United States Patent [19]

Allen

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[54] **CATHODE RAY TUBES TO FACILITATE RECORDING**

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[52] **U.S. Cl.**..... **315/21 PR,** 178/6.6 A, 346/110 R

[51] **Int. Cl.**..... **H01j 29/70**

[58] **Field of Search**.. 315/21 R, 21 PR; 178/DIG. 2, 178/6.6 A

[56] **References Cited**

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[57] **ABSTRACT**

A cathode ray tube with a conventional screen for providing a visible monitoring image is additionally formed with a second output portion on its envelope, the second output portion including a multiplicity of fibre-optics, electrically conductive particles, or other elements for transferring elements of the image from the internal surface of the envelope wall to the external surface to facilitate recording of an image on a sensitised sheet presented to the external surface. Deflection means guide a recording beam either to the monitoring screen or to the second output portion of the envelope, as required, or alternately to the two output portions of the envelope in rapid succession.

11 Claims, 5 Drawing Figures

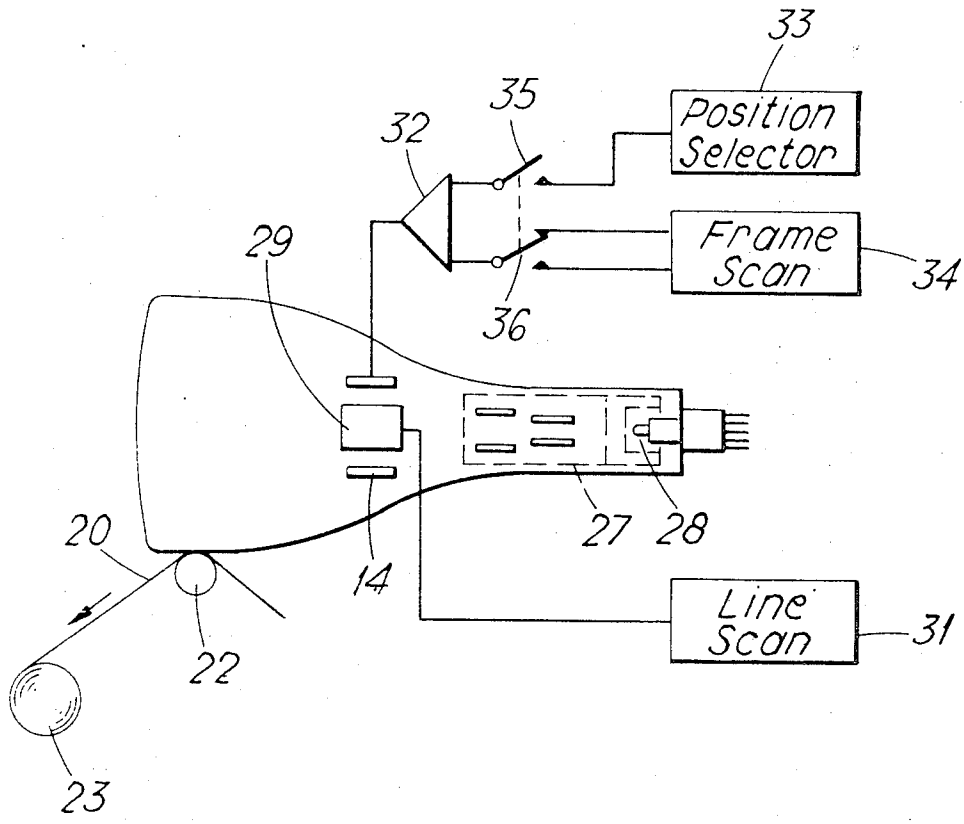


Fig. 1a.

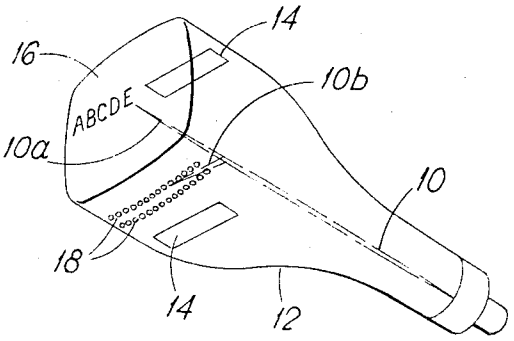


Fig. 2.

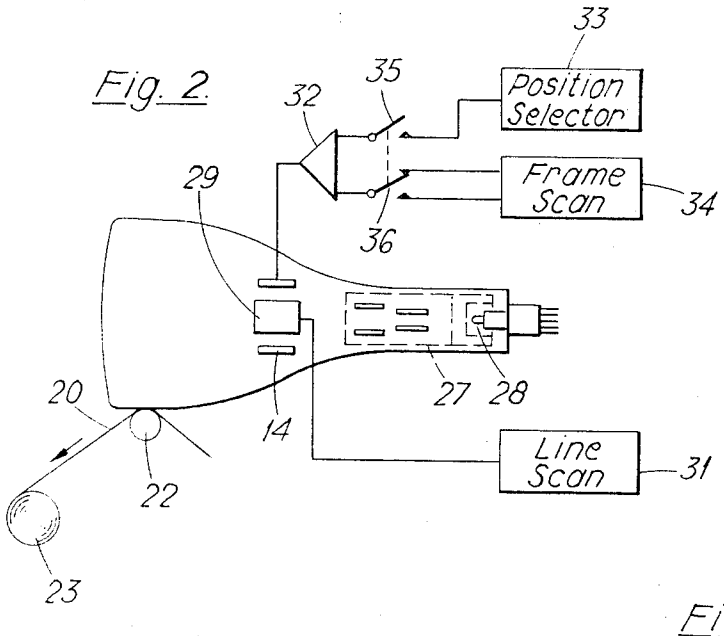


Fig. 1b.

