

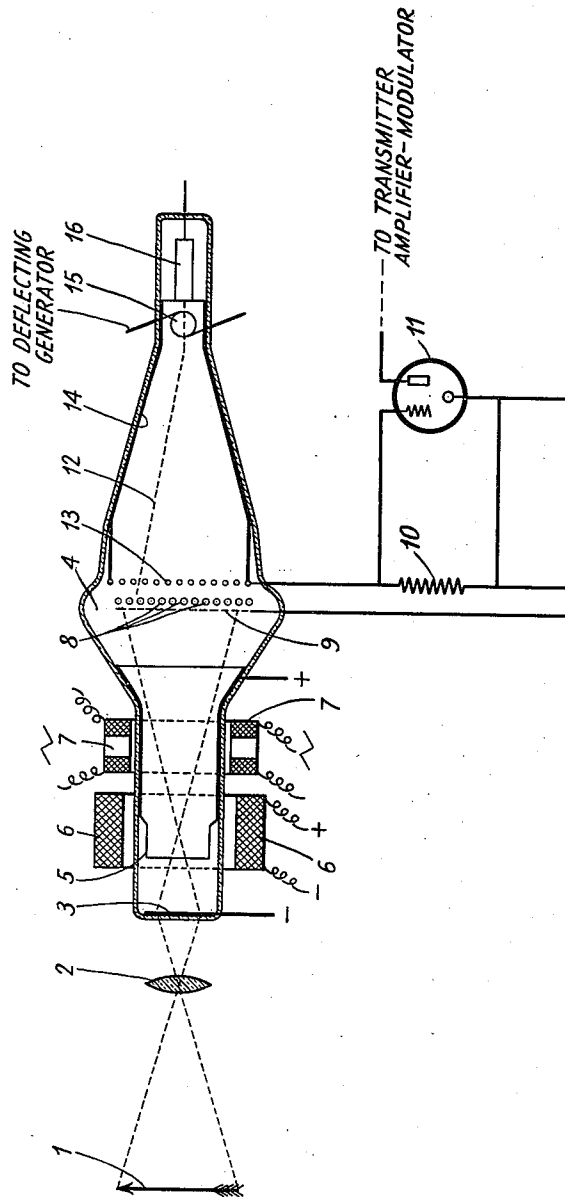
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CATHODE RAY TUBE

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CATHODE RAY TUBE

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My invention relates broadly to scanning de-
vices for television purposes and more particu-
larly to a cathode ray type of scanning appa-
ratus. In my previous application, S. N. 32,768
filed July 23, 1935 and entitled "Television scan-
ner" there is described the combination of a
single line cathode ray scanning device associ-
ated with an optical arrangement by means of
which the optical image to be transmitted is dis-
placed across the scanning line in the direction
of the second analyzing coordinate by means,
for instance, of a mirror wheel.

The present arrangement has for its object to
eliminate all inconvenient mechanical accessory
means and to this end the original image is
transformed in two dimensions into an electron
image and the electron image is drawn a line
at a time across a series of electrodes, which are
linearly arranged with respect to each other,
and the cathode ray beam developed in the tube
scans the single line of electrodes on the side
opposite that on which the lines of the electron
image fall.

My device in general operates in the follow-
ing manner:—the optical image to be trans-
mitted is first transformed into an electron im-
age and by means of electron optical means, the
electron image is greatly enlarged in size. The
enlarged electron image is then brought into
contact with a set of individual cells which are
linearly arranged so as to contact a single line
of the electron image. The image is then brought
into contact with the line of cells, one line at
a time, and each individual line charges the
cells with charges corresponding on each cell to
the electron value of the line at that point. This
single line of the electron image is scanned by
means of a cathode ray and a secondary emis-
sion is developed therefrom, which is propor-
tional to the charge on each cell. After the
single line has been scanned, the electron image
may be moved down one line, where it again
charges the cells and the steps, as outlined be-
fore, are repeated.

My invention will best be understood by ref-
erence to the figure which shows an embodiment
of my invention.

Referring to the figure, 1 is the optical view
which is to be transmitted by television and 2
is an objective lens reproducing the optical im-
age on a homogeneous surface 3 which is photo-
electrically sensitive, the optical image having
passed through the transparent front wall of
the cathode ray tube 4 and through a trans-
parent conducting layer. The electron image

formed by 3 is then influenced by a magnet coil
excited with a direct current which acts as a
reproducing lens. This coil produces in the
plane of a cell line 8 an enlarged electron image
of the object 1 which is to be transmitted. For
the sake of simplicity, the turning of the elec-
tron image by the magnetic lens is not consid-
ered herein.

