Sept. 18, 1951 W. F. STEERS 2,568,668

CATHODE RAY TUBE FOCUSING DEVICE OF THE PERMANENT MAGNET TYPE

Filed Aug. 18, 1950 3 Sheets-Sheet 1

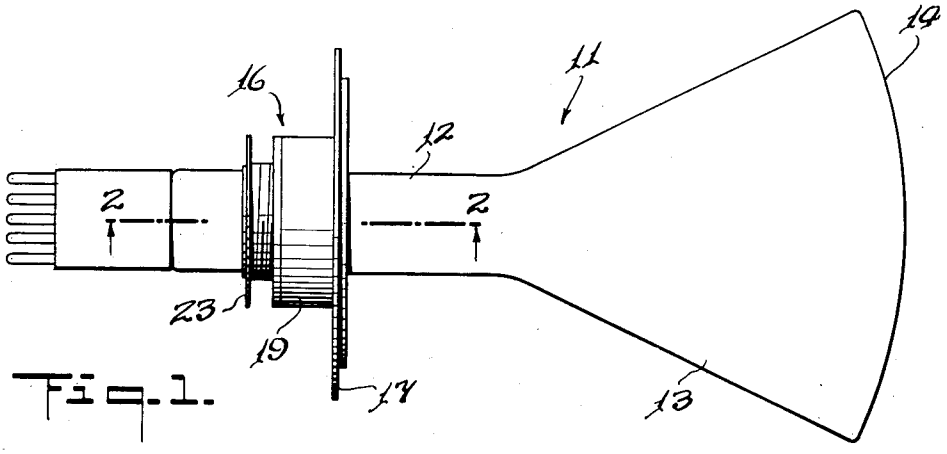


Fig. 1.

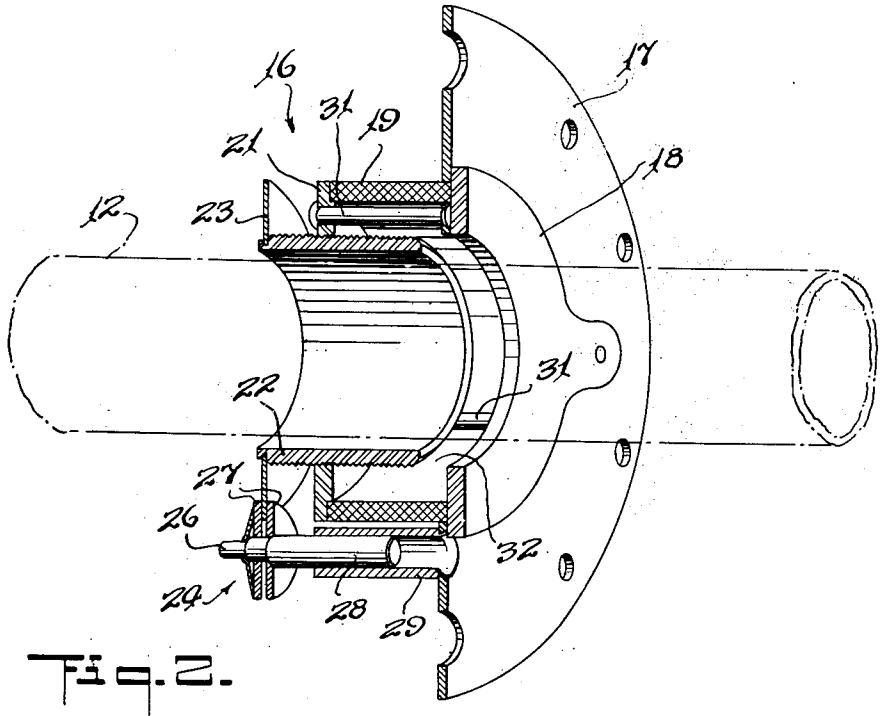


Fig. 2.

