

June 15, 1965

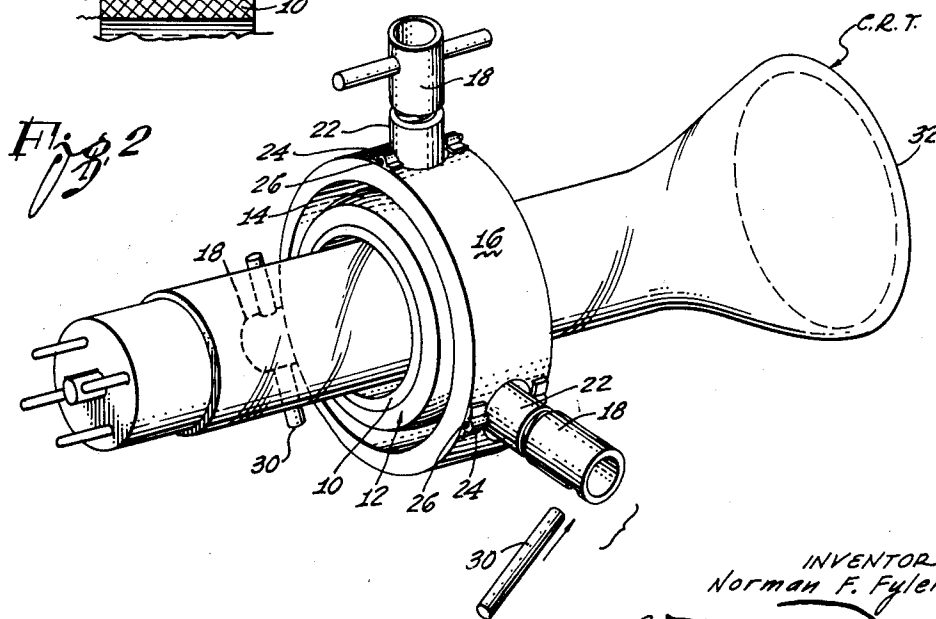
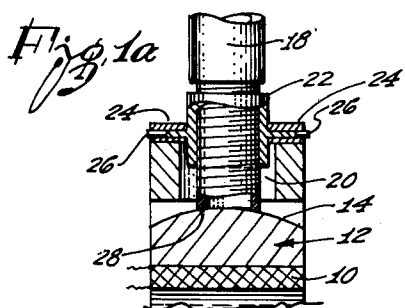
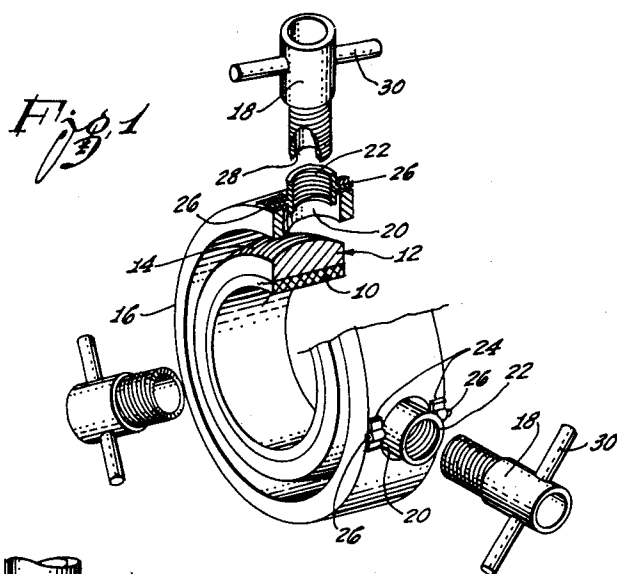
N. F. FYLER

