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CATHODE RAY SWITCH

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Fig. 1b

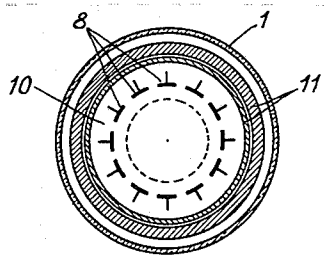


Fig. 1a

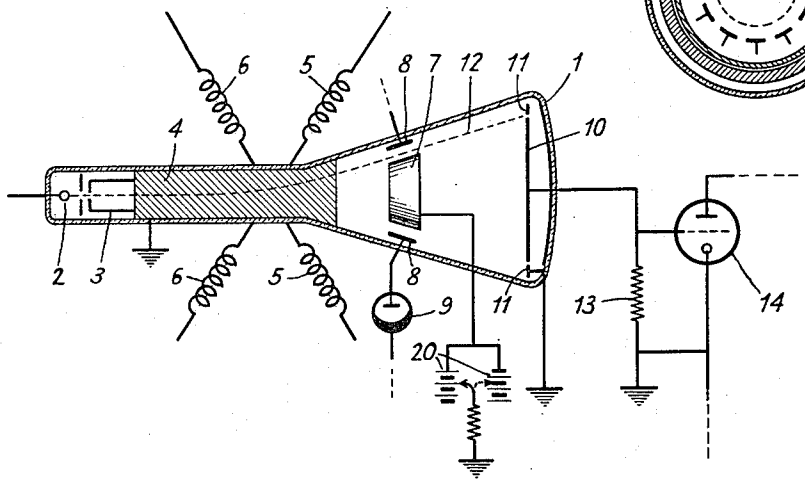
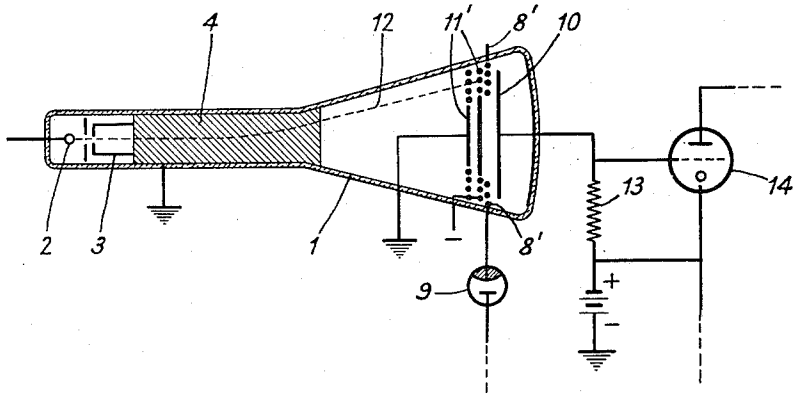


Fig. 2



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CATHODE RAY SWITCH

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7 Claims. (Cl. 178—7.2)

The invention relates broadly to a cathode ray tube arrangement which serves as a rapid switching device, and more particularly to a cathode ray tube employing an electron beam of comparatively small cross-sectional area which is caused to perform oscillatory or rotative movements by means of a rotating field, and which is successively deflected in accordance with the light values falling on a plurality of photocells.

Such a device is readily adapted to use in analyzing television pictures where the problem arises of using light values of elemental picture areas falling upon minute photocells to obtain signals which may be radiated to a receiving arrangement which reconstructs the picture in accordance with the electric values transmitted at the sending apparatus. The cathode ray switch is adapted to develop an electrical pulse, the value of which corresponds either for a portion only or in a predetermined fashion to the amount of light falling on each of either a small or large number of photocells.

The invention will be best understood by reference to the drawing, in which:

Fig. 1*a* shows one embodiment of my invention in elevation,

Fig. 1*b* is a cross-sectional view of a cathode ray tube looking into the viewing end, and

Fig. 2 is another embodiment of my invention.

