

Nov. 18, 1947.

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2,431,077

CATHODE RAY TUBE WITH REVOLVING MAGNETS AND ADJUSTABLE SLEEVE

Filed Aug. 31, 1943

Fig. 1.

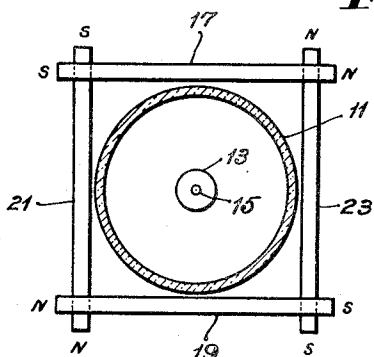


Fig. 2.

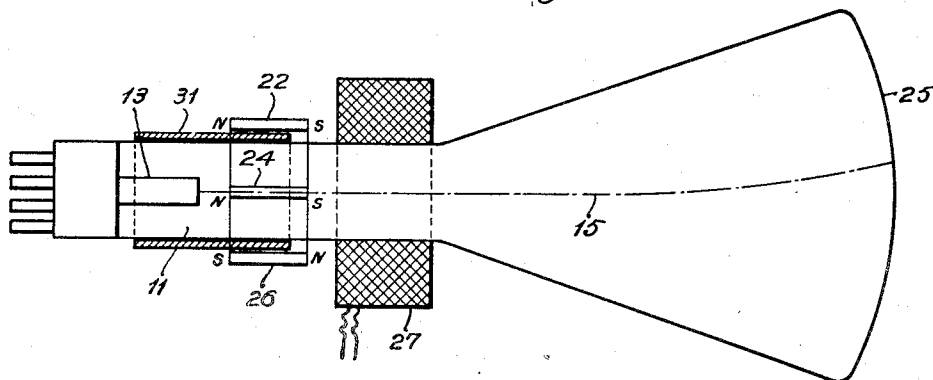
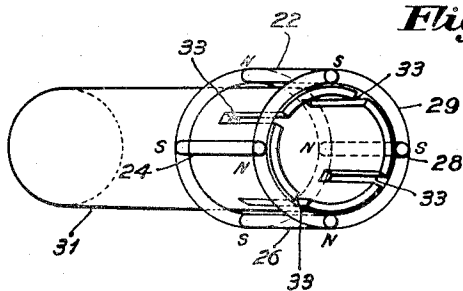


Fig. 3.



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UNITED STATES PATENT OFFICE

2,431,077

CATHODE-RAY TUBE WITH REVOLVING
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Application August 31, 1943, Serial No. 500,706

4 Claims. (Cl. 250—161)

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The present invention relates to electronic apparatus and particularly to a combination of electronic apparatus and electro-magnetic apparatus which will serve to center or otherwise locate the electron beam within a cathode ray tube when the beam is in a position of rest, for instance.

In the prior art, recourse has usually been had to various ways and means by which electrical cathode ray apparatus is utilized to provide a direct current flow through the deflecting coils in such a way as to develop a field to provide adequate centering or locating of the cathode ray beam. An example of this type of apparatus is found in United States Patent No. 2,007,380 of W. J. Morlock, granted July 9, 1935. Such methods have proven very satisfactory but tend, nevertheless, to introduce objectionable resistance into the deflecting circuit and also tend to demand a relatively high current drain through the centering potentiometer to enable as low a resistance as possible to be used. Very low impedance yokes cannot be used for deflection under such circumstances because of the centering current requirements.

The present invention, however, makes provisions for avoiding the difficulties of the prior art through the complete elimination of the necessity of providing a direct current flow through any yoke windings in order to center or otherwise position the electron beam within the tube.

It becomes especially important in the development of cathode ray apparatus, such as used for television purposes, oscillographic purposes and other measuring purposes, to have the electron beam accurately centered or located in order that the raster finally scanned shall be of uniform dimensions, assuming the tube to be symmetrical, or so that the pattern trace shall be from some suitable predetermined point.

According to the present invention, provision is made for a plurality of magnetic deflecting means for the electron beam, in addition to the normal deflecting coils formed about a yoke member, with these magnetic means developing a permanent electro-magnetic field which can be short circuited, as desired, to vary and control the exact position of the undeflected electron beam within the tube.