A line of electron image impinging upon a
row of small individual cells 8, which are linearly
arranged, produces charges on the cells of a
value depending upon the secondary emission
from the cell surfaces and upon the velocity and
density of the impinging image electrons. Ad-
jacent the cell line 8 is a common conductor 9
arranged so as to form a capacitive element with
each of the cells 8 and is so arranged as to be
out of reach of the reproducing electrons, as well
as the scanning electrodes. This may be ac-
complished by a physical positioning and shield-
ing. In the opposite end of the cathode ray
tube, from the end in which the optical image
entered, there is developed a cathode ray beam
which may be deflected by well known deflec-
tion arrangements. For the sake of simplicity,
I have indicated one magnetic coil 15. However,
it is understood that electrostatic means may be
used as well as a dual magnet coil arrangement.
An anodic layer 14 is provided which may be
joined at the end remote from the cathode ray
generating means by means of a mesh 13 of
fine wires.

The line movement of the ray may be obtained
by means of a magnetic field produced by relax-
ation current which is established by the coils
15. The movement of the cathode ray across the
side of the cell line 8, which is remote from the
electron image, will return the cells to an equi-
librium state and will cause the production of
secondary emission of a value which is depend-
ent on the charge on the cell as well as the ac-
celeration of the beam. This secondary emis-
sion is collected by the mesh member 13 and
produces a varying potential across the resistor
10. This varying potential may then be used to
modulate the transmission apparatus in well
known fashion.

So far there has been explained the scanning
of one line of the image. After scanning the
single line, the electron image may be moved
with respect to the cell line 8 by a distance cor-
responding to one line of the image by means of
a coil pair 7. The coil pair 7 is fed with a relax-
ation current of the frequency corresponding to
the picture frequency and naturally moves the

electron image in a direction at right angles to the line 8. As a result thereof, the various lines of the image act in succession upon 8 in accordance with the linear distribution of their electron density so that all picture points will be evacuated in proper sequence. In this manner, the cathode ray scanning beam is moved only in one direction, that is, along a single coordinate, which is at right angles to the movement of the electron image.

Where interlaced scanning is desirable, the electron image is moved by the coil 7 a space of more than one single line or as it is generally termed, more than the width of a single elemental picture strip.

For more effective scanning performance, the individual cells 8 can be so constructed and biased that the image electrons impinging thereon, multiply through secondary emission the accumulated charges. For instance, the surface of the cells 8 exposed to the image electrons may be coated with caesium or other electro-positive material in known manner for the production of photocells, and thereby a multiplication up to about five times the impinging electron quantity is obtained. The most favorable potential value for utilizing the secondary emission can be given the cells 8 by properly choosing the potential of the accelerating anode 14 of the tube.

On the other hand, it is also possible to merely suppress secondary emission on the surface of the individual cells which is struck by the image electrons. This may be accomplished by suitably covering that face of the cell with a carbonaceous material. The front of the cell may be covered with the carbonaceous material as hereinbefore stated and the surface of the cells, remote from the electron image, may be coated with a material which has a high secondary emission characteristic. In this manner, there will be obtained a reduced inner resistance of the cells for the compensation of the stored charges. The important advantage of the described single line arrangement resides in the easy assembly of the cell row line 8 in forms susceptible of wide variations. The required insulation resistance of the cells relative to each other can be easily attained.

It is possible to construct the individual cells of the scanning line as insulated electrostatic miniature cages and a high multiplication of the entering charge in each cage may be attained.

What I claim is:

1. In television apparatus for transmitting signals representative of an optical image, means for converting the optical image into an electron image, electron optical means for magnifying the electron image, a plurality of discrete cells, a conducting member adapted to form with said cells a plurality of electrical storage means, the cells being arranged to embrace a single elemental strip of the electron image, electrical means for passing sequentially successive elemental width strips of the electron image to the cells in a direction at right angles to the strip of cells, and producing thereon an electric charge, cathode ray producing means, means scanning the cells with the cathode ray to neutralize the accumulated charge on each cell, and means for collecting the secondary emission produced by the scanning action of the cathode ray beam upon the cells to develop electrical signals for transmission.

