

July 22, 1947.

I. L. STEPHAN
ADJUSTABLE MOUNTING

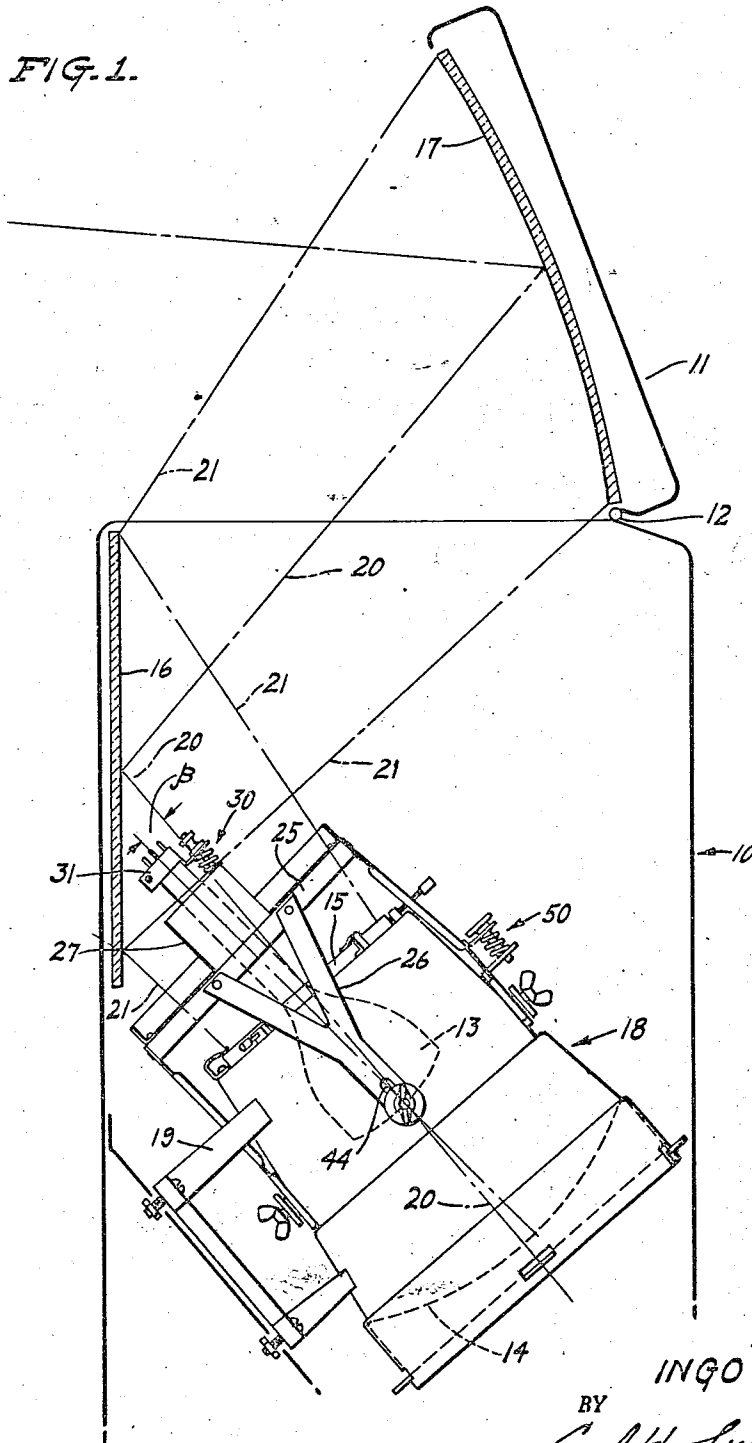
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Examiner

Filed May 31, 1946

4 Sheets-Sheet 1

FIG. 1.



INVENTOR.

