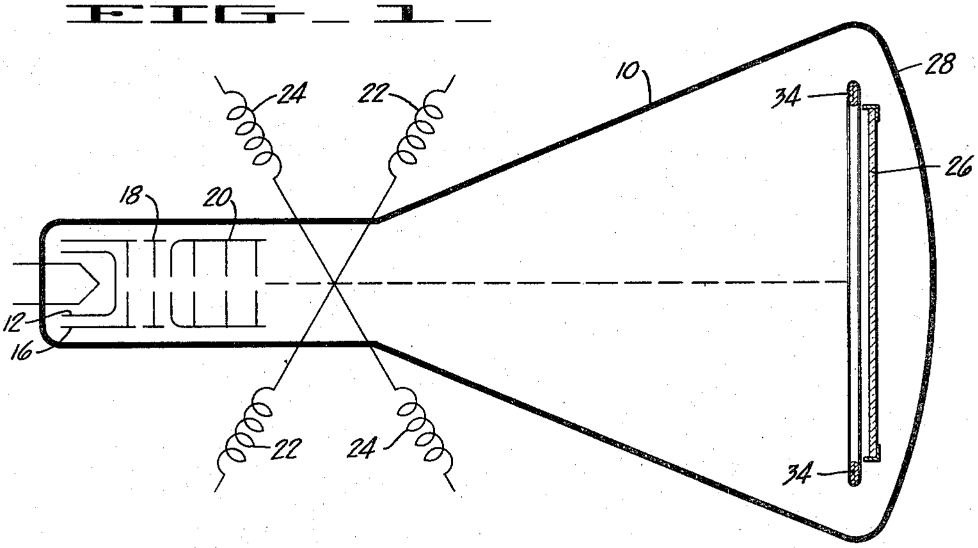
Jan. 8, 1957 L. W. ALVAREZ 2,777,083

ELECTRODE CONSTRUCTION FOR CATHODE-RAY TUBES

Filed April 19, 1954 2 Sheets-Sheet 1

FIG_1_



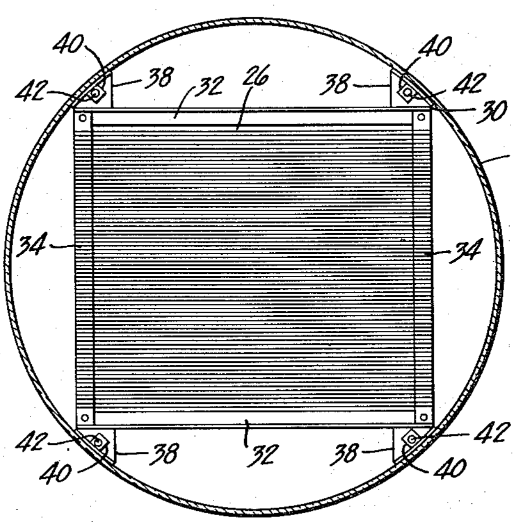


FIG_2_

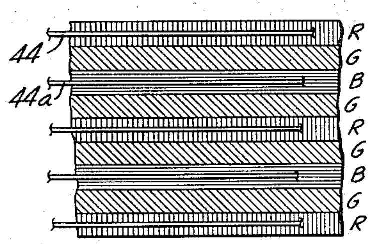


FIG_7_

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ELECTRODE CONSTRUCTION FOR CATHODE-RAY TUBES

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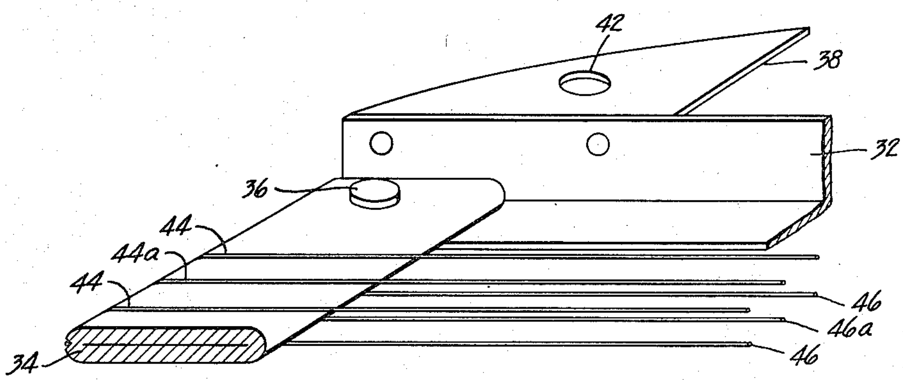

