May 13, 1958 W. H. BARKOW ET AL 2,834,901

CATHODE RAY TUBE ADJUNCT

Filed May 6, 1954

Fig. 1.

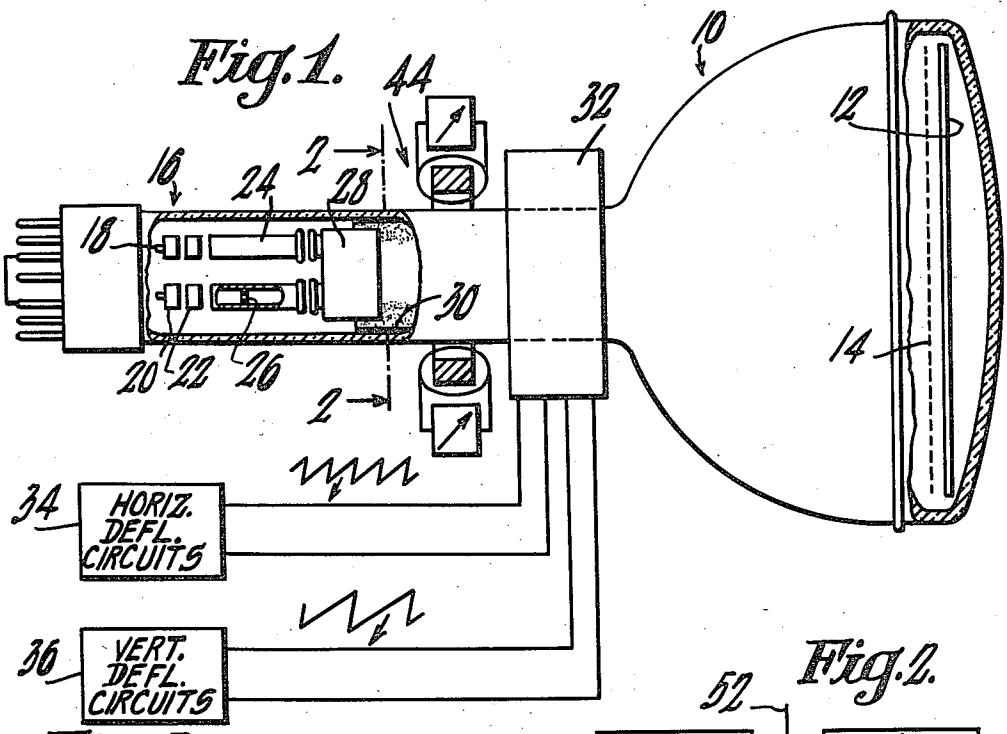


Fig. 2.

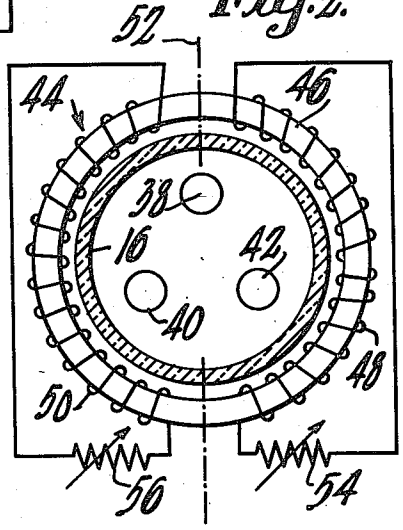


Fig. 4.

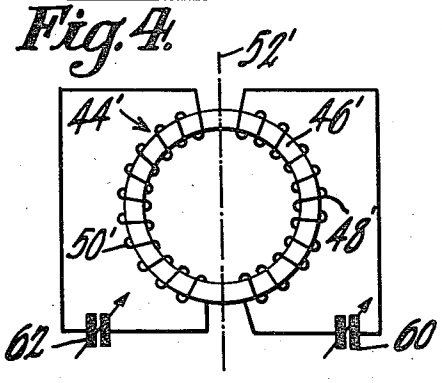
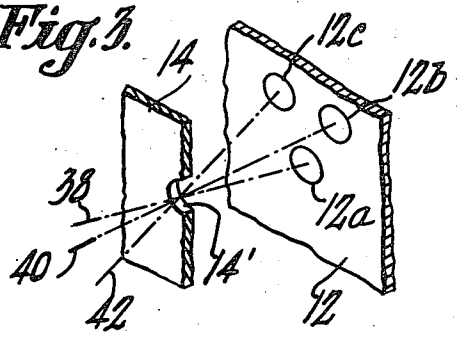


Fig. 3.



