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MESH ELECTRODE SUPPORT STRUCTURE

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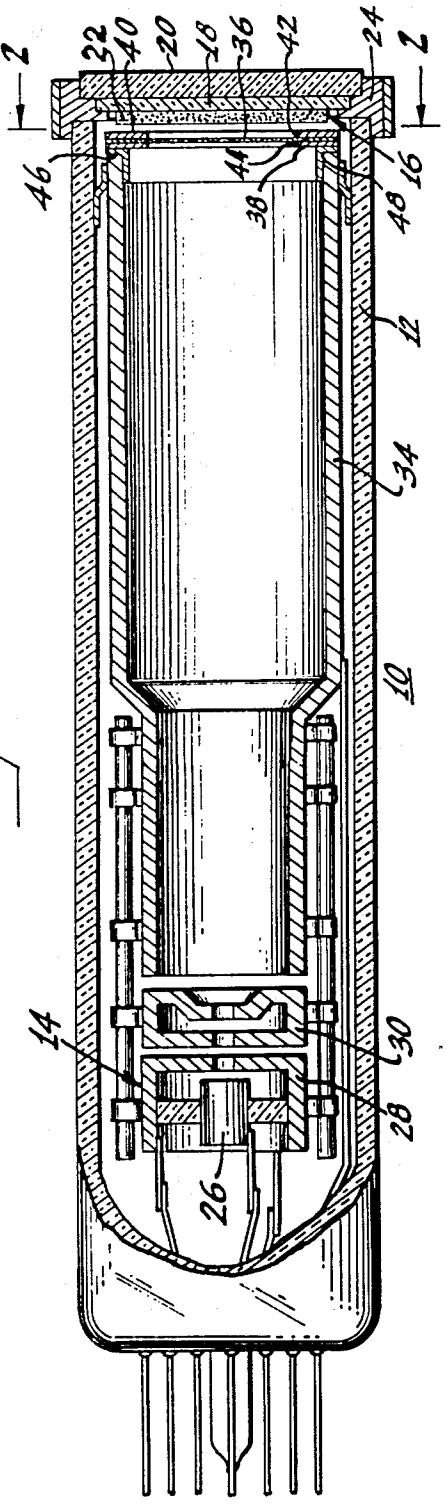
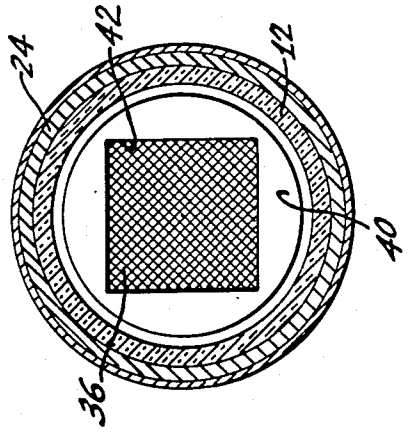



Fig. 1.

Fig. 2.




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# MESH ELECTRODE SUPPORT STRUCTURE

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This invention relates to pickup or camera tubes of the type having a photoconductive material as the photosensitive element. In particular, this invention relates to an improved photoconductive pickup tube having a novel, rigid mount for the decelerating mesh screen electrode.

One of the several known types of pickup tubes generally comprises an evacuated tubular envelope enclosing an electron gun and a photoconductive target electrode. The target electrode is supported upon a transparent support member, which normally is the optically clear transparent face plate sealed to the end of the envelope and facing the electron gun. The target electrode includes a transparent conductive coating, or signal electrode, on the gun side of the transparent support member, and a deposit of photoconductive material on the transparent conductive coating. Photoconductive materials are materials which change their electrical conductivity in response to incident radiations. These materials have a relatively high electrical resistance when in the dark and a relatively high electrical conductivity when exposed to light of a selected wavelength. Closely spaced adjacent to the surface of the photoconductive material that is exposed to the electron beam is a fine mesh screen or beam decelerating mesh electrode.

One of the problems that has limited the usefulness of the tubes briefly described above, is the problem of microphonics. Microphonics is a physical vibration of some portion of a tube which, because of its movement, produces an undesired electrical signal output or noise. One of the principal electrodes in a tube of the type discussed, which causes microphonic action, is the fine mesh screen or decelerating mesh electrode. The mesh screen electrode is particularly troublesome when considering microphonic action. The reasons for this stem from the fact that the electrode is an extremely fine mesh, e.g., 700–1000 wires per inch, and the electrode is supported on an annular ring like member positioned at the periphery of the mesh screen. Because of this type of support and the fineness of the screen itself, any physical movement of the tube is likely to start vibrations of the mesh screen electrode relative to the photoconductive target. Because of the close spacing between the mesh screen electrode and the photoconductive target, relatively large electrical noise signals are produced in the output of the tube as a result of such motion.

