

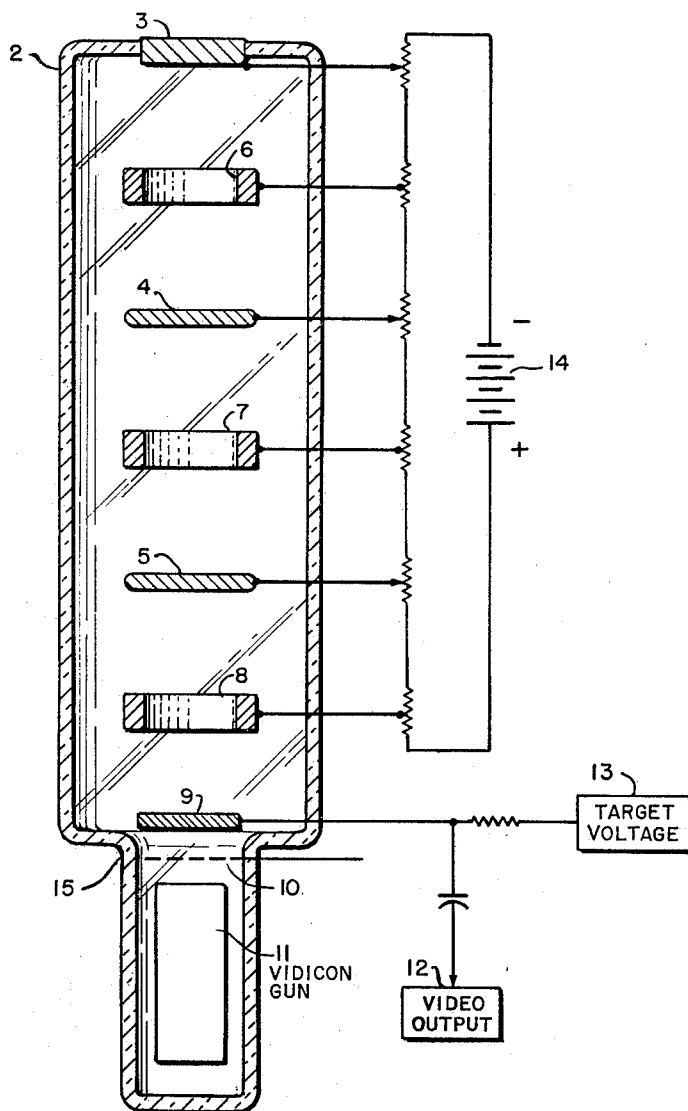
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LOW LIGHT LEVEL CAMERA TUBE

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LOW LIGHT LEVEL CAMERA TUBE

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4 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a low light level camera pickup tube having a series of electron multipliers that focus onto a target that is scanned by an electron beam of a vidicon gun. One or more transmission secondary emission dynodes are employed as electron multipliers with a secondary emission conduction storage target.

BACKGROUND OF THE INVENTION

The present invention relates generally to camera tubes, and, in particular to a low light level camera tube having a photocathode, image intensifying transmission secondary electron (TSE) dynodes, a secondary emission conduction (SEC) target and a scan section of the vidicon type.

Various types of low light level tubes have been constructed but have generally been unsuccessful in providing the proper persistence, gain, and picture quality necessary for successfully viewing outdoor scenes illuminated only by starlight or weaker illumination. One of such prior art tubes contains various focusing electrodes and a target commonly known as an electron bombardment induced conductivity (EBIC) target made of arsenic trisulphide or arsenic disulphide. The principal disadvantage of such a target is its poor picture quality and its long persistence militating against a direct near-instantaneous readout of the vidicon type.

SUMMARY OF THE INVENTION

It is the general purpose of this invention to provide highly sensitive, single envelope camera tube wherein a photocathode emits electrons in response to light impinging thereon. The electrons are multiplied in one or a series of TSE dynodes and impact a SEC target producing various areas of conductivity thereon. The target is then scanned by an electron beam that deposits more or less electrons thereon in accordance with the conductivity produced by varying external light conditions. A vidicon output is derived from the target in the conventional manner.

It is a further purpose of this invention to provide a novel combination within a single envelope, such combination consisting of a multialkali photocathode, transmission secondary emission dynodes, a secondary emission conduction target and a vidicon scan section.

It is a further purpose of the instant invention to provide a tube of simple manufacture requiring but a single photoemitting cathode with all other elements made and tested before final tube assembly.