INVENTORS
WILLIAM H. BARKOW
& JERROLD K. KRATZ
BY
ATTORNEY

United States Patent Office

2,834,901

Patented May 13, 1958

2,834,901

CATHODE RAY TUBE ADJUNCT

William H. Barkow, Pennsauken, and Jerrold K. Kratz, Haddonfield, N. J., assignors to Radio Corporation of America, a corporation of Delaware

Application May 6, 1954, Serial No. 428,014

9 Claims. (Cl. 313—76)

The present invention relates to novel apparatus for use with cathode ray image reproduction apparatus and, more particularly, although not necessarily exclusively, to deflection controlling apparatus for use with multiple gun kinescopes of the varieties employed in color television receivers.

While the invention will be described herein in connection with a three-gun color kinescope of the shadow mask type such as is described in an article entitled "A three-gun shadow-mask color kinescope," by H. B. Law, in the Proceedings of the IRE, October 1951, its applicability to other types of image reproducers should be borne in mind.

In the three-gun shadow-mask color kinescope described in the cited article, three electron beams are employed, one for each selected component color. The beams strike a phosphor screen composed of a regular array of red, green and blue light emitting phosphor dots. Between the electron gun position and the phosphor screen there is placed a thin perforated metal sheet which masks the electron beams. The phosphor screen is made up of closely spaced trios of phosphor dots on a glass plate, each trio consisting of a red, green and blue dot with the centers of the dots lying at the corners of an equilateral triangle. The trios themselves lie at the corners of a still larger equilateral triangle. Associated with each of the phosphor trios is a hole or aperture in the shadow mask, such holes also being located at the corners of an equilateral triangle. The three beams, located 120° apart about the longitudinal axis of the tube are converged to a point on the mask by a lens system. The electron beam which is to contribute the red portions of the picture is prevented by the mask from striking those areas on the screen containing blue and green light-emitting phosphors. Similarly, the green and blue beams are permitted to strike only the green and blue phosphor dots, respectively.

In an article entitled "Effects of screen tolerance on operating characteristics of aperture mask tri-color kinescopes," by Van Ormer and Ballard, in the same issue of the Proceedings of the IRE, the basic requirements for proper operation of a shadow mask, tri-color kinescope are disclosed. As pointed out therein, the concept of a "color center" is quite useful in the process of setting up the aperture mask or shadow mask color kinescope for proper operation.

A color center may be defined as any point in space, determined by the geometry of the screen assembly, from which an observer could "see," through the aperture mask, only the phosphor dots of a particular color. In the tri-color tube, the positions of the three color centers, one for each color of phosphor, determined the "color plane" or "plane of color centers" parallel to the plane of the screen. In the color plane there exists an array of color centers. It would be possible to see only the phosphor dots of a particular color from any one of these color centers, but only the set which is nearest the symmetrically

located with respect to the central axis of the screen assembly is of interest.

If the three electron beams deflected by a common yoke field are considered, the three centers of deflection will determine the "deflection plane" or "plane of deflection centers." If the position of each deflection center coincides with that of a color center, then each deflected beam will excite only the phosphor dots of a particular color. The manufacturing deviations in the production of the screen assembly and its placement with respect to the electron guns can be interpreted in terms of the effects on this condition of coincident deflection and color centers.

In the completed tube these centers are not accessible, i. e., they are within the tube envelope. Therefore, the relative positions of the deflection centers and the color centers must be determined from the effects produced on the viewing surface of the screen. Ideally, the projections of the electron beams through the apertures of the mask onto the phosphor plane coincide with the phosphor dots. The problem thus becomes one of interpreting a three-dimensional system in terms of the effects observed on a two-dimensional surface.