FIG. 5

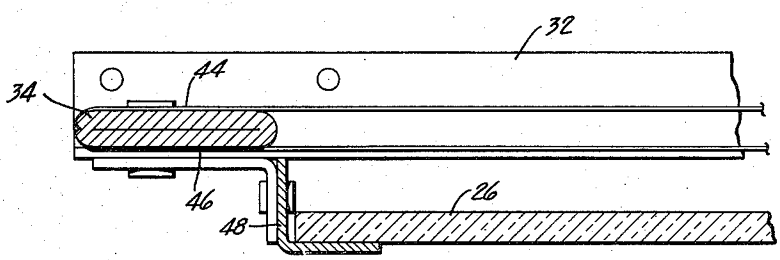

FIG. 3

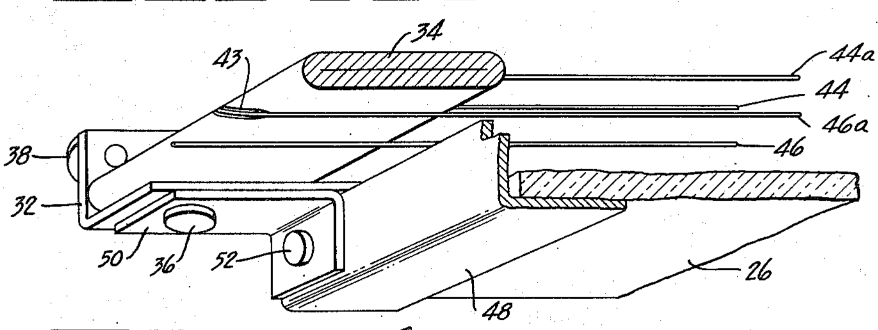

FIG. 4

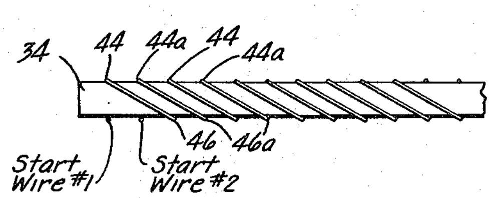

FIG. 6

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ELECTRODE CONSTRUCTION FOR CATHODE-RAY TUBES

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Application April 19, 1954, Serial No. 423,935

7 Claims. (Cl. 313—78)

The present invention relates to electrode structures for image-producing cathode-ray tubes. More particularly, the invention relates to an electrode structure, designed for cathode-ray tubes adapted to reproduce polychrome images, which is not only of a simple nature and readily fabricable but which in addition acts to bring about an auxiliary, or micro-deflection, of the cathode-ray beam in the vicinity of the target with a minimum of deflecting power.

Cathode-ray tubes are now known in the art which have a grid of parallel linear conductors located adjacent to a striped phosphor screen. A grid of this nature may serve as one component of an electron lens system to focus the beam electrons into a pattern of thin lines registered with the phosphor strips of the screen, and, by the application of proper switching potentials to the linear conductors of the grid, a selective micro-deflection of the beam onto the various phosphor areas may be brought about and hence the reproduction of a polychrome image.

One form which these linear conductors may take is that of a series of strips of sheet metal mounted parallel to one another in the dimension extending across the target area and lying in planes substantially parallel to the paths of electrons from the gun to the phosphor-coated target proper. Adjacent strips are mutually insulated from one another, and alternate strips are connected together to respective output terminals. The elements of this strip assembly are so arranged that the structure as a whole is at a substantially uniform distance from the surface of the target area. The latter is coated with a conductive film having electron-permeable characteristics, so that, when suitable potentials are applied thereto and to the strips of the electrode structure, these elements will together constitute an electron lens which has a converging effect upon the electrons of the scanning beam which pass between adjacent plates. This convergence may be to a line focus on the target surface.

Alternatively, instead of plates, linear conductors as wires may be employed. All of these linear conductors are intended to lie in a single plane close to the surface of the target electrode.

