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COLOR CONTROL GRID STRUCTURE FOR CATHODE-RAY TUBES

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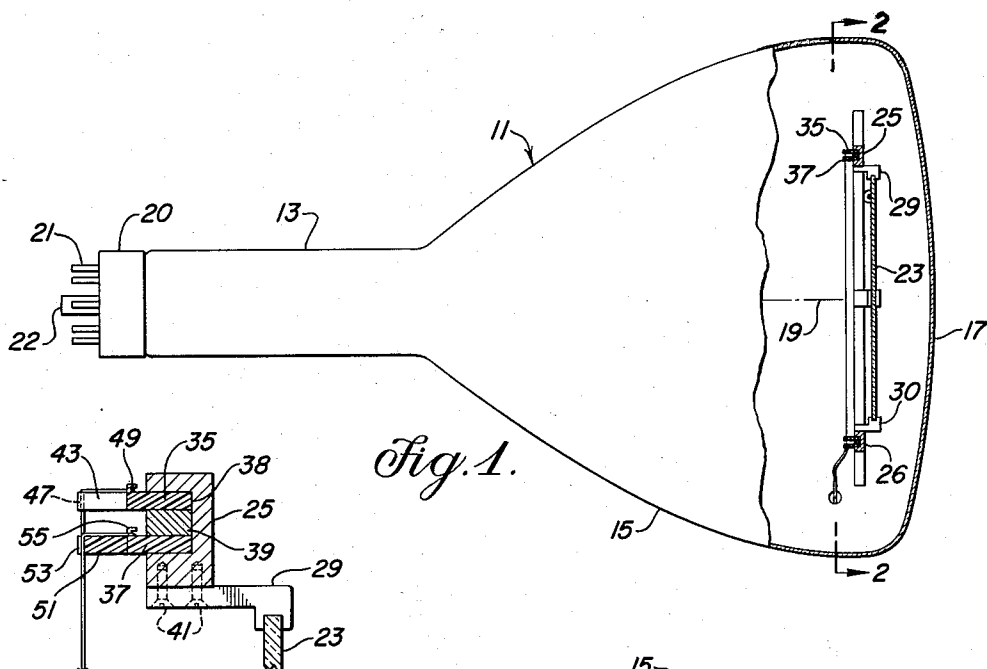


Fig. 1.

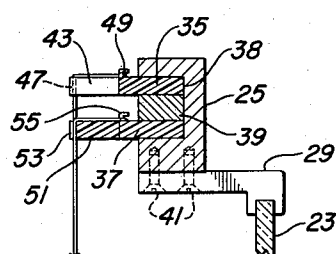


Fig. 3.

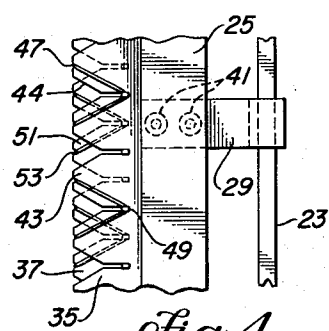


Fig. 4.

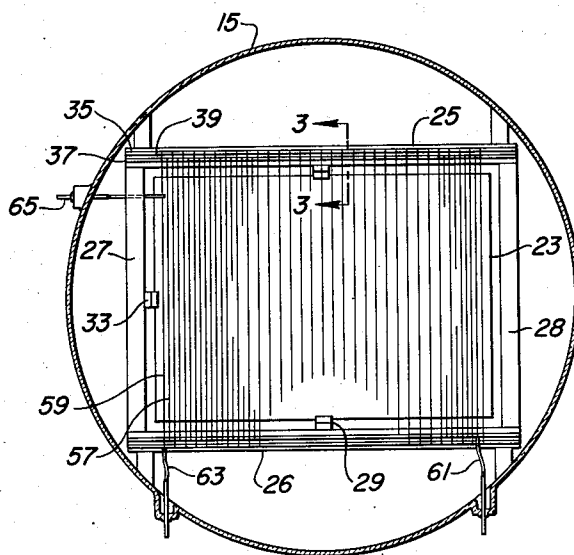


Fig. 2.