The two basic requirements for the proper operation of the aperture-mask color kinescope are that the deflection center and the color center of each of the three beams be coincident, and that the beams converge at the aperture mask. These two conditions insure pure color fields in proper registry.

It is, therefore, a primary object of the present invention to provide new and useful apparatus for controlling electron beam deflection in such manner as to afford the proper color purity in a multiple gun color kinescope.

Another and more specific object of the invention is to provide means for insuring the proper relationship between the color center plane and the deflection center plane of a kinescope of the type in question.

As will be understood by those skilled in the art, axial movement of the deflection yoke comprising the horizontal and vertical windings will move the deflection region correspondingly. By virtue of the fact, however, that the horizontal and vertical scanning frequencies differ greatly, it has been found that the effective deflection center for the horizontal winding does not always coincide with the effective deflection center of the vertical winding. In view of the apparent anomaly presented by these facts, there has existed the problem of effecting the necessary coincidence between the horizontal deflection center plane and the vertical deflection center plane at the color center plane. Moreover, in the case of certain manufacturing deviations, there are instances in which it is necessary that the deflection center planes of the two windings be separated by predetermined axial distances.

Thus it is a further object of the present invention to provide novel means capable of shifting the effective center of deflection of one of the mutually perpendicular magnetic fields of a deflection yoke with respect to the center of deflection of the other field thereof.

In general, the present invention, in accordance with one embodiment, takes the form of a continuous core of magnetic material about which is wound a plurality of coils. In one embodiment, there are two coils, each wound about half of the core, so that the two coils are separated by a center line drawn diametrically through the core. The assembly including the core and coils is mounted co-axially about the neck of the tube and each coil comprises a series circuit with a variable element operatively coupled thereto for changing the effect of the assembly upon the deflection characteristics of the yoke which is associated with the tube.

It has been found in the operation of the apparatus of the present invention that it affords certain additional useful functions. For example, as will become more

fully apparent hereinafter, the apparatus may be employed for selective amplitude control of the deflection of the electron beam within the tube. Variation of the external elements in circuit with the coils affords adjustability of their effect. A further useful purpose which is served by the present invention is that of acting as a directional shield for the flux of the deflection yoke itself. Additional objects and advantages of the present invention will become apparent to persons skilled in the art from the following detailed description of the following drawings in which:

Figure 1 is an elevational view of a tricolor kinescope of the type described in the Law article cited supra having associated therewith a conventional deflection yoke and apparatus embodying the principles of the present invention;

Figure 2 is a vertical sectional view taken along line 2—2 of Figure 1, with certain parts removed in the interest of simplicity;

Figure 3 is a fragmentary view illustrative of the operation of a kinescope of the type shown in Figure 1; and

Figure 4 illustrates another form of the invention.

Referring to the drawing, and, more particularly, to Figure 1 thereof, there is illustrated a tri-color kinescope **10** of the type described in the above-mentioned Law article. The kinescope includes a phosphor screen **12** and a shadow mask **14**, both of which are described in detail by Law. Three electron guns are located within the neck portion **16** of the kinescope and are arranged at the apices of an equilateral triangle. In the drawing, only two of the three guns are shown, but it will be understood that each of the guns includes an indirectly heated cathode **18** enclosed within a cylinder **20** (closed at the target end by an apertured disc), which cylinder serves as the control grid. Each gun further includes an anode cylinder **22** (having an apertured end plate at its target end) and a second, or beam-focusing, anode cylinder **24** which includes a limiting aperture disc **26**. The kinescope is also provided with a substantially cylindrical convergence anode **28** which is common to and surrounds the paths of all three guns. Another important part of the electron lens system of the kinescope is the final, or beam-acceleration, anode **30** which is illustrated herein as a conductive wall coating formed on the interior of the kinescope and which extends from the neck thereof in the vicinity of the convergence anode **28** along the flared portion to a region in the vicinity of the target structure.

