

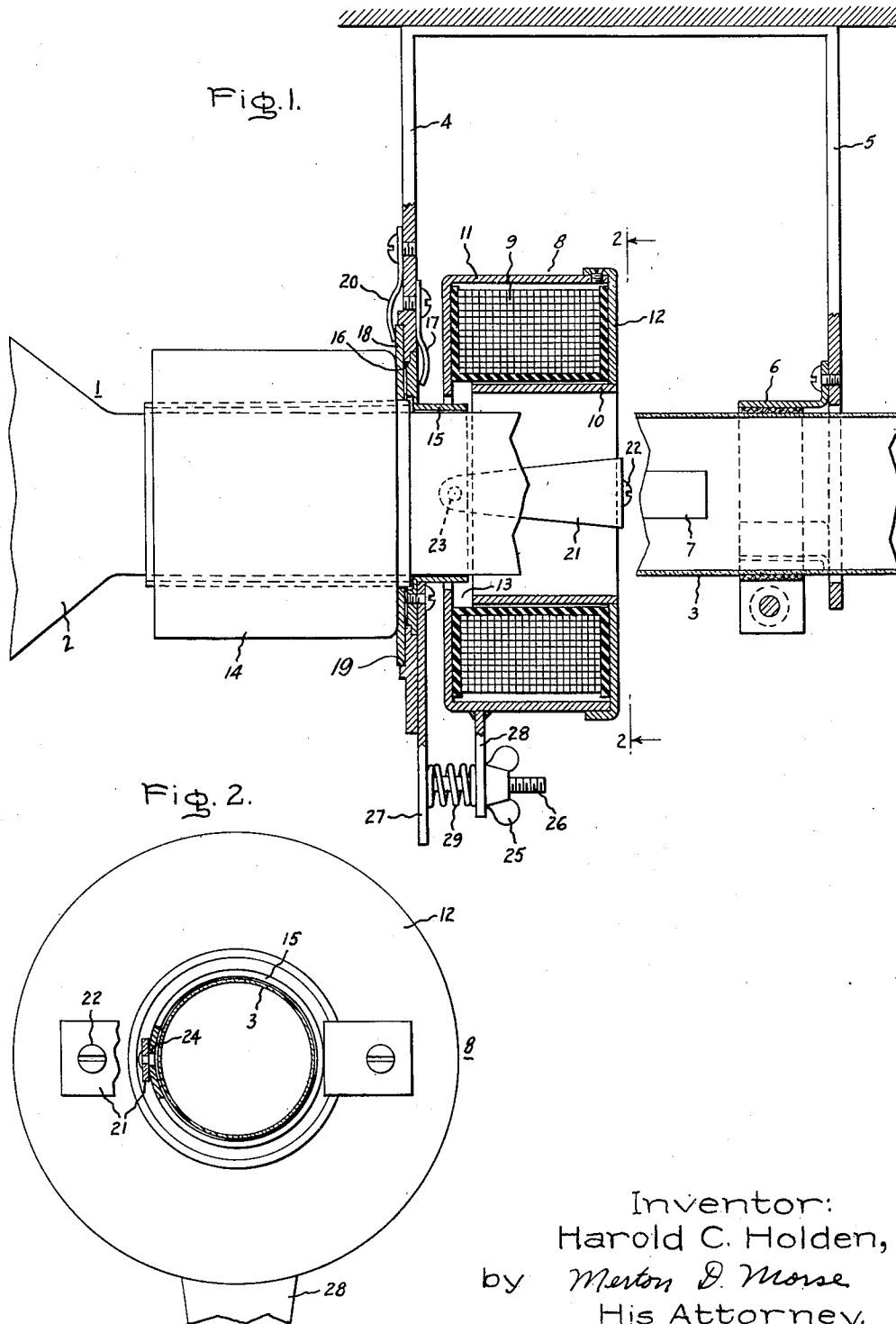
March 21, 1950

H. C. HOLDEN
DEFLECTING AND FOCUSING DEVICE
FOR CATHODE RAY APPARATUS

2,501,516

Filed Dec. 31, 1947

2 Sheets-Sheet 1



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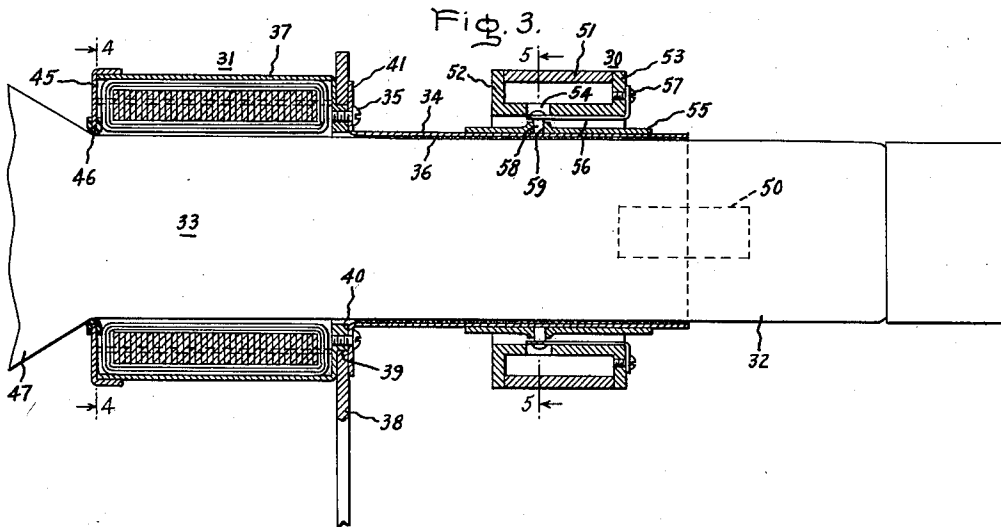
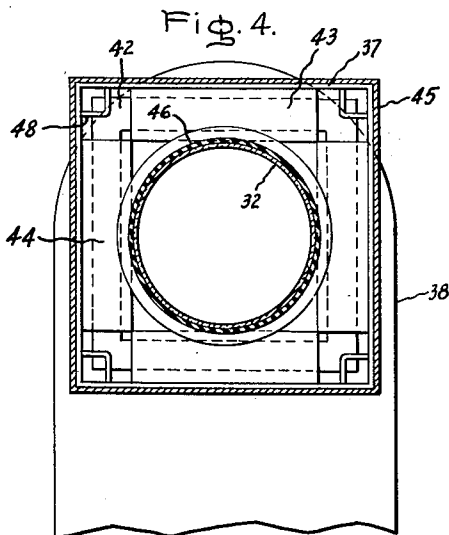
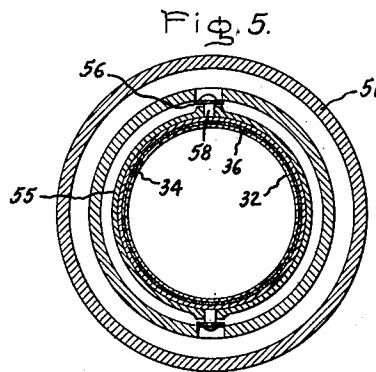
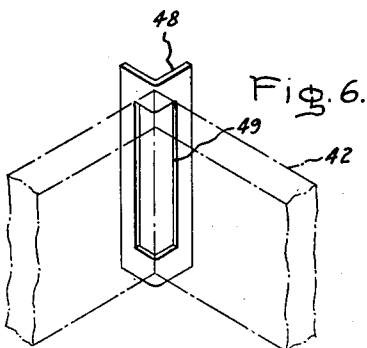
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UNITED STATES PATENT OFFICE

2,501,516

DEFLECTING AND FOCUSING DEVICE FOR
CATHODE-RAY APPARATUS

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4 Claims. (Cl. 250-161)

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My invention relates to devices for deflecting and focusing cathode ray beams in electron discharge devices of the cathode ray type and has particular application to cathode ray tubes for television receivers.

In television receivers and similar apparatus it is desirable to provide some arrangement for centering and adjusting the cathode ray beam in the picture tube and for aligning the horizontal and vertical axes of the picture. Such adjustment makes it possible to replace the tube and adjust the new tube satisfactorily without the necessity of providing a new tube which is so constructed that it produces its cathode ray beam in the exact location of that produced by the replaced tube. Relatively complicated mountings have been provided for this purpose heretofore. Accordingly it is an object of my invention to provide an improved adjustable beam deflecting and focusing arrangement for electron discharge devices of the cathode ray type.

