Oct. 5, 1965 W. P. SIEGMUND ETAL 3,210,597

ELECTRON BEAM INDEXING MEANS FOR CATHODE RAY TUBES

Filed March 19, 1962 2 Sheets-Sheet 1

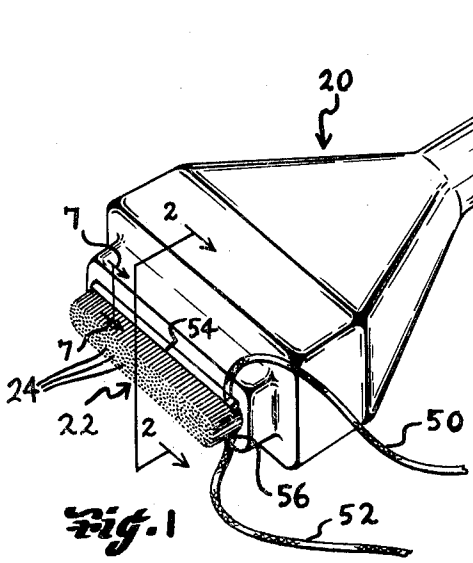


Fig. 1

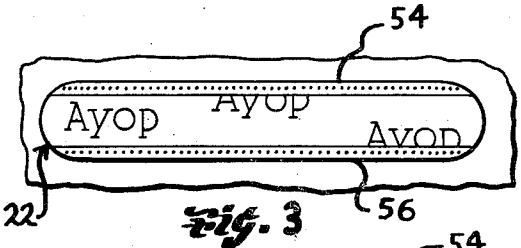


Fig. 3

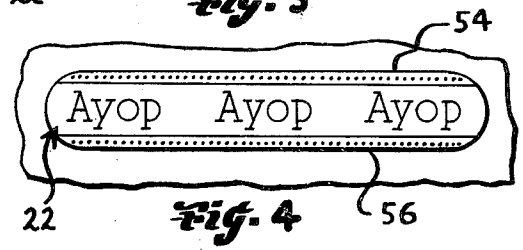


Fig. 4

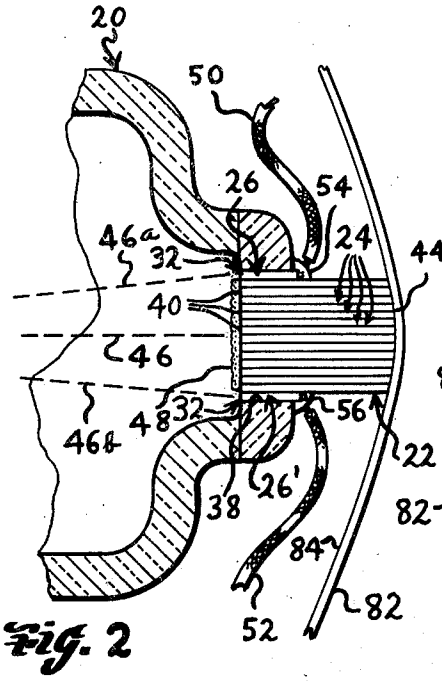


Fig. 2

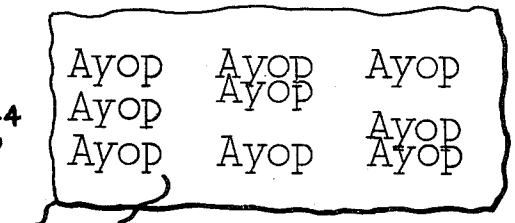


Fig. 5

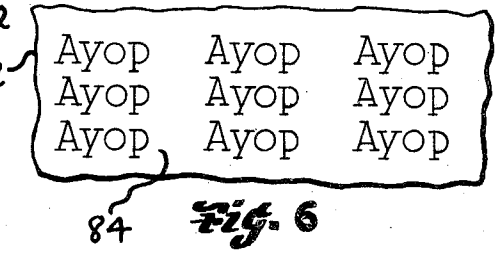


Fig. 6

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ELECTRON BEAM INDEXING MEANS FOR CATHODE RAY TUBES

Filed March 19, 1962 2 Sheets-Sheet 2

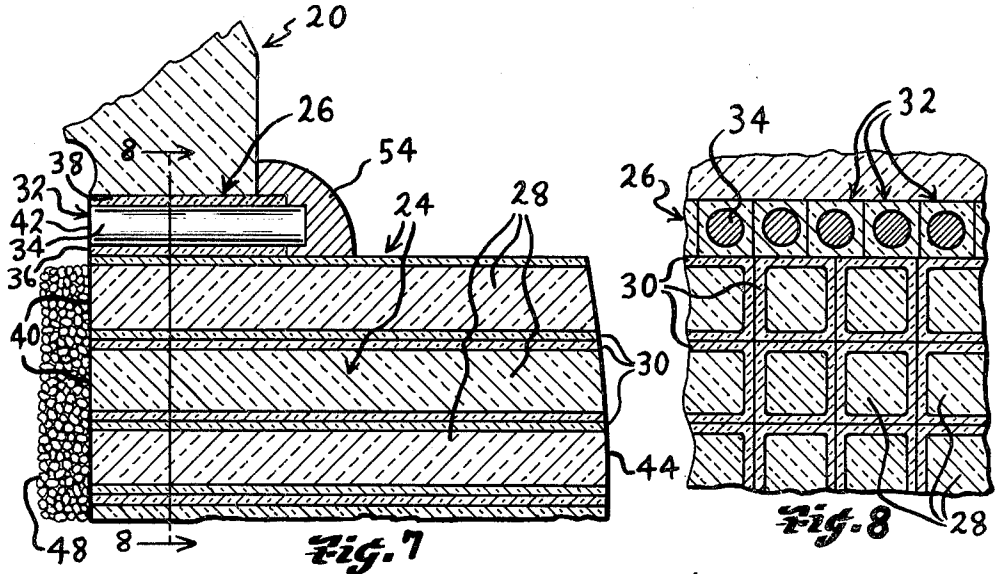


Fig. 7 Fig. 8

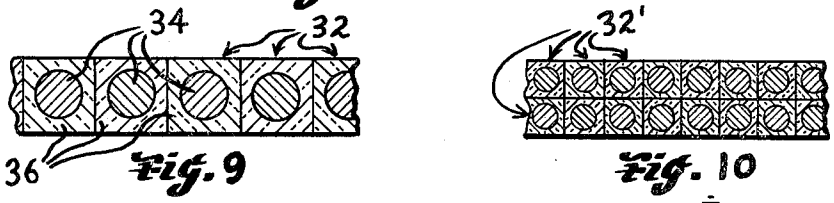


Fig. 9 Fig. 10

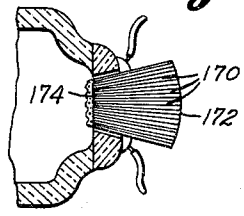