The above effect will be more clearly understood when the action of the electrostatic field in the region of the conductors on an electron passing between adjacent conductors is considered. The lines of force which comprise this electrostatic field set upon the electrons in the scanning beams in such a manner that any particular electron passing through the space between two adjacent strand conductors (unless it passes through the exact center of the space between these conductors and normal to the plane thereof) is directed away from the nearest conductor by the lateral component of this electrostatic field. Expressed differently, an electron passing perpendicularly through the exact center of the space between adjacent conductors will cross or cut none of the lines of force, and therefore will hold to its original path. An electron passing very close to either conductor

will cut a major portion of the field lines terminating on that conductor, and therefore will be repelled from the latter by a relatively large lateral force. It may thus be said that all of the electrons in the scanning beam which pass between any two adjacent conductors are subjected to lateral forces which are at least approximately proportional to their distance from the axis of the individual lens defined by the conductors in question, so that there is a resultant convergence of the beam electrons toward a single line upon the phosphor-coated target surface.

As brought out above, adjacent conductors of the electrode assembly are mutually insulated and alternate strips or conductors are connected together. If now a difference of potential is applied between these two sets of conductors, a deflection field is created such that all of the electrons in the beam passing through the interspace between the conductors will be given equal accelerations away from the conductor which is negative toward the one which is positive. The result is a shifting of focus toward whichever of the conductors happens to be positive at the moment. In adjacent elementary lenses, therefore, the deflection occurs in opposite directions.

In the case of deflection of the beam at a field-sequential rate, the color-control voltage used will preferably be of substantially rectangular wave form of a frequency equal to one-third the field frequency, the wave form having a positive potential for the first one-third of the cycle, zero for the next one-third, and negative for the last one-third of the cycle. With a line-sequential system, the wave form might be substantially the same but at one-third line instead of one-third field frequency. The dot-sequential system, or one in which colors are displayed at so-called element frequency, could still use the same wave form at a corresponding higher frequency, or this wave form could be that of a sine wave which would display green twice per cycle for a short period, and red and blue once per cycle for a longer period. As a still further example, this sine wave could be broken up into display periods spaced 60 electrical degrees apart.

When the phosphor-coated target is covered with an electron-permeable layer of conductive material, and when this electron-permeable layer has a potential applied thereto which is considerably higher than the average, or mean, potential of the deflecting electrode, then very little power will be required to cause a deflection of the cathode-ray beam back-and-forth between various colored phosphor areas of the screen in the manner above described. It will also be recognized that the frequency of color change has a very material effect upon the power requirements, the latter being very much higher for color change produced at so-called "element" frequency than it is for either line- or field-sequential color change.

In any grid structure constructed in accordance with the above, it is fundamental that the lateral velocity imparted to electrons passing between adjacent conductors, is proportional to the number of lines of force they cross or cut. It is also fundamental that the number of lines of force produced in the space between adjacent conductors is proportional to the high frequency alternating current which charges and discharges the conductors to create the electronic field. Since the power requirement of the structure are directly proportional to the voltage multiplied by this charging current divided by the circuit efficiency factor Q, it will be seen that a reduction in the required power may be brought about if some way can be found of operating the tube with a lower voltage on the grid conductors without decreasing deflection field strength. This the present invention is designed to accomplish.

In accordance with a principal feature of this disclosure, the power requirements for a cathode-ray tube of the nature described above are materially reduced by lowering the voltage applied to the strand conductors of the grid structure in order to produce a micro-deflection of the scanning beam. Inasmuch as this power varies in direct proportion to the applied voltage, and inasmuch as the latter is inversely proportional to the capacity between adjacent elements of the grid, this capacity is raised by utilizing two sets of linear conductors instead of one set lying one behind the other along the electron path to the phosphor target.

One object of the present invention, therefore, is to provide a grid structure of the above nature for image-reproducing cathode-ray tubes designed to reconstitute images in polychrome.

A further object of the present invention is to reduce the power required for micro-deflection in a cathode-ray tube of the above type.

A still further object of the present invention is to provide a cathode-ray tube designed for polychrome image reproduction and incorporating a grid structure positioned adjacent to a striped phosphor screen, in which the power required by this grid structure for micro-deflection of the cathode-ray beam is materially reduced over structures previously employed.

