March 11, 1941. D. R. DE TAR 2,234,720

ELECTRON DISCHARGE APPARATUS

Filed Aug. 10, 1939 2 Sheets-Sheet 1

Fig. 1.

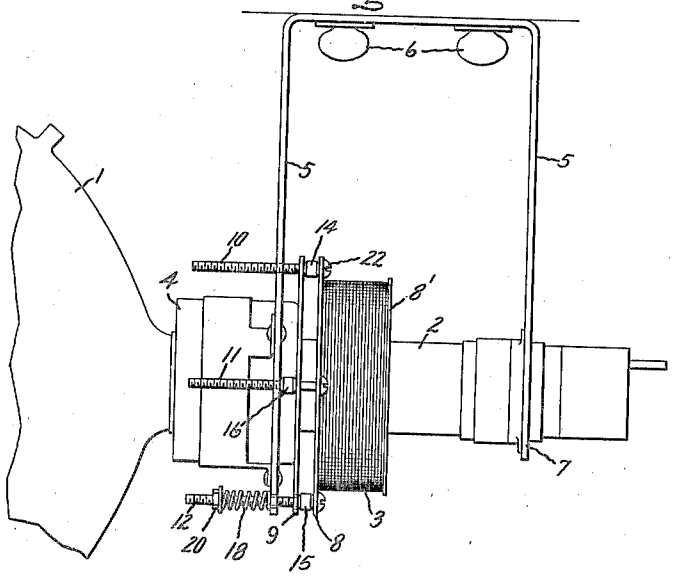


Fig. 2.

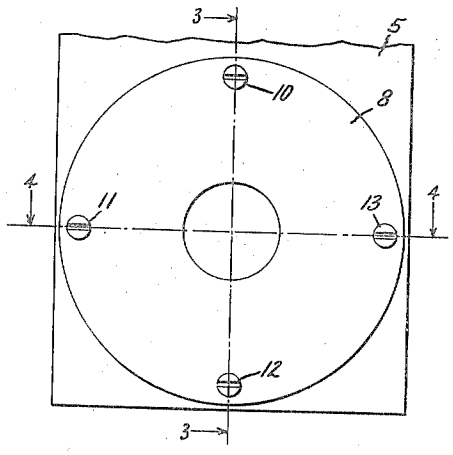


Fig. 3.

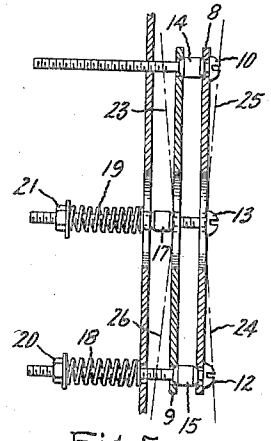


Fig. 4.

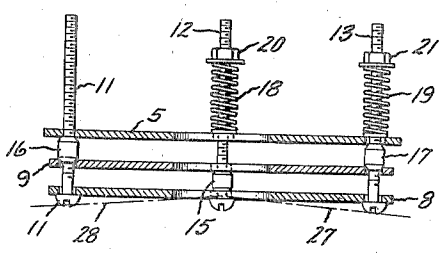
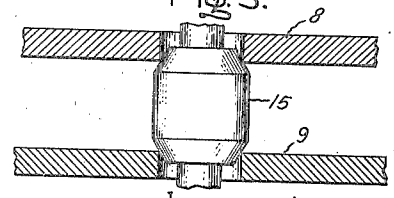


Fig. 5.



Inventor:
Donald R. DeTar,

by Harry E. Dunham
His Attorney.

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Filed Aug. 10, 1939 2 Sheets-Sheet 2

Fig. 6.

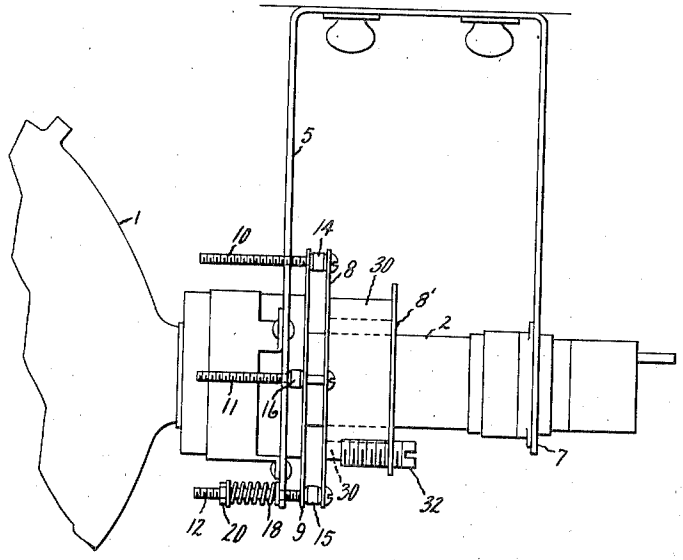


Fig. 7.