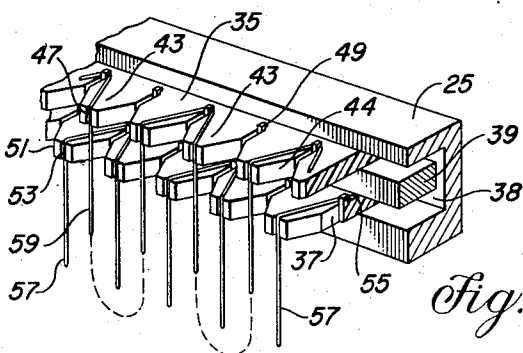


Fig. 5.

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COLOR CONTROL GRID STRUCTURE FOR
CATHODE-RAY TUBESErnest O. Lawrence, Berkeley, Calif., assignor to
Chromatic Television Laboratories, Inc., San
Francisco, Calif., a corporation of CaliforniaOriginal application February 11, 1952, Serial No.
252,686. Divided and this application January
8, 1952, Serial No. 265,365

12 Claims. (Cl. 313—78)

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This invention relates to cathode-ray tubes of the character used particularly to display images created on the tube target surface under the control of appropriately applied signal energy. The invention, of course, is applicable to cathode-ray tubes of all general types, including those used for oscilloscopes, radar installations and monochromatic television. However, in its principal application it is directed to certain more detailed aspects relating particularly to polychrome television image reproduction.

For purposes of explaining the invention, the apparatus and tube structure herein to be set forth and described will be related to a tube of a variety particularly adapted to the production of tricolor images. The disclosed principles are, however, applicable to more or less colors.

In the transmission of signals according to any now proposed system of color transmission, whether it be field-sequential, line-sequential, segment-sequential or dot-sequential, or even certain varieties of the latter system developing control signals which, in effect, practically amount to simultaneous transmissions, it has become the practice so to regulate the transmissions that all color values are represented by three primary colors additively combined in proper intensity and hue to recreate an image. Reasonably good likenesses of images on correct color can be recreated through the use of apparatus of this variety.

Various forms of apparatus for recreating television images in color are set forth and described in co-pending United States patent applications Serial Nos. 219,213 and 234,190, filed by this applicant on April 4, 1951 and June 29, 1951, respectively, with the said applications being entitled "Cathode-Ray Focusing Apparatus" and "Direct-View Color Tube." These pending patent applications are particularly concerned with apparatus to recreate tricolor television images. The apparatus there set forth is of the cathode-ray tube type. It utilizes, among other features, a principal for accelerating the scanning cathode-ray beam to high velocity in the general region of the target under the influence of a high voltage effective as an accelerator only in that region of the tube. The high impact beam velocity increases the resultant image brilliance. Also, through the provision and inclusion of suitable electrode structure in a region closely adjacent to the target, and the application of suitable control voltages, electric fields are developed whereby the scanning beam is brought to a high degree of focus as it reaches the target.

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The beam focusing is actually to a spot size materially smaller than that normally realizable under conditions of scanning beam projection toward the target.

The target area, upon which the scanning beam is disclosed as being projected is formed of a plurality of phosphor coatings of characters such that when activated by the impact of the scanning cathode-ray beam, light in one of the selected additive primary colors is produced by each separate phosphor. Phosphors suitable for producing light in such colors are well known and their specific composition, per se, forms no part of this invention or of the companion inventions hereinabove mentioned.

It is also explained in the applications above mentioned, reference to which is herein incorporated, that the point of scanning cathode-ray beam impact on the target and thus the color of light emission from the target is controllable, either by a control of direction of the scanning beam in its path to the target through the electrode structure adjacent to it, or, alternatively, by the application of suitable control voltages on the grid electrode structure adjacent to the target. In the latter case the scanning beam is displaced relative to the target by a supplementary force over and above that displacement produced by normal deflection. In either case the scanning beam impacts discrete phosphor coatings in such manner that the desired color is realized.