Other objects and advantages of the present invention will be apparent from the following description and from the drawings, in which:

Figure 1 is a semi-diagrammatic view of a cathode-ray tube showing in cross-section a color grid structure in accordance with the present invention;

Figure 2 is a plan view of the color grid structure of Fig. 1 as seen from the electron gun end of the cathode-ray tube;

Figure 3 is a detailed view of a portion of Fig. 2;

Figure 4 is a perspective view of Fig. 3, showing in addition one manner of securing the base plate assembly to the color grid unit;

Figure 5 is a perspective view of a portion of Fig. 3, showing in further detail the manner in which the two sets of grid conductors are positioned by the grooved side members;

Figure 6 is an end view of one of the side members of Figs. 3, 4, and 5, showing the manner in which arriving and departing wires of a single turn are caused to be positioned one above the other by means of grooves cut into the surface of the side member; and

Figure 7 is a plan view of a portion of the target area of Fig. 2, showing one preferred relationship between the grid conductors and phosphor strips.

Referring now to the drawing, there is shown in Fig. 1 a cathode-ray tube certain parts of which are conventional. For example, in the neck end of the envelope **10** there is an indirectly-heated cathode **12** which acts as a source of electrons for development into a scanning beam. The latter is indicated schematically by the trace **14**. Adjacent to, and partially surrounding, the cathode **12** is a control grid #1 or electrode **16** suitably apertured to permit the passage of electrons which are subsequently formed into the beam **14**. The control grid **16** functions in the usual manner to modulate the emitted stream of electrons in accordance with the potential applied thereto relative to the cathode **12**. Also in the neck end of the tube there is provided a grid #2 or first anode (identified by reference numeral **18**) to which suitable potentials may be applied so as to result in an initial acceleration of the electrons emitted from the cathode **12**. Adjacent to the grid #3 there is positioned a grid #2 or second anode (reference numeral **20**) for supplying an additional acceleration to the electron.

Deflecting coils, comprising a horizontal pair **22** and a vertical pair **24**, are provided for the usual scanning purposes. Obviously, the terms "horizontal" and "vertical" are used herein in a descriptive sense only.

Thus, the electron beam **14** is caused to scan a phosphor-coated target, or base plate, **26** to develop light which is visible through the end wall **28** of the envelope **10**.

Best shown in Fig. 2 is a substantially rectangular frame **30** adapted to fit within the envelope of the cathode-ray tube **10**. This frame **30** is made up of a pair of oppositely-disposed L-shaped channel members **32**, which form two sides of the frame, and a pair of grooved side members **34** which form the remaining two sides, thus defining a central "window" area. The L-shaped members **32** are respectively secured to the side members **34** by rivets **36**, one of which is shown in each of Figs. 4 and 5. Each side member **34** is of generally flat configuration, and may be fabricated for example, from .062" thick type 430 stainless steel sheet bent double as indicated in the drawing. However, the particular manner of fabricating the frame **30** forms no part of the present invention, and any indication that it may be formed by bending and riveting operations is merely for the purpose of explanation.

The frame **30** is provided at each corner with a lug or tab **38** which is shown in Fig. 2 as having a contour generally similar to the internal periphery of the envelope **10**. In the case of a metal envelope **10**, small angles **40** may be welded to the inside surface of the envelope at positions where it is desired to attach the lugs **38**. The lugs are joined to the angles by means of rivets **42** which preferably pass through ceramic bushings (not shown) which are provided with insulating discs on each end to isolate electrically the frame **30** from the envelope **10**. Other means of attachment may be employed, especially when glass instead of metal envelopes are used. However, these constructional features per se form no part of the present invention, and furthermore are of the same general nature as already in use in the art, so that no further details in regard thereto will be set forth herein.

A first continuous filamentary conductor (such as #302 stainless steel of 6 mil thickness) is wound around the oppositely-disposed frame side members **34** in coil-like fashion so as to form two sets of strands. One such set of strands (indicated in the drawing by the reference numeral **44**) is composed of those which pass along the upper surface of each grooved side member **34** (as best shown in Fig. 5) and the other set of strands (identified as **46**) is composed of those passing along the under surface of the side member. It will be apparent from a consideration of the drawings, and especially Figs. 3, 4 and 5, that these two sets of strand conductors lie in separate planes one above the other, the distance between the planes being determined by the thickness of the frame member **34**.

