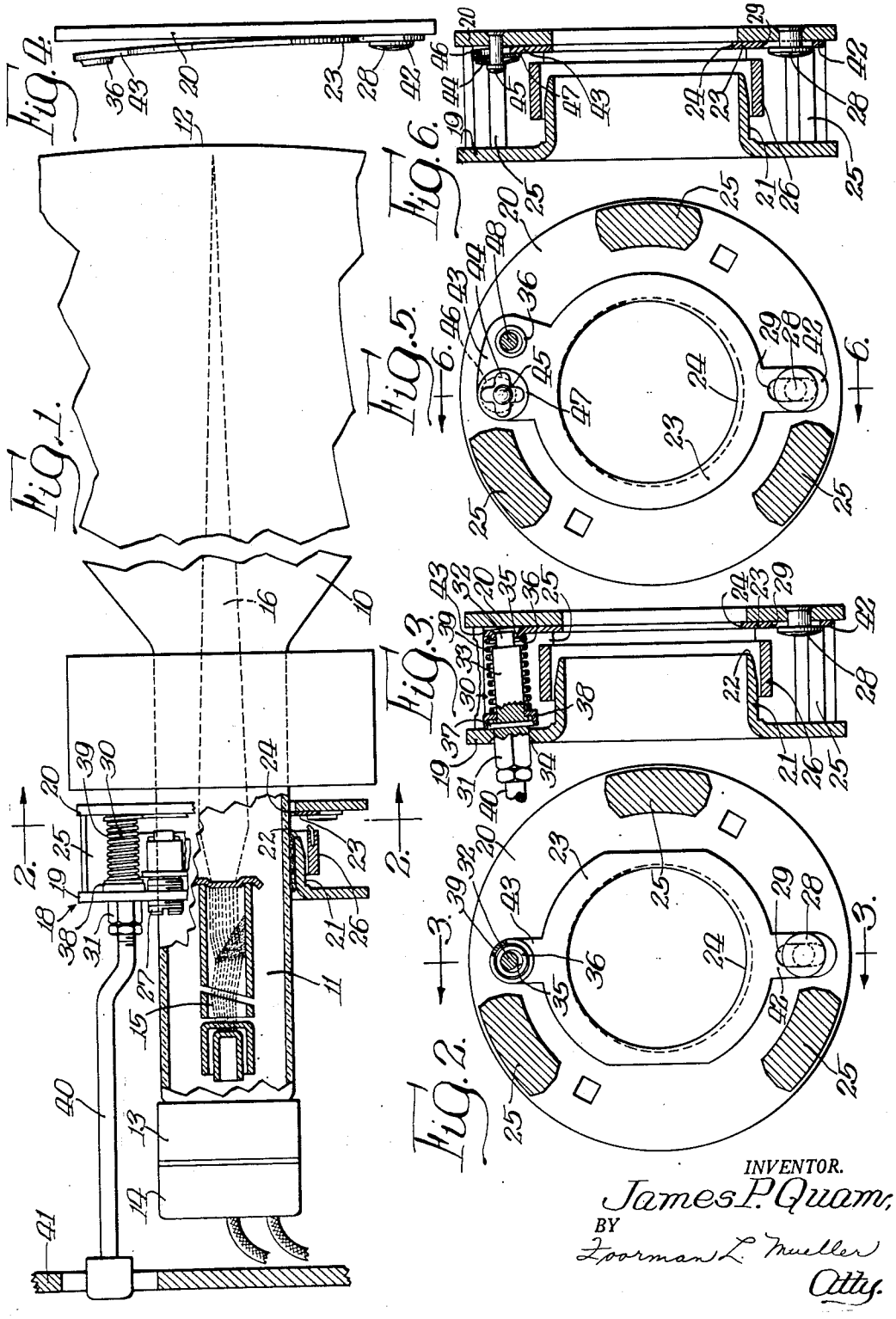
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FOCUSING DEVICE

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FOCUSING DEVICE

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This invention relates generally to a device for centering an electron beam, and more particularly to centering means for use with a magnetic focussing device for the cathode ray tube of a television receiver.

In television equipment for transmitting and reproducing images, the cathode ray tubes used have a beam which scans a screen to produce a signal in accordance with the image at the transmitter, or to reproduce the image at the receiver. The cathode ray tube must be focussed on such screen and must be centered with respect to the screen in order that the image will be properly reconstructed. Magnetic devices of both the electromagnet and permanent magnet type have been used for this purpose with such devices having adjustable means for controlling the centering of the beam. Such a device is disclosed in my Patent No. 2,533,688, issued December 12, 1950, entitled Focusing Device, issued December 12, 1950, as Patent Number 2,533,688 and this application is an improvement of the focussing devices disclosed and claimed in the patent resulting from said patent.