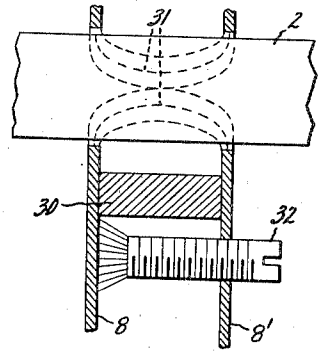
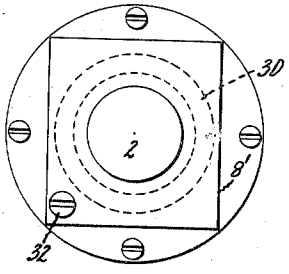


Fig. 8.



Inventor:
Donald R. DeTar,
by Harry E. Dunham
His Attorney.

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UNITED STATES PATENT OFFICE

2,234,720

ELECTRON DISCHARGE APPARATUS

Donald R. De Tar, Stratford, Conn., assignor to General Electric Company, a corporation of New York

Application August 10, 1939, Serial No. 289,428

6 Claims. (Cl. 250—161)

My invention relates to electron discharge apparatus and particularly to such apparatus in which a beam, or ray, of electrons is directed upon a screen, the ray being deflected to produce a desired figure upon the screen, as for example, in the picture tubes used in television reception.

One of the objects of my invention is to provide improved means to center the figure upon the screen.

Frequently the centering of the beam is effected by adjustment of a magnetic field producing means such as a solenoid positioned along the axis of the discharge apparatus along which the beam is projected. Another of the objects of my present invention is to provide improved means to support such a solenoid, or other means for focusing the electron stream, for independent adjustment in different planes to facilitate centering of the figure on the screen.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention, itself, however, both as to its organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which Fig. 1 represents an embodiment of my invention; Figs. 2 and 5 illustrate details thereof, and Figs. 3 and 4 represent certain sectional views.

Referring to the drawings, I have shown at 1 an electron discharge device such as is commonly used for the reproduction of pictures in television reception, for example. This discharge device has a neck 2 within the right hand end of which the cathode, or so called electron gun, not shown, is supported. This beam of electron is projected outward along the axis of the neck and along the axis of a focusing coil 3 which causes the electron beam to converge and focus on the screen, and a deflection yoke 4, whereupon it finally emerges into the large bulbous end of the tube and impinges upon a screen (not shown) at the left hand of the tube. Upon the cylindrical yoke 4 about the neck 2 are mounted certain coils in accordance with now common practice in television receivers, through the energization of which the beam is caused to deflect across the screen in accordance with a desired configuration. By modulation of the intensity of the beam so deflected, a desired figure, representation, or picture is reproduced upon the screen.

It is necessary to provide some means whereby this figure may be properly centered upon the screen. To this end, in Fig. 1, the solenoidal coil 3, mounted upon the neck 2 of the discharge device, between pole pieces 8 and 8', is arranged to be positioned in such a way as to provide the desired centering of the beam. As shown, this coil is mounted in the vertical plane and arranged to produce a magnetic field axially of the discharge device between the pole pieces 8 and 8'. If it be tilted from this vertical plane its field then has a vertical component, which tends to deflect the beam horizontally. Similarly, tilting the coil sidewise deflects the beam vertically. Thus, by tilting of this coil, in one way and the other, the figure produced by the beam upon the screen may be adjusted either vertically, or horizontally, to center it upon the screen.

This solenoidal coil is supported from a plate 5. This plate may be attached as shown at 6, to any suitable stationary part of the apparatus and supports not only the coil 3 but also the deflection yoke 4 and the neck of the discharge device as indicated at 7.

The coil 3 is directly mounted upon an annular plate, or pole piece, 8, which is positioned parallel with, but spaced from, a second annular plate 9, both of which plates are secured to the member 5 by bolts 10, 11, 12 and 13, only the first three of which are shown in Fig. 1. The position of these bolts is better shown in Fig. 2. One pair of these bolts 10—12, is positioned one above the neck of the discharge device and the other below it so as to define a vertical plane including the axis of the coil 3. These bolts carry spacer members 14 and 15 between annular members 8 and 9 so that these members are positioned at a definite distance apart in this vertical plane. The second pair of bolts 11 and 13, one of which is positioned at either side of the neck of the discharge device to define a horizontal plane including the axis of the coil 3, carries spacer member 16 on bolt 11 as shown in Fig. 1 and spacer member 17 on bolt 13 as will presently be seen in Figs. 3 and 4, these spacer members being positioned between plates 5 and 9.