The above operation, which may be termed the first, or initial, winding, is so carried out that the spacing between adjacent turns is substantially twice the spacing desired between adjacent conductors of the finished grid assembly. Furthermore, since each turn of the first winding operation consists of an "arriving," or upper, strand **44** and a "departing," or lower, strand **46**, these two strands which constitute a single turn are intended to lie in a plane which is nominally vertical, or normal, to the surface of the base plate **26**, but at the same time departs from this normal state by varying amounts from one section of the finished grid assembly to the other depending upon the angle of incidence of the electron beam as it arrives at such point from the electron gun end of the cathode-ray tube. Expressed differently, the plane in which these two strand conductors of a single turn lie is substantially parallel to the path of a scanning beam electron the trajectory of which lies in or adjacent to this plane. Hence, in a general sense, it may be said that this plane (which includes the two strand conductors making up a single turn of the so-called first winding) also includes the center of deflection of the cathode-ray beam.

In order to insure that each of the strand conductors 44 and 46 which together constitute a single turn of the first winding lie in such a plane, grooves are cut into the outer edge of one of the side members 34, with the direction of such grooves being nominally vertical or normal to the plane of the finished grid, but at the same time deviating from this normal condition by an amount necessary to take into account the angle at which the cathode-ray scanning beam arrives at the plane of the grid assembly. Such grooves are generally indicated by the reference numeral 43 in Fig. 4, and are so cut into the side member 34 that the first winding operation described above results in the continuous filamentary conductor being received in these grooves to thus establish the position of the strands as they cross the open, or "window" area defined by the frame members. It is intended that the parallel condition of the wires constituting each turn be maintained across the entire window area of the cathode-ray tube.

Means must also be provided for causing the wire to be shifted laterally to a new position following the completion of any particular turn and prior to the commencement of a succeeding turn, so that during the latter winding the two strand conductors 44 and 46 thereof will also be substantially parallel to one another and lie directly one above the other as "seen" by an electron passing adjacent thereto. To produce this offset condition of successive turns of the so-called first winding operation, the remaining one of the two side members 34 has grooves cut into its outer edge which are not substantially normal to the plane of the grid assembly (as are the grooves of the first-mentioned member) but instead are caused to have the angular relationship best illustrated in Fig. 6 of the drawings.

As shown in this figure, the upper, or arriving, strand conductors 44 which are formed by the first winding operation (or by wire #1 as indicated in this figure) arrive along the upper surface of the side member 34 in the position shown. However, in passing over the outer edge of this side member, they fall within grooves which are cut angularly as indicated in the drawing. By the time the wire reaches the lower, or under, surface of the side member, it is offset to the position 46 shown therein. This position 46 bears such a relationship to the position 44 that (considered in a plane normal to the plane of the frame member) it is shifted laterally by substantially twice the distance desired between adjacent turns of the finished grid assembly.

Following the first winding operation set forth above, a second winding operation is carried out in an exactly similar manner except that (as best shown in Fig. 6) wire #2 begins at a point midway between two adjacent turns of wire #1. This second winding operation produces two further sets of conductors lying intermediate the conductors 44 and 46, and hence these two second sets of conductors are given the designations 44*a* and 46*a* (see Figs. 4, 5 and 6). Each turn of the second winding operation forms two strand conductors 44*a* and 46*a* lying in an essentially vertical plane in the same manner as two corresponding conductors 44 and 46 formed by the first winding operation. Thus, the finished grid assembly, as shown in the drawings, consists of two sets of strands lying intermediate each other (insofar as the spacing between adjacent turns is concerned) and with each turn of each winding operation producing two conductors which lie one above the other as they are viewed by an electron of the scanning beam 14. Consequently, such an electron passing between two adjacent upper strand conductors 44 and 44*a* will likewise pass between two lower strands 46 and 46*a*. This will be clear from a consideration of Figs. 3 and 4 of the drawings.

Since different potentials are intended to be applied to the two sets of strand conductors respectively formed by the two winding operations (or, in other words, wires

#1 and #2 as indicated in Fig. 6) means are provided for insulating these two sets of conductors both from each other and from the electrically-conductive side members 34 which form part of the frame 30. One preferred means of accomplishing this result is by coating the entire frame 30 (or, alternatively, coating only the grooved side members 34) with a suitable insulating substance. This coating may be applied by spraying the frame with thermo-setting enamel or liquid porcelain, for example, prior to the above-mentioned winding operations. This will result in a thin film of insulation being formed over that portion of the surface of the frame contacted by the strand conductors of the grid assembly.

