March 24, 1959 R. W. REDINGTON 2,879,419

TARGET ELECTRODE ASSEMBLY

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Fig. 1.

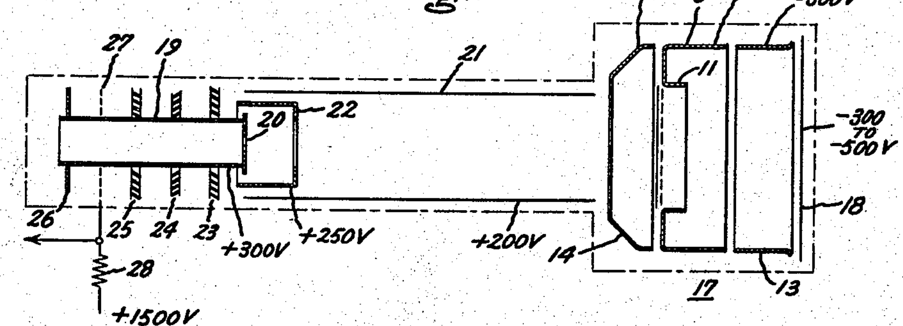


Fig. 2.

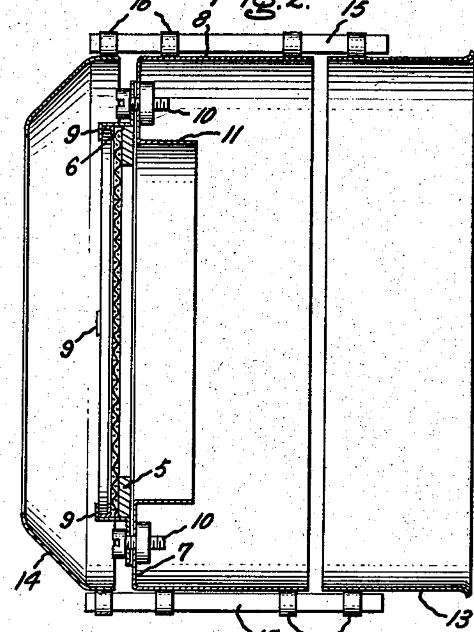


Fig. 3.

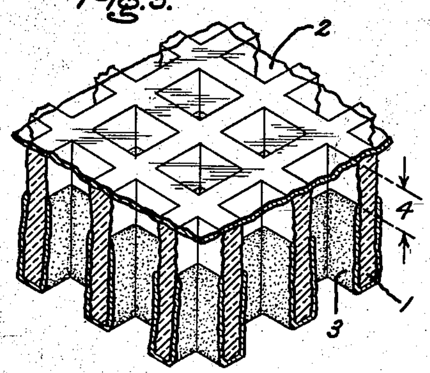
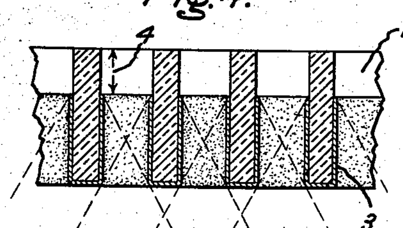


Fig. 4.



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TARGET ELECTRODE ASSEMBLY

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4 Claims. (Cl. 313—68)

The present invention relates to an improved target electrode assembly and more particularly to an improved assembly of this type for producing a point-by-point electric charge pattern corresponding to a visual image or other information to be converted to electrical signals by scanning the target electrode with an electron beam.

In a known type of television camera tube, referred to as an "image orthicon," the target electrode assembly includes a thin glass membrane and a collector mesh of metal, closely spaced therefrom, with both the membrane and the mesh supported from their peripheries in drumhead fashion. This structure is subject to mechanical vibration, which results in a rapid variation in capacity between the mesh and membrane which in turn produces unwanted modulation of the electrical signal output, not related to the charge pattern established on the membrane and usually termed "microphonics."

Accordingly, it is an important object of my invention to provide a new target electrode assembly, which is relatively free from rapid vibration and the resulting unwanted signal modulation.

In accordance with a preferred embodiment of my invention, both the glass membrane and the conducting mesh are supported from opposite sides of a relatively rigid glass mesh structure having a large number of closely-spaced openings extending generally perpendicular to the membrane. The thickness of a readily available mesh is substantially greater than the transverse dimensions of the openings and the metal of the conducting mesh extends part way along the side walls of the openings and terminates a predetermined distance from the membrane. In use, this structure may be supported in a camera tube of the type mentioned above with the metal mesh facing the photocathode which forms a part of the image section of the tube.