One bolt in each pair, namely the bolt 12 of the pair 10—12 and the bolt 13 of the pair 11—13 pass loosely through each of the members 5, 9 and 8 and are provided with springs 18 and 19 between the member 5 and a nut 20 on bolt 12, or 21 on bolt 13 tending to bias the members 5, 9 and 8 together. The other bolts of each pair

namely, the bolts 10 and 11 pass loosely through apertures in plates 8 and 9 but are threaded into the plate 5 and these bolts may be used to effect the desired adjustment of the coil 3.

As thus assembled, the desired adjustment of the coil 3 may be effected as follows: To adjust the figure on the screen horizontally, one rotates the bolt 10 as by means of a screw driver applied to the head of the bolt as indicated at 22. This rotation of bolt 10 draws the upper portion of plates 9 and 8 toward member 5, in unison, tending to compress the spring 18 between member 5 and the nut 20, the members 9 and 8 rotating about a pivot determined by the spacer members 16 and 17. In this way the coil 3 may be adjusted in the vertical plane to provide sidewise deflection of the figure for centering.

To adjust the figure vertically bolt 11 may be adjusted by means of a screw driver. Plate 9 is now prevented from rotation by spacer members 16 and 17 and adjustment of bolt 11 draws plate 8 toward plate 9 as shown in Fig. 1 of the drawings, the plate 8 pivoting about spacer members 14 and 15. In this way the coil 3 is rotated about a vertical axis determined by spacer members 14 and 15 and provides vertical deflection of the figure upon the screen.

Fig. 2 is an elevation view showing the end of plate 5 to which the plate 8 is attached by means of the bolts 10, 11, 12 and 13. This figure shows the bolts 10 and 12 arranged in the vertical plane defined by these two bolts and the axis of the coil 3. Similarly, it shows the bolts 11 and 13 positioned in the horizontal plane which includes the axis of the coil 3.

Fig. 3 is an edgewise sectional view along the line 3—3 of Fig. 2 looking toward the right. It will be seen from this figure that upon adjustment of the bolt 10 both of plates 8 and 9 are rotated about a pivot determined by the spacer member 17 on the bolt 13 and a spacer member 16 on bolt 11 which is shown in Fig. 1, this adjustment tending to compress or release spring 18 on bolt 12. Movement of bolt 10 to the left may move plate 9 to the position indicated by line 23 and plate 8 to the position indicated by line 24 thus tensioning spring 18. Movement of bolt 10 to the right allows plate 8 to move under influence of spring 18 to the position indicated by line 25 and plate 9 to the position indicated by line 26. In this way the coil 3, which is mounted upon member 8 may be rotated about the horizontal axis.

Fig. 4 is a sectional view along the line 4—4 of Fig. 2 looking downward. In this figure it will be seen that tightening of bolt 11 moves plate 8 to the position indicated by line 27 thus tensioning spring 19. Releasing, or movement of bolt 11 downward, moves plate 8 to the position indicated by line 28 under influence of spring 19. During this movement, plate 9 is restrained from movement by the spacer members 16 and 17 and thus the movement of the coil in the horizontal plane is made without any movement of the coil in the vertical plane, that is, the two adjustments, the horizontal adjustment and the vertical adjustment may each be made without disturbing the other adjustment. Accordingly, the figures on the screen may be centered with reference to the vertical without altering its position with reference to the horizontal and similarly, it may be centered with reference to the horizontal without disturbing its adjustment with reference to the vertical.

It will also be noticed that each adjustment is made without encountering any substantial frictional forces, the adjustment either being aided by a spring or resisted thereby. Since no substantial frictional forces are involved, the adjustment is smoothly and readily effected, that is, it does not involve storing forces, which are resisted by friction and which are suddenly released to produce a jerky motion of the elements to be adjusted. Instead, each increment of adjustment of the bolts 10 and 11 effects a corresponding adjustment of the coil 3.

Fig. 5 is a detail view showing somewhat more clearly the spacer members positioned upon any one of the bolts and between members 8 and 9. Of course, the spacer members 16 and 17 between members 5 and 9 are similarly arranged and snaped.

Fig. 6 shows an arrangement similar to that in Fig. 1 but in which the focusing solenoid is replaced by an annular permanent magnet 30 arranged similarly to produce a magnetic field axially of the discharge device but adjustable as in Fig. 1. This magnet preferably is one of the alloy commonly known as Alnico comprising aluminum, nickel, and cobalt and it is arranged between the pole pieces 8 and 8' so as to produce the field within the discharge device as better indicated at 31 in Fig. 7. The plate 8 carrying the magnet is arranged to be adjusted as in Fig. 1.

