Jan. 1, 1952 W. SCHIEL ET AL 2,580,606

CATHODE-RAY TUBE FOCUSING DEVICE

Filed March 21, 1951 2 SHEETS—SHEET 1

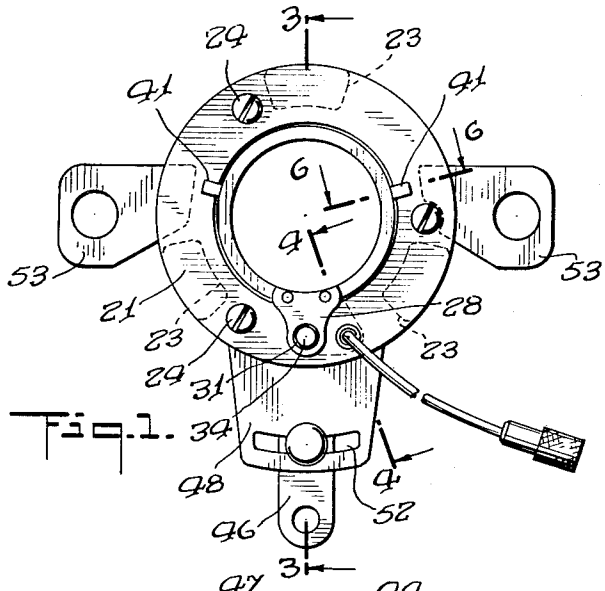


Fig. 1.

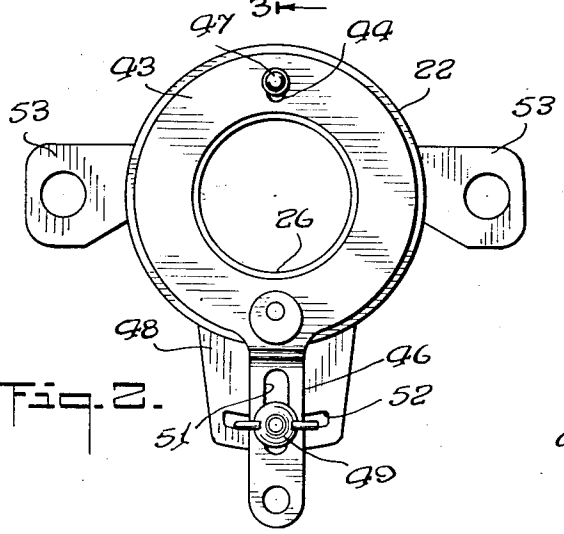
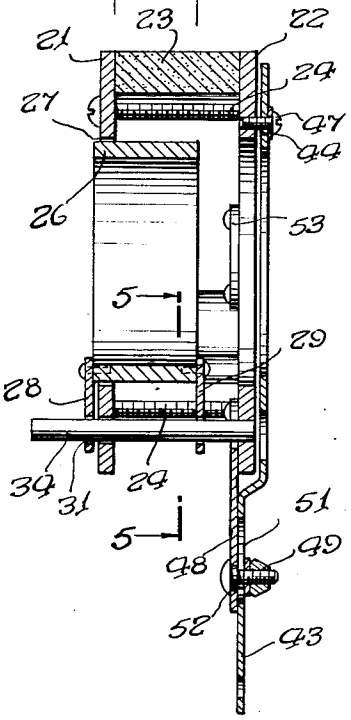


Fig. 2.

Fig. 3.



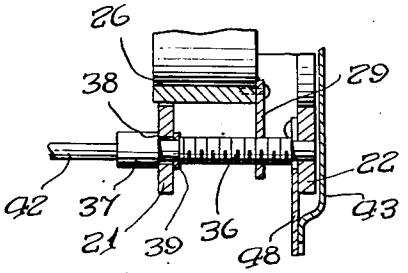


Fig. 4.

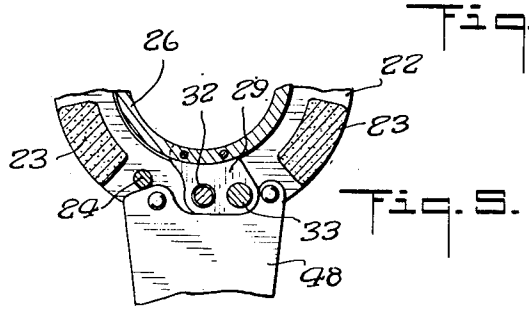


Fig. 5.