BRIEF DESCRIPTION OF THE DRAWING

The exact nature of this invention will be readily apparent from consideration of the following specification relating to the annexed drawings in which is shown a schematic sectional view of the low light level camera tube in accordance with the teachings of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, a low light level camera pickup tube is shown comprising a gas tight envelope 2 of

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generally circular cross-section and approximately 21" long in the preferred embodiment. At one end of the envelope 2 is mounted a photocathode 3 that emits electrons in response to light impinging on the outer surface thereof. Although numerous photocathode materials have been employed, a multialkali photocathode composed of potassium, sodium, antimony and cesium has been found to be most suitable. Such material is commonly known as the S-20 photocathode and is readily available. Positioned within envelope 2 are two transmission secondary emission (TSE) dynodes 4 and 5. These TSE dynodes are of the solid potassium chloride type but may be constructed of any suitable material. The dynodes 4 and 5 are of the same general size as the photocathode 3 and are generally equally spaced in the forward end of tube 2. Primary electrons striking the photocathode side of the dynodes 4 and 5 cause secondary electrons to be emitted from the target side of the dynodes with a gain ratio of secondary electrons to primary or photocathode emitted electrons, of from 2.8 to 9.5. It is to be understood that dynode gains may be and have been varied within the selected ranges and that, likewise, loop voltages from power supply may be varied with measurable results.

Positioned between the TSE dynodes 4 and 5 and photocathode 3 are loops 6, 7, and 8 with suitable potentials thereon for providing uniform acceleration and focusing of the electrons emitted from photocathode 3 and each of the dynodes 4 and 5. Although only three such loops are shown, the actual tube constructed had three such loops in place of each of the loops shown, i.e. a total of 9 loops.

Positioned within the envelope 2 near the neck 15 is SEC target 9. SEC target 9 is composed essentially of a lamination of an electrically conductive aluminum film facing TSE dynode 5 and a smoke deposited porous or low density alkali film such as KCl. The alkali film emits secondary electrons thereby varying the local potential of the exterior surface of such film in various areas corresponding to the primary bombarding electrons. The collector mesh 10 provides suitable exit potential for target 9. Typically the target 9 voltage is a positive 30 volts. The SEC target 9 is scanned by vidicon gun 11 providing an output 12 in the conventional manner.

Shown schematically in the figure are the various high voltages from supply source 14 to accelerate and focus electrons emitted from photocathode 3. Typical voltages that have been employed are: photocathode 3 to dynode 4, from 3.8 to 5.3 kv.; TSE dynode 4 to TSE dynode 5, from 4.0 to 6.0 kv.; and TSE dynode 5 to target 9, from 5.6 to 8.0 kv.; and a target voltage of about 30 volts positive.

The disclosed combination gives a superior low light level camera pickup tube with total tube gains in excess of 4,700, good picture quality and a non-blooming target under overload, and a rapid vidicon readout. Resolutions have been achieved in excess of 600 TV lines per inch on a 1" target and a photocathode sensitivity of 70 microamps per lumen.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit or scope set forth in the appended claims.

I claim:

1. A low light level camera pickup tube comprising: a gas tight envelope having a first and second ends; a photocathode positioned at said first end of said envelope for emitting electrons in response to light impinging thereon; transmission secondary electron multiplying means mounted within said envelope adjacent said photo-

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cathode for increasing the number of electrons emitted from said photocathode;
 said multiplying means being composed of solid potassium chloride;
 a secondary emission conduction target mounted within said envelope for receiving said increased number of electrons and providing an output of said tube; said target consisting of a lamination composed of an electrically conductive aluminum film facing said multiplying means and a smoke deposited porous film facing said vidicon; and,
 a vidicon scan section mounted at said second end of said tube for continuously scanning said target.
 2. A low light level camera pickup tube comprising:
 a gas tight glass envelope of generally circular cross-section having a first end and a second end of reduced diameter;
 an S-20 photocathode mounted at said first end of said envelope for emitting primary electrons in response to light impinging thereon;
 a series of transmission secondary emission multiplying dynodes concentrically mounted within said envelope in said first end and producing secondary electrons;
 a secondary emission conduction target mounted within said tube at the junction of said first and second ends for providing an output of said tubes;
 loop means positioned between said dynodes, between

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said photocathode and dynodes and between said target and said dynodes for accelerating and focusing said secondary electrons; and,
 a vidicon scan section mounted within said envelope at said second end for continuously scanning said target.
 3. A low light level camera pickup tube according to claim 2 wherein:
 said series of dynodes is composed of two transmission secondary emission multiplying dynodes; and, said loop means is composed of three loops for accelerating and focusing said secondary electrons.
 4. A low light level camera pickup tube according to claim 3 wherein:
 said dynodes are composed of solid potassium chloride and said secondary emission conduction target consists of a lamination composed of an electrically conductive aluminum film facing said multiplying means and a smoke deposited porous film facing said vidicon.

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