electrode which will withstand handling and normal mechanical shock during use without the metal plugs falling out of the interstices. Such sintering also reduces the electrical resistance of the plugs. After the sintering operation the screen is heated in hydrogen at a temperature of 400° C. for a period of approximately 15 minutes to reduce any nickel oxide which may have been formed on the rear surface of the screen. Such treatment insures a uniform conducting surface over the uninsulated portion of the screen

which is conducive to good barrier grid action. The assembly then appears as shown in Fig. 5 wherein the metal plugs 7 are insulatingly supported from the wire mesh screen 2 by the insulation 3, but leaving the screen 2 exposed on the rear surface.

An electrode structure made in accordance with the foregoing is sealed in the envelope of a television tube such as a television transmitting tube, and during the process of evacuation the metal plugs in the electrode are photosensitized by depositing the caesium or other photosensitive material on the surface in the usual way. One method which has proven satisfactory for photosensitizing either one or both sides of the metal plugs is that disclosed by S. F. Essig in U. S. Patent 2,065,570.

By my invention I have been able to make well insulated electrodes of the double-sided mosaic type wherein the exposed portions of the foundation wire mesh serve as barrier grid elements for preventing the distribution of secondary electrons from the plugs being scanned, to adjacent plugs without destroying or affecting the insulation between the various plugs. In use the potential of the foundation screen 2 of the mosaic electrode with respect to an electron collecting electrode is so adjusted that the secondary electrons emitted from the metal plugs 7 will not return to the mosaic electrode but will flow to the collecting electrode, the desired barrier grid action thereby being obtained.

From the foregoing description it will be apparent that various other modifications may be made in my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be placed thereon as are necessitated by the prior art and set forth in the appended claims.

I claim:

1. The process of fabricating a mosaic electrode with an apertured metallic foundation which comprises insulating one side of the foundation and the walls of the apertures of the foundation with a coating of electrical insulation and leaving the opposite side of the foundation uninsulated, covering the uninsulated side of the foundation with an adherent coating removable without injury to said insulation, filling the apertures of the foundation with an electrically conductive material, and removing the adherent coating from the uninsulated portions of the foundation.

2. The process of fabricating a mosaic electrode with an apertured metallic foundation which comprises coating the walls of the apertures and one side of the foundation with electrical insulation leaving the opposite side of the foundation uninsulated, covering the uninsulated portions of the foundation and the apertures on the opposite uninsulated side of the foundation with a removable coating, filling the apertures of the foundation with electrically conductive material from the insulated side, and removing the coating from the uninsulated portions of the foundation.

3. The process of fabricating a mosaic electrode with a wire mesh screen which comprises insulating the walls of the interstices and one side of the wire mesh screen with a coating of electrical insulation, filling the interstices with a semi-fluid substance which dries into an adherent solid, drying said substance to form in each of the interstices a solid concave wall closing the interstices on the uninsulated side of the screen,

filling the interstices of the screen with an electrically conductive material, and removing the adherent solid substance from the wire mesh screen.

5 4. The process of fabricating a mosaic electrode with a wire mesh screen which comprises
10 coating the wall of the interstices and one side only of the wire mesh screen with insulating material, applying a removable base to the uncoated
15 side of the screen, filling the interstices of the screen with a soluble semi-fluid substance which when dried produces an adherent coating on the
20 uninsulated portions of the wire mesh screen, drying the substance to close the interstices on the uninsulated side of said screen and form individual cup-shaped recesses open on the insulated side of the screen, filling the cup-shaped recesses with an electrically conductive material, and dissolving the substance and removing the base from the wire mesh screen simultaneously.

25 5. The process of fabricating a mosaic electrode with a wire mesh screen which comprises covering the walls of the interstices and one side only of the wire mesh screen with a coating of vitreous enamel, covering the uninsulated portion of the screen with a solution of a soluble organic substance which when dried produces an adherent coating on the uninsulated portions of the screen,

drying the substance to form an adherent coating, filling the interstices of the screen with powdered metal, and firing the screen to remove the adherent coating and sinter the powdered metal.

6. The process as claimed in claim 5 including the step of photosensitizing one side of the sintered metal supported in the interstices of the insulated wire mesh screen.

7. The process of fabricating a mosaic electrode with a wire mesh screen which comprises
10 applying a vitreous enamel to the walls of the interstices and to one side only of the wire mesh screen and leaving the other side of the screen unenameled, coating the unenameled portions of the screen with a sugar solution, drying the sugar
15 solution to form an adherent coating on the unenameled portions of the screen, filling the interstices of the screen with powdered metal, dissolving the adherent coating, and firing the screen to sinter the metal powder to form electrically conductive plugs in the interstices of the screen.

8. The process as claimed in claim 7 including the step of photosensitizing one side of the electrically conductive plugs supported in the interstices of the insulated wire mesh screen.

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