The backing area, or base plate, 26 carries on one of its surfaces a series of phosphor strips laid down in a manner such as will be described in connection with Fig. 7. That is, the sequence of these phosphor strips may be, for example, red, green, blue, green, red, green, etc. For satisfactory operation of the tube being described, it is necessary that each of the strand conductors be properly positioned with respect to these phosphor strips. That is, wires are associated with each red and blue strip but none with the green.

The base plate 26 is mounted in a pair of L-shaped support members 48, one of which is shown in each of Figs. 3 and 4. The plate 26 is cradled in these support members in the manner shown, the latter being preferably composed of the same material as the frame sections 32 and 34.

There have now been described two units, or sub-assemblies, one of which may be designated as the grid wire sub-assembly, as shown in Fig. 5, for example, and the remaining one constituting the base plate sub-assembly, which includes the phosphor-coated plate 26 and the two support members 48. These two sub-assemblies are now brought into position as best shown in Fig. 4, and, in this position, the two units are secured together by means of the angles 50 (one of which is shown in Fig. 4). The rivet 36, which joins one of the L-shaped channel members 32 to one of the grooved side members 34, may also pass through this angle 50, as best shown in Fig. 4, while another rivet 52 secures the angle 50 to the base plate support member 48. Obviously, four such securing means are employed, one on each corner of the frame 30.

The relative position of the conducting strands, or grid wires, and the red, blue and green phosphor strips which are applied to that surface of the base plate 26 impacted by the electron scanning beam 14, is shown in Fig. 7. Although the particular arrangement of the phosphor strips forms no part of the present invention, nevertheless a desirable pattern has been found to consist of repeating groups of strips in the order red, green, blue, green, red, green, etc. The strip widths are chosen in accordance with tube design so as to provide electro-optical rather than physical relationships between the grid wires and the phosphor strips. Each adjacent pair of grid wires accordingly is designed to subtend (in an electro-optical sense) a portion of the target electrode surface which includes phosphor areas of each of the component colors. Generally speaking, however, it may be said that the distance between adjacent grid wires is substantially equal in one dimension to a single elemental area of the image to be resolved by the cathode-ray tube.

It will now be appreciated that an electron of the scanning beam 14 arriving at the grid wire assembly from the main deflecting area of the cathode-ray tube 10 will pass first through one of the apertures formed by a strand conductor 44 and an adjacent strand conductor 44*a*. As such, the electron will be subjected to a micro-deflection in a sidewise, or transverse, direction the magnitude of which depends upon the potentials applied to these conductors 44 and 44*a*. Expressed differently, there is an electric field established between these conductors and the electron in question will be subjected to a lateral deflection depending upon the number of lines of force of this electrostatic field cut by the electron during its passage between the two strand conductors. After passing through this area, the electron continues toward the base plate **26**, and passes through a second electric field developed between two "lower" conductors **46** and **46a**. In passing through this second electrostatic field, the electron cuts a further number of lines of force, and, hence, is subjected to a further transverse or micro-deflection depending again upon the number of field lines cut thereby. These two micro-deflection forces when added together, produce a total deflection of the electron which is greater than that produced by either field alone.

Instead of producing a greater overall deflection of the electron beam, it will be recognized that a deflection may be obtained which is equal to that produced by the electrostatic field developed between a single set of conductors through the expedient of causing each of the two fields to produce approximately half the total desired deflection. The voltage required for producing such a total deflection by these two individual fields acting in sequence may be only half of the voltage required to produce the same deflection by a single field, inasmuch as the capacity factor of the grid assembly has been doubled.

A still further advantage to be realized by employing the concept set forth in the present application is that the tendency of the individual strand conductors of the grid to vibrate due to rapid changes in the value of the color switching potentials is very materially reduced as the magnitude of these deflection potentials is lowered. The importance of inhibiting grid wire vibration is brought out in a copending United States patent application of Howard R. Patterson, Serial No. 364,778, filed June 29, 1953, and assigned to the same assignee as the present application. In this Patterson application, it is brought out that unrestricted vibration of the grid wires, in many cases, produces such severe color contamination in the reproduced image as to make the latter commercially unacceptable. By producing the same degree of micro-deflection of the cathode-ray beam with reduced deflection potentials, as is accomplished by use of the concept disclosed herein, the vibrational effects of the grid assembly are much less severe, and in some cases it may even be possible to omit the various "damping" devices which previously had been mandatory in grid wire construction of the present type.

