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P. M. G. TOULON
ELECTRON RAY SCANNING DEVICE
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Fig. 1.

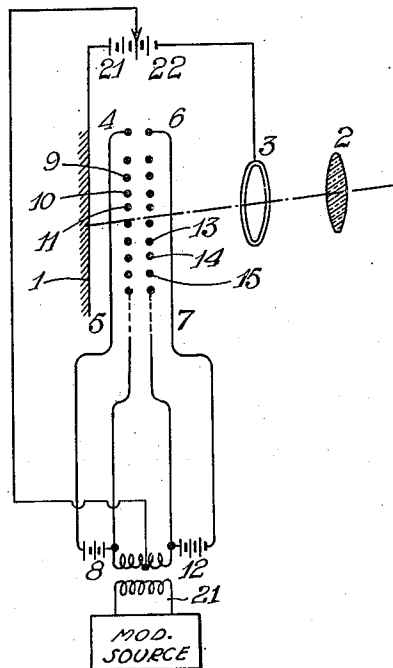


Fig. 2.

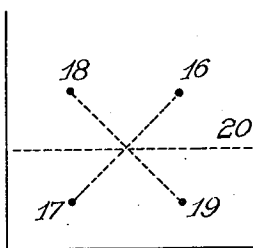
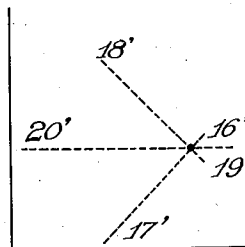


Fig. 3.



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ELECTRON RAY SCANNING DEVICE

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8 Claims. (Cl. 178-7.2)

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The invention relates to television apparatus and more particularly to scanning process for same. The problem of scanning a surface becomes more difficult as the number of explored points per second increases. With the scanning at the rate of 50 pictures, five hundred-line frames the light beam should be displaced by the optical or mechanical systems at very high speeds and the luminous flux emitted or received is very small.

The object of the present invention is to provide a new scanning device that has the advantage of being an entirely electrical device, whereby greater speeds can be obtained. It belongs to that class of scanners where the image is entirely projected on a photoelectric surface.

According to the invention the surface scanning is obtained point by point by interposing, between this surface and a collecting electrode, a suitably energized scanning device which only allows the emitted electrons to pass at a single point. This energizing is variable so that the point is continually shifted.

The process can be applied not only to the transmitters (photoelectric surface) but also to the receivers (for example an electron-emitting surface of a slow-discharge tube).

In the following description and for a better understanding of the apparatus the process has been represented as applied to a photo-electric cell of rectilinear operating characteristics as for example is used for scanning a horizontal line of a moving picture film.

Figure 1 shows, partly in section, the general principle of the arrangement of the electrodes in the photo-cell for performing the scanning process; and Figures 2 and 3 are diagrams showing the potentials of various points on the various grids as a function of time and illustrating their operation. It should be understood that these figures are merely given as illustrating an example of the invention.

In Figure 1, 1 is a cathode emitting electrons under the action of light rays supplied through lens 2 which projects the televised image on said cathode.

According to the invention two grids are interposed between cathode 1 and anode 3, one being shown at 4-5 and the other at 6-7.

The emitted electrons can only reach the collecting anode 3 if the potential of these two grids located in the path of travel between anode and cathode is positive. Should either one of the grids be brought to a negative potential the electrons will no longer be able to travel along a straight line and they will fall back onto the cathode.

The grids are made of resistance wire so that the different meshes of which they consist are

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brought to different potentials; it may be for example a resistant wire arranged zigzag fashion. The ends of grid 4-4 are connected to a battery 8 allowing of a weak current flowing through this resistance. The effect of this current is to bring the various grid meshes to a series of potentials showing gradual increase from one to another.

Under these conditions intermediate points such as 9, 10, 11 are impressed with different potentials ranging in close vicinity to one another between the potentials of the terminal parts 4 and 5. Grid 6-7 is connected likewise to a battery 12 so that the meshes 13, 14, 15 are brought to a series of slightly differing potentials comprised between those of points 6 and 7. The tension applied to the whole of grid 4-5 on the one hand and to grid 6-7 on the other hand is modulated, that is to say the potential value of all the meshes on either grid varies as a function of time.

Under these conditions there never is but one point on cathode 1 facing which the meshes of the two grids are simultaneously at potential zero; and through this point only are electrons given off by the photo-electric process able to escape and reach anode 3.

The principle of the scanning process can be grasped by considering Figure 2. At 16, 17, the tension of different points on grid 4-5 at a given moment has been illustrated (tensions being shown as ordinates, and lengths associated with different points in the grid being carried on the figure as abscissae), whilst at 18, 19 is represented the tension of different points of electrode 6-7 at the same instant. If the potential at middle-point on these two grids is zero at the moment considered, only electrons given off by the middle part of the cathode will reach the anode.

Modulation of grid 4-5 with regard to grid 6-7 results in a sliding movement being imparted to curve 18-19 to the effect of bringing it for example to 18', 19' (Fig. 3), whilst line 16, 17 is shifted to 16', 17'.