Fig. 13

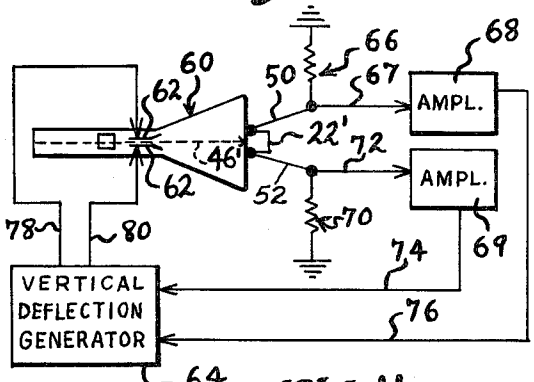


Fig. 11

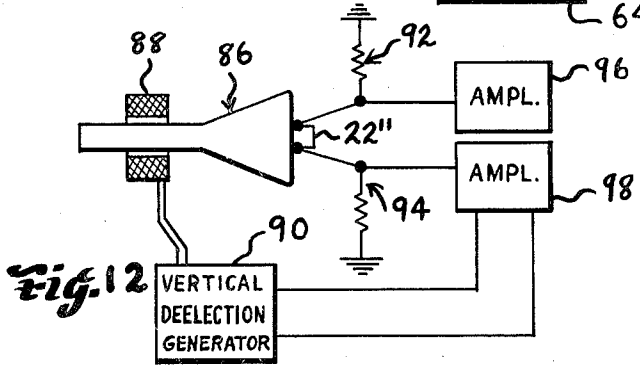


Fig. 12

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ELECTRON BEAM INDEXING MEANS FOR CATHODE RAY TUBES

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Filed Mar. 19, 1962, Ser. No. 180,629
7 Claims. (Cl. 315—21)

This invention relates to cathode ray tubes and video recording systems embodying such tubes and has particular reference to an improved face section for a cathode ray tube and means associated therewith for indexing the electron beam of the tube in such manner as to maintain the presentation of video information produced upon said face section in a fixed pre-established location during operation of the tube.