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 is a side elevation view, partly in section, illustrating one embodiment of my invention; Fig. 2 is a sectional view on the line 2-2 of Fig. 1; Fig. 3 is a side elevation view, partly in section, of another embodiment of my invention; Fig. 4 is a sectional view on the line 4-4 of Fig. 3; Fig. 5 is a sectional view on the line 5-5 of Fig. 3; and Fig. 6 is an enlarged perspective view showing a detail of construction of the deflecting coil assembly of Fig. 3.

Referring now to the drawings, the apparatus illustrated in Fig. 1 includes an electron discharge device 1 which is of the cathode ray type commonly used for the reproduction of pictures in television receivers. The device is provided with a glass envelope comprising a bowl portion 2, only a part of which is shown in the drawing, and an elongated cylindrical neck 3. The envelope is supported on suitable brackets 4 and 5, the bracket 5 being provided with an adjustable collar 6 clamped about the neck 3. The device 1 may have as an additional support a clamping arrangement (not shown) which is positioned about the edge portion of the bowl 2 adjacent the usual fluorescent screen on which the picture is reproduced. Within the neck 3 near the end remote

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from the bowl 2 there is provided the usual cathode ray beam forming device commonly called an "electron gun" an anode portion of which is indicated generally at 7. The construction and arrangement of the electron gun to produce a cathode ray beam is well known and a detailed description is not necessary to an understanding of the present invention. The electron beam is projected along the axis of the neck 3 onto the fluorescent screen and produces a spot of light at the point at which it impinges on the screen. In order to focus the spot of light upon the screen, a focusing yoke 8 is mounted about the envelope 3 near the source of the electron beam. The yoke 8 produces a magnetic field which constitutes a magnetostatic lens for concentrating the beam of electrons. As illustrated, the yoke 8 comprises a coil 9 arranged within a hollow ring of magnetic material comprising an inner cylinder 10, an outer cylinder 11 and an end member 12, the outer cylinder 11 being formed to provide the opposite end member. The inner cylinder 10 is spaced from the outer cylinder 11 at its inner periphery to provide an annular air gap 13, the magnetostatic lens being formed generally in the plane of the air gap so that the center of the lens coincides with the longitudinal axis of the coil 9. The focusing of the beam is effected by adjusting the excitation of the coil 9 which is supplied with direct current from a suitable source (not shown).

In order to produce the television picture which requires horizontal and vertical deflection of the cathode ray beam in a manner which is well understood in the art, a deflecting coil assembly 14 is mounted about the neck 3 between the bowl 2 and the focusing yoke 8. The television picture is produced by modulating the intensity of the beam while it is being deflected over the surface of the screen so that the intensity of any given area of the screen corresponds with that of the transmitted picture of that area. The yoke 8 is supported within the bracket 4 and is rotatable about the neck 3 on a nonmagnetic sleeve 15 which is rotatably fitted in an opening 16 in the bracket 4 and is retained in place by a plurality of spring clips 17, one of which is shown. The deflecting coil assembly 14 is rotatably mounted with respect to the bracket 4 on a circular plate 18 held in an annular retaining shoulder 19 formed on the bracket and retained in place frictionally by a plurality of spring clamps 20 only one of which has been illustrated on the drawing. The plate 18 and the end portion of the assembly 14 are spaced from the sleeve 15 so that the sleeve

and the assembly may each be rotated in the bracket 4 independently.

It is impractical to provide television receivers which are so adjusted at the factory that no further adjustment or servicing is necessary in order to center the picture on the screen. Furthermore, the cathode ray tubes employed for television receivers are not identical so that when it becomes necessary to replace a tube it is also necessary to readjust the focusing and deflecting devices to secure the desired position of the picture. In the apparatus illustrated, this adjustment can be accomplished by first rotating the reflecting coils 14 about the envelope 3 until the edges of the rectangular picture are parallel to their desired final positions. The spring clamps 20 then retain the deflecting coils in their required positions. The next step in adjusting the picture is to move the center of the picture until it coincides with its required center position. This is accomplished by rotating and tilting the focusing yoke 8 in a manner to be described.