It is an object of the present invention to provide a simple and improved centering plate for use with a magnetic focussing unit.

A further object is to provide an improved centering plate structure which simplifies the construction of the focussing and centering unit and at the same time improves the operation thereof.

A feature of this invention is the provision of a magnetic focussing device having a centering plate on one pole piece thereof with the centering plate being bowed and held against the pole piece at the ends thereof so that the centering plate bears against the pole pieces over the entire surface thereof.

A further feature of this invention is the provision of a focussing and centering device including a pole piece having a flat portion with an opening therein, and a centering plate having a flat portion with an opening therein, with the centering plate being bowed and held against the pole piece at one side of the opening and held against the pole piece at the other side of the opening by a resilient means extending between the pole pieces. The spring may be provided about a control handle for adjusting the position of the centering plate to thereby hold the centering plate in position and also provide a restraining tension for the control handle.

Further objects, and features and attending advantages of the invention will be apparent from a consideration of the following description when taken in connection with the accompanying drawings in which:

Fig. 1 illustrates the focussing and centering device in accordance with the invention in operating position on a cathode ray tube;

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Fig. 2 is a cross sectional view along the lines 2—2 of Fig. 1;

Fig. 3 is a cross sectional view along the lines 3—3 of Fig. 2;

Fig. 4 illustrates the bowed configuration of the centering plate;

Fig. 5 illustrates a second embodiment of the invention; and

Fig. 6 is a cross sectional view along the lines 6—6 of Fig. 5.

In practicing the invention there is provided a permanent magnet focussing device for a cathode ray tube including a pair of spaced pole pieces having openings therein for receiving the neck of a cathode ray tube through which the beam passes. Permanent magnets may be provided between the pole pieces for providing a field therethrough. For centering the beam, a centering plate or shutter is provided on one of the pole pieces and is mounted for sliding movement thereon. The shutter has an opening therein somewhat smaller than the opening in the pole piece, which may be shifted in position to shift the center position of the beam. The shutter is bowed between the end portions thereof, one of which is secured to the pole piece by a rivet or the like and the other of which is held against the pole piece by resilient means. Because of the bowing of the centering shutter it is firmly held against the pole piece at all points about the opening therein. Control means are provided for shifting the position of the centering plate. The resilient means for holding the plate against the pole piece may be coupled to the control means and serve to provide tension for the control means. Alternatively, the spring means may be entirely separate from the control means.

Referring now to the drawings, in Fig. 1 there is illustrated a cathode ray tube 10 having a neck portion 11 and a front face 12 on which there is provided a screen. The tube may include a base 13 through which connections are made to the elements within the tube. The socket 14 may be connected to the base 13 for making connections to the elements within the tube. As the tube structure itself may be of any standard construction, it will not be described in detail herein. However, the tube necessarily includes an electron gun structure 15 for producing a beam of electrons 16.

The permanent magnet device for focussing and centering the beam is indicated generally at 18 and includes annular spaced pole pieces 19 and 20 positioned about the neck 11 of the cathode ray tube. The pole piece 19 includes an inturned rim 21 which extends a substantial part of the distance between the pole pieces. The rim 21 may be beveled to provide a relatively narrow end or pole face 22. Secured to the pole piece 20 is

an annular centering shutter 23 which is adjustably positioned with respect to the pole piece 20. The shutter has an opening 24 therein which has a smaller diameter than the opening in the pole piece 20 and which forms the second pole face of the air gap. A plurality of magnets 25 may be provided between the pole pieces 19 and 20 for providing a flux therebetween which passes through the annular air gap between the pole faces 22 and 24. For adjusting the strength of the field in the air gap, a magnetic shunting sleeve 26 may be provided about the inturned rim 21. The position of this shunting sleeve is controlled by an adjustable mounting stud 27 threaded in the pole piece 19. A control mechanism 30 is provided for the centering plate 23 having a control handle 40 which may extend to the rear of the tube to be positioned in an opening in the wall 41 of a cabinet enclosing the tube.

The structure of the centering plate of the shutter is best shown in Figs. 2, 3 and 4. The shutter 23 is positioned on the inside surface of the pole piece 20 and includes two supporting portions 42 and 43 on substantially opposite sides of the opening 24. The supporting portion 42 is secured to the pole piece 20 by a rivet 28 or the like which is positioned in slot 29 in the portion 42. The supporting portion 43 of the shutter is in engagement with the adjusting mechanism 30 which is supported on the pole piece 19. The adjusting mechanism 30 includes a stud having a hexagon shaped head portion 31, a reduced end portion 32 and an intermediate portion 33. The hexagon shaped head 31 is positioned in a hexagon shaped opening 34 in the pole piece 19 which opening is somewhat larger than the head so that the head can move freely therein. Universal movement of the head 31 in the limited orbit provided by the opening 34 results in movement of the end portion 32 of the stud in a much larger orbit. The end portion 32 is positioned in an opening 35 in the portion 43 of the shutter and may have a rim 36 formed thereabout so that the end of the stud cannot easily slip out of the opening. To prevent withdrawal of the stud through the opening 34 in the pole piece 19, a pin 37 is provided in the head 31, and a cup-shaped washer 38 is provided about the stud with the lip thereof covering the pin 37 and bearing against the pole piece 19. Positioned about the intermediate portion 33 of the stud is a spring 39 which bears against the washer 38 and the shutter 23. The spring provides a tension for holding the adjusting studs in a particular position and also holds the shutter against the pole piece 20 in a manner to be more fully explained.