To adjust the intensity of the magnetic field a suitable adjustable shunt path such as that indicated by the screw 32 is provided. This screw may be threaded through an aperture in pole piece 8', its end being adjustably positioned with respect to pole piece 8 to form a variable air gap between the pole pieces. This adjustment may of course, take many different forms.

Fig. 8 is an end view of Fig. 6 showing the pole piece 8' of rectangular shape having the adjustable shunt 32 positioned at one corner thereof. If desired, additional such shunts might be employed.

While I have shown particlar embodiments of my invention, it will, of course, be understood that I do not wish to be limited thereto since different modifications may be made and I contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The combination, in an electron discharge apparatus in which a beam of electrons is focused upon a screen, of a magnetic field producing device arranged about said beam near its origin to control the direction thereof, said device being mounted upon a pair of parallel members extending about said beam, both of said members being adjustable in unison about an axis at right angles to said beam, and one of said members being adjustable about an axis at right angles to said first axis and said beam and independently of the plane of the first member, said device being movable with said one member about either of said axes.

2. The combination, in an electron discharge apparatus in which a beam of electrons is focused upon a screen, of a magnetic field producing device about said beam near its origin arranged to control the direction thereof, a support for said device comprising a member extending on either side of said discharge device, a plate spaced from said support by spaced members positioned on either side of said discharge apparatus, said plate being adjustable about an axis determined by

said spacer members, a second plate spaced from said first plate by spacer members positioned between said plates on opposite sides of said discharge device and at substantially right angles to the axis formed by said first spacer members, and means to adjust the second plate relative to the first plate about an axis formed by said second spacer members, and said device being mounted on said second plate, whereby said device may be adjusted about either one of said axes while maintaining its adjustment about the other axis.

3. In an electron discharge apparatus in which a beam of electrons is focused upon a screen, having means to deflect said beam to produce a figure upon said screen and a magnetic field producing device about said beam adjustable to center said figure on said screen, the combination of a support for said device comprising a plurality of means for adjusting said device in planes extending at substantially right angles to each other and intersecting in said beam, each adjusting means adjusting the device in its respective plane about an axis in the other plane and means to retain the device in position in either of said planes during adjustment of the device in the other plane, and resilient means operating substantially free from friction to resist each of said adjusting means.

4. In an electron discharge apparatus in which a beam of electrons is focused upon a screen, having means to deflect said beam to produce a figure upon said screen, and a magnetic field producing device about said beam adjustable to center said figure upon said screen, the combination of three parallel plates positioned side by side and having openings therein through which said discharge apparatus projects, one of the outer of said parallel plates comprising a support, and said device being mounted about said apparatus on the other of said outer plates, said plates being secured together by a plurality of bolts spaced apart about said discharge apparatus, one pair of bolts on opposite sides of said discharge device carrying spacer members between two of said plates and another pair of said bolts on opposite sides of said discharge device carrying spacer members between the other two plates, each of said pair of bolts including one bolt threaded into said support and extending loosely through the plates to a head and a second bolt extending loosely through all of said plates and carrying a spring biasing said plates together.

5. The combination, in an electron discharge apparatus in which a beam of electrons is focused upon a screen, of a magnetic field producing device arranged about said beam to control the direction thereof, said device being supported upon a pair of parallel members extending in planes at right angles to said beam, one of said parallel members being pivoted to rotate about an axis extending through said beam at right angles thereto and the other being pivoted for rotation about an axis at right angles to said last-mentioned axis, said parallel members being supported upon a third supporting member by means of parallel screws extending therethrough longitudinally of said beam and positioned upon said axes, one of said screws being arranged upon rotation thereof to rotate one of said members about its axis and another of said screws being arranged to rotate both of said members about the other axis, whereby said magnetic device may be readily adjusted by adjustment of said screws from a position longitudinally of said device.

6. The combination, in an electron discharge apparatus in which a beam of electrons is focused upon a screen, of a magnetic field producing device arranged about said beam to control the direction thereof, said device being supported upon three parallel members, one of said members being fixed in position, another of said members supporting said field producing device, and a third of said members between the other two, being attached to both of said two members by screws extending through all three members longitudinally of said beam, said screws being positioned around said beam at intervals of a quarter of a circumference, spacer members on one opposite pair of said screws between one pair of said members, spacer members on the other pair of opposite screws between the other of said members, one screw of each pair being threaded into said fixed member and the other screw of each member extending freely through said fixed member and provided with a spring connection with the fixed member to bias each of the other members to positions adjustable about axes formed by said spacer members, said positions being adjustable by rotation of the other of said screws, whereby said screws may be readily adjusted from a position longitudinally of said discharge apparatus.

DONALD R. DE TAR.