The present invention forms an improvement, not only upon the electrode structure for assembly in the region generally adjacent the final phosphor coated target of the hereinabove-mentioned co-pending United States applications, but it is also related to and represents an improvement and refinement of the electrode structure for accomplishing the stated objectives which are set forth in a concurrently-filed United States patent application of this applicant which is entitled "Grid Structure for Cathode-Ray Tubes." Furthermore, the subject matter of this invention is related to that set forth in a concurrently-filed United States patent application of James T. Vale, entitled "Focusing Grid Structure for Electron Tubes," to which reference is also made at this time.

This invention, in its essence, relates to ways and means by which the grid structure for use in a region adjacent to the tube target may be more readily fabricated and assembled than in heretofore disclosed arrangements. It also represents a form of electrode structure which provides suitable ways and means for alin-

ing the conducting strands or wires of the color-control grid structure relative to the tube target. Still further it offers means for maintaining the aligned conductors or strands in proper relationship relative to the target whereby improved image reproduction and greater fidelity of operation is maintained.

Consequently, among the objects of this invention are those of providing a color-control grid structure for use in cathode ray tubes, particularly of the tricolor variety, which will insure the production of brighter images correctly allocated to color, and producible in high detail.

Further than this, the present invention has as one of its objectives that of providing a color-control grid structure for use in connection with a phosphor-coated target of a cathode-ray tube which may be fabricated more rapidly and at reduced cost relative to proposals heretofore made.

It is also an object of the invention to provide a color-control grid structure for use in a cathode ray tube designed to provide multicolor images wherein the duty cycle of operation may be maintained high without resultant color contamination in the finally-produced image.

A further object of the invention is to provide a color-control grid in which alinement of the grid conductors with the phosphor target coating is easily obtained.

Still other and further objects and advantages of the invention will, of course, become apparent from a reading of the following specification and appended claims in connection with the accompanying drawings, wherein:

Fig. 1 represents a cathode-ray tube of the tricolor variety in elevation and partly in section, to show the arrangement of the color-control grid of the instant invention relative to the phosphor coated target and viewing window of the tube;

Fig. 2 is an end view of the tube of Fig. 1 taken along the section 2—2 looking from left to right, particularly to show the general positioning of the color-control grid conductors relative to the other tube components;

Fig. 3 is a section through a portion of the color-control grid structure of Fig. 2 taken along the line 3—3 and looking in the direction of the arrows. This view is to show particularly the cantilever-type support for the various grid conductors;

Fig. 4 is a plan view of the color-control grid conductor cantilever support looking downward upon the section shown in Fig. 3; and

Fig. 5 is an isometric showing of a portion of the color-control grid conductor support at the upper end looking through a section thereof generally along a line to the left of the line 3—3 and continuing for a limited number of supported conducting strands.

Referring now to the drawings for a further understanding of the invention, the cathode-ray tube 11 comprises the usual tube neck portion 13 and a somewhat bulbous or frusto-conical end portion 15 which terminates in a flattened viewing window 17, as is well known. The viewing window 17 is a transparent vitreous material. The remainder of the tube may be of like character material, although, in some instances, it is desirable that the frusto-conical tube portion be formed according to well established practice as a metal sidewall secured to the glass viewing window 17 and the neck portion 13, which is also usually of glass. As is well known in practice, the complete tube envelope is highly evacuated, and there is provided in the neck portion thereof

an electron gun comprising at least a cathode, a control electrode and an accelerating anode (none of which are shown, for reasons of drawing simplification) to form and accelerate a cathode ray beam schematically represented at 19. The velocity imparted to the electrons forming the cathode ray beam as it leaves the gun is sufficient to cause it to move through the tube in the direction of the viewing window 17 and thereby to strike the target area upon which it is to create electro-optical effects. The tube is appropriately based, as indicated at 20, and provided with prongs for connecting the device to an electric circuit for the application of control and signaling voltages to selected electrode elements. The center pin 22 of the base is used to position the tube in well known manner in the supporting socket (not shown).