Respective focusing lenses formed between the individual beam-focusing anodes **24** and the common convergence anode **28**, when all are suitably energized, function to effect the proper focusing of the individual electron beams (not shown) so that they may have the proper individual scanning spot size at the target. A convergence lens formed between the convergence anode **28** and the beam acceleration anode **30** functions to effect substantial convergence of the several electron beams in the plane of the aperture mask **14**. For a more detailed explanation of a multiple gun structure of the type illustrated reference is made to the copending U. S. application of Hannah C. Moodey, Serial No. 295,225, filed June 24, 1952, for "Multiple Beam Tube." In a conventional manner the kinescope **10** is further provided with a deflection yoke **32** situated on the tube neck as shown for effecting the desired raster scanning deflection of the beams, which yoke may comprise the usual arrangement of horizontal and vertical deflection windings assembled so that the yoke is substantially anastigmatic. The horizontal and vertical windings of yoke **32** are further illustrated as being energized, respectively, by means of horizontal and vertical deflection generators **34** and **36** which serve to drive currents of saw-tooth wave form and of the proper line- and field-frequencies through their associated windings.

Although they do not form a part of the present invention, it may be noted in the interest of completeness of description that means may be provided for effecting rotatable positioning of the electron beam in accordance with the invention described and claimed in the copending U. S. application Serial No. 385,748, filed October 13, 1953, by J. K. Kratz for "Beam Controlling Apparatus." Briefly, such means, known as "beam alignment" or "beam positioning" apparatus may comprise three permanent magnets held in spaced relationship 120° apart about the longitudinal axis of the tube, so that each of the magnets may be adjustably positioned with respect to an associated electron beam in such manner as to produce what amounts to radial positioning of the beams, in order that each such beam be initially directed toward its position at the shield mask **14**.

Means (not shown, since they also are not a part of the present invention) may further be provided for shifting the three beams as a group with respect to the tube axis, such shifting being in addition to the alignment function performed by the positioning magnets referred to supra. This shifting of the three beams constitutes what is known in the art as "color purification" and may take the form, for example, of a "color purity coil" which is described in detail in an article by A. W. Friend entitled "Deflection convergence in color kinescope," which appeared in the same issue of Proceedings of the IRE cited above. The "color purity coil" is further described and claimed in the copending U. S. application of Friend, Serial No. 202,185, filed December 22, 1950, for "Beam Alignment Devices."

As thus far described, the apparatus of Figure 1 comprises an arrangement now well-known in the art. As described in the Van Ormer et al. article the two basic requirements for proper operation of a color kinescope of the type shown are, first, that the three electron beams converge to a point at the aperture mask and, second, that the deflection center and the color center of each of the three beams be coincident. The first of these requirements is normally accomplished through convergence apparatus of the type set forth, for example, in the Friend article but may take any suitable form capable of producing the result shown in Figure 3, wherein the three electron beams **38**, **40** and **42** are illustrated as converging to a point within the plane of shadow mask **14** and, further, within the aperture 14'. After convergence, the three beams diverge to strike, respectively, color phosphor dots shown by the dotted line areas **12***a*, **12***b* and **12***c* on the screen **12**.

The second requirement, namely, that having to do with the coincidence of color center plane and deflection center planes is met, in accordance with one aspect of the present invention, by the apparatus indicated generally by reference numeral **44** in Figure 1. This apparatus, as shown more clearly in the eniarged view of Figure 2, is or may be in the form of a continuous core **46** of annular shape, as shown, and of a high permeability material such as a ferrite or ferrospinel material. The ring **46** encircles the neck portion **16** of the kinescope behind (i. e. nearer the electron guns) the deflection yoke **32**. Wound about the core member **46** are two coils **48** and **50**, each of which surrounds no more than half of the core, that is to say, the two coils **48** and **50** are separated by a center line **52** which is drawn diametrically of the core. The ends of coil **48** are connected to each other through an external circuit element such as the resistor **54** which is variable between zero resistance (i. e. substantially a short circuit) and infinite resistance (i. e. substantially an open circuit). The ends of coil **50** are similarly connected by a variable resistor **56** which is variable between the same limits.