In a system of recording video image information from a cathode ray tube wherein recording material is directed over the face of such a tube to receive image information, the position at which such information is displayed on the tube face is critical. That is, the degree of accuracy with which video information can be displayed within given boundaries upon the image producing or recording face of such a cathode ray tube determines the accuracy of reproduction on the recording material. A fixed registration of video information on the recording face of a cathode ray tube of the above type would produce accurate, uniform and compact recordings and would result in more efficient use of recording material.

Unfortunately, however, voltage fluctuations are inherent in the deflection signals of conventional cathode ray tube circuits and these voltage fluctuations have, heretofore, rendered it difficult to produce a stable video image upon the image forming or recording face of such a tube. Such voltage fluctuations need only to be of relatively small magnitudes to produce a substantial fluctuation or shifting of the image information. For example, in an average electrostatic deflection tube, an overall variation of one volt on the vertical deflecting plates might produce image misalignment errors in the order of $\frac{1}{32}$ of an inch.

Since standard single spaced typewriter type is approximately $\frac{11}{64}$ of an inch between corresponding points in two adjacent lines while the distance between the lowest character (the tail of a y, for example) and the tallest character (a capital letter) in the next line is only $\frac{1}{32}$ of an inch, it is necessary to maintain alignment of these characters in the video image to better than $\frac{1}{32}$ of an inch in order to prevent overlap in the recording. That is, in order to prevent overlapping of image characters in successive lines of single spaced typewriter type being recorded from a cathode ray tube face, the cathode ray tube vertical deflection voltage must not fluctuate by more than one volt. Actually in order to produce an exact copy of single spaced typewriter type, the cathode ray tube vertical deflection voltage should not fluctuate at all.

While the above discussion has related more particularly to the line presentation of subject matter such as typewriter type, it is pointed out that the same conditions and drawbacks to recording with unstable video images would be applicable to various other forms of information such as picture information or computer information intended to be recorded or stored. That is, for example, overlap of picture image information due to shifting of the elements of a video picture image being recorded would produce distortions and consequently poor definition in the resultant composite recording of the picture.

The present invention overcomes such difficulties as have been mentioned above with relation to cathode ray tube recorders or the like and has for its general object the provision of a novel cathode ray tube face structure and electrical system associated therewith for use in recording systems or the like.

Another object is to provide an improved image forming and transmitting face section for a cathode ray tube having an area on which video information is intended to be presented bounded by electrical conductive means constructed and arranged to be used in conjunction with the operation of the tube for the purpose of stabilizing the presentation of video information on said area.

Another object is to provide a face section for a cathode ray tube of the above character wherein the area thereof upon which video information is to be presented is formed of a plurality of light-conducting fibers secured together in vacuum tight side-by-side relation with each other and bounded along at least two of its opposite sides by electrical conducting members adapted to be electrically charged when impinged by the image producing electron beam of the tube.

Another object is to provide means adapted to receive and utilize electrical charges produced in said electrical conducting members in such manner as to index the image-producing electron beam of the cathode ray tube sufficiently to cause its trace to be contained within the area bounded by said electrical conducting means.

Another object is to provide a cathode ray tube face of the above character wherein said electrical conducting means along each of the opposing sides of the area intended to receive video information is comprised of a row of metallic fibers electrically connected together in their respective rows and disposed substantially parallel to the axes of the light-conducting fibers in said face.

Another object is to provide a cathode ray tube having a face structure of the above character wherein means may be connected to said rows of metallic fibers externally of the cathode ray tube for the purpose of receiving electrical charges from the same and for applying said charges to the usual electron beam deflection circuits of the tube.

Another object is to provide a novel cathode ray tube recording face of the above character which is compact, relatively simple and economical to construct, and so uniquely arranged upon the tube envelope as to perform its intended function with the utmost in precision and efficiency.

A further object is to provide, in general, an improved cathode ray tube recording system of the above character which is capable of producing highly accurate undistorted reproductions of original image information and by means of which exceptional efficiency in the use of recording material is made possible.