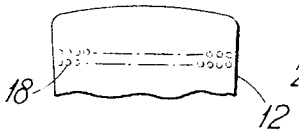


Fig. 4

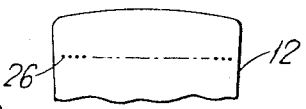
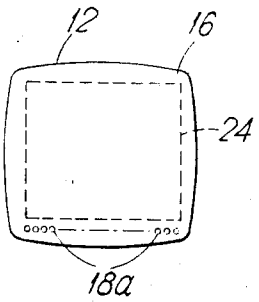


Fig. 3.



CATHODE RAY TUBES TO FACILITATE RECORDING

Cathode ray tubes may have already been used to provide visible alpha-numerical information, for example as a monitor at the output of a computer or for photocomposing. The characters may be generated on the face of a cathode ray tube by means of circuits which synthesise the character shapes or by using templates within a tube to create the required characters, for example. Usually, it is also required to have a permanent record of at least some of the output of a computer and consequently the data signals are separately fed to a high speed printer.

According to the present invention, a single cathode ray tube has, in addition to a gun for generating an electron beam with means for modulating the beam, deflection means for deflecting the beam at any instant to either of two paths so that the modulated beam forms similar images in two alternative positions on the tube envelope, the image formed in at least one of the positions being visible and providing a monitoring output and the tube wall at the position of the other image including a multiplicity of elements for transferring elements of the image, or representations of the said image elements, from the internal surface of the tube wall to the external surface thereof to facilitate recording of the image on a sensitised sheet. The reference to "similar images" in two alternative positions means that the same instantaneous image modulation is produced at the two alternative positions. It does not means that the two images are necessarily both visible or both of the same form; for example, the image at the position at which recording will take place may consist of a single scanning line, movement of a sensitised sheet taking the place of the frame scan present in the monitoring image.

As an example, the image for recording may be formed on a side wall of the tube. To facilitate recording, the part of the tube on which this other image is formed may consist of a piece of fibre-optic material providing a highly efficient light coupling to the outside of the tube. Images may then be reproduced on a light-sensitive sheet by direct contact of the sheet with the outside of the fibre-optic material. The light-sensitive sheet may, for example, pass over a roller in contact with the external ends of the fibre-optics. Only a narrow fibre-optics strip is necessary, since the light-sensitive sheet may be in continuous movement.

In an alternative form, the multiplicity of elements consists of electrically conductive particles in the tube wall capable of transferring representations of the image elements, in the form of electric charges, from the beam of the tube to the external wall of the envelope so that characters may be electrically recorded on a sensitised sheet at the external wall.

In order that the invention may be better understood, one example will now be described with reference to the accompanying drawings, in which:

FIG. 1*a* shows diagrammatically a cathode ray tube with two alternative beam paths;

FIG. 1*b* shows the fibre-optics strip in the bottom of the cathode ray tube shown in FIG. 1*a*;

FIG. 2 illustrates the path of the recording sheet with a tube of the kind shown in FIG. 1*a*;

FIG. 3 shows a tube face with the fibre-optics strip in an alternative position; and

FIG. 4 illustrates an alternative form of recording strip for the cathode ray tube.

In FIG. 1, the beam 10 within the cathode ray tube 12 can follow either of the paths 10*a* or 10*b*, depending upon the potentials applied to the deflector plates 14. When the beam follows the path 10*a* it produces a normal monitoring visible output on the screen 16 of the cathode ray tube. When it follows the path 10*b* it scans over a very narrow strip 18 of fibre-optic elements in the bottom face of the tube (see also FIG. 1*b*). For the path 10*b*, the frame deflection may be just sufficient to accommodate a line of type and the image reproduced by the fibre-optics may be stationary during recording or may move continuously in the "frame" direction of the fibre-optic strip. Alternatively, the phosphor behind the fibre-optic strip may be subjected to repetitive scanning along a single scanning line. The fibre-optic material efficiently couples the light generated at the phosphor to the outside of the tube. As shown in FIG. 2, a recording paper 20 is drawn by a driven roller 23 over a roller 22, the axis of which lies immediately under the fibre-optic strip, the paper being substantially in contact with the outer surface of the fibre-optic strip. The paper is advanced continuously if there is a single line scan along the phosphor behind the fibre-optic strip.

