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C. S. SZEGHO ET AL

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IMAGE CONVERTER TUBE

Filed Feb. 19, 1948

2 Sheets-Sheet 1

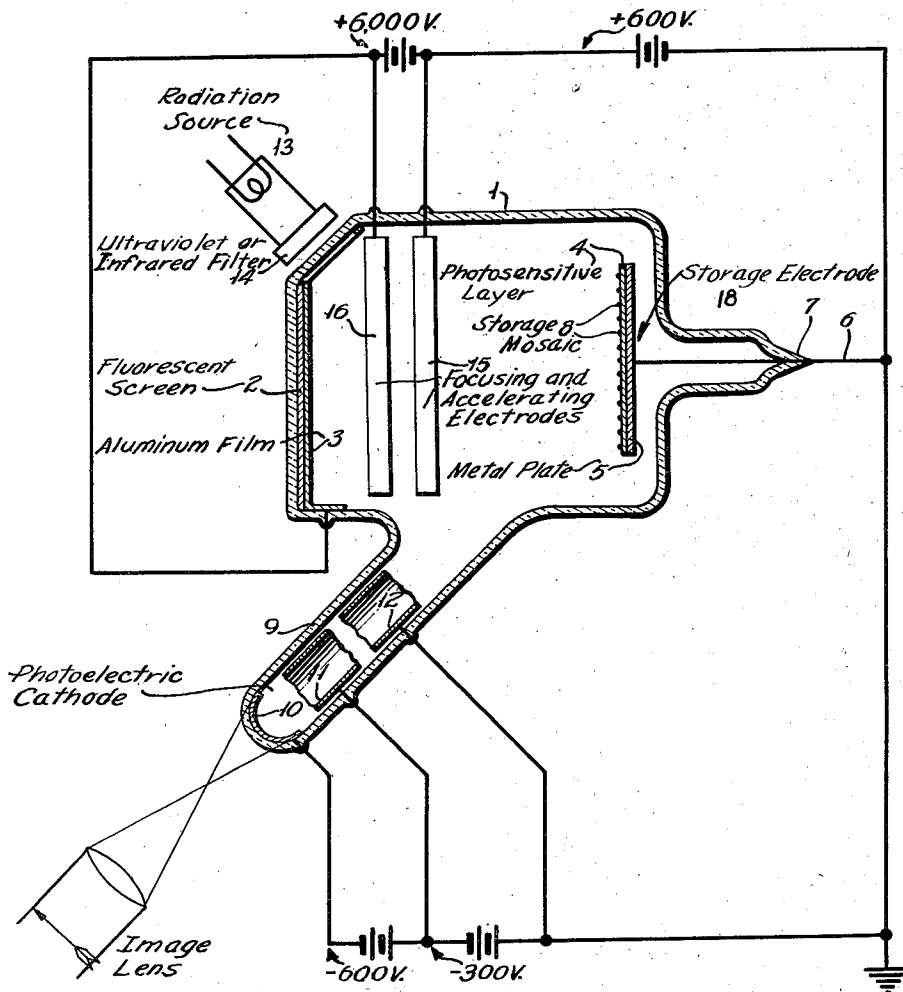


Fig. 1

Inventors
CONSTANTIN S. SZEGHO
WILLIAM O. REED

Paul Kolisch
Attorney

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2 Sheets-Sheet 2

FIG. 2.

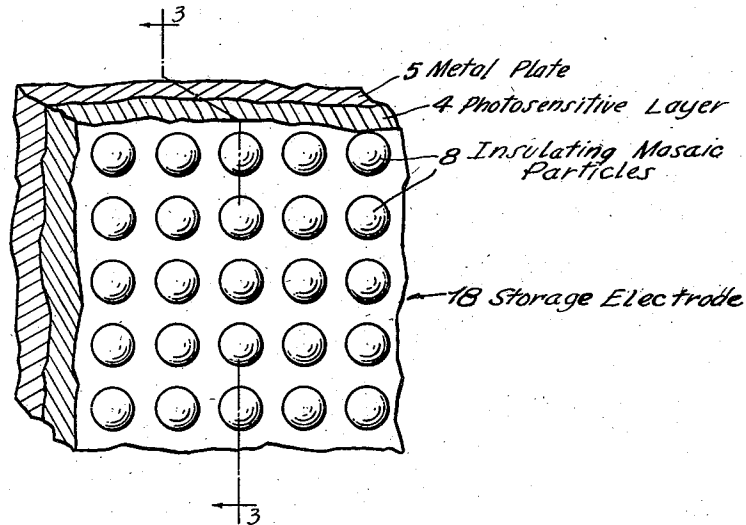
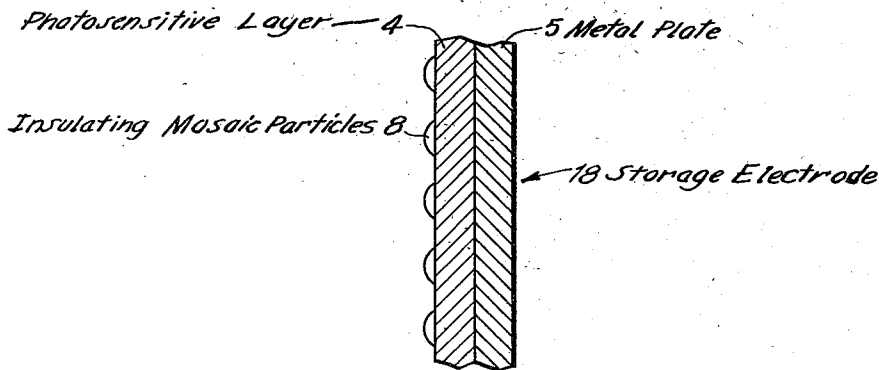