The electron beam developed within the tube is controlled both as to its instantaneous impact position at the target and its path of sweep in both horizontal and vertical directions, as is well known, by magnetic deflecting coils formed into the yoke (not shown) which is arranged to surround the neck of the tube in the region whereat the tube neck merges with the frusto-conical sidewall. Alternatively, the developed electron beam 19 may be deflected by the aid of electrostatic deflecting means, as is particularly represented in the hereinabove-identified co-pending United States patent application Serial No. 234,190, which likewise schematically represents the magnetic deflection means.

As the scanning cathode-ray beam 19 is moved longitudinally of the tube, it is arranged ultimately to impact a phosphor-coated target schematically represented at 23, which is observed through the viewing window 17. The phosphor-coated target, as is explained in all of the above-mentioned co-pending applications, preferably comprises a series of strips of phosphor coatings, all adapted to become luminescent under electron beam impact to produce colored images. In the preferred form of arrangement, the strips have one dimension which is but a fraction of that of the elemental areas into which an image may be assumed to be divided for the purpose of production according to all accepted television operational standards. The phosphor strips may be assumed to repeat in any desired and selected color cycle chosen from among suitably selected primary colors of red, blue and green, which constitute the generally accepted primaries additive to produce white light.

For the purpose of developing high-detail color television images, as explained in the above-mentioned co-pending United States patent applications, the phosphors are arranged in cyclically repeating sequences so that in one dimension at least they repeat at least once for each spot or elemental area of the final electro-optical image to be recreated. As such, the phosphor strips may be selected in a repeating color cycle to include red, green and blue, with the width of each of the red, green and blue strips corresponding to one-third that of one dimension of an elemental picture point. The other dimension of the phosphor strips may be representative of either the height or the width of the raster to be traced, depending upon whether the scanning pattern primarily is to trace transversely to the long dimension of the phosphor strips or longitudinally thereof. Suffice it to say, for illustrative purposes, that any selected cyclically repeating sequence of the phosphor strips in one dimension is

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such that when activated by the scanning cathode ray beam effective over an area equal to one picture point shall all become luminescent. Each separate phosphor-coated strip develops light in one of the colors of an additive tricolor pattern, assuming, of course, that signal modulation results on the impacting scanning cathode-ray beam as it reaches each individual phosphor, and the image point color representation is then established.

For convenience, it is often desirable to form the phosphor-coated strips in such fashion that the phosphors to produce red and blue light are twice as wide as those used to produce green light. Under such circumstances, a sequence of phosphor strips may be assumed to comprise, illustratively, a strip to produce green light, a double-width strip to produce red light, a strip to produce green light, and a double-width strip to produce blue light, after which the sequence repeats. A group of phosphor strips of this character has a width equal to that of two elemental areas or picture points of the image to be reproduced. It will be seen, however, that the same three primary colors are present for each point, with the color cycle, under these circumstances, comprising red, green, blue, for one spot or point, and blue, green, red for the adjacent spot or point, after which the color cycles and sequence repeat in the stated order. However, since the phosphor strips are each of sub-elemental width and a portion of each wider strip may be considered as included in each color cycle, since, in the example assumed, the precise arrangement is of no moment; the significant factor is that for each elemental picture point width there is a sub-elemental width phosphor strip representative of each color, assuming, of course, that the elemental area begins and terminates at an intermediate point on each of the wider strips.

In the assembly of the tube for one suitable form of operation it will be assumed that the scanning cathode-ray beam is adapted to traverse, in its rapid deflection path, the phosphor-coated strips in their short dimension, so that in the completion of scanning of each raster the scanning beam traverses longitudinally the target strips from one end to the other.