FIG. 2 also shows the electron gun 27 with cathode 28 and the horizontal and vertical deflection plates 29 and 14, the horizontal deflection plates being connected to a line scan deflection generator 31 and the vertical deflection plates being connected to a semi-amplifier 32 which adds signals received from a position selector 33 and the normal frame scan deflection generator 34. Switches 35 and 36, shown as contact switches for convenience, are connected in the two input leads to the amplifier 32 and are coupled for simultaneous operation. The switch 35 permits the position selector 33 to add its deflecting bias when required and the switch 36 permits one of two outputs of the frame scan generator 34 to be selected, a first of these outputs giving a full height monitoring picture on the front face of the tube envelope and the second of the two outputs giving a very restricted vertical scan, for use when the switches cause the beam to be deflected on to the fibre-optic strip 18.

FIG. 3 shows a form of cathode ray tube in which a single line fibre-optic strip 18*a* is set into the bottom part of the front face 16 of the cathode ray tube 12, under the area 24 occupied by the monitoring scan.

FIG. 4 shows an alternative form of cathode ray tube in which the bottom wall includes a piece of material including fine electrically conductive substances 26 to transfer an electric charge from the cathode ray tube beam to the external surface of the tube envelope so that characters may be electrically recorded on a sensitised sheet at the external wall of the envelope.

In its recording position, the light beam may also be used to discharge a photoconductive transfer plate for xerographic recording.

The field which forms the image in the second position may be electromagnetic or electrostatic. It may be a simple deflection field that simply changes the angle of the beam whilst maintaining its focus and other characteristics or it may completely reform the image in the second position.

Where occasional printing of the visible monitoring output is required, a switch can be arranged to permit

an operator watching the tube screen to cause the beam to be deflected to the "printing" image position when he wishes the visible output to be recorded. The tube thus acts as monitor and printer on a time-sharing basis. If printing and the monitoring output are required together, for example if all the data appearing in the monitoring position is to be recorded, the time-sharing operation can be made to occur at a much higher frequency.

Although the primary use of the invention is expected to be in the field of alpha-numeric data presentation and recording, it wlll be appreciated that it can also be used with other kinds of image, for example curves or drawings.

I claim:

1. A cathode ray tube comprising:

an envelope having first and second output portions;

a gun for generating an electron beam including means for modulating the beam;

deflection means for deflecting the beam at any instant to either of two paths so that the modulated beam defines corresponding image elements at said first and second output portions of said envelope;

said first output portion of said envelope carrying a luminescent screen to provide a visible monitoring image;

and said second output portion of said envelope including a multiplicity of elements for transferring elements of the image from the internal surface of said second output portion of said envelope to the external surface thereof to facilitate recording of the image on a sensitised sheet presented to said external surface.

2. A cathode ray tube in accordance with claim **1,** in which said multiplicity of elements at said second output portion consists of fibre optics having a phosphor material coated on their inner surfaces.

3. A cathode ray tube in accordance with claim **2,** in which the fibre optics together form a narrow strip in the tube envelope.

4. A cathode ray tube in accordance with claim **1,** in which said multiplicity of elements at said second output portion consists of electrically conductive particles in the tube envelope capable of transferring an electric charge from said beam to said external surface of said second output portion so that characters may be electrically recorded on a sensitised sheet at said external surface.

5. A cathode ray tube in accordance with claim **1,** in which the part of the envelope on which said second output portion is formed is in a side wall of the envelope.

6. A cathode ray tube in accordance with claim **1,** in which both the first and second output portions of the envelope are formed are in the front wall of the envelope.

7. Cathode ray tube apparatur comprising:

a cathode ray tube including an envelope having first and second output portions, and also including a gun for generating an electron beam including means for modulating the beam, and beam-deflecting members;

deflection-control means connected to said beam-deflecting members for deflecting the electron beam at any instant to either of said first and second output portions to define similar image elements at said first and second portions;

said first output portion of said envelope carrying a luminescent screen to provide a visible monitoring image;

and said second output portion of said envelope including a multiplicity of elements for transferring elements of the image from the internal surface of said second output portion of said envelope to the external surface thereof to facilitate recording of the image on a sensitised sheet; and

means for presenting a sensitised sheet to said external surface of said second output portion of said envelope.

8. Apparatus in accordance with claim **7,** in which said deflection-control means deflects said electron beam over only a narrow strip at said second output portion of said envelope.

9. Apparatus in accordance with claim **8,** in which said second output portion of said envelope consists of a narrow strip including a multiplicity of fibre optics elements, the apparatus further including a roller positioned adjacent the external surface of said second output portion of the envelope and means for passing a record material over the roller substantially in contact with said fibre-optics strip.

10. Cathode ray tube apparatus including a cathode ray tube in accordance with claim **1,** further including a manually operable switch to permit the beam to be deflected to form an image on said second output portion of the envelope when required by an operator watching the monitoring first output portion of the envelope.

11. Cathode ray tube apparatus including a cathode ray tube in accordance with claim **1,** including switching means for deflecting the beam between said first and second output portions of said envelope alternately at high speed so that the image elements at said two output portions are formed substantially simultaneously.

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