Referring to Fig. 1, the cathode ray tube, whose envelope is indicated by 1, contains the usual electrode 2, 3 and 4 by means of which a cathode ray beam is developed. 4 is a conducting layer on the tube wall, the use of which is quite common at the present time. 5 and 6 represent a series of coils by means of which there may be developed a rotating field progressively around the tube and, therefore, the electron beam will be forced into a path which corresponds substantially to that of the rotating field developed in the elements illustrated by 5 and 6. The electron beam is indicated by 12.

The operation of the device is as follows. The electron beam 12 in its rotating path is caused to pass between a cone-shaped conducting member 7 and a plurality of conducting plates 8 arranged around the cone, each of these plates is connected to a photocell, and for the purpose of convenience and clarity, only one photocell 9 has been shown connected to the plate. By connections well known in the art, the plate 8 is charged to a value with respect to the element 7 which corresponds to the light value falling on the photocell 9. Accordingly, the action here will be the same as that of the ordinary pair of deflecting plates in the well known cathode ray tube arrangement. Hence, the electron beam 12 will be deflected in accordance with the electrostatic field between the plate 8 and the element 7.

At the end of the tube is a conducting plate 10 joined to a resistor 13, the latter being adapted to be connected to the control element 14 of the ordinary amplifying tube arrangement. Hence, electrical impulses developed across the resistor will be amplified and may be used in any desired fashion. Surrounding the plate 10, but spaced therefrom, is a conducting ring 11 which is at ground potential. The potential of this latter plate may, of course, be made of any suitable value according to the desires of the designer for the purpose which he has in mind for the operation of the tube. Normally, that is, when no light strikes the photocell 9, there will be no charge on plate 8 with respect to the element 7, and the cathode ray beam when it passes between these two elements will continue onward until it strikes the element 11 where it is conducted to ground. However, should a light value strike the photocell, there will be a charge deposited on plate 8 and, accordingly, the cathode ray beam will be deflected towards the plate 10 rather than the element 11. The number of electrons which strike the plate 10 will depend upon how far the beam has been deflected and, hence, the number of electrons collected by 10 will be proportional in a measure to the potential of plate 8 with respect to the element 7. These electrons striking the plate 10 pass through the resistor 13 to ground, causing a potential to be developed across the resistor which is amplified as hereinbefore stated. The element 7 may be connected through the adjustable biasing arrangement 20 to ground and, hence, may be maintained either at ground potential or any desirable potential with respect thereto.

Referring to Fig. 2, a somewhat different arrangement is shown in which a very accurate circular movement of beam is not necessary and no stable size of the initial radius need be maintained. The cathode ray 12 is produced and radiated in the same manner as in Fig. 1*a* and herein penetrates a ring-shaped mesh connected with the anodic plate 11'. In back of this mesh, a second ring-shaped mesh 11'' is arranged which has a high negative potential relative to 11', the potential being substantially the value of the potential of the cathode ray tube. Consequently, the electrons of the ray in front of 11'' will be so decelerated that the velocity thereof will be very small or zero; thus forming at this location a virtual cathode arrangement. The photocells 9, which in this case are shown as a single photocell for the purpose of clarity, are connected to small individual grids 8', said individual grids being arranged in a circular fashion corresponding to the manner in which the plates 8 of Fig. 1 were arranged, and these meshes may be penetrated in succession by the radiating cathode ray beam. In view of the deceleration of the electron speed which has taken place, the electrons will

penetrate only when the respective individual grid is positively charged by the exposure of its co-operating photocell to such a degree that the electrons are again accelerated and passed to the absorption plate 10. Again, depending on the number of electrons which strike the plate 10, there will be developed a potential across the resistor 13 which may be amplified and used in a well known manner in so far as transmission signals are concerned. The number of electrons reaching 10 naturally will depend on the charge on the meshes 8'. Hence, a potential will be developed across 13 which is proportional to the light value striking the photocell plate connected to each individual mesh.