According to usual tube practice, the phosphor coatings have thereover on the side toward that from which the cathode-ray beam emanates, an aluminum film coating or covering the phosphors. The aluminum film serves to provide a conducting electrode at the target area, as well as to function in well known manner to eliminate the detrimental effects of the "ion spot" which would otherwise be present on the tube target. The coating also aids in the intensification of the resultant image due to the fact that the reflecting aluminum film or coating through which the scanning cathode ray beam passes to reach the phosphor serves as a light reflector, with a result that substantially all light emanating from the phosphor coating is directed outwardly of the tube according to well known practice.

The grid with which this present invention is particularly concerned is supported on a framework comprising a pair of spaced beams 25 and 26, separated from one another by spacers 27 and 28. The support frame formed by the combination of the beams 25 and 26 and the spacers 27 and 28 defines the limiting boundaries of the window area in which the target is to be viewed. It will be observed that this area exceeds slightly that of the coated target area 23, as becomes

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particularly apparent from the showing of Figs. 1 and 2, although this is illustrative and not a limiting feature of the invention.

The target area 23 is held tightly to the support beam 25 by an upper bracket 29. It is secured to the lower beam 26 by a similar bracket 30. If desired, a plurality of brackets of this nature may be interposed along the edges of the target 23 and the beams 25 and 26. Similar brackets 33 are used to secure spacers 27 and 28 relative to the edge of the target area 23.

Within the boundaries of the support beams 25 (and the construction of the beam 26 will be mentioned only incidentally in what is to follow), there is preferably located a plurality of comb-like cantilever strips 35 and 37. These cantilever strips are preferably formed from insulating material. They are confined within a more or less U-shaped section 38 of the beam 25 and separated one from the other by a suitable support bracket 39, tightly wedged therebetween and securely holding the insulating cantilever strips 35 and 37 into the channel formed in the beam 25 by the U-shaped configuration. The beam 25 is securely held to the bracket 29 by any desired form of fastening means, such as the indicated screws 41, which may also serve as a part of the adjusting mechanism.

The cantilevers 35 and 37 secured to the upper beam 25 are formed with a series of teeth 43, which are of generally flattened V-shape, and which are spaced from each other by V-shaped openings 44 (see particularly Fig. 5). The outer ends of the flattened V-shaped teeth have grooves or recesses 47 extending laterally thereof. At the base of the teeth, and between and substantially intermediate the flattened portion of adjacent teeth, conductor-locating pins 49 are positioned. The pins 49 extend transversely of the cantilever strip and preferably have a generally L-shaped head thereon, with the open end of the L facing away from the slotted end of each tooth. As will later appear, this forms a convenient way to locate and anchor the conductors to be described. The lower cantilever element 37 constituting the inner one with respect to the beam 25 is of similar construction, with the flattened V-shaped teeth 51 notched at the outer ends at 53. Pins 55, similar to the pins 49, are supported on the cantilever strip intermediate adjacent teeth.

The teeth 53 of the innermost cantilever strip 37 are arranged to protrude outwardly in the spaces between adjacent teeth 43 of the outer or upper cantilever strip 35. This likewise provides an arrangement where the upper teeth 43 are located intermediate the lower teeth 51. The opposite side of the support frame is similar constructed and consequently need not be discussed in detail.

After the cantilever strips 35 and 37 have been located within the U-shaped channel section 38 of the beam 25, a suitable conducting strand in the form of wire, preferably of hardened steel or nickel, and of a size of the order of only 2 or 3 mils (0.002" to 0.003") is arranged to be strung between the various cantilever elements and across the window area. In the assembly of the structure, a suitable conducting wire or strand such as that represented at 57 is first strung back and forth between the innermost strips. This wire is anchored about opposite pins 55 and arranged to pass from one pin over one of the teeth to be located by the notch in the flattened tooth. This locates the wire at the free end of