Other objects and advantages of the invention will become apparent from the following description when taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of a cathode ray tube embodying a face section of the type relating to this invention;

FIG. 2 is an enlarged fragmentary cross-sectional view of the cathode ray tube taken approximately as indicated by line 2—2 in FIG. 1 looking in the direction of the arrows and further illustrating photocopy material against said face section for receiving image information therefrom;

FIGS. 3 and 4 are diagrammatic fragmentary front elevational views of the cathode ray tube face section wherein video information is depicted as it would be displayed on said face section under different tube operating conditions;

FIGS. 5 and 6 are diagrammatic representations of recordings of said video information;

FIG. 7 is a greatly enlarged fragmentary cross-sectional view taken on line 7—7 of FIG. 1;

FIG. 8 is a fragmentary cross-sectional view taken on line 8—8 of FIG. 7;

FIGS. 9 and 10 are enlarged cross-sectional views of modified electrical energy-conducting sections each of a type adapted for use in the fabrication of cathode ray tube face sections in accordance with this invention;

FIG. 11 is a schematic illustration of the cathode ray tube image producing system of the invention as adapted for use with the electrostatic type of cathode ray tube;

FIG. 12 is a schematic illustration of the system of the invention as adapted for use with the electromagnetic type of cathode ray tube; and

FIG. 13 illustrates a modification of the invention wherein a cathode ray tube is provided with an image enlarging face plate.

Referring to the drawings wherein like characters of reference designate like parts through the several views, it can be seen that the invention relates primarily to the provision of an improved energy-conducting face section for a cathode ray tube or the like.

In one aspect of the invention (see FIGS. 1–8) a cathode ray tube **20** is provided with a face section **22** formed in part of optical fibers **24** which receive image information internally of the cathode ray tube **20** and convey said information to a point outwardly of the tube where it may be viewed or preferably recorded for future use.

The face section **22** which has been shown for purposes of illustration as being formed primarily of optical fibers **24** also embodies a first row of electrical-conducting fiber elements **26** (see FIGS. 2 and 7) extending along its upper side and a second row of similar electrical-conducting fiber elements **26'** extending along its underside.

The optical fibers **24** each embody a core part **28** formed of a light-conducting material such as optical glass having a relatively high index of refraction and a relatively thin cladding **30** of material (preferably glass) having a relatively low index of refraction. The fibers **24** may be of any desired cross-sectional shape and size and are arranged in fused side-by-side relation with each other so as to form a vacuum-tight structure.

As it can be seen in FIG. 8 the optical fibers **24** have been shown as being generally square in cross-sectional shape so as to form a compact mosaic-like structure. They may, however, be hexagonal, triangular or of any interfitting shape such as to produce a vacuum-tight fused assembly. The cross-sectional size of the optical fibers **24** is selected in accordance with the image resolving power desired of the face section **22** and, accordingly, for most practical purposes, optical fibers ranging in size from several thousandths of an inch to only a few ten-thousandths of an inch or less in thickness may be used. Optical fibers having a cross-sectional dimension of approximately from one quarter to three thousandths of an inch are generally considered the most practical for use as cathode ray tube image transfer means.

Since each optical fiber **24** in the face section **22** is intended to receive an element of a total image received by the face section **22** and should function to transfer this image element through the face section **22** independently of other optical fibers, the indices of refraction of its core **28** and claddings **30** are preselected so that the claddings **30** will function to prevent cross talk or interaction of image light between fibers. In this respect, a typical optical fiber **24** might embody a core part **28** formed of optical flint glass having an index of refraction of approximately 1.75 and a cladding **30** of soda lime glass or the like having an index of refraction of 1.52. The thickness of the cladding **30** might be, for example, approximately $\frac{1}{10}$ that of the overall thickness of the fiber **24**.

The optical fibers **24** in the particular instance illustrated in FIGS. 1–8 in the drawings are arranged to form a relatively long and narrow generally rectangular face section **22** which extends horizontally across the forward end of the cathode ray tube envelope.

The first and second rows **26** and **26'** of electrical-conducting fiber elements are positioned to extend across the respective upper and lower edges of the face section **22**. Each fiber element **32** comprises a metallic core section **34** which is preferably shorter in length than the optical fibers **24**. The core sections **32** may be formed of stainless steel and are preferably relatively closely spaced and similar in diameter to that of the optical fibers **24**. Tungsten, copper or other metals or alloys thereof may be used for the core section **34**. The metallic core sections **34** of the fiber elements **32** are individually electrically insulated from one another by a cladding **36** of dielectric material preferably consisting of a glass which is readily fusible to the claddings **30** of the optical fibers **24**.

In fabricating the rows **26** and **26'** of electrical-conducting fiber elements, their core sections **34** would be clad individually with glass as shown in FIG. 9 and assembled along with and substantially parallel to the optical fibers **24** whereupon the whole structure would be fused to form the vacuum-tight face section **22** shown in FIG. 8.

As an alternative to the structure of the single row of electrical-conducting elements which is shown in FIGS. 1, 7, 8 and 9, two or more superimposed rows of glass clad metallic fiber-like elements **32'** may be arranged as shown in FIG. 10 and fused to the optical fiber assembly.