INGO L. STEPHAN

BY

Carl H. Spennett

AGENT

Examiner

See Epstein
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2,455,476

Dec. 7, 1948 (178/7.5)

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2,467,185

April 12, 1949 (178/7.5)

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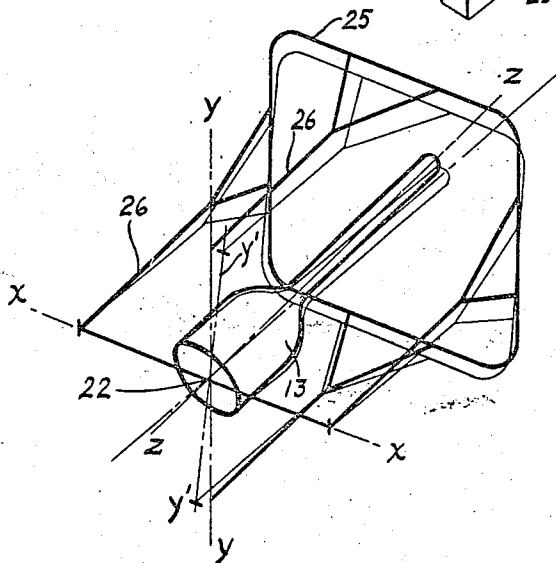
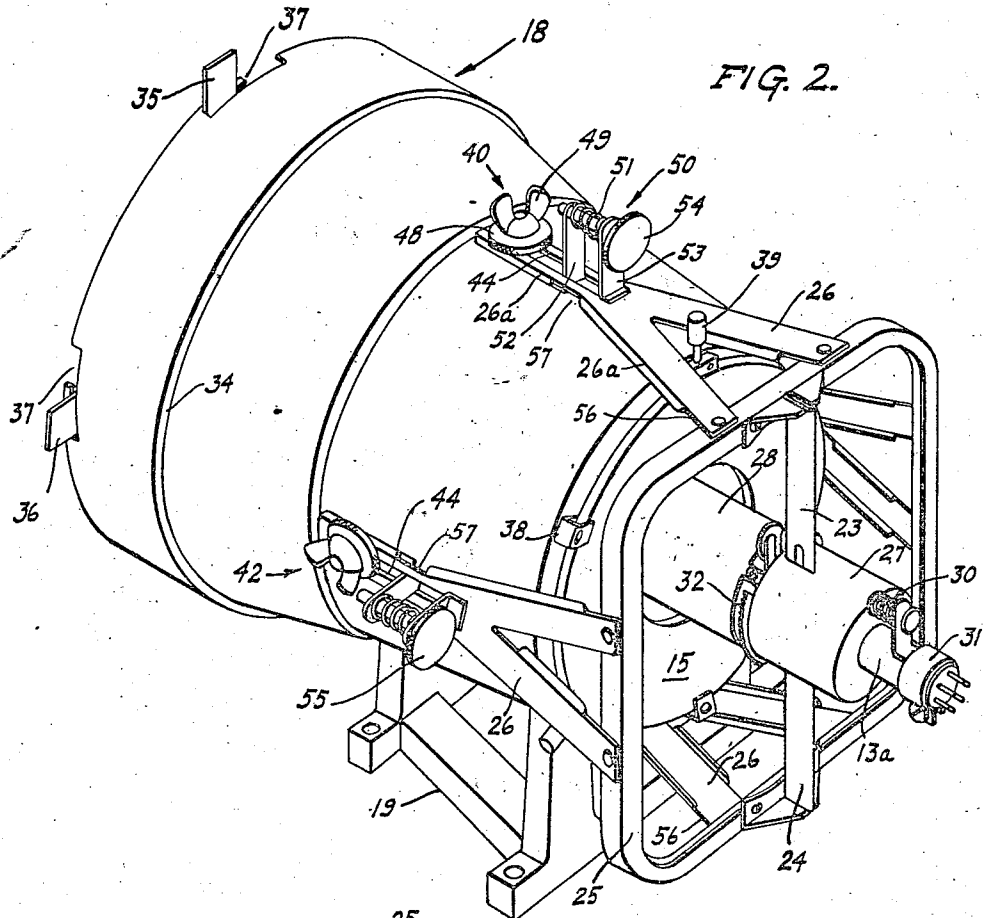
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I. L. STEPHAN
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4 Sheets-Sheet 2



INVENTOR.
INGO L. STEPHAN

BY

Carl H. Symmett
AGENT

July 22, 1947.