Further objects and advantages which characterize my invention will become more apparent as the following description proceeds, reference being had to the accompanying drawing, and its scope will be pointed out in the appended claims.

In the drawing,

Fig. 1 is an elevational view in section, schematically representing a camera tube of a type to which my invention may be applied;

Fig. 2 is an enlarged elevational view in section, showing the electrode assembly, including the target electrode, of the image section of the tube shown in Fig. 1;

Fig. 3 is a perspective view, partially in section and greatly enlarged, showing the construction of the target electrode assembly of my invention, and

Fig. 4 is an enlarged elevational view in section of a portion of the target electrode assembly, illustrating a step in its manufacture.

As best shown in Fig. 3, the target electrode assembly of my invention includes a relatively rigid insulating support in the form of a glass mesh 1, on one face of which is supported a glass or similar insulating membrane 2 which provides the target or storage electrode

and on the opposite side of which is the conducting mesh or collector electrode 3. The glass mesh 1 may have in the order of 10,000 to 360,000 openings per square inch, for example, and in a particular embodiment, constructed in accordance with the present invention, a mesh having 90,000 openings per square inch is utilized. In this mesh the openings are about .002 inch in transverse dimension and the separating ribs are about .001 inch. Readily available mesh is about .005 inch thick so that the supporting mesh is 2½ times as thick as the transverse dimensions of the openings.

The capacitance desired for the storage electrode is attained by proper spacing between the storage surface provided by the glass membrane 2 and the adjacent surfaces of the mesh electrode 3. This is accomplished in accordance with a preferred method of making the device of the present invention by directively evaporating the metal of the mesh electrode onto the glass mesh, so that it terminates a predetermined distance from the membrane 2. The directive evaporation is indicated schematically in Fig. 4. The direction of travel of the deposited metal vapor is indicated by the dotted lines and is so chosen that the space 4 is of the desired amount. In a particular target constructed, this distance is approximately .002 inch. Any suitable metal may be used for this mesh electrode but either gold or silver is particularly well suited for evaporation and adhering to the glass support.

The glass storage membrane 2 may then be applied to complete the electrode. The membrane glass is chosen for both its mechanical and electrical properties and is in the order of .0001 inch thick. When the storage electrode is to be used in a television camera tube, the glass of the membrane may be of a high quality (optical grade) soda lime glass having a resistivity in the order of 10^{11} ohm centimeters. Such a glass is available as Corning glass No. 0083. The glass membrane may be adhered to the glass mesh by supporting the membrane on the mesh between two graphite plates and placing in an oven where it is heated to a temperature in the order of 575° C. for a period of about one hour. This is sufficient to cause good adherence between the membrane and mesh. It is to be understood that this particular processing is not critical and the glass membrane may be adhered to the mesh in any suitable manner. The mesh electrode thus far described is illustrated in Fig. 3 of the drawing. As a practical application of this target electrode, I have illustrated in Figs. 1 and 2, somewhat schematically, an image orthicon type of camera tube and an enlarged view of the image section of the tube, respectively.

Referring now to Fig. 2, the target electrode assembly of Fig. 3 is supported from its periphery between an annular ring 5 and a ring 6 of angular cross section, having an upstanding flange portion extending to the left. This assembly is clamped against an inturned flange 7 of a cylindrical mesh supporting electrode 8 by means of a plurality of sheet metal clamps 9 which engage the flange at 6 and are held against the inturned flange 7 by means of suitable holding bolts 10. The target electrode is supported opposite an opening in a cylindrical flange 11 formed integrally with flange 7 and forming a part of the mesh supporting electrode 8. The latter electrode forms a part of an assembly including an accelerating grid electrode 13 and a decelerating grid electrode 14. These three electrodes are supported relative to one another by suitable ceramic rods or stalks 15 spaced around the circumference of the electrodes and are held thereto by suitable straps 16. This assembly is supported in the enlarged image section of the tube shown in Fig. 1 and designated generally by the numeral 17, with the accelerating grid electrode 13 spaced slightly from the photocathode **18** which provides a source of photoelectrons. The photoelectrons are accelerated toward the targe electrode and upon impact release secondaries in greater numbers which are collected by the mesh electrode. In this manner a positive charge pattern is established thereon in accordance with the image falling on the photocathode. At the opposite end of the tube is the electron gun and electronmultiplier structure which are concentrically arranged. The gun, which provides the scanning beam, is shown merely as a hollow cylindrical electrode **19**, having a small aperture **20** in the order of .002 inch in diameter in the end wall thereof, for producing a fine scanning beam. The outer surface of this end wall surrounding the aperture provides the first dynode of the electronmultiplier as will be described in more detail hereinafter. A cylindrical electrode which may be formed as a metallic coating **21** on the neck of the tube provides for focusing the beam and the decelerating electrode **14** decelerates the beam to near zero velocity as it approaches the storage electrode. As will be readily appreciated by those skilled in the art, the entire camera tube is subjected to an essentially homogeneous longtudinal collimating magnetic field. This field may have a strength of 75 gauss, for example. Electrons are returned from the target electrode in accordance with the charge pattern on the membrane **2**. These electrons do not re-enter the aperture **20** but rather strike the plate surrounding the aperture, which is a secondary emitter so that there is a multiplication of the electrons emitted compared with those returned from the storage electrode.