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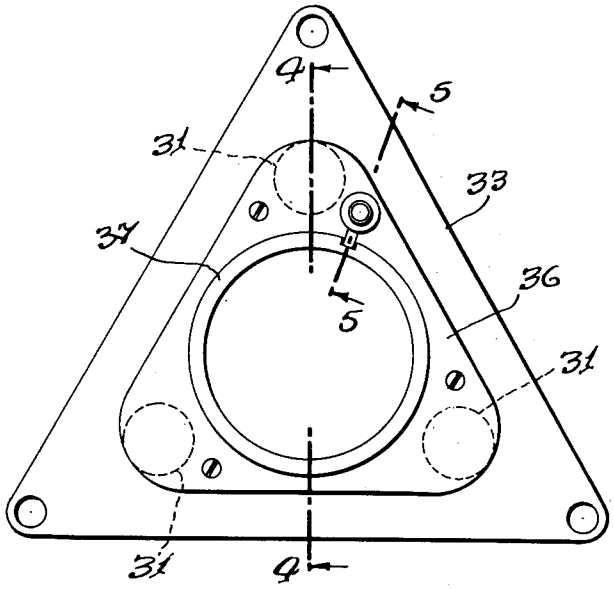


Fig. 3.

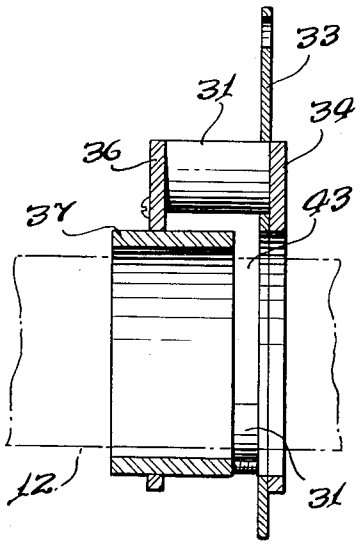


Fig. 4.

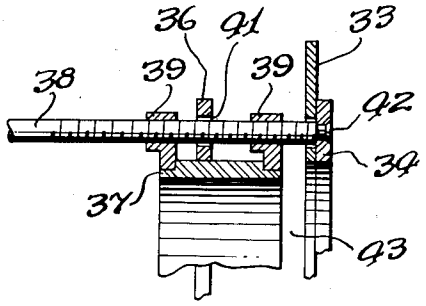


Fig. 5.

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CATHODE RAY TUBE FOCUSING DEVICE OF THE PERMANENT MAGNET TYPE

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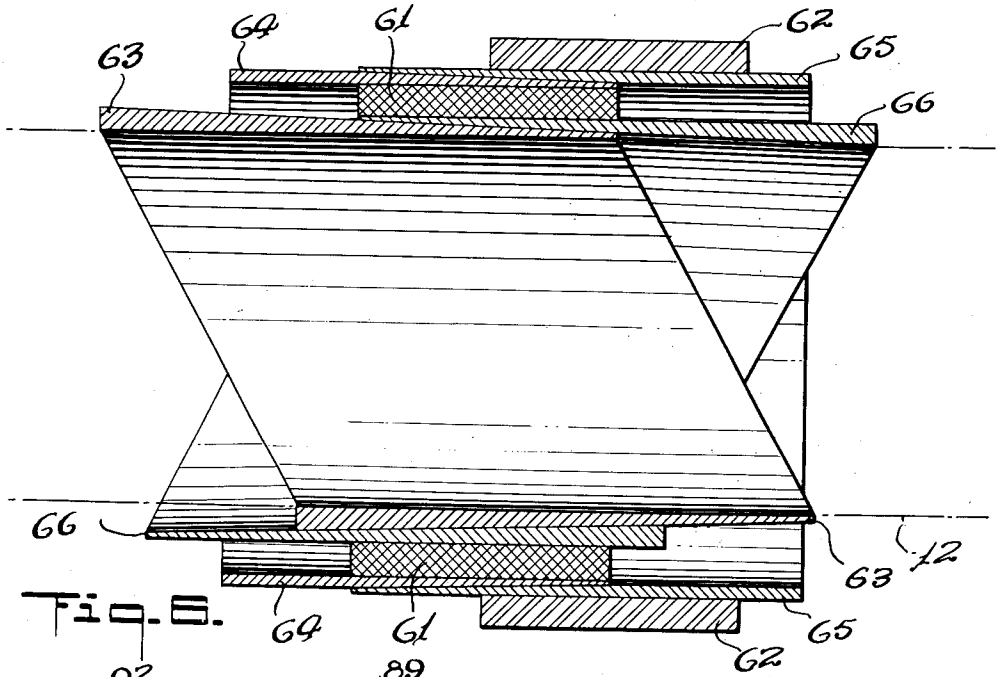


Fig. 6.