FIG. 3.



Inventor
CONSTANTIN S. SZEGHO
WILLIAM O. REED

By *Paul Kolisch*
Attorney

1

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IMAGE CONVERTER TUBE

Constantin S. Szegho and William O. Reed, Chicago, Ill.,
assignors to The Rauland Corporation, Chicago, Ill.,
a corporation of Illinois

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9 Claims. (Cl. 313—66)

This invention relates to new and useful improvements in electronic devices for storing intelligence impressed on a photosensitive surface.

The object of the invention is to insure visible reproduction of the intelligence at any desired time after receipt of this intelligence.

The object is attained by modulating in accordance with the intelligence a photoelectric instead of the customary electron beam, and focusing the photoelectron image onto the storage electrode.

In accordance with another feature of the invention, the fluorescent screen of the device is covered on the side of the envelope facing the storage electrode by a thin film of aluminum to stop slowly moving electrons and ions, and to insure maximum light reflection towards the person viewing the screen.

These and other features of the invention will more clearly appear from the claims and the detailed description of an embodiment.

In the drawings:

Fig. 1 is a diagrammatic side elevation in section of the tube showing circuit connections between elements;

Fig. 2 is an enlarged fragment of the storage electrode; and

Fig. 3 is a cross section on lines 3—3 of Fig. 2.

An evacuated envelope 1 of glass or other suitable material carries on the inside of one wall a screen of fluorescent material 2 which is covered with a film of aluminum 3. This film is thin enough to permit the passage of electrons having a certain velocity but will block slower electrons and ions. Also, this film acts as a light reflector insuring maximum visibility when viewing the outside surface of screen 2. It also provides protection to the fluorescent screen against cesium vapor during processing, which would cause the fluorescent screen to lose efficiency if this vapor permeates it. To insure more effective protection, it is advisable to keep the aluminum film during processing at a positive potential of the order of 250 volts, thereby repelling positive cesium ions.

Within the main chamber of the envelope parallel with the screen 2, a storage electrode 18 is mounted comprising an electrode 4 of photosensitive material, e. g. a silver-cesium-oxide or other suitable surface deposited on a metal plate 5 connected to ground in the control circuit over conductor 6 extending through nipple 7 which projects from the main chamber of envelope 1. The surface of electrode 4 facing screen 2 is covered with a mosaic of separate insulating particles 8 of quartz, alumina or the like, for the storage of charges. The details of storage electrode 18 are shown in Figs. 2 and 3.

The convex end of a hollow branch 9 of envelope 1 supports an image cathode 10 having a surface of photoelectric material (e. g. silver-cesium-oxide serving as the source of electrons for the device) carrying a negative potential of 600 volts. Branch 9 is inclined at an angle so that the electron image corresponding to the light image striking the image cathode 10 may be focused on the surface of electrode 18. Electrodes 11 and 12 perform

2

electrostatic focusing and acceleration of the electron image from image cathode 10. Electrode 11 also performs the function of a gating grid to cut off the electron image when desired.

The intensity of the photoelectric image is modulated in accordance with the intelligence signal received at any instant and it is focused on the storage electrode 18 by means of the electrodes 11 and 12. The beam striking the insulating particles 8 builds up a positive or negative charge, depending on whether the secondary emission ratio of these insulating particles is greater or less than unity. This ratio depends on the velocity of the arriving electrons. This in turn can be influenced by the accelerating voltage on electrodes 11 and 12, e. g. negative potential of 300 volts on electrode 11 and electrode 12 at ground potential.