A generally cylindrically focusing electrode **22** for the multiplier section of the tube is supported at the end of the gun electrode **19** intermediate that electrode and the beam focusing grid electrode **22**. Several stages of electron multiplication are provided by electrodes **23–26** inclusive and the amplified electron current is collected by the anode **27** of the photomultiplier to produce a signal across the resistor **28** which varies in accordance with the charge pattern on the membrane **2**.

In Fig. 1 of the drawing, suitable direct current operating voltages for the various electrodes have been indicated. These voltages are relative to the cathode and may vary appreciably from the values given.

The variation in beam current collected by the anode **27** as the target is scanned by an electron beam produces point-by-point an electrical signal varying in accordance with the potential pattern on the target electrode. Electrons from the photoemitter **18** flow to the surface of the membrane **2** and release secondary electrons in an amount greater than the impinging primary electrons, the secondary electrons being collected by the mesh electrode **3**. This establishes a pattern of positive charges on the membrane **2** varying in accordance with the photoelectrons released by the photocathode **18**. This charge or potential pattern on the target causes selective collection of the electrons of the beam as it scans the side of the membrane facing the electron gun so that the electrons returning to the electron multiplier section are a function of the total beam current less the electrons collected by the membrane **2**. This in turn is a function of the potential pattern on the membrane **2**. It will be apparent that mechanical vibration of the membrane with its resultant variation in the capacity between the mesh electrode and the membrane will change the potential of the target electrode and will result in an electron beam intensity variation not related to the image falling on the photocathode, and accordingly cause deterioration of the picture. The present invention provides a simple yet effective structure for essentially eliminating the problems due to microphonics.

While I have described a particular embodiment of my invention, it will be apparent to those skilled in the art that changes and modifications may be made without departing from my invention in its broader aspects and I aim therefore in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of my invention.

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

1. A target electrode for establishing a point-by-point charge pattern in accordance with information to be converted to an electrical signal by scanning said target electrode with an electron beam, said electrode comprising a supporting mesh having a large number of openings therethrough, a conducting electrode on one face of said mesh having openings therein overlying the openings in said mesh, said electrode extending a predetermined distance along the side walls of said openings in said supporting mesh and terminating in spaced relation to the other face of said mesh and an imperforate storage membrane adhered to the opposite side of said mesh.

2. A target electrode assembly for establishing a point-by-point charge pattern corresponding to information to be converted to electrical signals by an electron beam scanning one side of said target electrode comprising a rigid glass mesh structure, a metallic electrode overlying one side of said mesh structure and extending a predetermined distance within said glass mesh structure and terminating in spaced relation to the other side of said mesh structure and an imperforate thin glass membrane providing a charge storage electrode overlying and adhered to the opposite side of said mesh structure.

3. A target electrode assembly for establishing a point-by-point charge pattern corresponding to information to be converted to electrical signals by an electron beam scanning one side of said target electrode comprising a rigid glass mesh structure, a metallic electrode overlying one side of said mesh structure and extending a predetermined distance within said glass mesh structure and terminating in spaced relation to the other side of said mesh structure and an imperforate thin membrane providing a charge storage electrode overlying the opposite side of said mesh structure.

4. A target electrode assembly for establishing a point-by-point charge pattern corresponding to a visual image to be converted to electrical signals by an electron beam scanning one side of said target electrode comprising a rigid glass mesh structure having a dimension in the direction of the openings of the mesh substantially greater than the transverse dimensions of the openings, a metallic electrode overlying one side of said mesh structure and extending along the side walls of said openings and terminating in spaced relation to the opposite side of said mesh structure and a glass membrane overlying the opposite side of said mesh structure.

References Cited in the file of this patent

UNITED STATES PATENTS

2,507,958	Cassman	May 16, 1950
2,765,422	Henderson	Oct. 2, 1956
2,773,992	Ullery	Dec. 11, 1956
2,777,084	Lafferty	Jan. 8, 1957
2,802,963	Sheldon	Aug. 13, 1957