A still further benefit obtained from the use of a grid assembly constructed in accordance with the present invention is that "stars" or random spots of intense illumination developed on the phosphor-coated target, are reduced both in number and severity due to the decreased electron emission from the grid wires when lower deflecting voltages are employed. Still further, a grid structure wound in continuous fashion (as in the one set forth herein) does not possess many of the properties inherent in grid structures fabricated by "back-and-forth" winding techniques, such as the problem of the wires adhering to the hooks around which they pass.

In summary, therefore, it may be said that one of the principal advantages of the present invention resides in a lowering of the power requirements for micro-deflection of a cathode-ray beam, in a tube of the nature described above, by causing the scanning beam electrons to pass sequentially through two electrostatic fields each of which produces a lateral deflection of the cathode-ray beam for color-changing purposes. The two fields acting together may create a condition in which an electron passing therethrough cuts double the number of lines of force which it would cut in passage through one of the two fields alone. Consequently, its lateral deflection may be double that of a single field. For the same amount of deflection, each of the two fields of this disclosure may be so developed that the number of lines of force cut by an electron is substantially equal to that of a single grid. This requires but half as much voltage on the conductors and consequently less deflecting power.

Having thus described the invention, what is claimed is:

1. In a grid structure designed for incorporation into a cathode-ray tube having a phosphor-coated target electrode on which images are reconstituted in a plurality of colors: the combination of a frame having two pairs of oppositely-disposed members together defining a window area therebetween, one member of one of the said pairs being provided with a series of parallel grooves on its outer edge, the direction of said grooves being essentially normal to the plane of said frame, the other member of said one pair also being provided with a series of parallel grooves on its outer edge, the direction of said last-mentioned grooves being other than essentially normal to the plane of said frame; a first continuous conductor wound in coil-like fashion around said frame and electrically insulated therefrom with successive turns of said coil lying within alternate grooves in each of said one pair of frame members; and a second continuous conductor also wound in coil-like fashion around said frame and electrically insulated therefrom with successive turns of said coil lying within the alternate grooves in each of said one pair of frame members not occupied by said first conductor, thereby to form two sets of interleaved parallel strands across the window of said frame respectively lying in planes which are separate yet parallel to one another, with each complete turn of both said first conductor and said second conductor consisting of two strands defining a plane which is substantially parallel to the trajectory of an electron developed within said cathode-ray tube and directed to that area of the said target electrode proximate to the said two strands.

2. In a grid structure designed for incorporation into a cathode-ray tube in which an electron scanning beam is developed and then deflected so as to scan a phosphor-coated target thereby to reconstitute images in a plurality of colors, the combination of a grid structure positioned adjacent to said target and in the path of the said scanning beam, said grid structure including a pair of continuous electrical conductors wound in coil-like fashion so that each turn of each conductor consists of two strands lying in a plane substantially parallel to the trajectory of an electron developed by said cathode-ray tube and directed to that portion of said target adjacent said two strands, such that the latter are passed sequentially by said electron in its journey to said target, and means for electrically insulating one of said pair of conductors from the other so that different electrical potentials may be applied thereto while maintaining all portions of each individual conductor in a substantially unipotential condition.

3. In a grid structure designed for incorporation into a cathode-ray tube having a phosphor-coated target electrode which the electron scanning beam of said tube is caused to impinge thereby to reconstitute images in a plurality of colors, the combination of a substantially rectangular frame, a first continuous conductor wound in essentially coil-like fashion around oppositely-disposed portions of said frame so that each turn of said coil-like winding consists of two strands each of which lies substantially equidistantly throughout its length from the phosphor-coated surface of said target electrode, and with the two said strands defining a plane essentially parallel to the path of an electron of said scanning beam passing adjacent to said strands toward said target electrode, whereby the electron in following this path will pass the two said strands in sequence, a second continuous conductor also wound in essentially coil-like fashion around said frame so that the turns formed by said second conductor are interleaved with the turns formed by said first conductor and are electrically insulated therefrom, each turn formed by said second conductor also consisting of two strands each of which lies substantially equidistantly throughout its length from the phosphor-coated

surface of said target electrode, and with the two last-mentioned strands also defining a plane essentially parallel to the path of an electron of said scanning beam passing adjacent to said strands toward said target electrode such that the electron in following this path will pass by the two said strands in sequence.