The yoke 8 is mounted on the sleeve 15 on two spring arms 21 attached by screws 22 to opposite sides of the yoke. The arms 21 extend axially of the yoke within the cylinder 10 and are provided with pivots 23 which engage diametrically opposite holes 24 in the sleeve 15, as clearly shown in Fig. 2. The spring arms take up any slack or endplay in the pivot members and, since the pivots 23 are located so that the pivotal axis passes substantially through the center of the magnetostatic lens, tilting of the yoke produces little shifting of the lens center and maintains the center of the lens substantially on the axis of the electron gun regardless of the tilt of the yoke. After the electron beam has been focused by adjusting the strength of the magnetic field as determined by the excitation of the focusing coil 9, and after correct alignment of the picture by adjustment of the deflecting coils 14, the focusing yoke 8 is rotated on the collar 15 about the neck 3 until the axis of the pivots 23 is at right angles to a line passing through the centers of the picture in its incorrect position and in its desired position. It will now be apparent that the picture can be centered merely by tilting the yoke until the center points coincide. The tilting is accomplished by adjusting a wing nut 25 threaded on a stud 26 which is attached to an extension 27 on the sleeve 15 and passes through a lug 28 attached to the outer cylinder 11 of the yoke 8. Lost motion between the lug 28 and bracket 4 is prevented by a compression spring 29 arranged about the stud 26 between the bracket and lug 28. It is thus apparent that the entire adjustment necessary may be made simply by rotation of the deflecting assembly 14 about the envelope 3, rotation of the yoke 8 with the sleeve 15, and tilting of the yoke by adjustment of the wing nut 25.

Referring now to Fig. 3, I have illustrated a deflecting and focusing assembly embodying my invention and in which a permanent magnet focusing yoke 30 is employed. The yoke 30 and a deflecting coil assembly 31 are rotatably mounted on a neck 32 of a cathode ray tube 33 of the same type as the tube 1 of Fig. 1. The yoke 31 is secured directly to a sleeve 34 by screws 35 and the sleeve 34 fits about the neck 32, a suitable intermediate or spacing sleeve 36 of felt or other suitable material being provided so that the sleeve 34 may readily be rotated about the glass envelope. The yoke 31 includes a casing or shell 37 and the focusing and deflecting assembly is

rotatably secured within a support 38 which is provided with a circular opening 39 rotatably engaging a boss 40 on the shell 37. A flange 41 on the sleeve 34 prevents axial movement of the deflecting and focusing assembly in the opening 39. This flange may be resilient to provide spring pressure for retaining the assembly in position on the support. The deflecting coil assembly 31, as shown in Fig. 4, comprises a square magnetic core 42 on which are arranged two sets of deflecting coils 43, 44 for providing deflecting fields at right angles to one another. The casing 37 is of square cross section and is closed by a cap 45 having a circular opening provided with a suitable resilient gasket 46 engaging the neck 32 of the tube adjacent the bowl indicated at 47. The cap 45 thus encloses the yoke and coils within the casing 37. The yoke 42 is secured within the casing 37 on four corner pieces 48 which are welded or otherwise secured in position and are provided with rectangular openings for receiving the corners of the yoke, as clearly indicated in Fig. 6, which illustrates one of the corner pieces 48 showing the opening at 49 and the position of the core 42, as indicated in dot and dash lines. It will thus be seen that the deflecting coil assembly 31 may readily be rotated within the support 38 about the envelope 32 so that the cathode ray beam generated by the usual electron gun, the anode of which is indicated at 50, may be deflected along the desired paths.