The intelligence thus conveyed may be stored for a long period on the storage electrode 18.

The means for releasing the energy (intelligence) from the storage electrode may be ultra-violet or infra-red light passed from a source 13 into the main chamber of the envelope through a filter 14 which impedes the passage of ambient visible light into envelope 1. The photoelectric layer 4 of storage electrode 18 thereupon will emit electrons. By means of electrodes 15 and 16 to which positive potentials of 600 volts and 6,000 volts are respectively applied, the electrons released by 4 will be accelerated and focused to strike the fluorescent screen 2 through the aluminum film 3.

The electrons emitted by an elemental photosensitive area of electrode 4 surrounded by positively charged particles 8 will be concentrated in a corresponding region of 2 which will fluoresce more or less brilliantly depending on the amount of charge on the particles 8.

The image originally impressed on image cathode 10 may thus be seen when desired on fluorescent screen 2. Spurious signals generated by stray infra-red radiation striking image cathode 10 are eliminated by applying a suitable negative potential to the electrode 11 while the stored intelligence is being read.

It is advisable to make the spectral sensitivity of electrode 4 to cut off at infra-red, e. g. by using an antimony cesium surface. Then light through image cathode 10 reaching electrode 4 has no influence. The storage electrode 18 may be cleared of charges by flooding it with electrons from the uniformly illuminated image cathode 10 and accelerated to a voltage corresponding to the sign of the charges and enough coulombs to override these charges. Another way to erase the charges on the insulating mosaic 8 is to illuminate uniformly the photo-sensitive electrode 4 and establish a cloud of electrons in the neighborhood of insulating mosaic 8 through proper adjustment of the voltages of electrodes 15 and 16. These electrons will neutralize positive charges on the insulating mosaic 8.

Improved focusing of the image from the storage electrode 18 may be obtained by the addition of an electromagnetic focusing coil about the main envelope 1.

What is claimed is:

1. An electronic storage device comprising an evacuated envelope enclosing a storage electrode, a fluorescent screen exposed to emissions from the storage electrode, a photosensitive cathode in the envelope arranged to emit a photoelectric beam to impinge on the storage electrode, and means for releasing energy from the storage electrode.

2. The storage device according to claim 1, and in which the cathode is applied to a transparent portion of the envelope.

3. The storage device according to claim 1, and in which the screen is applied to a transparent portion of the envelope.

3

4. The storage device according to claim 1, and in which the screen and storage electrode are parallel.

5. The storage device according to claim 1, and in which the storage electrode has a photosensitive layer provided with a mosaic surface.

6. The storage device according to claim 1, and in which the axis of the beam emitted by the cathode is at an angle to the surface of the storage electrode.

7. An electronic storage tube comprising an evacuated envelope enclosing a storage electrode having a photosensitive layer, one face of which is covered by metal and the other face by a mosaic of insulated particles, a fluorescent screen on a wall of the envelope, means between the storage electrode and screen for accelerating the electrons emitted by the storage electrode and focusing them on the screen, a photosensitive cathode on the envelope, means for accelerating the photoelectric beam emitted by the cathode and focusing it on the storage electrode, and a window in the envelope through which the mosaic surface of the storage electrode may be irradiated.

8. An electronic storage tube comprising an evacuated envelope having a chamber enclosing a storage electrode having a photosensitive layer of silver-cesium-oxide one face of which is covered by a metal plate and the other face by a mosaic of insulating particles, a fluorescent screen on a wall of the chamber parallel with the storage electrode, a thin film of aluminum covering the screen on the face opposing the storage electrode, electrodes between the storage electrode and screen for accelerating the photoelectrons emitted by the storage electrode and

4

focusing them on the screen, an arm of the envelope opening into the chamber at an angle to the surface of the storage electrode and having a convex end, a photosensitive silver-cesium-oxide cathode coated on the inside of the convex end, an electrode within the arm for accelerating the photoelectric beam emitted by the cathode and focusing it on the mosaic surface of the storage electrode, a grid in the arm for controlling the intensity of the beam, and a window in the chamber through which the mosaic surface of the storage electrode may be irradiated.

9. An electronic storage tube comprising an evacuated envelope enclosing a storage electrode having elemental photosensitive areas in electrical connection to a metal plate, the photosensitive areas being surrounded by insulating areas, a fluorescent screen on a wall of the envelope, means between the storage electrode and screen for accelerating the electrons emitted by the storage electrode and focusing them on the screen, a photosensitive cathode on the envelope, means for accelerating the photoelectric beam emitted by the cathode and focusing it on the storage electrode, and a window in the envelope through which the mosaic surface of the storage electrode may be irradiated.

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