the cantilever from which point it is strung to overlap the flattened tooth end of the opposite cantilever strip, after which it is wrapped about a locating pin positioned in a relative location to the cantilever tooth somewhat like that shown for 53, except that it is laterally displaced by a distance representing the space between adjacent teeth. The process of wrapping back and forth for the innermost of the two cantilever strips is repeated until a strand of wire is strung between opposite ends of the assembly. The plan of wrapping is clearly shown by Fig. 5. With the completion of the wrapping and securing of a conducting strand or wire to the inner cantilever strip a wire fastening to the outer (upper in Fig. 5) cantilever strips is established. The wire or conducting strand 53 is secured to one of the outer cantilever strip 35 and wrapped about the anchoring pins 49, and thence over the edges of the outwardly-extending teeth 43 to be located by the grooves 47 in the end thereof. This wrapping back and forth and further stringing of the conducting strand is carried from one edge of the cantilever strip to the other. An examination of the showing of Fig. 5 will indicate that the conducting strands or wires 57 and 59, when so positioned relative to the teeth of the comb-like cantilever strips, alternate in position one with respect to the other, so that the support for one wire is from the inner cantilever strips, while the wire adjacent thereto on either side is supported from the outer cantilever strips. The next succeeding wires are supported from the inner cantilever strips, and so on. In the illustrated form of color control grid the cantilever strips have teeth separated by a distance corresponding to two picture elements, so that by alternating the position of the teeth with respect to each other and having the protruding tooth of the adjacent cantilever strip project in the space intervening, the wires 57 and 59, when strung between the cantilever strips supported by the opposite beams 25 and 26 may be spaced from each other by a spacing corresponding to the width of a single image point or picture element to be traced upon the target area.

By locating the cantilever strips in fixed position relative to one another, and spacing the teeth thereof equidistant from each other, it is apparent that the strung wires 57 and 59 will all be positioned equidistant and parallel one with respect to the other. The insulating cantilever strips (for which various forms of ceramics or vitreous plastics are suitable) have sufficiently high resilience to hold the wires, when strung, under tension. Then, by initially stringing the wire rather tightly between the teeth and anchoring it about the pins at the base of each tooth, it can be appreciated that the cantilever formed between the outer edge of each tooth, constituting the free end of the cantilever, and the support beam (constituting the base or anchor) provides sufficient resiliency continually to hold the strung wires taut to maintain substantially precise parallelism.

The wires as they are connected at the ends of the strip provide terminal points 61 for connecting to the innermost set 57 and terminal point 63 for connecting to the wires 59 strung to the outermost set of cantilever strips 35.

For the operation of the tube herein described, it is essential that the strung wires be maintained in substantially precise parallel relationship with respect to the phosphor-coated strips on the target 23. For this purpose, suitable minute ad-

justments may be brought about whereby the relative position of the support beams 25 and 26 with respect to the brackets 29 holding the target 23 may provide for making slight adjustments in the positioning of the conducting strips relative to the edge of the phosphor-coated strips.

In one preferred form of operation of the here-indescribed electrode, the conducting wire strip preferably is centrally positioned relative to the assumed double-width phosphor strips which produce blue and red light, respectively. Under these conditions of operation, the aluminum film coating on the target strip may be provided with a suitable high voltage applied relative to the cathode (not shown) of the electron gun, which voltage is applied in a positive sense to the coating relative to cathode at the terminal point 53. If, for instance, the target is maintained at a voltage relative to the cathode which is positive by the order of approximately 16,000 volts and the conducting wires 57 and 59 are maintained at a potential which is negative relative to the final target by some value of the order of about 12,000 volts, it will be appreciated that the scanning of cathode ray beam 18, after penetrating the plane of the grid wires 57 and 59, is immediately subjected to an accelerating field of the value of 12,000 volts prior to its reaching the target area. As explained in the above-mentioned co-pending applications, and particularly United States patent application Serial No. 234,190, this accelerating voltage and the field developed between the target and the grid also brings about a sharp focusing action at the target.