The problems of microphonic action are particularly pronounced in a shutter type television camera. In this type of camera, a shutter is opened and closed mechanically to expose a particular scene. The mechanical movements necessary to open and close the shutter may, at times, be enough to set the mesh screen electrode into vibration. In a slow speed scanning unit, because of the use of a scan time which is relatively short, a constant microphonic signal becomes a relatively large part or proportion of the total output signal and thus, is more observable.

It is therefore an object of this invention to provide an improved photoconductive pickup tube.

It is a further object to provide a novel photoconductive camera tube characterized in its rugged structure and freedom from objectionable microphonic action.

These and other objects are accomplished in accordance with this invention by providing a novel photoconductive camera tube wherein the decelerating mesh screen electrode is physically supported between two metallic members each having a rectangular opening or aperture in the center portion thereof. The apertures in the metallic members are of a size slightly larger than the scanned area of the adjacent photoconductive target. By bonding the metallic members together, with the mesh screen sandwiched therebetween, a more rugged mesh support structure is provided and the rectangular opening in each metallic member tends to dissipate the energy of any vibrations at the corners of the openings and thus, substantially reduces the amplitude and persistance of any mesh vibrations which may occur.



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

FIG. 1 is a longitudinal sectional view of a photoconductive type of pickup tube in accordance with this invention; and,

FIG. 2 is a sectional view taken along line 2—2 of FIG. 1.

Referring now to FIG. 1 in detail, there is shown a photoconductive pickup tube **10** of a type known commercially as a Vidicon and which includes features constituting improvements in accordance with this invention as will be pointed out hereinafter. The tube **10** comprises an elongated, evacuated envelope **12** having an electron gun **14** in one end thereof, and positioned substantially on the axis of the tube. The electron gun **14** is provided for the purpose of producing an electron beam and directing the beam towards a target electrode **16**. The target electrode **16** comprises a transparent electrical conductor **18** supported upon a transparent end or face plate **20** of the envelope **12**. On the transparent electrical conductor **18** there is provided a photoconductive member **22**. The photoconductive member is made of a material the resistance of which decreases when exposed to radiant energy. Many photoconductive materials are known for many different spectral regions and one material for the visible spectrum, by way of example, is antimony tri-sulfide. The transparent conductor **18** may be made of any material which is electrically conductive and transparent to the radiations to which the photoconductor **22** is responsive, and a suitable material for the visible range is tin-oxide, for example. The transparent conductor **18** is connected to an electrically conductive sealing ring **24** so that a potential may be applied through the sealing ring to the conductor **18** during tube operation. In this way, the transparent conductor **18** will function as an output electrode or signal plate.

The electron gun **14** comprises a thermionic cathode **26**, a control grid **28**, an apertured accelerating electrode **30**, and a hollow tubular beam focusing electrode, or $G_3$ electrode **34**.

In the conventional photoconductive pickup tube, the tubular beam focusing electrode **34** is terminated at one end thereof, by a fine mesh screen that spans the ends of the beam focusing electrode and is supported thereby. Since the mesh screen normally is made of electroformed copper, and has at least 700 wires per inch, the mesh screen electrode is conventionally supported by spot welding onto an annular ring which is substantially the same diameter as the end of the beam focusing electrode **34**. The annular ring is then fixed to the beam focusing electrode **34**.

In accordance with this invention, however, a mesh screen electrode **36** is sandwiched between two apertured metallic mesh support members **38** and **40**. The metallic member **38** has a rectangular opening **44** therein (FIG. 1), and the metallic member **40** has a rectangular opening **42** therein (FIG. 2). The rectangular openings **42** and **44** may be square, as shown, or may be similar in

shape to the scanning raster, which is produced by conventional scanning coils and deflection yokes (not shown) and which normally has a 4 x 3 aspect ratio. The rectangular openings **42** and **44** are of a size only slightly larger than the scanned area of the photoconductive target **16**. Thus, for a conventional 1 inch diameter tube, an opening of one-half inch has been found to be suitable.

The mesh support members **38** and **40** are made of a rather rigid material so that they will not be susceptible to any vibrations. As an example, mesh support members made of 0.015 inch thick nickel-chromium alloy have been successfully used.