3,189,775

ADJUSTABLE MOUNTING ASSEMBLY FOR CATHODE RAY TUBES

Filed Sept. 11, 1961

2 Sheets-Sheet 1



INVENTOR:
Norman F. Fyler

By *Richard E. Fyler*
Agent

June 15, 1965

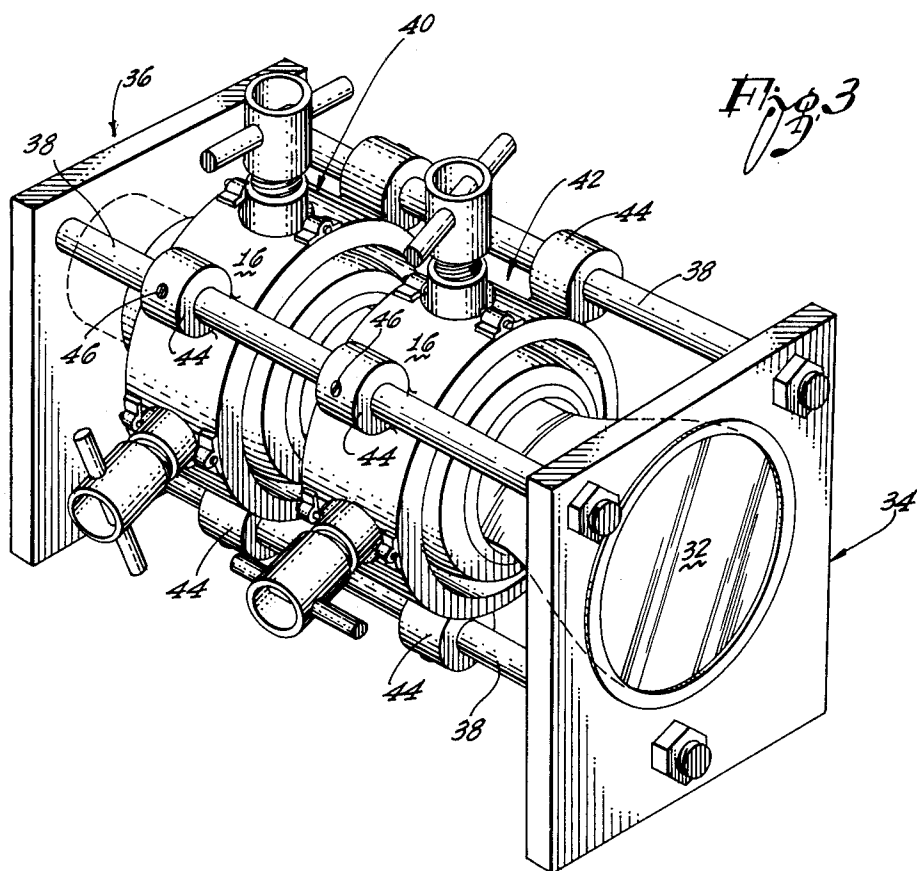
N. F. FYLER

3,189,775

ADJUSTABLE MOUNTING ASSEMBLY FOR CATHODE RAY TUBES

Filed Sept. 11, 1961

2 Sheets-Sheet 2



INVENTOR:
Norman F. Fyler

By *[Signature]* Agent

1

3,189,775

ADJUSTABLE MOUNTING ASSEMBLY FOR CATHODE RAY TUBES

Norman F. Fyler, Menlo Park, Calif., assignor to Litton Electron Tube Corp., San Carlos, Calif.
Filed Sept. 11, 1961, Ser. No. 137,132
12 Claims. (Cl. 313-84)

This invention relates to cathode ray tubes and, more particularly, to precision assemblies for adjustably mounting and aligning focus coils, deflection coils or other field producing components in their optimum operating position on the neck of a cathode ray tube.

Numerous arrangements have been suggested for the purpose under consideration and most of them are based on multiple pivot type couplings. This term designates an assembly in which a first degree of freedom is imparted to the coil by a pair of aligned pivots which permit angular adjustment of the coil about one axis. By adding a second, similar pivot arrangement associated with the first one in a well-known manner, angular adjustment about a second axis is achieved, which second axis is generally perpendicular to the first one. It will be understood that this type of universal joint leads to a suspension of the coil with two degrees of freedom, so that the coil may be adjusted in any desired angular position.

Universal joint suspensions such as described above were found satisfactory when used in connection with, for example, television tubes, where comparatively little precision is required; however, for high precision cathode ray tube applications in which the electron beam has a diameter of 0.0001 inch or less, the prior art arrangements are far too crude. It is one of the more significant shortcomings of such prior art devices that they do not permit lateral displacement of the suspended coil in a direction perpendicular to the axis of the tube. In other words, suspension mountings used heretofore lack the desired third degree of freedom. Additionally, under some circumstances a fourth degree of freedom involving displacement of the entire coil suspension assembly in a direction parallel with the tube axis is highly desirable.