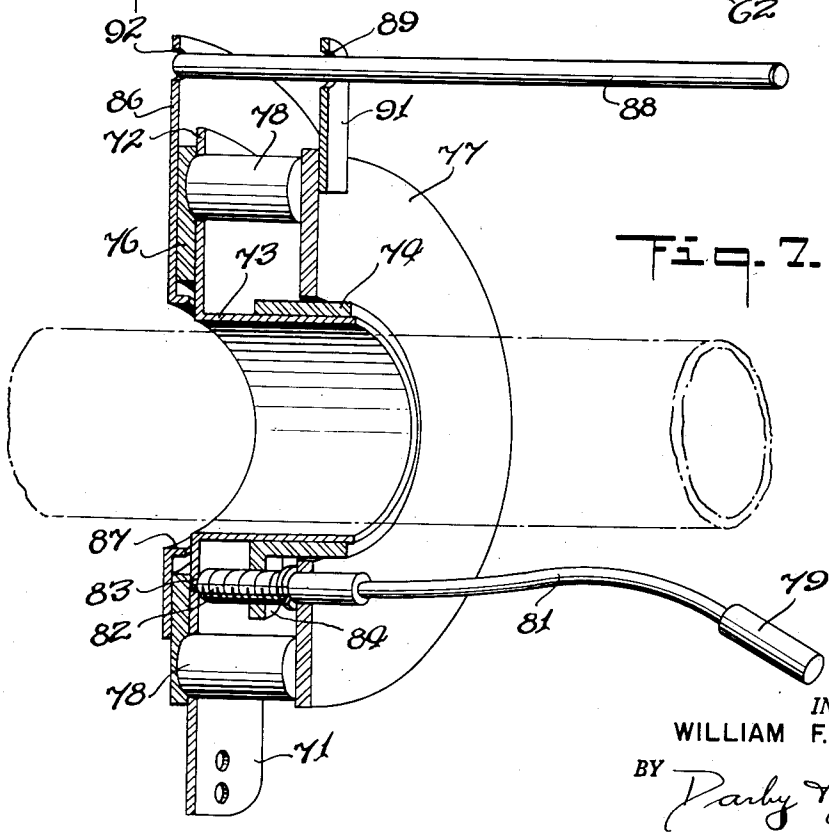


Fig. 7.

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UNITED STATES PATENT OFFICE

2,568,668

CATHODE-RAY TUBE FOCUSING DEVICE OF THE PERMANENT MAGNET TYPE

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Application August 18, 1950, Serial No. 180,135

3 Claims. (Cl. 313—84)

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

In the prior art it has been customary to provide focussing for cathode ray beams by use of a focussing coil surrounding the cylindrical neck of the tube and excited by direct current. This structure provides a simple means for adjusting the degree of focussing merely by adjusting the magnitude of direct current flowing in the focussing coil. However it suffers from certain disadvantages including a variation of focussing with line voltage changes, the absorption of power from the television receiver or oscilloscopes, the creation of heat dissipation problems, and an increase in costs by virtue not only of the cost of the coil itself, but the cost of the auxiliary apparatus such as a potentiometer required for adjustability, and the labor costs of assembly of all these elements.

According to the present invention these disadvantages of the use of focussing coils are substantially overcome by providing a permanent magnet type of focussing structure. According to the present invention means are provided for adjusting the degree of focussing just as readily as in the prior art. By use of this arrangement the focussing stability is increased since focussing is no longer dependent on line voltage, the heat dissipation and power requirements are reduced, and both labor and material costs are lowered since it is no longer necessary to wire the focussing device into the circuit or to provide auxiliary adjusting apparatus.

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—

Figure 1 is a side elevation view of a cathode ray tube having one form of a permanent-magnet focussing arrangement according to the present invention mounted thereon;

Figure 2 is a longitudinal cross sectional perspective view of the focussing structure of Figure 1 showing only part of the cathode ray tube neck;

Figure 3 is an end view of a modified form of focussing arrangement;

Figure 4 is a longitudinal cross sectional view of the device of Figure 3, taken along line 4—4 thereof;

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Figure 5 is a longitudinal cross sectional view of a fragmentary portion of the device of Figure 3 taken along line 5—5 thereof;

Figure 6 is a longitudinal cross sectional view of another form of focussing device according to the present invention; and

Figure 7 is a similar longitudinal cross sectional perspective view of still another form of the present invention.