In each embodiment of this invention which has been illustrated, naturally either the mesh 8' of Fig. 2 or the plate 8 of Fig. 1 may be biased in any desirable fashion so as to provide an initial operating condition. One such arrangement is shown in Fig. 1, but no such arrangement has been shown in Fig. 2; however, its desirability is obvious and it may be used where desired without departing from the spirit of this invention. The control of the electrons illustrated by Fig. 2 corresponds to the function of electron amplifier tubes having a virtual cathode and several grids.

What we claim is:

1. An electron switch comprising means for developing a cathode ray beam, a plurality of light current translating devices, a plurality of conducting means each joined to at least one of said light current translating devices, an electrode member adjacent to said plurality of conducting means and at least partially enclosed thereby and adapted to produce with said plurality of conducting means an electrostatic field in accordance with the light values impinging on the light current translating devices to which each conducting means is connected, means for passing the cathode ray beam to successively changing positions where said beam interacts with and is deflected in accordance with the value of each of the electrostatic fields individually and sequentially, and at least one target member.

2. In an electron switch, means for developing a cathode ray beam, a plurality of light current translating devices, a conducting member, a plurality of conducting plates arranged adjacent said conducting member, each of said plates forming a condenser therewith which is adapted to be charged by at least one of said light current translating devices, means for passing the cathode ray beam successively between each conducting plate and the common conducting member in a position substantially transverse to the direction of the field between the conducting plate and the common conducting member, and a plurality of conducting targets.

3. In an electron switch, means for developing a cathode ray beam, a plurality of light current translating devices, a conducting member, a plurality of conducting plates arranged adjacent said conducting member and at least partially enclosing said conducting member, each of said plates forming a condenser therewith which is adapted to be charged by at least one of said light current translating devices, means for passing the cathode ray beam successively between each conducting plate and the common conducting member whereby said beam is deflected in accordance with the value of the electrostatic field between the common conducting member and each conducting plate successively, a plurality of conducting targets, and means joined to at least one of said targets for developing a potential from the electronic flow in the target which is occasioned by the impinging of the cathode ray beam on the target.

4. In an electron switch, means for developing a cathode ray beam, a plurality of light current translating devices, a biased conducting member, a plurality of conducting plates arranged adjacent said conducting member and at least partially enclosing said conducting member, each of said plates forming a condenser with the conducting member which is adapted to be charged by at least one of said light current translating devices, means for passing the cathode ray beam successively between each conducting plate and the common conducting member whereby said beam is deflected in accordance with the value of the electrostatic field between the common conducting member and each conducting plate successively, and a plurality of conducting members.

5. In an electron switch, means for developing a cathode ray beam, a plurality of light current translating devices, a biased conducting member, a plurality of conducting plates arranged adjacent said biased conducting member, each of said plates forming a condenser therewith which is adapted to be charged by at least one of said light current translating devices, means for passing the cathode ray beam successively between each conducting plate and the common conducting member in a position substantially transverse to the direction of the field between the conducting plate and the common conducting member, a plurality of conducting targets, and means joined to at least one of said targets for developing a potential from the electronic flow in the target which is occasioned by the bringing of the cathode ray beam on the target.

6. In an electron switch, means for developing a cathode ray beam, a plurality of light current translating devices, a frustroconical conducting member, a plurality of conducting plates arranged adjacent said frustroconical conducting member around the periphery thereof, each of said plates forming with said frustroconical member an electrical storage element adapted to be charged by at least one of said light current translating devices, means for rotating the cathode ray beam so that it passes successively between each of the conducting plates and the frustroconical member, and a plurality of conducting targets.

7. An electron switch comprising means for developing a cathode ray beam, a plurality of light current translating devices, a plurality of conducting means each joined to at least one of said light translating devices adapted to produce an electrostatic field in accordance with the light values impinging on the light current translating device to which it is connected, said conducting members being arranged radially with respect to the normal direction of the cathode ray beam, means for rotating the cathode ray beam to successively changing positions where said beam interacts with each of the electrostatic fields individually and sequentially, and at least one target member adapted to be impinged upon directly by said beam for sequentially collecting a number of electrons proportional to the intensity of each electrostatic field.

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