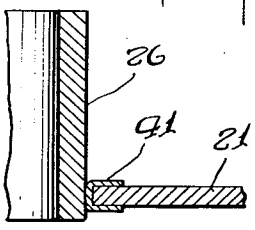


Fig. 6.

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CATHODE-RAY TUBE FOCUSING DEVICE

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Fig. 8.

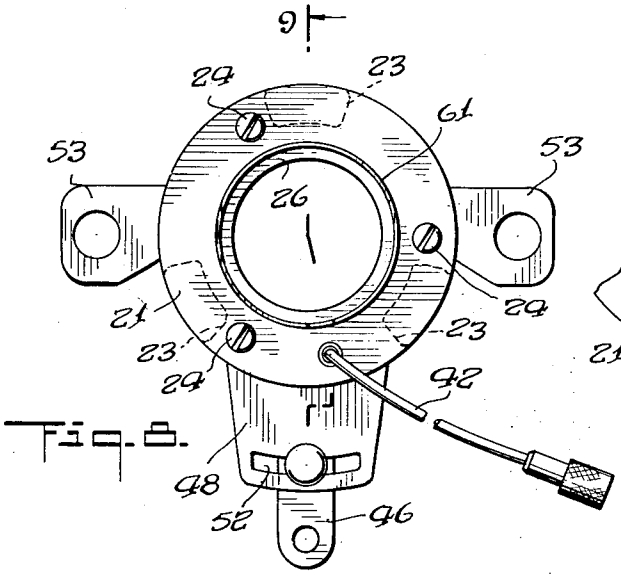


Fig. 7.

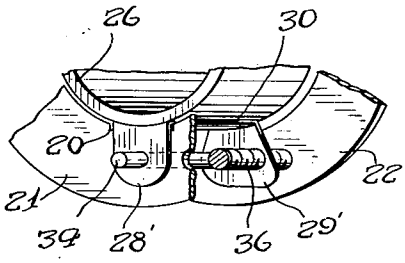


Fig. 9.

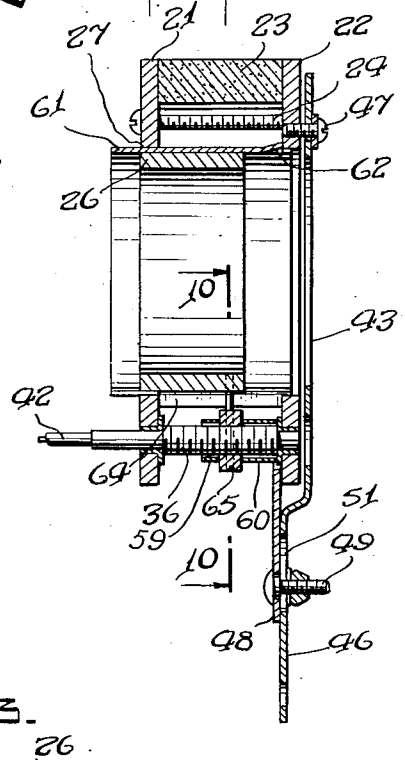


Fig. 10.

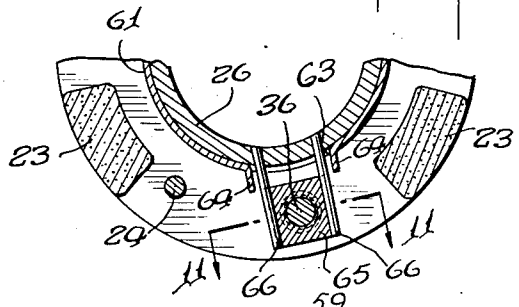


Fig. 11.

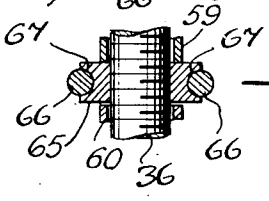


Fig. 12.