Generally the effects of the coils upon the deflection characteristics of the arrangement disclosed may be described as depending inter alia upon the axial spacing between the core and coils and the yoke **32**, the radial orientation of the center line **52** and the variable resistors **54**

and 56. In order that a proper understanding may be had of the reasons for the effectiveness of the apparatus in conjunction with a color kinescope, it is necessary to appreciate the general effects of the several elements of the assembly. With the assembly including core 46 and coils 48 and 50 thereon about the neck of the kinescope as shown in Figures 1 and 2 and with the resistors 54 and 56 adjusted to their largest value (e. g. substantially open circuit), the effect upon deflection is such that the amplitude of deflection is reduced in both the horizontal and vertical directions, so that the raster is reduced in size. This effect may be explained upon the basis that the high permeability core 46 acts as a magnetic shunt for some of the flux of the yoke 32, so that a portion of the yoke flux travels through the core 46 rather than through the neck 16 of the kinescope. When, however, the resistors 54 and 56 are adjusted to their smallest value (i. e. short-circuited), the deflection in a direction perpendicular to the center line 52 will be increased by substantially 75% of the amount which it was reduced when the coils were open-circuited. This latter result may be understood to occur for the following reason: Assuming that the center line 52 is vertically disposed, the horizontal deflection field of the yoke 32 which comprises vertically disposed flux lines will induce a voltage in the coils 48 and 50. This induced voltage will, in turn, produce a flux which opposes the horizontal flux of the yoke, thereby, in effect, preventing the horizontal deflection flux from being shunted by the ferrite core 46. On the other hand, the deflection in a direction parallel to the center line 52 (i. e. vertical deflection) will be unaffected by the coils 48 and 50. Thus, it will be appreciated that, by controlling the value of the resistors 54 and 56, the magnitude of deflection in one direction may be controlled without affecting the deflection in a direction perpendicular thereto. It should also be noted that the effectiveness of the core 46 and its coils is a function of the axial distance between that assembly and the yoke 32. That is to say, the directional control of deflection amplitude is greater when the assembly 44 is closer to the yoke 32.

Translating the above explanation regarding deflection amplitude control into terms of their meaning with regard to axial shifting of deflection centers, it should be understood that decreasing the amplitude of deflection in a given direction by shunting flux at the rear of the deflecting yoke is tantamount to moving the center of deflection for that direction closer to the target of the tube. Thus, when the center line 52 of the assembly 44 is vertical, the effect upon deflection amplitude is such that vertical deflection will be reduced, so that the deflection center of the vertical winding of yoke 32 is moved forward (i. e. toward the target) a greater amount than is the effective deflection center of the horizontal winding. Moreover, this difference is, as will be appreciated from the explanations made above, a minimum if the resistors 54 and 56 are very large and a maximum if the resistors are very small.

The utility of the present invention may be best understood from an appreciation of the manner in which a color kinescope of the type described is manufactured. That is, the plane of color centers is established for any given tube as soon as the tube has been assembled. The plane of deflection centers, on the other hand, is dependent upon the axial position of the deflection yoke along the tube neck and must be made to coincide, in the normal case, with the plane of color centers. Since the horizontal and vertical deflection centers do not necessarily lie in the same plane transversely of the tube (as by reason of the difference in frequency of operation of the horizontal and vertical windings), the present apparatus affords a relatively simple but effective mode of accomplishing the required coincidence. It is also to be noted that, in certain tubes, and for such reasons as stretching of the shadow mask 14 in production and the like, proper

operation of the tube may require that the vertical and horizontal deflection centers actually lie in different transverse planes. By orienting the center line 52 of the assembly 44 properly and by selecting the proper value for resistors 54 and 56 and spacing between the assembly and the yoke 32, the requisite positioning of the deflection planes may be had.

From the foregoing, it should be apparent that, in addition to its usefulness as an adjunct for a color kinescope insofar as color purity is concerned, the present invention affords a simple control over either one of the horizontal and vertical deflection amplitudes. Moreover, by reason of the directional nature of the control which the invention provides, and since the center line between the coils may be oriented at any angle, it is also feasible to employ the instant apparatus for controlling other characteristics of the raster which is scanned. For example, in a situation in which horizontal and vertical deflection are not truly perpendicular to each other, with the result that the raster is in the nature of a parallelogram rather than a rectangle, the raster shape may be corrected by rotating the assembly 44 so that its center line is parallel to the longer diagonal of the parallelogram or, at least, closer to that diagonal than to the shorter diagonal.