Accordingly, it is one of the more important objects of the present invention to add at least one degree of freedom to adjustable coil mounting arrangements for cathode ray tubes. It is a further object of this invention to improve the precision with which the position of a suspended coil can be adjusted.

Another disadvantage of the prior proposals involves the necessity of successive adjustments. Thus, for proper operation of a cathode ray tube deflection system, the coils should be concentric with the electron beam. In prior adjustment systems of the double pivot type, assuming initial concentricity, a slight tilting of the deflection coil will destroy the concentricity, and successive adjustments are therefore required.

Accordingly, another object of the present invention is to provide a coil mounting arrangement which will permit tilting of the coil without loss of concentricity of coil and electron beam.

A further object is the simplification of suspension structures, so that they include a minimum of movable parts.

Additional objects of this invention include the addition of a fourth degree of freedom, thus permitting lateral displacement in a direction parallel with respect to the assembly axis, and an increase in reliability with respect to shock resistance by rigidly locking a coil or other component in place, once it is adjusted in the desired position.

In accordance with the invention, a position adjustment assembly, especially useful in coil suspension arrangements for cathode ray tubes, includes a preferably ring-

2

shaped structure having a spherical convex outer surface associated with the coil, or generally speaking, with the element which must be adjustably mounted. This supporting structure is suspended by means of radially and adjustably mounted members engaging it at at least three distinct locations on the outer convex surface. In practice, and in accordance with one of the more important features of this invention, the suspension members may be sections of tubes which are radially mounted at substantially equal distances from each other to point toward the center of the sphere defined by the convexly curved surface of the ring-shaped coil support. Preferably, each of the tubes is provided with an external thread cooperating with an internally threaded element such as a sleeve associated with a second outer ring surrounding the first-mentioned ring-shaped support.

Other features of the invention include matching spherical surfaces provided at the inner end of each tube section to cooperate with and to engage the spherical surface of the inner ring-shaped support, arrangements for displacing the entire assembly in a direction parallel with the cathode ray tube axis, as well as pivot mounting for the internally threaded sleeves cooperating with the externally threaded tubing sections to facilitate manipulation of the mounting assembly and to ensure concentric gripping action of the inner ends of the tubes on the spherical surface of the inner ring-shaped support.

At this point it should be considered that, under the assumption that each adjustable member engages one distinct point on the spherical surface of the inner ring, four such points of contact would be required for defining a sphere in a definite position with respect to its surroundings. However, and when using radially adjustable tubing sections, the contact area is not a geometrical point but an annular area, so that in actual embodiments of the invention incorporating tubes as the adjustable members, three such sections are sufficient.

It will be apparent from the foregoing that an object having a spherical surface, when suspended at at least three locations by supporting members which are individually and radially adjustable in a direction toward and from the center of the sphere, can readily be adjusted with respect to three degrees of freedom. This means that, by radially adjusting the supporting members, the suspended object can be laterally displaced and, upon slightly loosening the engagement between one of the members and the spherical surface, the object can be subjected to angular adjustment by rotation about any axis through the center of the sphere, which rotation may be termed a swiveling or tilting movement.

The coil supporting structure of the present invention, which includes a spherically curved surface and radially adjustable supporting members engaging the spherical surface, clearly has many advantages. Thus, it provides all of the degrees of freedom required for precision adjustment assemblies of the type contemplated herein, in a greatly simplified structure having a minimum of movable parts. With regard to another advantage, the lateral and the tilting adjustments may be performed independently of each other. Accordingly, after initial radial adjustment for concentricity of beam and coil, the coil may be tilted without loss of concentricity, or the necessity for subsequent readjustments.

Other objects, features and advantages of the invention will become apparent from a consideration of the following detailed description and from the drawings, in which:

FIGURE 1 is an isometric view, partly broken away and partly disassembled, illustrating one embodiment of an adjustable suspension assembly in accordance with the invention;

FIGURE 1a is a cross sectional view of an assembled detail of FIGURE 1;

FIGURE 2 is an isometric view of the assembly of FIGURE 1 shown when assembled with a cathode ray tube and supporting a coil; and

FIGURE 3 is an isometric view of a complete assembly including a frame supporting a cathode ray tube and a pair of suspension assemblies of the type shown in FIGURE 1.