The permanent magnet focusing yoke 30 comprises a permanent magnet in the form of a cylinder or ring 51 and two pole pieces 52 and 53 forming with the magnet 51 a hollow ring provided with an annular air gap 54 between the pole pieces 52 and 53. The yoke 30 is pivotally mounted on a sleeve 55 which is slidably mounted on the sleeve 34 so that it may be rotated and moved axially along the sleeve 34. The yoke 30 is provided with two diagonally opposite spring arms 56 secured to the yoke by screws 57 remote from the air gap 54. The spring arms 56 extend axially of the yoke 30 and cross the air gap 54, and pivot members or trunnions 58 are secured in the ends of the spring arms and are journaled in bearings 59 in the sleeve 55. It will thus be apparent that the yoke 30 can be moved axially of the sleeve 32, rotated thereon, and tilted with respect thereto along the axis of the pivots 58. The axial movement of the yoke is necessary in order to adjust the effect of the magnetostatic lens on the cathode ray beam since it is not possible to adjust the strength of the permanent magnet in a manner similar to the adjustment of the field strength by changing the excitation of the coil 9 of the yoke in Fig. 1. Except for the different method for focusing the beam, the adjustment of the deflecting and focusing yoke of the apparatus shown in Fig. 3 is the same as that of the apparatus shown in Fig. 1, the edges of the picture first being made parallel with their required positions and the yoke thereafter being tilted to bring the center of the aligned picture into coincidence with the required center for the picture.

The positioning of the yoke pivots in the plane of the air gap so that the pivotal axis passes substantially through the center of the magnetostatic lens insuring minimum shifting of the center of the lens when focusing yoke is tilted to center the picture. The mounting of the yokes on spring arms provides an arrangement for taking up end-play in the pivots and facilitates the assembly of the yoke.

From the foregoing it is readily apparent that I have provided a simple and easily adjusted arrangement for securing the proper positioning of the deflecting coils and focusing yoke so that the picture presented on the screen of an electron discharge device of the cathode ray type may be made to appear in its required position. Although I have illustrated and described specific arrangements embodying my invention, modifications will occur to those skilled in the art. I do not, therefore, desire my invention to be limited to the particular constructions illustrated and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

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

1. In an electron discharge apparatus of the cathode ray type including an envelope having therein a screen and an electron gun for projecting a cathode ray beam onto the screen, a support, a magnetic deflecting coil attached to said support and mounted about said envelope between said gun and said screen, a magnetic focusing yoke for providing a magnetostatic lens in the path of said beam, said yoke being attached to said support and mounted about said envelope near the origin of said beam, said coil and said yoke both being rotatable relative to each other and to said support and said envelope about the axis of said beam, the mounting for said yoke including pivot members positioned in the plane of said lens whereby the direction of said beam may be adjusted.

2. In an electron discharge apparatus of the cathode ray type including an envelope having a screen and an electron gun for projecting a cathode ray beam onto the screen, a support, a sleeve rotatably mounted about said envelope and rotatably secured to said support, a magnetic deflecting coil mounted on said support for rotation about the axis of said beam and arranged about said envelope between said gun and said screen, a magnetic focusing yoke for providing a magnetostatic lens in the path of said beam, said yoke being mounted about said envelope near the origin of said beam and being secured pivotally to said sleeve for rotation about said envelope with respect to said coil, the pivotal mounting for said yoke being located on a transverse axis passing substantially through the center of said lens normal to the central axis thereof.

3. In an electron discharge apparatus of the cathode ray type including an envelope having therein a screen and an electron gun for projecting a cathode ray beam onto the screen, a mag-

netic deflecting coil mounted about said envelope between said gun and said screen, a magnetic focusing yoke comprising a magnetic shell in the form of a hollow ring having an annular air gap in the inner wall thereof for providing a magnetostatic lens in the path of said beam, a sleeve rotatably fitted about said envelope, and means including axially extending spring arms secured to said shell remote from said air gap and having pivot members engaging said sleeve in the plane of said air gap for mounting said yoke on said sleeve to afford tilting of the central axis of said lens with respect to the central axis of said envelope whereby the direction of said beam may be adjusted.

4. In an electron discharge apparatus of the cathode ray type including an envelope having therein a screen and an electron gun for projecting a cathode ray beam onto the screen, a sleeve rotatably mounted about said envelope, a magnetic deflecting coil mounted on said sleeve and arranged about said envelope between said gun and said screen, a second sleeve rotatably and slidably mounted on said first sleeve, a magnetic focusing yoke for providing a magnetostatic lens in the path of said beam, said yoke being mounted about said envelope near the origin of said beam and being secured pivotally to said second sleeve for rotation about said envelope with respect to said coil, the pivotal mounting for said yoke being located on a transverse axis passing substantially through the center of said lens normal to the central axis thereof.

HAROLD C. HOLDEN.

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