Referring to Figure 1 of the drawings, there is shown a conventional cathode ray tube 11 having a neck portion 12, generally cylindrical in shape, and a flaring portion 13 terminating in the usual viewing screen 14. Placed around the cylindrical neck 12 of the tube 11 is a permanent magnet type of focussing arrangement 16 according to one form of the present invention.

As shown more fully in Figure 2 this focussing arrangement 16 has a mounting plate 17 of generally circular or any other preferred shape surrounding the neck 12 of the tube. Mounting plate 17 is adapted to be secured in any suitable manner to a frame or chassis for supporting the focussing arrangement 16. Suitably fastened to the mounting plate 17 is an end ring 18 of magnetic material, it being understood that the mounting plate 17 is preferably of non-magnetic material, such as aluminum, brass or the like. Ring 18 has a central aperture adapted to accommodate the neck 12 of the tube 11.

A cylindrical magnet 19 is arranged coaxially with respect to plate 17 and ring 18, being held in place by a second magnetic ring 21 and suitable fastening means, such as rods 31. Ring 21 is internally threaded, and is threadedly engaged with an outwardly threaded cylinder 22 of magnetic material. Cylinder 22 is fixed to a disc 23 serving as a drive member for rotating the threaded cylinder 22, as by means of a suitable friction drive indicated schematically at 24, having a rotatable control shaft 26 to which is fixed drive members 27 frictionally engaging the disc 23. The shaft 26 may be extended to form a guide 28 sliding within a tubular member 29 fixed to plate 17, for purposes of support and alignment.

It will be thus seen that the magnetic members 18 and 19, 21 and 22 provide a nearly closed path for the magnetic field except for the gap 32 between the threaded cylinder 22 and the end ring 18, and this gap 32 is adjustable by means of the friction drive 24. By adjusting the length of the gap 32 any desired value of magnetic field intensity can be obtained within the tube 11, thereby providing a readily adjustable perma-

nent magnet type of focusing arrangement. The magnetic field is axially symmetrical.

Figures 3 to 5 show another form of the invention in which a non-magnetic mounting plate 33 supports a magnetic plate 34 apertured to receive the tube neck 12. Fixed between the magnetic plate 34 and a further magnetic plate 36 are a plurality of permanent magnets 31. A magnetic cylinder 37 is slidably retained within the central aperture of magnetic plate 36 and is axially adjustable with respect to the tube 11 by means of a suitable drive shown in Figure 5, comprising a threaded shaft 38 threadedly engaged in lugs 39 affixed to the cylinder 37, the shaft 38 passing freely through an opening 41 in the plate 36 and being rotatably seated in mounting plate 33, as at 42. It will be understood that any other suitable means for conveniently axially adjusting the cylinder 37 may also be utilized.

In this form of the invention also, magnetic members 34, 36 and 37 form a complete magnetic pole piece structure for the focussing arrangement, providing a gap 43 which is conveniently adjustable to adjust the magnetic field within the tube 11 and thereby adjust the focussing effect. As before the field is circularly symmetrical by virtue of the cylindrical member 37 and the circularly apertured magnetic pole piece 34. In this instance the mounting plate 33 and plates 34 and 36 are shown as generally triangular in shape, which may be a convenient shape for physically mounting the apparatus on a chassis or the like. However it will be understood that in this and other forms of the invention any desired shape may be utilized so long as a properly symmetrical and adjustable permanent magnet field is provided.

Figure 6 shows a form of the invention using a cylindrical permanent magnet 61 with an adjustable cylindrical magnetic shunt 62 exterior thereto. For the purpose of permitting adjustable positioning of either the magnet 61 or the shunting cylinder 62, there are provided a plurality of tapered cylindrical non-magnetic members 63, 64, 65 and 66. It will be understood that the members 63 and 66 taper oppositely, as do the members 64 and 65. The magnet 61 is first positioned on the tube neck as desired, and is then maintained in position by pressing the tapered cylinders 63, 66 in opposite directions toward one another so as to wedge themselves together within the magnet 61 which is thereby held in suitable position. Similarly, the shunting cylinder 63 is held in position relative to the magnet 61 by similar wedging action of the tapered cylinders 65 and 64. One of these cylinders, such as 63 or 66, may be suitably mounted on a mounting plate where desired in order to center the entire structure with respect to the tube axis.