2. In a television transmitting apparatus for transmitting an optical image, means for con-

verting the optical image into an electron image, electron optical means for magnifying said electron image, a plurality of discrete cells placed in a linear fashion facing the electron image, a common conducting member adapted to form with said cells a plurality of electrical storage means, electrical means for projecting the electron image one line at a time on one side of the line of cells and moving the electron image linearly in a direction at right angles to the line of discrete cells to produce electrical charges thereon, cathode ray producing means, means for moving the cathode ray on the side opposite the electron image across the line of cells in a direction perpendicular to the linear movement of the electron image in order to return each cell to an equilibrium state after accumulation of a charge for one picture element during a time interval between two successive passages of the cathode ray thereover, means for collecting the secondary emission occasioned by the impinging of the cathode ray on the line of cells, and means for modulating a carrier wave in accordance with the variations in the collected secondary emission.

3. In a television transmitting apparatus for transmitting an optical image, means for converting the optical image into an electron image, electron optical means for magnifying said electron image, a plurality of discrete cells placed in a linear fashion facing the electron image and a carbonaceous deposit on the side of the cell facing the electron image in order to reduce secondary emission from that side, a common conducting member adapted to form with said cells a plurality of electrical storage means, electrical means for projecting the electron image one line at a time on one side of the line of cells and moving the electron image linearly in a direction at right angles to the line of discrete cells to produce electrical charges thereon, cathode ray producing means, means for moving the cathode ray on the side opposite the electron image across the line of cells in a direction perpendicular to the linear movement of the electron image in order to return each cell to an equilibrium state after accumulation of a charge for one picture element during a time interval between two successive passages of the cathode ray thereover, means for collecting the secondary emission occasioned by the impinging of the cathode ray on the line of cells, and means for modulating a carrier wave in accordance with the variations in the collected secondary emission.

4. In a television transmitting apparatus for transmitting an optical image, means for converting the optical image into an electron image, electron optical means for magnifying said electron image, a plurality of discrete cells placed in a linear fashion facing the electron image, each of said cells bearing a deposit of material having high secondary emission properties on the side facing away from the electron image, a common conducting member adapted to form with said cells a plurality of electrical storage means, electrical means for projecting the electron image one line at a time on one side of the line of cells and moving the electron image linearly in a direction at right angles to the line of discrete cells to produce electrical charges thereon, cathode ray producing means, means for moving the cathode ray on the side opposite the electron image across the line of cells in a direction perpendicular to the linear movement of the electron image in order to return each cell to an equilibrium state after accumulation of a charge for one picture

element during a time interval between two successive passages of the cathode ray thereover, means for collecting the secondary emission occasioned by the impinging of the cathode ray on the line of cells, and means for modulating a carrier wave in accordance with the variations in the collected secondary emission.

5. In a television transmitting apparatus for transmitting an optical image, means for converting the optical image into an electron image, electron optical means for magnifying said electron image, a plurality of discrete cells placed in a linear fashion facing the electron image, said cells having a carbon deposit on the face of each cell facing the electron image and a deposit of a material having a low electron retention value on the face facing away from the electron image, a common conducting member adapted to form with said cells a plurality of electrical storage means, electrical means for projecting the electron image one line at a time on one side of the line of cells and moving the electron image linearly in a direction at right angles to the line of discrete cells to produce electrical charges thereon, cathode ray producing means, means for moving the cathode ray on the side opposite the electron image across the line of cells in a direction perpendicular to the linear movement of the electron image in order to return each cell to an equilibrium state after accumulation of a charge for one picture element during a time interval between two successive passages of the cathode ray thereover, means for collecting the secondary emission occasioned by the impinging of the cathode ray on the line of cells, and means for modulating a carrier wave in accordance with the variations in the collected secondary emission.

6. The method of scanning an optical image which comprises the steps of converting the optical image into an electron image, electro optically magnifying said electron image, storing an electric charge which is representative of the value of each element of the image for a single line of the image, electrically returning each charge to an equilibrium state subsequent to the accumulation of each charge thereon producing secondary electron emission upon the return of each stored charge to equilibrium value, collecting the secondarily emitted electrons produced, electrically moving the electron image in a direction transverse to the direction of scanning the charge image so as to store a single line of the image at any one time, repeating the steps set forth after the conversion of the optical image into an electron image.

7. The method of scanning an optical image which comprises the steps of converting the optical image into an electron image, electron optically magnifying the size of the electron image, storing an electric charge which is representative of the value of each element of the image for a single line of the image, electrically returning each charge to an equilibrium state subsequent to the accumulation of each charge thereon producing secondary electron emission upon the return of each stored charge to equilibrium value, collecting the secondarily emitted electrons produced, electrically moving the electron image in a direction transverse to the direction of scanning the charge image a space of one line, repeating the steps set forth after the magnification of the electron image.

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