To illustrate an embodiment of this tube for the purpose of explaining its operation, it may be assumed that the conducting strands or wires 57 and 59 are maintained parallel with each other and with an edge of one of the phosphor strips. Also, it may be assumed that the spacing between the wires 57 and 59 is equal to one picture point. The wires 57 and 59 then may be aligned with what would constitute the midpoints of each of the assumed double-width phosphor strips and extend parallel to the edge of the strips. If, in this assumed embodiment of the invention, all of the conducting strands 57 and 59 are maintained at the same potential relative to the target, it may be assumed that a scanning cathode-ray beam projected from the electron gun (not shown) will reach and be focused upon that phosphor strip which is between conducting wire strands 57 and 59. This, then, may be a phosphor to produce green light. If now, to produce a different color of light from impact of the scanning cathode ray beam upon the target, it be assumed that the wires 59, while maintained in the general region of 12,000 volts negative relative to the final target, are, nonetheless, maintained positive relative to the wires 57 (by a voltage difference of, say, 400 to 500 volts, for instance), the scanning cathode ray beam directed through the wires toward the target will tend to be repelled from the wires 57 and move laterally in the direction of the wires 59, whereupon, looking at Fig. 5, for instance, it can be assumed that the scanning beam impacts the target in a position slightly to the left of that which it would assume for all equal potential conducting strands 57 and 59. The color of light which will be developed from the impact of the scanning cathode-ray beam upon the target under such conditions is that due to activation of one of the other two phosphors.

Similarly, if the potential relationship between the conductors 57 and 59 is such as to make the conductor 57 positive relative to the conductor 59 (in a manner like that explained for conductor 59 relative to conductor 57), then the scanning cathode-ray beam may be assumed to move slightly to the right and to impact the third phosphor to produce the third color of light. By controlling the instantaneously effective potential on the grid wires 57 and 59 relative to the target it thus becomes possible to provide a supplemental deflection of the scanning cathode ray beam in the region immediately adjacent to the target 23 and to control thereby, as explained, the position of impact and thereby establish the color of light developed.

In the foregoing considerations it has been set forth that the parallelly strung color control grid wires are spaced to correspond to the width of any group of phosphor strips corresponding to one color cycle or corresponding to one dimension of a picture point or elemental area. This reference was particularly for ease of description. In the finally-produced tube it will be appreciated that the color-control grid wire spacing is actually slightly less than the set-forth width of phosphor strips, due to the fact that the color-control grid is positioned closer to the electron beam source and gun than the final phosphor target. The color-control grid is actually so close to the target that the spacing is almost equal to the described width of phosphor strips, but, in practice, the wire spacing may be regarded as being generally equal to that fraction of the width of the phosphor strips for each color cycle which is represented by the ratio of the distance of the color control grid from the virtual electron source to the distance of the target from the same virtual electron source.

Thus, within the meaning of what has herein been set forth and as the invention will be defined in the claims, any reference to identity of grid wire spacing and phosphor strip width for one color cycle or even the substantial equality thereof shall be understood to include at least that degree of tolerance herein stated.

From what has been stated above, it is believed to be apparent that the present invention is concerned particularly with that form of grid structure to bring about the color control, and at the same time to provide one electrode element for developing the accelerating field to produce high velocity scanning beam impact upon the target and a sharp focusing of the beam as it so impinges.

While the invention has been described with respect to one assumed relationship between the color control grid wires and the assumed target, it will be appreciated that this has been done purely for illustrative reasons, and that the invention should be broadly construed and in no way limited to the precise illustration proposed.

The foregoing constitutes a continuation-in-part of co-pending application for Letters Patent of the United States, Serial No. 252,686, filed by present applicant on October 23, 1951, and also entitled "Color Control Grid Structure for Cathode-Ray Tube."

Having now described the invention, what is claimed is:

1. An electrode structure for a cathode-ray tube comprising a support frame having spaced beams defining the limiting boundaries of a window area, a comb-like cantilever extending outwardly from each spaced beam, conducting

strands strung between the teeth of the cantilevers to extend transversely of the window area, means located substantially at the outer end of each comb-tooth for positionally locating the strung conductors in substantially precisely parallel paths equally spaced from each other, and means to connect said strung strands to an electric circuit.