The entire unitary structure of the optical fibers **24** and the rows **26** and **26'** of the electrical-conducting fiber elements is, as a whole, edge fused or otherwise heat sealed in a receiving opening **38** provided in the envelope of the cathode ray tube **20**.

As it can be seen in FIGS. 2 and 7 the inner or image receiving faces **40** of the optical fibers **24** and the adjacent inner faces **42** of the electrical-conducting fiber elements **32** are disposed in substantially flush relation with each other. Outwardly of the cathode ray tube envelope, however, the optical fibers **24** extend a substantial distance away from the cathode ray tube envelope to locate the image emitting face **44** thereof away from the tube envelope mainly for the purpose of avoiding interference with the tube envelope structure when directing image recording material over the face **44** in a manner to be described in detail hereinafter.

The outer ends of the electrical-conducting fiber elements **32** terminate adjacent the outer face of the cathode ray tube envelope (see FIGS. 2 and 7).

As it is conventional in the operation of cathode ray tubes, image information is directed upon the image receiving face of the tube in the form of an electron beam **46** (see FIG. 2) whose flow of electrons is modulated in accordance with the picture pattern to be produced upon the tube face plate. Also, the electron beam is caused to scan or trace across the image receiving face of the tube at a precontrolled rate sidewise and also vertically to produce a succession of line-like images which, in total, are known as the raster. In order to convert the electron energy in the electron beam into light energy so as to form an optical or video image upon the tube face, a phosphor coating **48** is applied to the inner faces **40** of the optical fibers **24** (see FIGS. 2 and 7).

The method and means for producing the raster on the cathode ray tube face section **22** and for producing optical images in said raster are conventional and require no further description with relation to this invention. However, it can be seen that when the raster becomes displaced above or below the area defined by the faces **40** of the optical fibers **24**, the uppermost or lowermost horizontal traces of the electron beam **46** will strike the inner faces **42** of the electrical-conducting fiber elements **32** in the rows **26** or **26'** thereof. This is illustrated diagrammatically in FIG. 2 wherein it can be seen that

when the raster is displaced upwardly, the electron beam (as shown by dash line 46*a*) will impinge upon the row 26 of electrical-conducting fiber elements 32. In a similar manner, when the raster is displaced downwardly, the electron beam (as shown by the dash line 46*b*) will impinge upon the row 26' of electrical-conducting fiber elements 32. In so doing, the metallic core sections 34 of these fiber elements become electrically charged and thus, an electrical signal can be derived from the fiber elements 32 immediately as they are impinged by the electron beam 46.

From the above, it can be seen that if the raster of a cathode ray tube such as 20 moves up or down, above or below the upper and lower boundaries of the optical fiber faces 40, an electrical charge will be produced in the particular electrical energy-conducting fiber elements 32 which are struck by the electron beam 46.

In accordance with this invention, any electrical charge produced in the fiber elements 32 is sensed, amplified and fed back into the tube operating circuits to cause the raster to be indexed or adjusted so as to be centered over only the inner faces 40 of the optical fibers 24. This operation of indexing will be described in detail shortly with particular reference being made to different types of cathode ray tubes.

In order to receive an electrical charge produced in any one or several of the electrical-conducting fibers of a particular row 26 or 26' thereof, each of the metallic core sections of the fiber elements in the row 26 are electrically connected to an electrical line 50 (see FIG. 1 or 2). Likewise, each of the metallic core sections of the electrical-conducting fiber elements in the row 26' thereof are similarly connected to a line 52 (see FIG. 1 or 2). The above electrical connections between the fiber elements 32 and the respective lines 50 and 52 are made by providing bus bars 54 and 56. The bus bar 54 makes electrical contact with each core section 34 of the fiber elements 32 in the row 26 thereof and the bus bar 56 makes electrical contact with each core section of the fiber elements in the row 26' thereof. The lines 50 and 52 are electrically connected to the respective bus bars 54 and 56.

The bus bars 54 and 56 may be formed of solder or the like, silver paint or a metal amalgam. In order to assure good electrical contact with the metallic core sections 34 of the fiber elements 32, the cladding material 36 therearound is preferably recessed back from the outer ends of the fiber elements 32 as shown in FIG. 7 to provide a larger area of contact between the material of the respective bus bars and the said core sections 34.

As mentioned above, the purpose of the cathode ray tube face structure just described is to provide means for keeping the picture raster of the cathode ray tube centered in the vertical meridian at all times upon optical section of the face structure (the optical section being that portion of the face structure which is made up of the optical fibers 24 only).