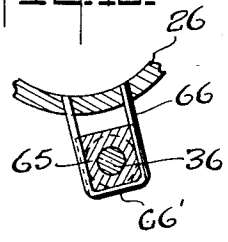
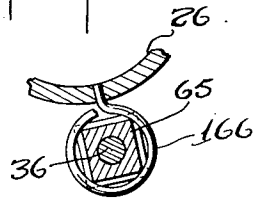


Fig. 13.



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CATHODE-RAY TUBE FOCUSING DEVICE

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6 Claims. (Cl. 313—84)

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The present invention relates to the art pertaining to cathode ray tubes, such as are used in television receivers or oscilloscopes, and is more particularly concerned with improvements in focusing arrangements for the electron beams of such cathode ray tubes.

Previously it was customary to provide focusing for cathode ray tube electron beams by the use of a focusing coil surrounding the cylindrical neck of the tube and excited by direct current. More recently such focusing devices have been replaced by permanent magnet structures which eliminate disadvantages due to changes in line voltage and dissipation of power and heat. The present invention is concerned with improvements in such permanent magnet focusing devices, and is particularly concerned with improved forms of such focusing devices which can be more readily and accurately adjusted and which are simpler to fabricate and lower in cost.

Further objects and advantages of the invention will become more clearly apparent from the following description of preferred embodiments thereof, taken in conjunction with the appended drawings in which:

Fig. 1 is a rear end view of one form of permanent magnet focusing devices according to the present invention,

Fig. 2 is a front end view of the device of Fig. 1,

Fig. 3 is a longitudinal cross-sectional view of the same device viewed along line 3—3 of Fig. 1,

Fig. 4 is a fragmentary longitudinal cross-sectional view of the device of Fig. 1 viewed along line 4—4 thereof,

Fig. 5 is a fragmentary transverse cross-sectional view viewed along line 5—5 of Fig. 3,

Fig. 6 is a fragmentary longitudinal cross-sectional view viewed along line 6—6 of Fig. 1,

Fig. 7 is a fragmentary perspective view partly in section of a modified guide arrangement for the device of Fig. 1,

Fig. 8 is a front end view of a modified form of permanent magnet focusing arrangement also according to the present invention,

Fig. 9 is a longitudinal cross-sectional view of the device of Fig. 8 viewed along line 9—9 thereof,

Fig. 10 is a fragmentary transverse cross-sectional view of the same device viewed along line 10—10 of Fig. 9,

Fig. 11 is a fragmentary cross-sectional view viewed along line 11—11 of Fig. 10,

Fig. 12 is a fragmentary transverse cross-sectional view of a modification of a portion of Fig. 10, and

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Fig. 13 is a similar view of another modification of a portion of Fig. 10.

Referring particularly to Figs. 1–6, there is shown one form of permanent magnet focusing device according to the present invention. This device is formed of a pair of parallel annular pole plates 21 and 22, made of magnetic material, such as a suitable grade of iron or steel. Between these pole plates 21 and 22 are clamped a plurality of permanent magnets 23, as by means of bolts 24 or other suitable means. The magnets 23 are preferably made of Alnico or similar highly retentive permanently magnetized material. A cylindrical pole piece 26 of magnetic material is axially adjustably mounted within the circular aperture 27 of the rear pole plate 21 and has an inner diameter slightly larger than the diameter of the neck of the cathode ray tube on which the focusing device is to be mounted.

The pole piece 26 has fixed thereto a pair of non-magnetic guide members 28 and 29 which may be suitably secured either to the edge of the cylindrical pole piece 26 or to the flat cylindrical wall thereof, as may be desired. Guide member 28 as shown in Fig. 1 has a single aperture 31 therein which is in alignment with a corresponding aperture 32 of guide member 29. Member 29 has a further aperture 33 which is internally threaded. Secured to either or both the pole plates 21 and 22 in any desired fashion, as by a pressed fit in apertures therein, is a non-magnetic guide pin 34 which has a sliding engagement with respect to the apertures 31 and 32 of brackets 29 and 28. Also passing through the pole plate 21 is a non-magnetic lead screw 36 which is threadedly engaged in the threaded aperture 33 of bracket 29. Screw 36 is preferably formed integrally with an extension 37, providing a shoulder 38 bearing against pole plate 21. Screw 36 and its extension 37 are retained against lateral movement by any desired means, such as a C-washer 39 or other suitable device. For retaining the pole piece 26 centered within the aperture 27 and for minimizing friction, a plurality of centering shims 41 are utilized. These are in the form of U-shaped strips of non-magnetic material seated at the inner edge of the pole plate 21.