Referring now to FIGURES 1 and 1a, there is shown one embodiment of the invention suitable for mounting a focus coil as generally described above. The assembly includes the coil 10, which may be secured to the inner surface of a ring 12 in any suitable manner, such as by means of screws, adhesive, or the like. In accordance with the invention, the outer surface of supporting ring 12 is curved to form a convex, spherical surface 14. The resulting ring and coil assembly is maintained suspended within a second, outer ring 16 by means of three identical, externally threaded tubular sections 18, shown disassembled in FIGURE 1 for easier understanding of the arrangement.

The outer ring 16 has three apertures 20 spaced at equal distances from each other along the periphery of the ring. Preferably, all three apertures lie in one plane positioned perpendicularly with respect to the axis of symmetry through the outer ring 16. Threaded sleeves 22 are mounted outside and in axial alignment with each of the apertures 20 by means of hinges 24 secured to ring 16 and pins 26 secured to the sleeves 22. As a result, the sleeves can pivot about an axis pointing in the direction of that of the coil-ring assembly. It should be noted that the diameter of apertures 20 exceeds the outer diameter of the sleeves 22 so that, by a small pivoting movement, each of annular front faces 28 of the sleeves may assume a concentric position with respect to the surface 14 so that a firm grip due to contact of the entire annular front face 28 with surface 14 is ensured. This is accomplished by threadably engaging the tubing sections 18 within the sleeves 22 until the annular front faces 28 of the tubing sections contact and engage the spherical surface 14 of support 12. For easy handling and performing the step of adjusting the position of the ring 12, each of the tubing sections 18 carries a cross handle 30.

It has been found advantageous to give the annular front faces 28 of tubular sections 18 a spherical shape also, to match that of surface 14, as shown in FIGURE 1 with respect to the upper of the three tubular sections, and especially in FIGURE 1a. As a result, the spherical shape of the front faces 28, when assuming a concentric position with respect to the spherical surface 14, provides a firm grip on the spherical surface of supporting ring 12.

As illustrated in FIGURE 1, the outer diameter of ring-shaped support 12 is smaller than the inner diameter of the outer ring 16. It will be apparent from the foregoing description that the tubular sections 18 act, in a certain respect, as set-screws. Due to the fact that the outer surface of the ring 12 is curved in the shape of a sphere, and upon loosening at least one of the tubing sections 18, the angular position of the ring-shaped support 12, and with it that of the coil 10, may be adjusted by a swivel movement or tilting to assume any desired inclination about any diameter of ring 12, of course within the limits of the width of the curved surface 14. Considering that for the specific purpose of suspending focus coils or deflection coils for cathode ray tubes only comparatively small adjustments are necessary, assemblies of the type described herein and having about the proportions shown in the drawings were found to have sufficient freedom to permit all necessary adjustments.

In addition to the tilting or swivel movement by inclination about any desired diameter, the assembly of

ring 12 with coil 10 may be laterally displaced by radially adjusting the position of tubular sections 18. When loosening two of them, and displacing the third one toward the center of the assembly by rotating the tubing section in a clock-wise direction using the cross-handle 30, the coil assembly is radially displaced in the direction in which the tubular section advances. It should be noted that a specific advantage of the arrangement so described resides in the fact that, once the desired position is assumed, ring support 12, and with it the coil 10, is firmly locked in this position without danger of being inadvertently displaced.

The distance between any of the front faces 28 of the tubes 18 and the axis of the cathode ray tube is a function of the advancement of the corresponding tubular section within the sleeve 22. Accordingly, by adjusting the length of the tubular sections protruding inwardly from the outer ring 16, the coil 10 can be displaced in a radial direction until it assumes the desired position.