The raster size in the present case is controlled conventionally to be of a height or vertical dimension equal to or slightly less than the vertical dimension of the optical section of the cathode ray tube face by means of vertical deflection control means provided either within (electrostatic deflection) or externally (electromagnetic deflection) of the neck portion 58 of the tube 20.

In FIG. 11 there is illustrated schematically an electrostatic deflection type cathode ray tube 60 having a face section 22' of the type shown in detail in FIGS. 1–8 of the drawings.

All parts of the cathode ray tube 60 are conventional with the exception of the face section 22' and accordingly, in the usual manner of operation, the vertical deflection plates 62 operate to control the vertical positioning and vertical size of a raster produced upon the receiving end of the face section 22'. An electrical signal is fed to the vertical deflection plates 62 from a conventional vertical deflection generator 64. The generator 64 functions to supply a signal to the plates 62 which is such as to deflect the electron beam 46' within the tube 60 vertically by controlled amounts and in controlled sequence with the horizontal scanning of the electron beam 46' so as to produce a raster on the face section 22' of a desired shape and size.

The art of controlling the shape and size of a raster produced in a cathode ray tube by means of electrostatic deflection techniques is well known. However, in conventional electrostatic cathode ray tube operating circuits, the signal from the vertical deflection generator 64 inherently and unavoidably fluctuates from time to time by a few volts more or less than the normal intended voltage. This naturally causes the raster to change in size and/or shift in position on the face of the tube in amounts in accordance with the extent of voltage fluctuation.

It has not been possible heretofore, from practical or economical standpoints, to eliminate voltage fluctuations in the deflection circuits and consequently fluctuations in the voltage of the signal applied to the vertical deflection plates of an operating cathode ray tube cause its raster and image produced thereon to shift up and down in accordance with the extent of such voltage fluctuations. It has been found that as small a fluctuation as one volt will shift a picture image as much as $\frac{1}{32}$ of an inch.

The results of such voltage fluctuations on the vertical deflection plates of conventionally operated cathode ray tubes are illustrated diagrammatically in FIG. 3 wherein it can be seen that the presentation of three groups of letters A*yop*, which should appear as shown in FIG. 4 on the cathode ray tube face section 22, have been shifted to different vertical positions. The entire line of the three groups of letters A*yop* may, in some instances, be shifted either up or down from a desired centered location on the face section 22.

The groups of letters A*yop*, in FIGS. 3 and 4, are shown, for purposes of illustration only, to represent cathode ray tube images of standard typewriter type being displayed upon the cathode ray tube face section 22. However, it should be understood that similar conditions of misalignment of other forms of image information would result from voltage fluctuations in the vertical deflection systems of conventional cathode ray tube image producing systems.

In order to overcome the above-described adverse effects of voltage fluctuations in the vertical deflection systems of operating cathode ray tubes and to produce image information on the cathode ray tube faces which is in fixed registration on said faces, the present invention operates as follows:

Referring again to FIG. 11 wherein the above-described electrostatic type of cathode ray tube 60 is illustrated, movement of a picture raster on the face section 22' upwardly will cause the electron beam 46' to immediately impinge upon the electrical-conducting fiber elements 32 of the upper row 26 thereof (see FIGS. 2 or 7). This will produce an electrical charge in the metallic core sections 34 of the fiber elements 32 which, in passing through the bus bar 54 and line 50, is sensed by a signal detector 66. The detector 66, for example, might comprise a simple shunt resistor connected to ground as illustrated schematically in FIG. 11. From the detector 66, the resultant electrical signal is fed by a line 67 to a conventional signal amplifier 68.

Similarly, movement of a picture raster downwardly on the face section 22' will cause the electron beam 46' to immediately impinge upon the electrical-conducting fiber elements 2 and of the lower row 26' thereof (see FIG. 2). This will then produce an electrical charge in the metallic core sections 34 of the row 26' of fiber elements which, in passing through the bus bar 56 and line 52, is sensed by a signal detector 70. The signal detector 70 is

identical to the detector 66 and the signal is fed from the detector 70 by a line 72 to a signal amplifier 69.

From the respective amplifiers 68 and 69, separate signal carrying lines 74 and 76 are provided which are each interconnected (internally of the vertical deflection generator 64) to one of the lines 78 and 80 which energize the vertical deflection plates 62 from the vertical deflection generator 64.