It will be understood that by rotating shaft 42 connected to the lead screw 36, the pole piece 26 is axially adjusted with respect to the pole plate 22, thereby varying the air gap between these elements so as to adjust the intensity of the magnetic field to which the electron beam of the cathode ray tube is subjected when the focusing

device is located around the neck of the cathode ray tube. The strips 41 and guide pin 34 provide an accurate guide for the pole piece 26 so that it does not rock or alter its position relative to the axis of the device during adjustment, while at the same time a relatively low-friction drive is provided.

The pole plate 22 may be fastened to a mounting plate 43 so as to provide a centering adjustment for the device. Thus, as shown in Fig. 2, the mounting plate 43 has a slot 44 at one end and a slotted extension 46 at the other. A pin or screw 47 passing through slot 44 restricts the plate 43 to sliding motion relative to pole plate 22. An extension 48 is secured to pole plate 22 and a suitable clamp device 49 clamps the centering plate extension 46 to the pole plate extension 48. Relative adjustment is secured by the slot 44, the slot 51 in extension 48, and the arcuate slot 52 in the pole plate extension 48. A pair of mounting ears 53 may be secured to the pole plate 22 for mounting the device upon any suitable bracket.

Fig. 7 shows a slightly modified form of guide arrangement. In this case the guide members 28 and 29 are joined, preferably integrally, by a saddle piece 30 which is secured to the outer cylindrical surface of the pole piece 26. The pole plate 21 is provided with a recessed aperture 29 to accommodate the saddle piece 30. The remaining portions of the device are the same as discussed with respect to Figs. 1–6, and the device operates in the same manner.

The remaining Figures 8–13 illustrate a modified form of device similar in operation and function to that already described, but additionally useful in having certain self-aligning features. Similar elements will be given numbers similarly in these figures. The main difference between the device of Figures 8–13 and that of the preceding figures is in the arrangement serving to guide movement of the pole piece 26. As shown in Figs. 8, 9 and 10, a non-magnetic cylindrical sleeve 61 is mounted at the inner edge of the aperture 27 of pole plate 21, and abuts pole plate 22 as at 62. This sleeve 61 is not a complete cylinder, but has a longitudinally extending gap 63 formed by the outturned edges 64 of the sleeve 61 which serve in part as a guide or passage for the drive mechanism. It will be understood that the pole piece 26 has a sliding fit within the sleeve 61. The non-magnetic lead screw 36 is mounted in pole plate 21 against axial movement, and engages the non-magnetic travelling nut 65 which in turn is held between a pair of non-magnetic posts 66 extending through the gap 63 and attached to the pole piece 26. A pair of sleeves 59, 60 may be slidably mounted on the screw 36 at opposite sides of the nut 65 so as to provide limits for the movement of the nut 65 in either direction. The travelling nut 65 as shown in Fig. 11 has channels 67 extending along opposite sides thereof, which slidably engage the posts 66, but which prevent any movement of the travelling nut 65 relative to the posts 66 along the axis of the focusing device.

Thus, upon turning the shaft 42 attached to the lead screw 36, nut 65 is axially adjusted, which simultaneously adjusts the pole piece 26 within the sleeve 61. However, any radial misalignment between the axis of lead screw 36 and the axis of the device, such as may be caused by unavoidable variation in dimensions during manufacture, is automatically taken up by the relative sliding movement between the nut 65 and the posts 66,

thereby accommodating the device to incidental inaccuracies in manufacturing procedures. As shown in Figure 12, the posts 66 may be joined by a cross piece 66' to form a U-shaped bracket which retains the nut 65 in place. Where radial adjustment of the nut 65 is not important, the posts 66 may be replaced by a single loop 166 suitably fastened to the pole piece 26 as shown in Fig. 13.