The point at which these two lines intersect is thus shifted along the line of travel 20 owing to the potential variation between the two grids. Thus it is possible to vary the fractional electronic image on the cathode which in turn produces electrons which are collected by the anode, and thus the scanning process is performed. Source 21 supplies the alternate tension required for this scanning operation. Usually the scanning is made to proceed in the form of a saw tooth wave by means of a "thyatron" relaxator, i. e. a tube filled with gas under reduced pressure which periodically causes the sudden discharge of a condenser, whilst on the contrary the charging of the latter proceeds slowly through a high resistance. By using polarisation sources 21 and

22, suitable adjustment relatively to the cathode of the anode tension on the one hand, and of two grids on the other hand can be obtained. This second adjustment results in the upward displacement of straight line 20 in Figures 2 and 3. This adjustment allows the cell to be put into the most favorable operating conditions.

The above example relates to a linear cell intended to transmit animated films with a continuous movement. It is obvious that the same process can be applied to surface cells. In the latter case one may either give a special shape and a particular arrangement to two above-mentioned grids or preferably insert a second structure of two grids in the path of travel of the electrons. Two relaxation tubes will be used, one energizing a grid structure so as to provide a one-way scanning (line scanning) the other energizing the other structure of a much lower frequency (picture frequency).

This process can be applied to the receiving where it can be used to cause the illumination of a low pressure gas tube with emitting cathode. The electrons which passed beyond the set of the two grids now being capable of causing the gas to become ionized or the emission of a secondary electron or any other optical phenomena.

Although only a single particular case has been represented of the new scanning process it is obvious that the new method of control by means of two or more grids set at a suitably distributed potential and suitably modulated can be made to ensure line 2 or pictorial scanning according to a predetermined law as well in the transmitter as in the receiver of a television apparatus.

I claim:

1. In a television system, an apparatus for sequential scanning of the elemental areas of an image, including in combination an electron-emitting electrode, means for projecting light rays onto said electrode, grids interposed in the path of the electrons emitted by said electrode, a source of scanning potential, and means for impressing upon said grids oppositely phased modulating potentials from said source of scanning potential.

2. In a television system, an extensive photo-sensitive electrode, a pair of grid structures substantially co-extensive with said electrode, and means for impressing upon said grid structures uniformly distributed direct current potential gradients and oppositely phased modulating potentials for establishing a point of zero potential at a single point of said electrode, said point of zero potential being movable relatively to said electrode in a scanning movement in response to said modulating potentials.

3. In a television system, a photo-sensitive linearly extensive electrode, including, a plurality of grid structures of resistance wire, said structures being co-extensive with said linearly extensive electrode, plural sources of direct current potential, said grid structures being shunted by said sources in such manner as to produce uniformly distributed potential gradients therealong, and means for impressing modulating potentials upon said grid structures, respectively, in such manner that a point of zero potential is produced at a single point upon said electrode, said point of zero potential being movable along said electrode in a scanning movement in response to said modulating potentials.

4. In a television system, an apparatus for

sequential scanning of the elemental areas of an image, including, in combination, an extensive photo-sensitive cathode for providing at different points of the surface thereof electron emission of different intensity, an anode for collecting said electrons, a grid structure interposed between said cathode and said anode for controlling the flow of electrons from said different points to said anode in succession, means for impressing direct current potential gradients on said grid structures, and means for impressing modulating potentials of mutually opposite phases upon said grid structures.

5. In a television system, an apparatus for sequential scanning of the elemental areas of an extensive image, including in combination, an extensive photo-sensitive cathode for producing electron emission locally variable thereon, in response to said image, an anode for collecting said electrons, grid structures interposed between said cathode and said anode, and means for impressing constant direct current potential gradients and varying modulating potentials upon said grid structures, respectively, for controlling electron flow from successive area portions of said extensive cathode in time succession.

6. In a television system, an apparatus for sequential scanning of the elemental areas of an image, including in combination, an electron emitting photo-sensitive extensive electrode, means for projecting light rays on a plurality of elemental areas of said electrode, a plurality of grids interposed in cascade in the path of electrons emitted by said elemental areas of said electrode, a source of scanning potential, and means for impressing upon said grids modulating potentials from said source of scanning potential for effecting electron flow from successive ones of said elemental areas in time succession.

7. In a television system, an apparatus for sequential scanning of the elemental areas of an image, including, an extensive photo-electron emitting electrode, means for impressing discrete elemental areas of said image on discrete elemental areas of said electrode for producing along all the surface of said electrode photo-electrons locally variable in intensity, a pair of grid structures co-extensive with said electrode, means for impressing upon said grid structures uniformly distributed direct current potential gradients, and means for impressing upon said grid structures, respectively, oppositely phased modulating potentials.

8. In a television system, an apparatus for rectilinear sequential scanning of the elemental areas of an image, including a rectilinear photo-sensitive electron emitting electrode producing along all its length electrons locally variable in intensity, a pair of grid structures co-extensive with said electrodes, means for impressing upon said grid structures uniformly distributed direct current potential gradients, and means for impressing on said grid structures, respectively, oppositely phased modulating potentials.

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