2. The electrode structure claimed in claim 1 wherein the conducting strands comprise a continuous member strung back and forth between opposite cantilever teeth.

3. The electrode structure claimed in claim 2 comprising, in addition, means located substantially at the plane of the base of the cantilever teeth and between each tooth for anchoring the conducting strands between the points of location thereof by the teeth.

4. An electrode structure for a cathode-ray tube comprising a support frame having spaced beams defining the limiting boundaries of a window area, a comb-like cantilever of insulating material extending outwardly from each spaced beam, conducting strands strung between the teeth of the cantilevers to extend transversely of the window area in planes substantially normal to the plane of the comb-like cantilevers, means at the outer end of each comb-tooth for positionally locating the strung conductors in substantially precisely parallel paths equally spaced from each other, means located generally at the plane of the base of each comb tooth and between each tooth to another the strung strands and terminal means to connect said strung strands to an electric circuit.

5. The electrode structure claimed in claim 4 wherein a single conducting strand is strung back-and-forth between the opposite cantilever teeth, and wherein each comb tooth has a grooved recess at the outer end extending in a direction coinciding substantially with that of the conducting strand path between opposite cantilever teeth.

6. The electrode structure claimed in claim 5 wherein the anchoring means comprises an anchor pin located between each tooth and extending outwardly from the comb base in a plate approximately parallel to that of the conducting strands across the formed window area.

7. An electrode structure for a cathode-ray tube comprising a support frame having spaced beams defining limited boundaries of a window area, a plurality of comb-like cantilevers extending outwardly from each spaced beam, said cantilevers associated with each beam having the teeth thereof laterally displaced so that the teeth of one cantilever protrude outwardly in the space separating the teeth of the adjacent cantilever, the cantilevers secured to opposite beams being symmetrically positioned relative to each other, a conductor strung between the teeth of each of the comb-like cantilever elements, and terminal means connected to the conductors.

8. An electrode structure for a cathode-ray tube comprising a support frame having a pair of spaced beams defining limited boundaries of a window area, a plurality of spaced comb-like cantilevers extending outwardly from each spaced beam, the teeth of the cantilevers associated with each beam being laterally displaced relative to the teeth of the adjacent cantilever and outwardly from the beam extending in the space separating the teeth of the adjacent cantilever so that the sets of teeth are interleaved, the

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cantilevers secured to opposite beams being symmetrically positioned relative to each other, a conductor strung between the teeth of each of the comb-like cantilevers similarly located relative to the spaced beams, and terminal means adapted for connecting the separate conductors to an electrical circuit.

9. The electrode structure claimed in claim 8 comprising, in addition, means to anchor the conducting strands between each tooth of the cantilever.

10. The electrode structure claimed in claim 8 comprising, in addition, means to maintain the sets of conductors electrically separated from each other.

11. The electrode structure claimed in claim 8 comprising, in addition, means to maintain each set of conductors substantially coplanar.

12. An electrode structure for a cathode-ray tube comprising a target having thereon a plurality of strips of phosphor coatings, each coating being sub-elemental extent in at least one dimension, the phosphor coatings being adapted to become luminescent under cathode ray beam excitation to produce light, the several phosphors being adapted to luminesce in individually ones of a plurality of component colors of an additive polychrome system, and wherein the different forms of phosphor coatings repeat in cyclic succession in at least one direction within one dimension of a picture image area of elemental size, a

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support frame having spaced beams defining limiting boundaries of a window area including substantially the phosphor-coated target, a comb-like cantilever extending outwardly from each spaced beam, a conducting strand strung between the cantilever teeth to extend transversely of the window area, means located generally at the end of each tooth for positionally locating the strung conductors in substantially parallel relationship one with respect to the other, means of aligning the conductors relative to one dimension of the phosphor coatings of the target, said comb-teeth having separations relative to each other coinciding substantially with the distance represented by the width of phosphor coatings of each repeating cycle on the target, and means for connecting the conducting strands to an electric circuit.

ERNEST O. LAWRENCE.

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