As an alternative to the assembly shown in FIGS. 1 and 2, the mesh screen **36** may be spot welded to only one support member **38** or **40**, and a standard annular ring used as the other support member. Such an arrangement decreases the harmful effects of vibrations to some extent but is not preferred. The embodiment shown in FIGS. 1 and 2 is much more effective in eliminating microphonic action and therefore is preferred.

Either of the mesh support members **38** and **40**, or both, may be coined in such a manner so as to produce a member that is very slightly thinner, e.g., 0.00025 inch, adjacent to the rectangular aperture **44** or **42**, than the portion of the member that is adjacent to the outer peripheral edge. Such a structure is believed to retard any mesh screen vibrations for reasons set forth above, and in addition, by absorbing the energy of such vibrations as the mesh screen goes into and out of contact with the thinned or coined down area or areas.

To manufacture the decelerating mesh screen subassembly, the mesh screen electrode **36** is positioned on the metallic mesh support member **38** and, the mesh screen **36** is in turn covered by the metallic mesh support member **40** with the apertures **42** and **44** in registration. The metallic mesh support members **38** and **40** are then spot welded together at a plurality of areas both adjacent to the periphery thereof and adjacent to the apertures **42** and **44**. The spot welding fixes the mesh support members **38** and **40** together and rigidly secures the mesh screen **36** between the mesh support members **38** and **40**. After this sub-assembly is completed, the metallic member **40** may be spot welded to an end of an annular member **46**. On the annular member **46** is an extension or lip **48** which may be seated in the decelerating electrode **34** in a snap-in arrangement, or may be spot welded thereto. A snap-in arrangement of a mesh screen sub-assembly is described in the copending application of L. D. Miller et al. filed May 22, 1959, Serial No. 815,193.

The operation of the device **10** is characterized by substantial absence of harmful microphonic action caused by vibration of the mesh screen electrode.

With a ruggedized mesh screen assembly made in accordance with this invention, it has been found that the amplitude of microphonic impulses in the tube **10** is reduced by more than 50% as compared to conventional tubes. Also, the persistence of these impulses or vibrations is reduced by more than 65% as compared to conventional tubes. Although the exact phenomena causing these striking reductions in harmful microphonic action are not fully understood, it is believed to be caused, at least in part, by the fact that any vibration of the mesh screen will tend to be in a circular wave from so that, when the vibration or wave is reflected from any corner of the apertures, for example aperture **42**, the reflected vibration, or harmonic wave, is out of phase or frequency, or both with respect to the primary vibration. This out of phase, or out of frequency, relationship tends to damp and dissipate both the primary and the harmonic or reflected vibrations.



What is claimed is:

**1.** A camera tube comprising an envelope having an axis, an electron gun in said envelope and substantially on said axis, for producing an electron beam, a photoconductive target electrode in said envelope and substantially normal to said axis and in the path of said electron beam, a mesh screen electrode extending parallel to said photoconductive target electrode and closing an end of said electron gun, and means for supporting said mesh screen electrode on said end of said electron gun, said means including a pair of electrode support members having an outer periphery substantially congruent to the outer periphery of said end of said electron gun, each of said electrode support members having a different opening therethrough, each of said openings including a plurality of right angle corners, said mesh screen electrode being secured between and directly to each of said support members adjacent to said corners.

**2.** A pickup tube comprising an envelope, an electron gun for producing an electron beam in said envelope, a photoconductive target electrode in said envelope and in the path of said electron beam, said electron gun including a hollow tubular electrode having an end spaced from, but adjacent to said photoconductive target electrode, an apertured annular member having a lip portion fixed to said end of said electron gun, first and second mesh screen support members, a mesh screen spot welded between and in direct contact with portions of said mesh screen support members, one of said mesh screen support members being fixed to said annular member, both of said support members being disc shaped and having registering and congruent centrally positioned rectangular openings therethrough, said electron beam being adapted to be scanned over said photoconductive target in a predetermined raster, and the size of said rectangular openings being at least as large as said raster, said portions being adjacent to said openings.

**3.** In a pickup tube comprising an envelope, an electron gun for producing an electron beam in said envelope, and a photoconductive target electrode in said envelope and in the path of said electron beam, said electron gun including a hollow tubular electrode having an end spaced from, but adjacent to, said photoconductive target; the improvement comprising a subassembly supported on said end of the tubular electrode and comprising a first mesh screen support member, a mesh screen member, and a second mesh screen support member, said members being fixed together in the order recited, said mesh screen member directly engaging each of said support members, said mesh screen support members including registering centrally positioned rectangular openings and having circular peripheries.


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