

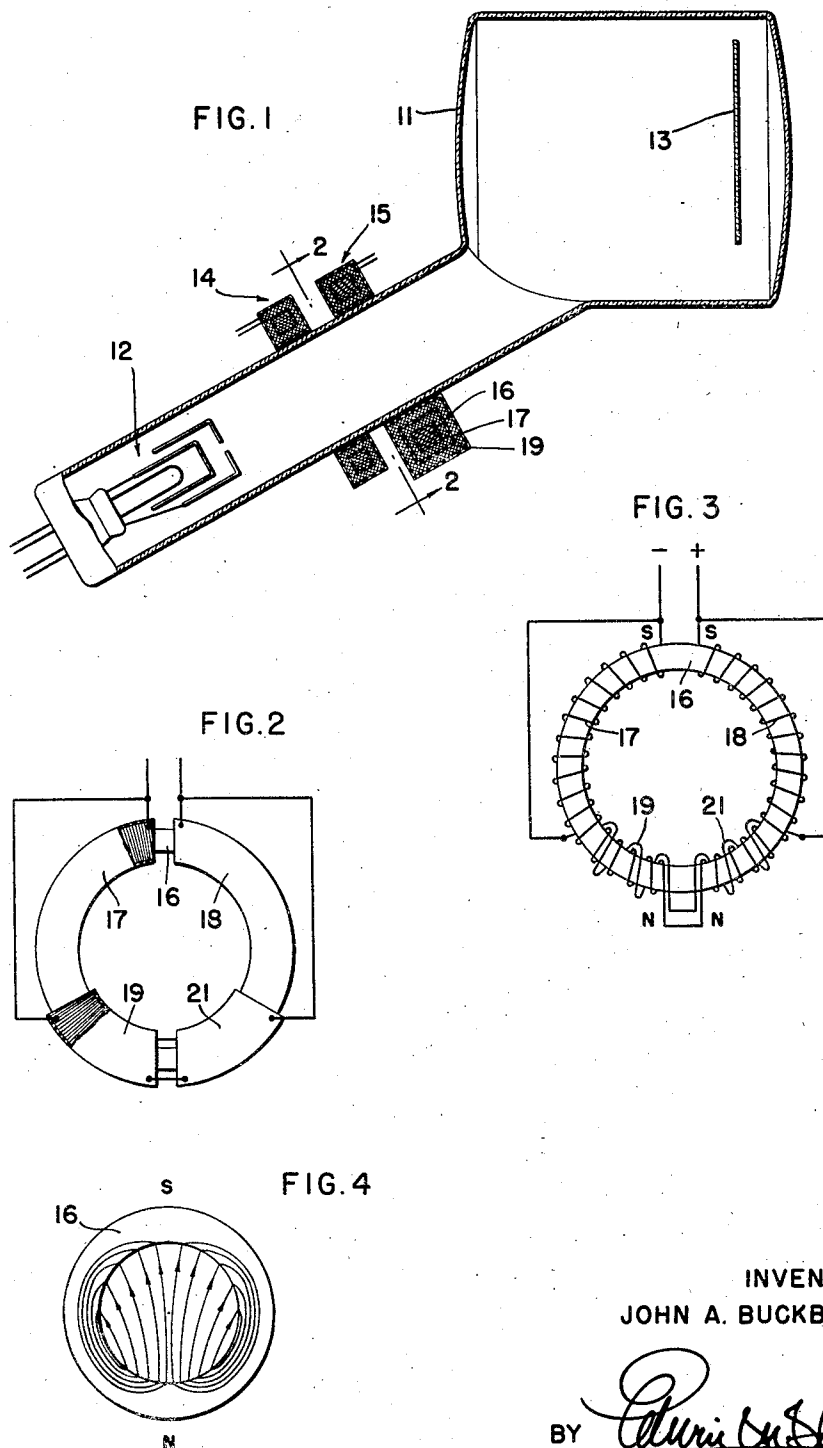
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KEYSTONE CORRECTION APPARATUS

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KEYSTONE CORRECTION APPARATUS

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3 Claims. (Cl. 250—157)

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This invention relates to magnetic field producing devices, and particularly to a scanning yoke for a cathode ray tube to produce an electromagnetic field of a predetermined non-uniform intensity.