As is also well-known to workers in the color kinescope field, one common problem is that of shielding certain regions of the tube from unwanted magnetic flux from the deflection yoke. One such critical region which it is desirable to shield is the electron gun region of the tube wherein proper beam convergence must be effected. One proposed method of shielding is that which employs a high permeability shunt path for the unwanted flux to cause such flux to travel around the shielded area rather than through it. Another proposal is that of employing a shield of highly conductive material which, through the production of eddy currents terminates the unwanted flux within itself. An arrangement of the type just mentioned is described and claimed in the U. S. application of A. M. Morrell, Serial No. 395,371, filed December 1, 1953, for "Cathode Ray Tube Device." As pointed out in the Morrell application, when a high permeability shield is provided, its shunting effects result in a redistribution of the flux outside of the shielded region, while a conductive shield brings about substantially no change in such flux distribution. The present invention, when viewed in the role of a shield, and when it includes a core 46 of high permeability material, serves as a shunt for flux in all directions when the coils 48 and 50 are open-circuited. The reason for this characteristic is that, when the coils are open, they do not produce eddy currents such as to prevent the yoke flux from passing into the shunt. Conversely, when resistors 54 and 56 are reduced to zero, the assembly acts as a "polarized" or direction-sensitive, conductive shield for flux which is parallel to the center line 52. Thus, for example, if the center line 52 is vertically oriented, the assembly serves as a shield of the conductive type for horizontal flux in the area of the device. Vertical flux, on the other hand, will be shielded by the shunting action of the core 46.

While the present invention has been described primarily with regard to its usefulness as a means for rendering the color center and deflection planes coincident, as "polarized" deflection amplitude controlling means and as a "polarized" flux shield, it has been found that other characteristics of the raster may also be controlled thereby. By way of illustration, an assembly of the type shown in Figure 2 may be advantageously employed as a linearity control of directional sensitive character such that, with the center line in a given direction, proper values of the resistors 44 and 46 will afford a correction for non-linear deflection field for deflection in a direction perpendicular to the center line.

Another form of the invention, and one which has been found in practice to be even more effective in the selective control of deflection amplitude and the shifting

of deflection centers, is shown in Figure 4. In view of the similarity of structure, reference numerals corresponding to those employed in Figures 1 and 2 but bearing the prime (') notation will be employed in describing this second form of the invention. Thus, there is shown an assembly 44' comprising a core of high permeability material 46' made of a ferrite, for example, about which there are wound coils 48' and 50', the coils being disposed on opposite sides of a center line 52'. In series with the coil 48' is a variable capacitor 60, a similar variable capacitor 62 connected in series with the winding 50'. With the assembly 44' located about the neck of a kinescope such as the color kinescope of Figure 1, by way of illustration, the horizontal scanning or deflection amplitude may be increased in the neighborhood of 25% over that which is possible without the assembly. Such an increase is effected by tuning the series arrangements of the coils 48' and 50' and their associated capacitors 60 and 62 to the horizontal scanning frequency (e. g. 15.75 kc.) and rotating the assembly so that its center line is vertical (i. e. perpendicular to the direction of the horizontal scan). The operation of this form of the invention may be understood as follows: the flux lines produced by the horizontal deflection coils of the yoke 32 link the coils 48' and 50', whereby to induce energy in the coils. Since the coils are tuned to the horizontal scanning frequency and may be designed to have a high "Q," they, in turn, produce a magnetic field substantially identical to that of the horizontal deflection coils of the yoke but located closer to the electron gun structure of the tube. Such auxiliary field, as it may be viewed, effectively shifts the center of deflection for the horizontal scan back toward the source of the electron beam or beams, hence producing an increased horizontal scanning amplitude. Where it is desired to vary selectively the vertical scanning amplitude or the location of the vertical deflection center, the capacitors 60 and 62 may be adjusted to tune their associated windings 48' and 50', respectively, to the vertical scanning frequency (e. g. 60 C. P. S.) and by rotating the assembly so that the center line 52' is horizontally disposed. Nearly the same effect upon the vertical deflection may be realized as has been explained with respect to the horizontal deflection. The embodiment of Figure 4, as stated, is even more effective in the control of deflection amplitude and location of deflection centers than is the arrangement of Figure 2 which employs resistors variable between open-circuited and short-circuited conditions. One difference to be noted, however, is that, while the arrangement of Figure 2 is also effective in controlling linearity of deflection, the embodiment of Figure 4 does not afford as much control in this regard. Another point to be noted in connection with the arrangement of Figure 4 is that the axial distance between the assembly 44' and the deflection yoke 32 must be chosen as by way of compromise. That is to say, since the operation of this form of the invention depends upon the production of an auxiliary field "by" the deflection yoke, it would appear that the farther the auxiliary assembly 44' be located from the yoke, the farther back the deflection center could be shifted. This analysis is, however, compensated for by the fact that the amount of energy coupled into the windings 48' and 50' decreases as the assembly 44' is moved from the deflection yoke. Thus, the assembly 44' should be located where the maximum amount of energy is coupled into it, while bearing in mind the fact that that location of assembly 44' also determines, at least in part, the location of the effective center of deflection.