In this way the entire sleeve 61 acts as a guide for the pole piece 26, assuring accurate retention of proper centering for the entire length of travel of the pole piece 26.

From the above description it will be apparent to those skilled in the art that the subject matter of this invention is capable of variation, and I do not, therefore, desire to be strictly limited to the illustrated embodiments herein set forth. I prefer to be limited only as required by the appended claims.

What is claimed is:

1. A focusing device for cathode ray tubes or the like, comprising a pair of annular pole plates, a plurality of permanent magnets mounted between said pole plates symmetrically about and parallel to the axis of said pole plates, a hollow cylindrical pole piece mounted for adjustment axially of said plates and within the aperture of one of said pole plates and adapted to accommodate the neck of a cathode ray tube, non-magnetic means between said pole piece and the inner edge of the aperture of said one pole plate for axially slidably centering said pole piece, a bracket fixed to said pole piece and having an internally threaded aperture radially outward of said pole piece, and a lead screw rotatably mounted in one of said pole plates against axial motion and engaging said threaded aperture, a second bracket fixed to said pole piece, said brackets having a pair of apertures in axial alignment, and a guide pin slidably engaging said latter apertures and fixed to said pole plates parallel to the axis of said device, for retaining said pole piece in axial alignment during its adjustment, whereby upon rotation of said lead screw said pole piece is adjusted relative to a pole plate to vary the gap therebetween and thereby to adjust the magnetic field produced by said magnets, substantially without transverse shifting of the image on said cathode ray tube.

2. A focusing device as in claim 1 wherein said non-magnetic means comprises a plurality of U-shaped shims having the bottom of the U between said pole piece and the edge of the aperture of the pole plate.

3. A focusing device for cathode ray tubes or the like, comprising a pair of annular pole plates, a plurality of permanent magnets mounted between said pole plates symmetrically about and parallel to the axis of said pole plates, a hollow cylindrical pole piece mounted for adjustment axially of said plates and within the aperture of one of said pole plates, non-magnetic means between said pole piece and the inner edge of the aperture of said one pole plate for axially slidably centering said pole piece, a member supported by said pole piece and having an internally threaded aperture radially outward of said pole piece, and a lead screw rotatably mounted in one of said pole plates against axial motion and engaging said threaded aperture, a pair of brackets fixed respectively to said pole piece and to one of said pole plates and having a pair of apertures in axial alignment, and a guide pin slidably engaged within said latter apertures and

fixed to said pole plates parallel to the axis of said device for retaining said pole piece in axial alignment during its adjustment, whereby upon rotation of said lead screw said pole piece is adjusted relative to a pole plate to vary the gap therebetween and thereby to adjust the magnetic field produced by said magnets.

4. A focusing device as in claim 3 wherein said non-magnetic means comprises a substantially cylindrical sheet within the aperture of said one pole plate and within which sheet said pole piece is axially slidable.

5. A focusing device as in claim 3, wherein said threaded-aperture member comprises a nut mounted radially slidable on said pole piece.

6. A focusing device as in claim 3, wherein said threaded-aperture member is mounted for radially slidable movement with respect to said pole piece to permit self-alignment relative to said screw.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,200,039	Nicoll	May 7, 1940
2,212,206	Holst et al.	Aug. 20, 1940
2,234,720	De Tar	Mar. 11, 1941
2,369,796	Ramberg	Feb. 20, 1945
2,416,687	Fry	Mar. 4, 1947
2,418,487	Sproul	Apr. 8, 1947
2,431,077	Poch	Nov. 18, 1947
2,442,975	Grundmann	June 8, 1948
2,503,173	Reisner	Apr. 4, 1950
2,533,687	Quam	Dec. 12, 1950
2,533,688	Quam	Dec. 12, 1950
2,533,689	Quam	Dec. 12, 1950

FOREIGN PATENTS

Number	Country	Date
459,860	Great Britain	Jan. 15, 1937
521,439	Great Britain	May 22, 1940
597,255	Great Britain	Jan. 21, 1948
615,553	Great Britain	Jan. 7, 1949