It has already been suggested in the prior art to deflect an electron beam electro-magnetically or electrostatically in a scanning tube of the so-called "Iconoscope" type, wherein a sloping target is positioned, and then to provide auxiliary magnetic fields for varying the strength of the magnetic field deflection at certain portions of

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the beam traverse, as is pointed out, for instance, by the R. L. Campbell Patent No. 1,995,376, of March 26, 1935. However, such arrangements of the prior art are for providing a correction for keystoneing, in contrast to an accurate centering or beam locating arrangement for an electron tube.

It becomes especially important to provide a simplified means by which the electron beam can be centered (or otherwise located in an undeflected state) in view of the fact that in the manufacture of tubes, the tube geometry changes from tube to tube due in many instances to evacuation difficulties. Frequently, the geometry of the tube, so far as the electron gun assembly and the like is concerned, changes with regard to the tube envelope due to difficulties of establishing the electron gun in accurate position while the tube is being assembled.

Accordingly, the present invention comprises the use of a series of permanent magnets positioned around the neck of the tube and the use of a cylindrical member of suitably soft magnetic material adjustably placed within the field of the magnetic member.

It accordingly becomes an object of the present invention to provide a simplified arrangement for developing electro-magnetic or magnetic fields which shall serve to position an electron beam in a position of rest within a tube at a predetermined point or plane with regard to an impacted target area.

Another object of the invention is that of providing an electron beam centering means for a cathode ray tube which will not require any flow of electrical energy but which, at the same time, will provide a system which is readily adjustable to control the beam centering from tube to tube through the use of similar adjusting arrangements.

Another object of the invention is that of providing an arrangement whereby adequate and proper centering or positioning of the electron beam within a cathode ray tube may be provided and still permit the use of a substantially cheaper yoke construction with many fewer turns than those now customarily in use.

Other objects of the invention are to provide a cathode ray beam locating or centering arrangement in which provision for avoiding high centering currents is made.

Other objects of the invention are those of providing ways and means by which separate and expensive centering yokes are avoided and, at the same time, whereby expensive potentiometer

devices through which the centering or beam positioning current flows are avoided.

Other objects of the invention are those of providing a simplified beam arrangement which is readily manufactured, easily installed and which may be adjusted from time to time to compensate for replacement tubes positioned within a single magnetic yoke.

Other objects and advantages will become apparent from reading the following specification and its claims, together with the drawings, wherein,

Fig. 1 shows one method of utilizing a series of permanent magnets relative to the electron tube;

Fig. 2 shows a modification of the arrangement of Fig. 1; and

Fig. 3 shows a more detailed section of the arrangement of Fig. 2.

Referring now to the drawings and first to Fig. 1, the electron tube of the cathode ray type is shown in section, with the section taken through the neck 11 of the tube.

Within the neck of the tube is provided the usual electron gun 13 in which the electron beam 15 is developed and directed toward the tube target area (see Fig. 2).

Positioned about the neck of the tube is a series of four permanent magnets 17, 19, 21 and 23 having north and south poles, as indicated by the letters N and S, respectively. With this arrangement, the various magnets 17 through 23 are secured together in a yoke, as shown, and when the yoke is positioned symmetrically about the neck of a tube 11, the electron beam 15 is substantially unaffected by the field developed. However, if the beam 15 does not center properly upon the tube target area, the yoke assembly is moved off-center in either a clockwise or a counter-clockwise direction, in order that the beam may be slightly deflected by a magnetic field, in addition to the electron beam deflecting field normally developed.

In the arrangement of Fig. 2, the electron beam 15 is shown passing through the tube longitudinally to strike or impinge upon the end wall 25 of the tube which, in the case of a receiver tube, will be coated with suitable luminescent material.

The conventionally shown magnetic deflecting yoke 27 is provided for deflecting the beam in two directions normally perpendicular to each other when suitably energized from well known sources (not shown).

In order that the electron beam 15 may be properly centered or otherwise located or positioned with regard to the tube end wall or target area 25 in the absence of a deflecting field being applied to the coils 27, a series of permanent magnets 22, 24, 26 and 28, and so on, may be provided with spacing as substantially indicated. These magnetic elements are preferably supported in a ring member 29 of non-magnetic material in order accurately to position them with regard to the tube neck 11.