Still another use to which the apparatus of Figure 4 may be put is that of eliminating "ringing" which may occur in the deflection yoke 32 as a result of a high frequency resonance. Such ringing, which manifests itself in "velocity modulation" of the scanning beam intensity, may be eliminated by tuning the series L–C circuits to the ringing frequency and orienting the center line 52' in a direction perpendicular to that deflection direction which contains the unwanted ringing component.

A second form of ringing which the apparatus of Figure 4 may be used to eliminate is that which results in the displacement of the electron beam from its normal direction of deflection. While the exact cause of this latter type of ringing is not known exactly, it may, for example, be due to the production of ringing in only a part of one of the deflection windings of the yoke, so that an unbalanced effect is produced. This form of ringing may be eliminated by tuning the series L–C circuits to the ringing frequency and by adjusting the rotational position of the device (i. e. orienting its center line 52') so that flux from both the horizontal and vertical deflection windings of the yoke is coupled into the windings 48' and 50'.

While the invention has been described in accordance with certain specific structures such as the annular core of high permeability material having a single pair of windings thereon, additional modifications within the scope of the invention will also suggest themselves to those skilled in the art. For example, a core of that type may be wound with two pairs of coils, the coils of each pair being separated by a center line which is perpendicular to the center line separating the coils of the other pair. With a variable resistor in series with each coil, it will be appreciated that there may be obtained independent control of the amplitude and center of deflection in both of the directions of deflection. Another change which may be made within the scope of the invention relates to the shape of the core which may assume a variety of shapes in addition to the ring form, such, for example, as rectangular or other polygon forms.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. An adjunct for a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward said target and electromagnetic means for deflecting such electron beam transversely of said target, said adjunct comprising: a continuous core member adapted to surround such tube and reside in a plane substantially normal to such axis; a first conductor wound about said core; a second conductor wound about said core but spaced from said first conductor on said core; means including a circuit element connecting the ends of said first conductor; and means including a circuit element connecting the ends of said second conductor, said first and second conductors forming electrically and physically separate coils.

2. An adjunct for a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward said target and electromagnetic means for deflecting such electron beam transversely of said target, said adjunct comprising: a continuous core member adapted to surround such tube and reside in a plane substantially normal to such axis; a first conductor wound about said core; a second conductor wound about said core but spaced from said first conductor on said core; means including a resistive element connecting the ends of said first conductor; and means including a resistive element connecting the ends of said second conductor.

3. An adjunct for a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward said target and electromagnetic means for deflecting such electron beam transversely of said target, said adjunct comprising: a continuous core member adapted to surround such tube and reside in a plane substantially normal to such axis and between such deflecting means and such beam-directing means; a first conductor wound about said core; a second conductor wound about said core but spaced in its entirety from said first conductor on said core; means including a circuit element connecting the ends of said first conductor to form a series circuit with said conductor; and means

including a circuit element connecting the ends of said second conductor to form a second series circuit electrically separate from said first circuit.

