SELENIUM STORAGE TUBE

This invention relates to recording apparatus and more particularly to electronic storage tubes for the recording of information.

Electronic storage tubes have been used to record information, particularly of a transient nature, so that the information may be reproduced at a later time or at a slower rate and thus be available for study and observation at a more convenient time and speed. Such tubes have utilized the received signals to modulate an electron beam which is focused onto the storage electrode in order to alter the charge pattern thereon in accordance with the electron beam modulation and deflection. Alternatively, some electronic storage tubes have utilized a storage medium which is sensitive to light in order to store a charge pattern thereon. In the past, reproduction of the stored signals was accomplished by focusing a "read-out" beam of electrons onto the storage electrode in order to detect the presence of a previously recorded charge thereon. Due to the nature of the storage mediums, presently utilized tubes have not shown themselves to be entirely reliable when operated in high ambient temperatures.

Accordingly, one object of this invention is to provide a novel electronic storage tube utilizing a beam of light for read-out.

Another object of this invention is to provide an electronic storage tube which may be operated in high ambient temperatures.

In accordance with an aspect of the invention, there is provided a storage tube in which an electron beam is modulated by signal energy and deflected across the face of the storage electrode to store the signals in the form of a charge pattern. The read-out of the stored charge pattern is accomplished by focusing a beam of light onto the storage electrode, thereby altering its resistance, and conducting the stored charge from the area of the target electrode illuminated by the beam of light.

In accordance with another aspect of the invention, a transparent storage electrode is utilized so that the write-in electron beam may be focused from one side of the storage electrode and the read-out light beam may be focused from the opposite side of the storage electrode.

The above-mentioned and other features and objects of this invention will be more apparent by reference to the following description, taken in conjunction with the accompanying drawing, in which:

FIG. 1 is a schematic illustration, partly in block form, of one embodiment of the novel electronic storage tube; FIG. 2 is a schematic illustration of an alternative embodiment of the novel electronic storage tube; and FIG. 3 is an illustration of one form of storage electrode for use in this invention.

Referring to FIG. 1 of the drawing, the novel storage tube comprises an evacuated envelope 1 containing a target electrode 2 and suitable electron gun structure 3 for producing a beam of electrons and for directing it through an aperture 4 in a mirror 5 which is angularly disposed within the envelope 1 relative to the axis of the electron beam. The electron beam is produced by a gun structure 3 well known to the art. The electron gun 3 may include a cathode 6 heated by filament 6a and grid 7. The cathode beam is focused and deflected by conventional means. For purposes of illustration, deflection coils 8 are illustrated as being coupled to deflection circuits 9. Obviously, electrostatic deflection may also be used. The electron beam passing through the aperture 4 in the mirror 5 is focused and deflected across the target electrode 10. The target electrode 10 comprises a conductive signal plate 11 which is coated with a photosensitive charge storing material 12 such as amorphous selenium. The target electrode coating should have the quality of very low dark current preferably at high ambient temperatures and a relatively low resistance in the presence of light. Amorphous selenium has these desired characteristics. The read-out mechanism comprises means for generating a ray of light and deflecting the ray across the target electrode 10. In the embodiment illustrated in FIG. 1 the read-out mechanism comprises a cathode ray tube 13 with its usual ray deflection circuits (not shown). The light ray from the surface of the tube 13 is focused by the lens 14 and mirror 5 onto the target electrode 10.

In operation, the signals to be stored from source 15 are coupled to the grid 7 and used to modulate the stream of electrons emitted by the electron gun 3. The modulated stream of electrons is deflected across the face of the target electrode 10 by the deflection circuits 8 and 9. As the electrons impinge upon the selenium coating 12 the potential of the elemental area is altered and a charge is stored due to the high resistance of the coating.

In order to read-out the information stored on the target electrode 10, a ray of light from the cathode ray tube 13 is focused by lens 14 and reflected by the mirror 5 onto the target electrode 10. In the usual manner, the ray of light from the cathode ray tube 13 may be deflected across the face of the electrode 10. As light strikes an elemental area on the electrode 10, the resistance of the coating is substantially lowered and if a charge is present it is transferred to the conductive plate 11. The transfer of a stored charge to the plate 11 under the influence of the read-out light causes the potential across the resistor 16 to change and thus the stored charge is detected.

It should be noted that the electronic storage tube illustrated in FIG. 1 of the drawing utilizes a standard cathode ray tube as the read-out structure and that the envelope 1 only contains a write-in structure.