Figure 7 shows another form of the present invention. In this case a non-magnetic mounting bracket 71 is provided having a disc portion 72 and a cylindrical portion 73. Slidably mounted on the cylindrical portion 73 is the adjustable magnetic sleeve or cylinder 74. Fixed to the disc portion 72 is a magnetic end plate 76, apertured to receive the tube neck 12. Fastened between the end plate 76 and a second magnetic end plate 77 are the bar type permanent magnets 78, two of which are shown in Figure 9, although it will be understood that a larger plurality will generally be utilized to provide a symmetrical magnetic field. Magnetic sleeve 74 is axially adjustable by means of the control member 79 coupled to a flexible shaft 81 terminating in a threaded member 82 which is rotatably seated in the mounting plate 71 as at 83. Threaded member 82 is threadedly engaged with a lug or bracket 84 formed on the adjustable sleeve 74 so that, upon rotation of the control 79, the threaded members 82, 84 cause the sleeve 74 to advance in the selected direction along the tube neck 12. For the purpose of centering the entire structure relative to the axis of the tube, an adjustable pole plate 86 is provided which is in magnetic contact with plate 76 and has an inwardly turned flange 87. Plate 86 is rotatably mounted eccentrically with respect to the tube 12. A centering rod 88 is provided which passes freely through an aperture 89 in the extension 91 of pole plate 77 and also into an aperture 92 in plate 86. By using the aperture 89 as a fulcrum for the rod 88 the plate 86 can be rotated with respect to the axis of the tube, thereby changing the axial relationship of the flange 87 with respect to the axis of the tube. This varies the axial distribution of magnetic field and thereby overcomes any undesired asymmetry. Normally this would be adjusted to center or otherwise set the electron beam spot with respect to the screen 14 of the tube. The adjustable pole plate 86 is suitably held to the fixed plate 76 by spring tension and magnetic force. The adjustment of control 79 then varies the gap between flange 87 and sleeve 74 to vary the intensity of the magnetic field for focussing.

Accordingly in each of the forms of the present invention there has been illustrated a permanent magnet type of focussing device requiring no energization and yet permitting full symmetrical and adjustable focussing control. It will be understood that in all of the above forms of the invention bar magnets may be replaced by cylindrical magnets, or vice versa, so long as proper symmetry is maintained. Also the entire unit may be supported in any desired manner either from the chassis or cabinet of a television set, oscilloscope or the like, wherever such a tube may be utilized.

It will be understood that in any of the above forms of invention any other desired form of mechanical drive for the adjustable sleeve may be used. Thus, in Fig. 2, in place of the friction drive 24, plate 23 may be formed as a gear, and an elongated spur gear pinion in mesh therewith may be mounted on shaft 26. Alternatively, a sprocket may be formed or fixed on plate 23, and a corresponding sprocket fixed to shaft 26, with a chain drive extending in engagement therewith. Other equally effective arrangements can be readily conceived.

What is claimed is:

1. A permanent magnet focussing device for cathode ray tubes, comprising a pair of centrally-apertured magnetic pole plates to surround the neck of a cathode ray tube, and arranged to extend radially from the axis thereof, an axially symmetrical permanent magnet sleeve extending between said pole plates, an inner magnetic sleeve within said arrangement extending coaxially with the tube opening from one of said pole plates to a plane adjacent to the other pole plate to define a magnetic circuit including an air gap formed by said sleeve and said pole plate, and means for axially adjusting said inner magnetic sleeve, comprising a non-magnetic plate on said sleeve paralleling said magnetic pole plates and a clutch engaging said plate and said first magnetic pole plate whereby relative movement of

said sleeve between said plates to vary the width of the said air gap may be accomplished.

2. In the apparatus in accordance with claim 1, the clutch including an internally threaded element fixed to said sleeve and a rotatable and non-translatable screw member engaged within said threaded element whereby upon rotation thereof said sleeve is correspondingly moved.

3. A permanent magnet focussing device for cathode ray tubes, comprising a pair of centrally apertured magnetic pole plates adapted to surround the neck of a cathode ray tube and extending radially from the axis thereof, an axially symmetrical permanent magnet arrangement extending between said pole plates, a magnetic sleeve inside said arrangement extending axially within one of said pole plates and adjacent the other to form a gap between one end of said sleeve and the edge of the aperture of said other pole plates, said sleeve being axially adjustable to adjust the size of said gap, and an internally threaded element fixed to said sleeve with a rotatable and non-oscillatable screw member engaged within said threaded element whereby upon rotation of said screw member said sleeve is longitudinally moved.

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