4. In a cathode-ray tube for color television, a grid structure adapted for positioning substantially adjacent to a target upon which is a coating of a plurality of different phosphors arranged in strip formation in a repeating cycle and which strips are adapted to become luminous in different colors under electron beam impact, which comprises a first plurality of generally uniformly spaced linear conductors supported in substantially parallel relationship to each other along a surface adapted to be located adjacent to the target and within the cathode-ray tube to extend within the electron beam path to the target substantially parallel to the strips of the target, a second plurality of linear conductors extending parallel to the linear conductors of the first set and spaced from each other by substantially the spacings of the conductors of the first set and uniformly spaced from the conductors of the first set, the linear conductors of the second set being adjacent to those of the first set and adapted to be held closer to the electron beam source than the linear conductors of the first set, means to connect electrically alternate linear conductors of each set to maintain the connected conductors at like potential and so as to connect adjacent conductors to permit the application of different relative potentials thereto, and means to connect the conductors of the two sets electrically in parallel.

5. A grid structure for a cathode-ray tube comprising a pair of parallelly positioned support elements spaced by substantially one dimension of a raster to be traced upon the tube target, a plurality of parallelly tautly strung conductors stretched between the supports, one part of the conductors being stretched between the supports to lie at one side thereof in a surface defined by the support and the other part of the conductors being stretched between the supports to lie at the other side thereof with each conductor of each set equally spaced from the space-related conductor of the other set, means to connect electrically alternate linear conductors of each set to maintain the connected conductors at like potential and so as to connect adjacent conductors to permit the application of different relative potentials thereto, and means to connect the conductors of the two sets electrically in parallel.

6. In color television apparatus, a grid structure adapted for positioning substantially adjacent to a target having thereon coatings of material adapted to luminesce in selected color light under electron beam impact according to a repeating pattern of strips arranged in a cycle of an additive color series which comprises a pair of supports separated from each other by a distance at least as great as one dimension of a raster to be traced in the target, a first conductor strung back and forth between and around each of the supports and in a continuous strand pattern extending lengthwise of the support with each adjacent strand substantially uniformly spaced and each adapted to extend parallel to the target strips and of which the portion spanning the distance between the supports on one side thereof is uniformly spaced from the portion spanning the distance between the supports on the other side thereof, a second conductor similarly strung between the supports with each conducting strand spanning the distance between the supports being positioned intermediate a corresponding strand of the first conductor, means electrically to insulate the conductors of each set and means to apply potentials to each conductor so that at either side of the supports a grid structure is provided wherein alternate conductors are maintained at like potential and adjacent conductors may be maintained at relative potentials in accordance with the supplied potentials.

7. In a cathode-ray tube for color television, having a target formed as a coating of a plurality of different light producing phosphors arranged in strip formation in a repeating cycle and adapted to become luminous under electron beam impact to develop light in colors additive to produce white light, a grid structure adapted for positioning adjacent to the target for color switching control which comprises a first plurality of generally uniformly spaced linear conductors in parallel relationship to each other supported along a surface adapted to locate adjacent to the target and in the cathode-ray beam path to the target with the conductors extending parallel to the strips of the target, a second plurality of uniformly spaced linear conductors also in parallel relationship to each other and extending parallel to the linear conductors of the first set and spaced from each other by substantially the spacings of the conductors of the first set and uniformly spaced from the conductors of the first set, the linear conductors of the second set being located adjacent to those of the first set and in such relation thereto as to be closer to the electron beam source and more remote from the target than the linear conductors of the first set, means to connect electrically alternate linear conductors of each set to maintain the connected conductors at like potential and so as to connect adjacent conductors to permit the application of different relative potentials thereto and means to connect the conductors of the two sets electrically in parallel.

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Re. 23,672	Okolicsanyi	June 23, 1953
1,565,708	Bullimore	Dec. 15, 1925
1,980,341	Kayko et al.	Nov. 13, 1934
2,067,825	Bullimore	Jan. 12, 1937
2,660,684	Parker	Nov. 24, 1953