In order for the centering plate or shutter 23 to shift the magnetic field and thereby shift the center position of the beam for centering the same on the screen, it is necessary that the centering plate 23 make firm mechanical contact with the pole piece 20 so that a low reluctance magnetic path is provided therebetween at all points around the openings therein. Applicant has provided a structure which meets these requirements and which is also inexpensive and of simple construction. The centering plate 23 is bowed when it is formed so that the portion between the supporting portions 42 and 43 is curved. This is illustrated in Fig. 4. The configuration of the centering plate is such that when the portion 42 is held against the pole piece 20 by the rivet 28 the opposite end of the centering plate is some distance from the pole piece 20. By providing a spring 39 about the control stud 33 having such a tension that the portion 43 is held against the pole piece 20, all of the intermediate portions of the centering plate will bear against the pole piece to cause firm engagement therebetween. This firm engagement is provided by the use of only two supporting points on the centering plate and thereby results in a relatively simple overall structure.

Figs. 5 and 6 illustrate an embodiment of the invention in which the resilient means for holding the centering plate and the control means for moving the centering plate are entirely independent of each other. In these figures the same reference characters are used as in Figs. 1 to 4 inclusive to indicate the corresponding parts. The supporting portion 43 differs from that in the prior embodiment and is held against the pole piece 20 by a spring washer 44 supported by stud 45 which is anchored in the pole piece 20. The stud 45 is positioned in a relatively large opening in the supporting portion 43 to permit movement of the portion 43 with respect to the pole piece 20. A plain washer 47 may be positioned between the spring washer 44 and the portion 43 of the centering plate. The centering plate is bowed and the spring washer 44 therefore holds the centering plate in such position that it bears against the pole piece 20 at all points around the openings therein.

Control means for moving the centering plate may be provided which may be similar to that of Figs. 1 and 3 but which need not include a spiral spring 39 for holding the shutter 23 against the pole piece 20. The end of such control means is indicated at 48 in Fig. 5. It is to be pointed out, however, that the control means may be relatively simple since the centering shutter is supported independently of the control mechanism and therefore various arrangements for moving the centering plate will be obvious to those skilled in the art.

It is apparent from the above that by the provision of a centering plate in accordance with the invention a relatively simple structure is provided, which when used together with a magnetic focussing device provides centering of the beam together with the focussing action. The use of a bowed plate requires only two supporting portions resulting in a simple structure. However, as the plate bears firmly against the pole piece at all portions around the openings therein, a low reluctance path is provided between the pole piece and the centering plate so that highly satisfactory operation is provided. This construction does not require critical components which would be necessary for providing a close sliding fit between parts without the pressure produced by the bowing action. The plate can be stamped from sheet material to provide the desired configuration both as to the outline thereof and the bowing.

Although certain embodiments of the invention have been disclosed which are illustrative thereof, it is obvious that various changes and modifications can be made therein without departing from the intended scope of the invention as defined in the appended claims.

I claim:

1. A magnetic structure for centering a beam of electrons including in combination, means for producing a magnetic field including a pole piece having a flat portion with a beam receiving opening therein, a centering plate having an opening therein of smaller diameter than said opening in said pole piece, said centering plate having

first and second supporting portions positioned on substantially opposite sides of said opening therein and being bowed between said supporting portions, means on said pole piece for securing said first supporting portion of said centering plate thereto with said centering plate being bowed away from said pole piece, said securing means and said first supporting portion cooperating to permit sliding and pivotal movement of said first supporting portion with respect to said pole piece, resilient means operatively connected to said second supporting portion of said centering plate for holding said second portion adjacent said pole piece, whereby said centering plate is flattened against said pole piece and bears thereagainst at all points about said openings therein, said resilient means and said second supporting portion cooperating to permit sliding movement of said second supporting portion with respect to said pole piece, and control means operatively connected to said centering plate for moving said centering plate with respect to said pole piece.