When a signal is sensed by the detector 66 which indicates that the raster on the face section 22 is too high and must be lowered, the signal is amplified at 68 and fed to the vertical deflection generator 64 where it is combined with the normal signal produced in lines 78 and 80 from the generator 64. In this way, the signal from the amplifier 68 functions to render the lowermost deflection plate 62 more positively charged so as to pull the electron beam 46' downwardly and thus lower the raster on the face section 22' without disrupting the normal sweep pattern of the electron beam 46'. As soon as the electron beam 46' ceases to impinge upon the row 26 of electrical-conducting fiber elements 32, no signal is detected at 66 or 70 and the cathode ray tube vertical deflection system continues to function conventionally.

When the raster on the face section 22' moves downwardly to the point where the electron beam 46' impinges upon the row 26' of electrical-conducting fibers (see FIG. 2) a signal is sensed by the detector 70, amplified at 69, fed into the generator 64 and to the deflection plates 62 in such manner as to render the uppermost deflection plate 62 more positively charged than normal which causes the raster to be raised until the electron beam no longer impinges upon the row 26' of electrical-conducting fiber elements 32.

The invention, therefore, provides electron beam indexing means which functions to maintain a cathode ray tube raster in a fixed predetermined vertically centered relation on the face section of the tube as shown in FIG. 4 at all times regardless of usual voltage fluctuations in the deflection circuits of such tubes.

In recording video information from a cathode ray tube, it is the practice to direct a photosensitive recording sheet 82 (see FIG. 2) over the image emitting face 44 of the tube 20.

The sheet 82 is moved in timed sequence with the presentation of the image information to expose its emulsion surface 84 and is thereafter photographically processed to produce the recorded image or succession of images, as the case may be.

It is demonstrated in FIGS. 3–6 that if the image being recorded were allowed to shift vertically as shown in FIG. 3 because of voltage fluctionations in the vertical deflection circuits of the cathode ray tube 20, the resultant recording would appear somewhat as shown in FIG. 5 wherein successive lines of the groups of letters *Ayop* become overlapped and difficult to read.

In accordance with this invention, however, when the image being recorded is maintained in fixed vertically centered relation on the image emitting face 44, and not permitted to shift positions because of voltage fluctuations, its recording would appear substantially as shown in FIG. 6.

In FIG. 12, it is illustrated that the system of the invention for indexing the electron beam of an electromagnetic deflection type of cathode ray tube is substantially identical to that described with relation to the electrostatic deflection type cathode ray tube in FIG. 11.

An electromagnetic deflection type cathode ray tube 86 is schematically illustrated in FIG. 12 as having deflection means 88 externally of the neck portion of the tube 86 in conventional fashion. The deflection means is operated to control the vertical sweep path of the electron beam in the tube 86 by means of the usual vertical deflection generator 90.

The electron beam control or indexing means in FIG. 12, which includes the face section 22'', signal detectors 92 and 94 and amplifiers 96 and 98, is identical in operation and function to the similar parts 22', 66, 70, 68 and 69 shown and described above with relation to FIG. 11.

In FIG. 13, it is illustrated that a fiber type face section which is substantially identical to the face section 22 in FIGS. 1, 2 and 7 may be constructed of tapered optical fibers 170 to provide an image-emitting face 172 which is larger than its image receiving face 174. In this manner of construction, images received at 174 are enlarged or magnified as they are emitted at the face 172.

It is also pointed out that in all instances where optical fibers were referred to hereinabove, these optical fibers may be replaced by glass clad metal core fibers. In all cases where optical fibers are used, their image-receiving faces would be provided with phosphor coatings. When metal core fibers are used, no phosphor coatings are applied to their image-receiving faces.

The alternative of using metal core fibers in place of glass core fibers would be employed in instances where it is desired to transfer image information through a cathode ray tube face section as a mosaic-like electrical charge pattern which may then be recorded by a xerographic process or the like.

From the foregoing, it can be seen that improved simple and economical means has been provided for accomplishing all of the objects and advantages of the invention. It should, however, be apparent that many changes in the details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as expressed in the accompanying claims and the invention is not to be limited to the exact matters shown and described as only preferred matters have been given by way of illustration.

Having described our invention, we claim:

1. A cathode ray tube face structure of the character described comprising the combination of an image-transmitting section formed of a multiplicty of glass clad energy-conducting fibers fused together in side-by-side relation with each other and a relatively narrow boundary section formed of glass clad electrical-conducting fibers disposed in side-by-side relation with each other along an edge of said image-transmitting section, the fibers of said boundary section being arranged substantially axially parallel to the fibers of said image-transmitting section and being fused one to the other and to adjoining fibers of said image-transmitting section and an electrical conductor connected to one end of each of said electrical-conducting fibers adjacent one side of said face structure.