4. An adjunct for a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward said target and electromagnetic means for deflecting such electron beam transversely of said target, said adjunct comprising: a continuous core member of high permeability material adapted to surround such tube and reside in a plane substantially normal to such axis; a first conductor wound about said core; a second conductor wound about said core but spaced as a unit from said first conductor on said core; means including a circuit element connecting the ends of said first conductor; and means including a circuit element connecting the ends of said second conductor, said first and second conductors forming, together with said circuit elements, respectively distinct electrical circuits.

5. An adjunct for a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward said target and electromagnetic means for deflecting such electron beam transversely of said target, said adjunct comprising: a continuous annular core member adapted to surround such tube and reside in a plane substantially normal to such axis; a first conductor wound about said core and confined to half of said core; a second conductor wound about the other half of said core so that said second conductor is spaced as a unit from said first conductor on said core; means including a capacitive element connecting the ends of said first conductor annular; and means including a second capacitive element connecting the ends of said second conductor annular.

6. The invention as defined by claim 2 wherein each of said resistive elements is variable from substantially zero to a maximum value.

7. Deflection controlling apparatus for association with a cathode ray tube having a target, means for directing an electron beam along the longitudinal axis of such tube toward such target, and electromagnetic means for deflecting such electron beam in two mutually perpendicular directions, which apparatus comprises: a continuous core member of high magnetic permeability having a central aperture for receiving such tube such that said core resides in a plane substantially perpendicular to such longitudinal axis; a first conductor wound around said core member to form a first coil; a second conductor wound around said core to form a second coil; said first and second coils being separated from each other by a reference line; means including a circuit impedance element for connecting the ends of said first conductor; and means including a second circuit impedance element for connecting the ends of said second conductor, said core and coils being rotatable in said plane about such axis.

8. Deflection controlling apparatus for a kinescope having a target, means for directing a plurality of spaced electron beams along the longitudinal axis of such tube toward such target and electromagnetic means between such target and such last-named means for deflecting such beams in two mutually perpendicular directions, whereby each beam is caused to scan a raster on such target, and means for causing each of such beams to strike only selected areas of such target, said apparatus comprising: a continuous core member of high permeability material adapted to surround such longitudinal axis and to reside in a plane substantially normal to such axis between such beam-directing means and such deflection means; a first conductor wound on said core to form a coil; a second conductor wound on said core to form a second coil, said first and second coils being separated from each other by a reference line transversely of said core and in its plane; means including an impedance element for connecting the ends of said first conductor to each other; means including a second impedance element for connecting the ends of said second conductor to each other; said core and coils being rotatable about such longitudinal axis in such manner as to permit said reference line to assume substantially any angle with respect to either of such mutually perpendicular directions of deflection.

9. In combination with a kinescope having a target, means for directing a plurality of spaced electron beams along the longitudinal axis of said tube toward such target and electromagnetic means between said target and said last-named means for deflecting said beams in two mutually perpendicular directions, whereby each beam is caused to scan a raster on said target, and means for causing each of said beams to strike only selected areas of said target, apparatus comprising: a continuous core member of high permeability material adapted to surround said longitudinal axis and to reside in a plane substantially normal to said axis between said beam-directing means and said deflection means; a first conductor wound on said core to form a coil; a second conductor wound on said core to form a second coil, said first and second coils being separated from each other by a reference line transversely of said core and in its plane; impedance means for connecting the ends of said first conductor to each other; impedance means for connecting the ends of said second conductor to each other; said core and coils being rotatable about said longitudinal axis in such manner as to permit said reference line to assume substantially any angle with respect to either of said mutually perpendicular directions of deflection.

References Cited in the file of this patent

UNITED STATES PATENTS

2,428,947	Torsch	Oct. 14, 1947
2,467,009	Bull et al.	Apr. 12, 1949
2,561,586	Montgomery	July 24, 1951
2,598,303	Reinhard	May 27, 1952
2,646,529	Werenfels et al.	July 21, 1953
2,719,249	Friend	Sept. 27, 1955
2,748,305	Davies	May 29, 1956