2. A magnetic structure for centering a beam of electrons including in combination, means for producing a magnetic field including a pole piece having a flat portion with a beam receiving opening therein, a centering member having an opening therein of smaller diameter than said opening in said pole piece, said centering member having first and second supporting portions positioned on substantially opposite sides of said opening therein and being bowed between said supporting portions, supporting means including said supporting portions for holding said centering member against said pole piece for sliding movement with respect thereto, said first supporting portion of said centering member being held against said pole piece with said centering member being bowed away therefrom, said supporting means including resilient means operatively connected to said second supporting portion of said centering member and exerting resilient pressure thereon for holding said second portion adjacent said pole piece, whereby said centering plate bears against said pole piece at all points thereon between said supporting portions, and control means operatively connected to said centering plate for moving said centering plate with respect to said pole piece.

3. A magnetic structure for centering a beam of electrons including in combination, means for producing a magnetic field including a pole piece having a flat portion with a beam receiving opening therein, a centering plate having an opening therein of smaller diameter than said opening in said pole piece, said centering plate having first and second supporting portions positioned on substantially opposite sides of said opening therein and being bowed between said supporting portions, said first supporting portion of said centering plate being secured to said pole piece with said centering plate being bowed away from said pole piece, and resilient means operatively connected to said second supporting portion of said centering plate and exerting resilient pressure thereon for holding said second supporting portion against said pole piece, whereby said centering plate bears against said pole piece at all points about said openings therein.

4. A magnetic structure for centering a beam of electrons including in combination, means for producing a magnetic field including a pole piece having a beam receiving opening therein, a centering plate having an opening therein of smaller diameter than said opening in said pole piece, said centering plate having first and second supporting portions positioned on substantially opposite sides of said opening therein and being bowed between said supporting portions, means securing said first supporting portion of said centering plate to said pole piece with said centering plate being bowed away from said pole piece, and spring means connected to said pole piece and to said second supporting portion of said centering plate and exerting resilient pressure on said second supporting portion for holding the same against said pole piece, whereby said centering plate exerts pressure against said pole piece at all points thereon between said supporting portions.

5. A device for focussing an electron beam and for shifting the position thereof including in combination, a magnetic structure including first and second spaced apart pole pieces each having a beam receiving opening therein, permanent magnet means extending between and magnetically coupled to said pole pieces, said first pole piece having a flat portion about said opening therein, a flat centering plate on said first pole piece having an opening therein, said centering plate having first and second supporting portions on opposite sides of said opening and a bowed body portion intermediate said supporting portions, said first supporting portion being operatively connected to said first pole piece and maintained thereon in pivotal and slidable relation therewith with said body portion of said centering plate bowed away from said first pole piece, and resilient means between said second pole piece and said second supporting portion of said centering plate and applying resilient pressure therebetween for holding said second end portion of said centering plate against said first pole piece, whereby said centering plate bears against said first pole piece at all points about said openings therein.

6. A device for focussing an electron beam and for shifting the position thereof including in combination, a magnetic structure including first and second spaced apart pole pieces each having a flat portion with a beam receiving opening therein, permanent magnet means extending between and magnetically coupled to said pole pieces, a centering plate on said first pole piece having an opening therein, said centering plate having first and second supporting portions on opposite sides of said opening and a bowed body portion intermediate said supporting portions, said first supporting portion being operatively connected to said first pole piece and maintained thereon in pivotal and slidable relation therewith with said body portion of said centering plate bowed away from said first pole piece, said second pole piece having a second opening therein, control handle means for said centering plate having a portion positioned in said second opening in said second pole piece for movement in a limited orbit therein, said handle means having an end portion thereof operatively connected to said second supporting portion of said centering plate, said control handle means being movable to move said end portion thereof through an orbit greater than the limited orbit provided by said second opening in said second pole piece to thereby shift said centering plate in any desired direction in its plane for shifting the magnetic field adjacent said centering plate, and spring means about said handle means be-

tween said second pole piece and said second supporting portion of said centering plate and applying resilient pressure therebetween for holding said second supporting portion of said centering plate against said first pole piece, whereby said centering plate bears against said pole piece at all points thereon between said supporting portions.

7. A magnetic structure for centering a beam of electrons including in combination, means for producing a magnetic field including a pole piece having a flat portion with a beam receiving opening therein, a bowed centering plate having an opening therein of smaller diameter than said opening in said pole piece, supporting means holding said centering member against said pole piece for sliding movement with respect thereto, with the convex side of said bowed centering plate engaging said pole piece, said supporting means including resilient means operatively connected to a portion of said centering member bowed away from said pole piece and exerting resilient pressure thereon for holding said portion adjacent said pole piece so that said centering plate is flattened against said pole piece, whereby said centering plate bears against said pole piece at all points about said openings therein, and control means operatively connected to said centering plate for moving said centering plate with respect to said pole piece.

JAMES P. QUAM.

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