2. A cathode ray tube face structure of the character described comprising the combination of an image-transmitting section formed of a multiplicity of glass clad light-conducting fibers each having a glass core, said fibers being fused together in substantially vacuum tight side-by-side relation with each other, a relatively narrow boundary section formed of glass clad electrical-conducting fibers each having a metallic core, said fibers of said boundary section being disposed in side-by-side relation with each other along an edge of said image-transmitting section and arranged substantially axially parallel to the fibers of said image-transmitting section and an electrical conductor electrically connected to one end of each metallic core of said electrical-conducting fibers.

3. The structure of a cathode ray tube face comprising a relatively large area, fiber optical image-transmitting section formed of a multiplicity of fused light-conducting fibers and a relatively long and thin electrical energy-transmitting section formed of electrical-conducting fiber elements disposed in side-by-side relation with each other along an edge of said image-transmitting section, said electrical-conducting fiber elements being arranged substantially axially parallel to the fibers of said image-transmitting section and fused together and to said image-transmitting section and electrical-conducting means electrically connected to one end of each of said electrical-conducting fiber elements adjacent one side of said face.

4. The structure of a cathode ray tube face comprising a relatively long and narrow image-transmitting section formed of a multiplicity of glass clad energy-conducting fiber elements arranged in fused side-by-side, substantially parallel relation with each other, a first row of glass clad electrical-conducting fiber elements arranged in fused side-by-side relation with each other along one edge of said image-transmitting section, a second row of glass clad electrical-conducting fiber elements arranged in fused side-by-side relation with each other along a second edge of said image-transmitting section, the electrical-conducting fiber elements of said first and second rows thereof being positioned on said image-transmitting section with respective longitudinal axes thereof disposed substantially parallel to the longitudinal axes of said fibers of said image-transmitting section, said electrical-conducting fiber elements being fused to said image-transmitting section, a pair of electrical-conducting members, one of said members being electrically connected to one end of each of said electrical-conducting fiber elements in the first row thereof and the other of said members being connected to one end of each of said electrical-conducting fiber elements in the second row thereof.

5. A cathode ray tube face structure of the character described comprising an image-transmitting section formed of a multiplicity of glass clad energy-conducting fibers having a relatively long axial dimension, said fibers being fused together in side-by-side relation with each other and with corresponding opposite ends thereof arranged to form image-receiving and image-emitting opposite faces of said section, a row of glass clad electrical-conducting fiber elements arranged in fused side-by-side relationship with each other along an edge of said image-transmitting section with respective axes thereof disposed substantially parallel to the axes of said fibers of said image-transmitting section, corresponding one ends of said electrical conducting fiber elements being substantially flush with said image-receiving face of said image-transmitting section and electrical-conducting means electrically connected to an end of each of said electrical-conducting fiber elements opposite to said one ends thereof, said electrical-conducting elements being of a shorter axial dimension than that of said first mentioned fibers whereby said electrical connections can be made without interference with the image emitting face of said image-transmitting section.

6. In combination with cathode ray means for emitting an electron beam to transmit image information and means for deflecting the beam to describe a trace of such information along a predetermined path, a multiplicity of energy-conducting fibers each having an energy-insulating cladding thereon, certain of said fibers being arranged in substantially parallel side-by-side relationship along said path and being adapted to receive and transmit said image information therethrough when the trace is maintained in said path, the remaining fibers being arranged in substantially parallel side-by-side relationship with said certain fibers along a side of said path to receive and transmit portions of said information caused to impinge thereupon when said trace deviates from said path and means responsive to information transmitted by said remaining fibers for regulating said beam-deflecting means to return said trace to said predetermined path.

7. In combination with cathode ray means for emitting an electron beam to transmit image information and means for deflecting the beam to describe a trace of such information along a predetermined path, an energy-conducting face plate comprising an image-transmitting section formed of a multiplicity of glass clad energy-conducting fibers fused together in side-by-side relationship along said path and being adapted to receive and transmit said image information therethrough when said trace is maintained in said path, a boundary section on said face plate of glass clad electrical-conducting fibers arranged along a side of said path to receive and transmit portions of said information impinging thereupon when said trace deviates from said path, said electrical-conducting fibers being fused together and to said image-transmitting section in substantially parallel side-by-side relationship with the fibers of said image-transmitting section and means responsive to information transmitted through said electrical-conducting fibers for regulating said beam-deflecting means to return said trace to said predetermined path.

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