According to conventional practice certain types of cathode ray devices employed in television systems require compensation for deficiencies inherent in these devices produced by certain structural limitations thereof. One device of this character is an iconoscope used as a television camera tube wherein, in order to avoid obstruction of the optical system, the electron gun for producing the scanning beam of electrons is disposed angularly with respect to the photosensitive electrode to be scanned. By reason of this angular relationship, in the absence of suitable compensating means, the area of the photosensitive electrode scanned by the beam has a trapezoidal or keystone shape. A number of proposed compensating arrangements to overcome this scanning deficiency comprise systems for deflecting the scanning beam by means of non-uniform electromagnetic fields having divergent intensity distribution characteristics. In order to produce a field of this character it has been proposed to suitably form opposed salient pole pieces of a deflecting yoke, about the legs of which the windings are placed. It also has been proposed to provide a greater number of winding turns upon one of two opposed salient pole pieces than upon the other. Another prior art expedient has been to concentrate a greater number of coil conductors in one portion of a cylindrically shaped coil than in others.

As is well known in the art, however, deflecting coils of these types are relatively inefficient for the reason that a large percentage of the fields produced thereby are disposed exteriorly of the tube and contribute nothing toward the deflection of the electron beam within the tube. As a consequence, a substantial portion of the energy supplied to the coil is dissipated without being gainfully employed. Furthermore, there is a tendency produced by the exterior portion of the field to create undesired electrical disturbances in other equipment associated with cathode ray tubes employed for conventional purposes, such as camera tubes in television systems.

It is an object of this invention, therefore, to provide a novel scanning yoke for a cathode ray tube which is characterized by its ability to produce in a highly efficient manner an electromagnetic field which has a predetermined non-uniform

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intensity distribution throughout a plane substantially normal to the path of the cathode ray.

In accordance with this invention, there is provided for use with a cathode ray tube an annular core which completely surrounds a portion of the tube through which travels the electron beam. There is wound about the core a coil array having a greater number of turns about one portion of the core than about others, whereby to produce within the tube space enveloped by the core a substantially unidirectional electromagnetic field having a predetermined divergent intensity distribution.

More particularly, there is wound about this core a pair of separate coils forming at least a portion of a toroid. The placing of the coils upon the core and the electrical interconnection thereof to a source of unidirectional energy is such that adjacent ends of the coils produce magnetic poles of like polarity. The ends of the two coils which are adjacent are relatively closely spaced on the core while the other ends of the coils are relatively widely spaced on the core. In this manner the field in the vicinity of the closely spaced coil ends is relatively strong while the field adjacent the opposite portion of the core is relatively weak. The structural arrangement of the coils upon the core is of such a nature that there is produced within the portion of the tube enveloped by the core, a non-uniform field which has a predetermined divergent intensity distribution characteristic.

For a better understanding of the invention, together with other and further objects thereof, reference is had to the following description, taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

In the accompanying drawing:

Fig. 1 is an elevational view in cross section of a cathode ray tube provided with a scanning yoke in accordance with this invention;

Fig. 2 is a sectional view of a portion of the cathode ray tube taken on the line 2—2 of Fig. 1;

Fig. 3 is a schematic diagram illustrating one manner of winding the coils on the core and the electrical interconnection thereof; and

Fig. 4 is a diagram illustrating the field distribution within the tube space enclosed by the scanning yoke illustrated in Figs. 1 and 2.

Referring now to the drawing and particularly to Fig. 1, there is provided, in accordance with this invention, a cathode ray tube 11 of conven-

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tional construction. This tube is a television camera tube of the iconoscope type and includes an electron gun assembly 12 for generating an electron beam with which to scan a mosaic electrode 13. The electrode 13 is mounted within the main body portion of the tube and is disposed in a plane which is substantially perpendicular to the axis of a conventional optical system (not shown) by means of which light reflected from the television subject is projected upon the mosaic. The electron gun structure 12 is located in the tubular neck portion of the tube which is angularly disposed with respect to the mosaic 13 in order not to interfere with the optical system. The neck portion of the tube 11 is enveloped, in the region between the electron gun assembly 12 and the main body portion of the tube, by a vertical scanning yoke 14 and a horizontal scanning yoke 15.