FIGURE 2 illustrates the adjustable mounting assembly of FIGURE 1 when used in connection with a cathode ray tube 32, with identical components being designated by the same reference numerals. In such assembly it is to be understood that the outer ring 16 supporting the sleeves 22 is rigidly secured to a chassis or frame which also maintains the cathode ray tube 32 in a fixed position. In this manner, loosening at least one of the tubular sections permits adjusting the angle of inclination between the assembly of ring 12 with coil 10 with respect to the cathode ray tube 32. Similarly, lateral adjustment of the coil with respect to the tube 32 is accomplished as described above.

Referring now to FIGURE 3, this figure illustrates a complete assembly of a cathode ray tube 32 with a pair of coil suspension assemblies as set forth in the foregoing description of FIGURES 1 and 2. The chassis maintaining all of the components in their position with respect to each other includes front and rear panels 34 and 36, respectively, connected to each other by three rods 38, as shown. The coil suspension assemblies, generally designated 40 and 42, each including all of the components described in connection with FIGURES 1 and 2, are provided with suitable collars or brackets 44 secured to their outer rings 16. The brackets 44 may be moved along the rods 38 to permit axial displacement of the coil assemblies in a direction parallel to the center line of the tube 32. They are maintained in their selected position by means of set-screws 46. As a result of this arrangement, all of the degrees of freedom of movement mentioned above are available for both of the coil mounting assemblies 40 and 42. In practice, and referring to cathode ray tubes for display purposes, one of the coils supported by one of the assemblies is generally a focus coil and the other coil is a deflection coil.

It will be understood that the spherical surface may be interrupted by areas having any other suitable shape. Since comparatively small adjustments are required in connection with focus and deflection coils for cathode ray tubes, the spherical areas cooperating with and facing the supporting tubular sections must permit adjustment only within the extent necessary for such adjustments. The remainder of the surface may, for example, be reduced in cross section to minimize the weight of the entire assembly. Accordingly, when reference is made to a spherical surface in this description and in the appended claims, such interrupted surfaces are understood to be included within the scope of the term.

Although focus coils and deflection coils have been mentioned in the foregoing, any other component producing an additional electric or magnetic field within a tube and of which the position with respect to the tube must be adjusted, may be suspended as described by securing it to the ring 12.

It is to be understood that the above-described arrangements are illustrative of the application of the prin-

5

ciples of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention. Thus, by way of example, and not of limitation, the components secured to ring 12 may be electrostatic deflection plates or permanent magnets. Furthermore, solid, externally threaded rods may be substituted for the tubular sections 18, with the front faces having the shape of complete spherical segments. It should furthermore be noted that the structure including the convex spherical surface need not be a complete ring. For specific purposes, an open ring or U-shaped support may be found advantageous.

Accordingly, from the foregoing remarks, it is to be understood that the present invention is to be limited only by the spirit and scope of the appended claims.

What is claimed is:

1. In an electron beam focusing and alignment apparatus, a cathode ray tube, a support structure having a spherical convex outer surface at least partially encircling said cathode ray tube, means including a field producing component mounted on said support structure, and means for adjustably mounting said support structure for engaging it at at least three distinct locations on its convex spherical outer surface.

2. In an adjustable mounting assembly for cathode ray tubes, a structure having a convex spherical outer surface, means for suspending the structure by adjustably engaging it radially at at least three distinct locations on the convex spherical outer surface, and a field producing component supported by the structure for cooperation with the cathode ray tube.

3. In an angularly and laterally adjustable mounting assembly for cathode ray tubes, a ring-shaped structure having a convex spherical outer surface, at least three tubular sections radially mounted at substantially equal distances from each other to point toward the center of the sphere, means for individually displacing each of the tubular sections along its own axis to engage said outer surface, and means for securing a field producing component to the ring-shaped structure.

4. In an angularly and laterally adjustable mounting assembly for cathode ray tubes, a ring-shaped structure for maintaining a field producing component in its operating relationship with the cathode ray tube and having a spherical convex outer surface, at least three supporting members for the structure, each supporting member having a matching surface for contacting the spherical surface of the structure in a concentric relation with respect to it, and means for individually adjusting the distance of each of the matching supporting member surfaces from the common center.

5. A cathode ray tube precision mounting, comprising a cathode ray tube having a neck, at least one coil encircling the neck, a ring-shaped support for the coil, the outer annular surface of the support being curved to form a convex spherical surface, and radially adjustable suspension means for individually engaging the ring-shaped coil support at three distinct locations of its convex spherical outer surface.