In the embodiment of this invention illustrated in FIG. 2, an electronic storage tube containing both the write-in and the read-out structure is shown to include an evacuated envelope 16 containing a target electrode 17. An electron gun structure (not shown) generates a beam of electrons which is modulated by the signal energy to be stored in a manner described above. The modulated beam of electrons is deflected by coils 18 across the face of the target electrode 17. The target electrode 17 comprises a conductive grid or conductive glass surface 19 which is coated with amorphous selenium 20. Read-out is accomplished by generating a ray of light on the phosphor coated plate 21. The ray of light on plate 21 is created by generating an electron beam from a gun structure (not shown) and allowing the electrons to activate the phosphor causing it to emit light. The spot of light on plate 21 is deflected by means of the coils 22 affecting the electron beam. The light from the plate 21 is focused onto the target electrode 17 by means of the lens system 23. The focused light passes through the conductive glass or grid signal plate 19 and alters the resistance of the selenium coating 20. If a charge is present on the area of the coating illuminated by the beam, a voltage drop is detected across the resistor 24.

Referring now to FIG. 3, an alternate form of electrode is illustrated, comprising a transparent glass base 25 coated with stannous chloride 26 to provide a transparent conductive signal plate. On top of the stannous chloride, a layer of amorphous selenium 27 is deposited to provide...
a signal storage medium which is photo-sensitive. In order to alter the resistance of the photo-sensitive storage medium, the opposite side of the glass base 25 is coated with phosphor 28 in order to produce light for the read-out function. The target electrode of FIG. 3 may be utilized in the storage tube structure shown in FIG. 2.

While I have described above the principles of this invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of this invention, as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A signal storage tube system comprising means for generating an electron beam of energy, a target electrode including a conductive signal plate and in intimate contact with said signal plate, a layer of photo-sensitive material capable of storing a charge pattern, said material having a characteristic of high electrical resistance in the absence of light and a relatively low electrical resistance in the presence of light, means for scanning said target electrode with said beam of energy to store a charge pattern on said material, means for generating a beam of light, means for scanning said target electrode with said beam of light whereby the charge stored on said material is coupled to said signal plate when said electrode is illuminated by said beam of light, and means coupled to said signal plate to detect the charge coupled thereto from said material under the influence of said beam of light.

2. A signal storage tube system comprising a target electrode including a conductive signal plate and in intimate surface contact with said signal plate, a layer of photosensitive material capable of storing a charge pattern, said material having the characteristic of high electrical resistance in the absence of light and relatively low electrical resistance in the presence of light, an electron gun structure for generating a stream of electrons, means for modulating said stream of electrons with the signals to be stored, means to cause said modulated stream of electrons to scan said target electrode in a predetermined pattern to cause a charge to be stored thereon, a source of light, means to focus said light on said target electrode, means to cause said light to scan said target electrode in a predetermined pattern, and means to couple from said signal plate the stored signals coupled from said layer of material to said signal plate under the influence of said light.

3. A storage tube system according to claim 2 wherein said signal plate is transparent and said light is focused onto one side of said plate and said layer of material is disposed on the opposite side of said plate.

4. A storage tube system in accordance with claim 2 wherein said signal plate is composed of a conductive grid and said layer of material consists said grid.

5. A storage tube system in accordance with claim 2 wherein said source of light includes a cathode ray tube.

6. A storage tube system in accordance with claim 5 which further includes a mirror disposed at an angle to the axis of said electron stream, said mirror having an aperture through which said electron stream is focused, and said cathode ray tube being disposed at an angle to said electron stream axis and the light from said cathode ray tube reflected by said mirror onto said target electrode.

7. A storage tube system comprising a target electrode including a transparent conductive signal plate and in intimate surface contact with said plate, a layer of photosensitive material capable of storing a charge pattern, said material having the characteristic of high electrical resistance in the absence of light and low electrical resistance in the presence of light, an electron gun structure for generating a stream of electrons, means to modulate said electron stream with the signals to be stored, means to cause said modulated electron stream to scan said target electrode in a predetermined pattern to cause a charge to be stored thereon, a photo-emissive electrode, means to cause said photo-emissive electrode to generate a beam of light, means to focus said light onto said target electrode, and means to couple signals from said signal plate which are coupled from said layer of material under the influence of said light.

8. A signal storage tube system according to claim 7, wherein said target electrode includes a transparent base, a layer of stannous chloride disposed on said base and a layer of amorphous selenium on said stannous chloride.

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