The vertical scanning yoke 14 is placed nearer to the electron gun assembly than the horizontal scanning yoke 15 in order that the electron beam may be suitably deflected in a manner to be described. The construction of the two scanning yokes is similar, and in general is in accordance with the structure disclosed in a copending application of John A. Buckbee, Serial No. 519,719, filed January 26, 1944, and entitled "Scanning and focusing yoke." Therefore, only the horizontal yoke embodying the instant invention will be described in detail by referring to Figs. 1 and 2. The yoke 15 consists of a ferromagnetic core 16 which preferably is of a laminated structure formed by winding a continuous ribbon of transformer iron to form a laminated ring of approximately one-eighth inch thickness, for example. A pair of coils 17 and 18 may be wound about the core 16 in such a manner that together they extend almost completely around the core. These coils may be wound identically and placed opposite to one another on the core, in which case they are electrically connected in parallel. Alternatively, they may be wound oppositely to one another and also placed oppositely to one another on the core, in which case they are electrically connected in series. It is the latter arrangement which is illustrated herein, and the series connected coils are connected to a source of unidirectional energy as indicated in Fig. 3. In either type of arrangement however, there are produced by the respective coils magnetic poles of like polarity adjacent to one another. For example, at the lower portion of the annular core 16, as viewed in Fig. 3, there are produced magnetic north poles while at the upper portion of the core magnetic south poles are produced. It will be obvious to those skilled in the art that the same results may be obtained by other coil arrangements together with appropriate electrical interconnections thereof.

In addition to the coils 17 and 18 there also is provided at the lower portion of the core 16 a pair of auxiliary deflection coils 19 and 21. These coils may be wound and arranged upon the core similarly to the coils 17 and 18 so that there are produced adjacent the lower portion of the core magnetic poles of like polarity which corresponds to the polarity of the magnetic poles produced in this portion of the core by the windings 17 and 18. As illustrated, the auxiliary coils 19 and 21 are wound about the exterior of the coils 17 and 18. However, it is contemplated to be within the scope of this invention that either the auxiliary coils be placed adjacent to the core with the coils 17 and 18 wound about the

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auxiliary coils, or the two sets of coils may be placed upon the core with the respective turns thereof intermingled, if desired. In any case the auxiliary coils 19 and 21 extend for only relatively short distances around the annular core 16, as indicated in the drawing. Alternatively, a single pair of coils may be employed, each coil having a distributed winding wherein a greater number of turns is concentrated at one end of the coil than at the other. In some cases only coils similar to the coils 19 and 21 may be sufficient to produce a field of the desired strength and intensity distribution.

The electrical interconnection of the auxiliary coils may or may not correspond to the interconnections of the coils 17 and 18, depending upon whether or not the winding of the auxiliary coils is the same as or different from the coils 17 and 18. The auxiliary coils are connected to a conventional source (not shown) of unidirectional sawtooth scanning energy which, if desired, may be the same source which supplies the coils 17 and 18 in which case the two sets of windings may be connected either in parallel, as shown, or in series to the source of energy.

Fig. 3 illustrates diagrammatically one manner in which the coils may be wound upon the annular core 16. As illustrated, the coils 17 and 18 and also the auxiliary coils 19 and 21 are wound oppositely upon the core and consequently are connected in series as indicated in the lower portion of Fig. 3. The other ends of the respective windings are connected, as shown, in parallel to a suitable source of unidirectional energy.

Referring now to the operation of the described apparatus embodying this invention, it is assumed that a concentrated beam of electrons is generated by the electron gun assembly 12, and is directed toward the mosaic electrode 13. In the tube space enveloped by the vertical scanning yoke 14 there is produced an electromagnetic field of substantially uniform intensity which extends from the lower to the upper parts of the neck of the tube 11. The magnitude of this field is varied in a well known manner under the control of a suitable scanning generator connected to the yoke 14. Under the influence of the vertical deflecting field thus produced the electron beam is deflected at a relatively slow rate so as to scan the mosaic electrode 13 from top to bottom, for example.