6. A mounting arrangement according to claim 5, in which the coil is a focus coil.

7. A mounting arrangement according to claim 5, in which the coil is a deflection coil.

8. A cathode ray tube precision mounting, comprising a cathode ray tube having a neck, at least one coil mounted around the neck, a ring-shaped support for the coil, the outer annular surface of the support being curved to form a convex spherical surface, radially adjustable suspension means for individually engaging the ring-shaped coil support at three distinct locations of the convex spherical outer surface, and means for displacing the suspension means in a direction parallel with the axis of the cathode ray tube.

9. A cathode ray tube precision mounting, comprising a cathode ray tube having a neck, at least one coil mounted

6

around the neck, a ring-shaped support for the coil, the outer annular surface of the ring being curved to form a convex spherical surface, and radially adjustable suspension means for individually engaging the ring-shaped coil support at three distinct locations of the convex spherical outer ring surface, the three locations being positioned in a plane substantially perpendicular with respect to the tube axis.

10. A device for adjustably mounting a coil substantially coaxially with the neck of a cathode ray tube for establishing a magnetic control field therein, which comprises a first, inner ring-shaped support having the coil secured to its inner surface, the outer annular surface of the ring being curved to form a convex spherical surface, a second, outer ring substantially coaxially surrounding the first ring, the smallest diameter of the second ring exceeding the greatest diameter of the first ring, and three externally threaded tubular sections, each tubular section engaging an internal thread associated with the outer ring, the annular front face of each of the tubular sections having a spherical shape matching that of the outer surface of the inner ring, the tubular sections being arranged substantially equidistantly from one another for radially and adjustably contacting the convex spherical surface of the inner ring to support it suspended within the outer ring.

11. A cathode ray tube mounting arrangement, comprising a cathode ray tube, at least one coil mounted substantially coaxially with respect to the neck of the tube, a first, inner ring-shaped support for the coil, the outer annular surface of the ring being curved to form a convex spherical surface, a second, outer ring substantially coaxially surrounding the first ring, the smallest diameter of the second ring exceeding the greatest diameter of the first ring, the second, outer ring having three apertures through it at substantially equidistant locations of its periphery, an internally threaded sleeve pivotally mounted adjacent each of the apertures and in alignment with it to extend radially from the outer surface of the second ring, and three externally threaded tubular sections, each tubular section engaging one of the threaded sleeves and extending through the adjacent aperture, whereby the annular front face of each tubular section engages one distinct area on the convex spherical surface of the first inner coil support ring to suspend the ring-coil assembly in a position which is adjustable with respect to both rotation about the sphere center and lateral displacement in any radial direction.

12. A cathode ray tube mounting arrangement, comprising a cathode ray tube, at least one coil mounted substantially coaxially with respect to the neck of the tube, a first, inner ring-shaped support for the coil, the outer annular surface of the ring being curved to form a convex spherical surface, a second, outer ring substantially coaxially surrounding the first ring, the smallest diameter of the second ring exceeding the greatest diameter of the first ring, the second, outer ring having three apertures through it at substantially equidistant locations of its periphery, an internally threaded sleeve pivotally mounted adjacent each of the apertures and in alignment with it to extend radially from the outer surface of the outer ring, three internally threaded tubular sections, each of them engaging one of the threaded sleeves and extending through the adjacent aperture, the annular front face of each of the tubular sections having a spherical shape matching that of the outer surface of the inner ring, the annular front face of each tubular section engaging one distinct area on the convex spherical surface of the first inner coil support ring to suspend the ring-coil assembly in a position which is adjustable with respect to both angular displacement about the center of the sphere defined by the curved surface and lateral displacement in any radial direction, and means for displacing the suspension assembly including the coil and

3,189,775

7

both rings in a direction parallel with the axis of the cathode ray tube.

References Cited by the Examiner

UNITED STATES PATENTS

1,780,383 11/30 Green ----- 248—181

8

2,533,073 12/50 Weimer.

FOREIGN PATENTS

312,746 6/19 Germany.

530,914 12/40 Great Britain.

5

GEORGE N. WESTBY, *Primary Examiner.*