Internally of the magnets there is adapted to be positioned a cylindrical member 31 formed of magnetic material, such as soft iron or steel, which, when coming within the field developed from any of the magnets, will serve to short circuit the field of the magnet. The cylindrical member is preferably positioned around the neck of the tube, as more particularly shown by Fig. 2, and brought up to a position closely adjacent the deflection yoke 27. The portion of the cylindrical member 31 which faces toward the yoke member 27 may have appropriately shaped pole pieces,

such as those indicated by way of the notched formation provided by the recess sections 33 in the cylindrical member.

If, now, the yoke or support 29 which carries the permanent magnets 22, 24, 26 and 28 is moved relative to the cylindrical member toward and away from the yoke 27, it will be apparent that the effect thereof is changed. Similarly, the yoke holding the permanent magnets may be rotated, where desired. In any event, the relative motion of the soft magnetic cylindrical member and the permanent magnets with regard to each other, about the neck of the tube, it will be seen, causes the electron beam flowing within the tube to be appropriately positioned relative to the target area 25.

Having described my invention, what I claim is:

1. Electronic apparatus for use in combination with a cathode ray tube having included therein means to develop a cathode ray beam and a target area upon which the cathode ray beam is adapted to impinge, which includes a plurality of permanent magnets positioned to surround the cathode ray beam path in a region closely adjacent the cathode ray beam source and intermediate the cathode ray beam source and the target, means located intermediate the said permanent magnets and the cathode ray beam path for modifying the magnetic field effective upon the said beam, means for rotating the said magnets to predetermined degrees relative to said field modifying means so as to locate the developed cathode ray beam in a position of rest at a predetermined spot upon the tube target and means for shifting the field modifying means longitudinally of the magnets.

2. In combination with electronic apparatus of the cathode ray tube type wherein there is included means to develop a cathode ray beam and a target area upon which the developed cathode ray beam is adapted to impinge, a yoke element, a plurality of permanent magnets positioned by said yoke element to surround the cathode ray beam in a region closely adjacent the beam source and intermediate the beam source and the target, a slotted field modifying element located intermediate the said permanent magnets and the beam path for modifying the magnetic field effective upon the said beam, means for rotating the magnets to predetermined degrees relative to said field modifying means so as to move the slots relative to the magnets and thereby to locate the developed beam when in a position of rest at a predetermined spot upon the tube target and means to move the elements longitudinally of one another to modify thereby the magnetic field strength effective on the electron beam.

3. In electronic apparatus of the type described wherein is included a cathode ray tube having a neck portion wherein means is provided for developing a cathode ray beam and including also a bulbous portion wherein is included a target area upon which the cathode ray beam is adapted to be directed, the combination which includes a plurality of permanent magnets positioned to surround the tube neck and also positioned relative thereto with substantially uniform spacing, a support yoke for positioning and locating the said magnets relative to each other, a field modifying sleeve element for modifying the effectiveness of the magnetic fields of the magnets upon the said electron beam, and means for rotating the said magnets and sleeve element relative to each other and the electron tube neck and also

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for moving the said element and magnets longitudinally relative to one another for changing the effectiveness of the magnetic field developed relative to the electron beam to position the electron beam in a position of rest at a predetermined point upon the target area.

4. In electronic apparatus of the type described, a cathode ray tube having a neck portion wherein means is provided for developing a cathode ray beam and having a bulbous portion wherein is included a target area upon which the cathode ray beam is adapted to be directed, a plurality of permanent magnets surrounding the tube neck and positioned relative thereto to surround the tube neck at substantially uniform angular spacings one from the other, a support yoke for positioning and locating the said magnets relative to each other, a field modifying sleeve element having a plurality of slots in one end thereof for modifying the effectiveness of the magnetic fields of the magnets upon the said electron beam, the number of said slots corresponding to the number of magnets surrounding the said tube neck, and means for rotating the said magnets and the sleeve element relative to each other and the electron tube neck for changing the effectiveness of

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the magnetic field developed relative to the electron beam to position the electron beam in a position of rest at a predetermined point upon the target area.

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