In the space of the tube neck enveloped by the horizontal scanning yoke 15 there is produced by means of the combined action of the coils 17-18 and 19-21 an electromagnetic field which has an intensity distribution which varies from one point to another in a predetermined manner. The general character of the field distribution is illustrated graphically in Fig. 4. It is seen that the field adjacent the lower portion of the core 16 is relatively strong, whereas, adjacent the upper portion of the core the field is relatively weak. The magnetic lines of force comprising this field diverge from a central line extending through the opposite ends of the coils 17 and 18. It is to be noted that a field having such a divergent characteristic is produced by the auxiliary coils 19 and 21, by reason of the positions in which they are mounted on the core 16. The field produced by the coils 17 and 18 is substantially uniform throughout the space enveloped by the core, and the lines of force comprising this field extend substantially parallelly from the lower to the upper portions of

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the core. It is apparent, therefore, that there is produced by means of the two sets of coils a composite electromagnetic field which is characterized by the described divergence of the lines of force.

The magnitude of this composite divergent field is varied in a well known manner by suitable connection of the coils to a source of deflection voltage. Under the influence of the varying magnitude of the divergent horizontal scanning field, the electron beam is deflected horizontally from one side of the mosaic electrode 13 to the other. However, by reason of the divergent character of this field, the electron beam when directed through the upper portion of the horizontal scanning field is not deflected horizontally as much as it is when traversing the lower portion of the divergent field. In the present case the compensation afforded by the divergent field produced in accordance with the present invention is sufficient in magnitude to cause the electron beam to traverse a substantially rectangular area of the mosaic 13.

It will be noted that, while not specifically illustrated herein, a means for focusing the electron beam will be required. Inasmuch as it is contemplated that such a structure may be conventional and forms no part of the present invention, it has been omitted from the drawing in order to simplify the illustration of the apparatus embodying the invention. If desired, the focusing of the electron beam may be effected by means of a coil wound on either or both of the scanning yokes 14 and 15. The focusing coil may be wound either externally or internally of the scanning coils.

While there has been described what, at present, is considered the preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and therefore, it is aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An electromagnet deflecting system for a cathode ray tube comprising, an annular ferromagnetic core disposed about the electron path of said tube, a first deflecting coil wound about said core in a manner to produce within the space

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enclosed by said core a unidirectional electromagnetic field of substantially uniform intensity distribution, and a second deflecting coil wound similarly to said first coil about only a portion of said core in a manner to produce within the space enclosed by said core a unidirectional electromagnetic field of non-uniform intensity distribution, said two fields being similarly poled and combining to form a composite unidirectional electromagnetic field of divergent intensity distribution.

2. An electromagnetic deflecting system for a cathode ray tube comprising, an annular ferromagnetic core disposed about the electron path of said tube, a first deflecting coil comprising two portions electrically interconnected and wound about said core in a manner to produce within the space enclosed by said core a unidirectional electromagnetic field of substantially uniform intensity distribution, and a second deflecting coil symmetrically disposed with respect to said first coil and comprising two portions electrically interconnected and wound similarly to said first coil about only a portion of said core in a manner to produce within the space enclosed by said core a unidirectional electromagnetic field of non-uniform intensity distribution, said two fields being similarly poled and combining to form a composite unidirectional electromagnetic field of divergent intensity distribution.

3. An electromagnetic deflecting system for a cathode ray tube comprising, an annular ferromagnetic core disposed about the electron path of said tube, a first deflecting coil comprising two portions electrically connected in series and wound in opposite directions about said core to produce within the space enclosed by said core a unidirectional electromagnetic field of substantially uniform intensity distribution, and a second deflecting coil symmetrically disposed with respect to said first coil and comprising two portions electrically connected in series and wound similarly to said first coil in opposite directions about only a portion of said core to produce within the space enclosed by said core a unidirectional electromagnetic field of non-uniform intensity distribution, said two fields being similarly poled and combining to form a composite unidirectional electromagnetic field of divergent intensity distribution.

JOHN A. BUCKBEE.