I. L. STEPHAN

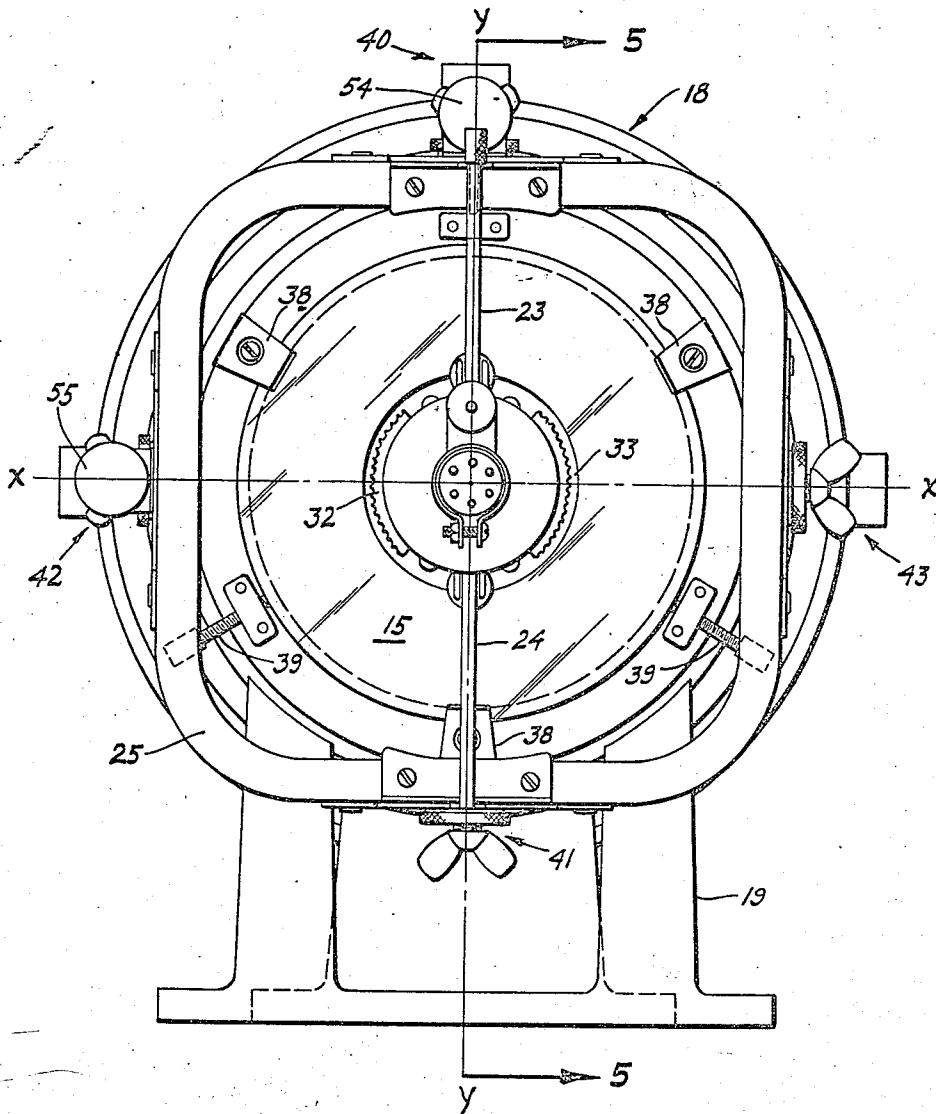
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ADJUSTABLE MOUNTING

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4 Sheets-Sheet 3

FIG. 4.



INVENTOR.

INGO L. STEPHAN

BY

Carl H. Symmes

AGENT

July 22, 1947.

I. L. STEPHAN

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ADJUSTABLE MOUNTING

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4 Sheets-Sheet 4

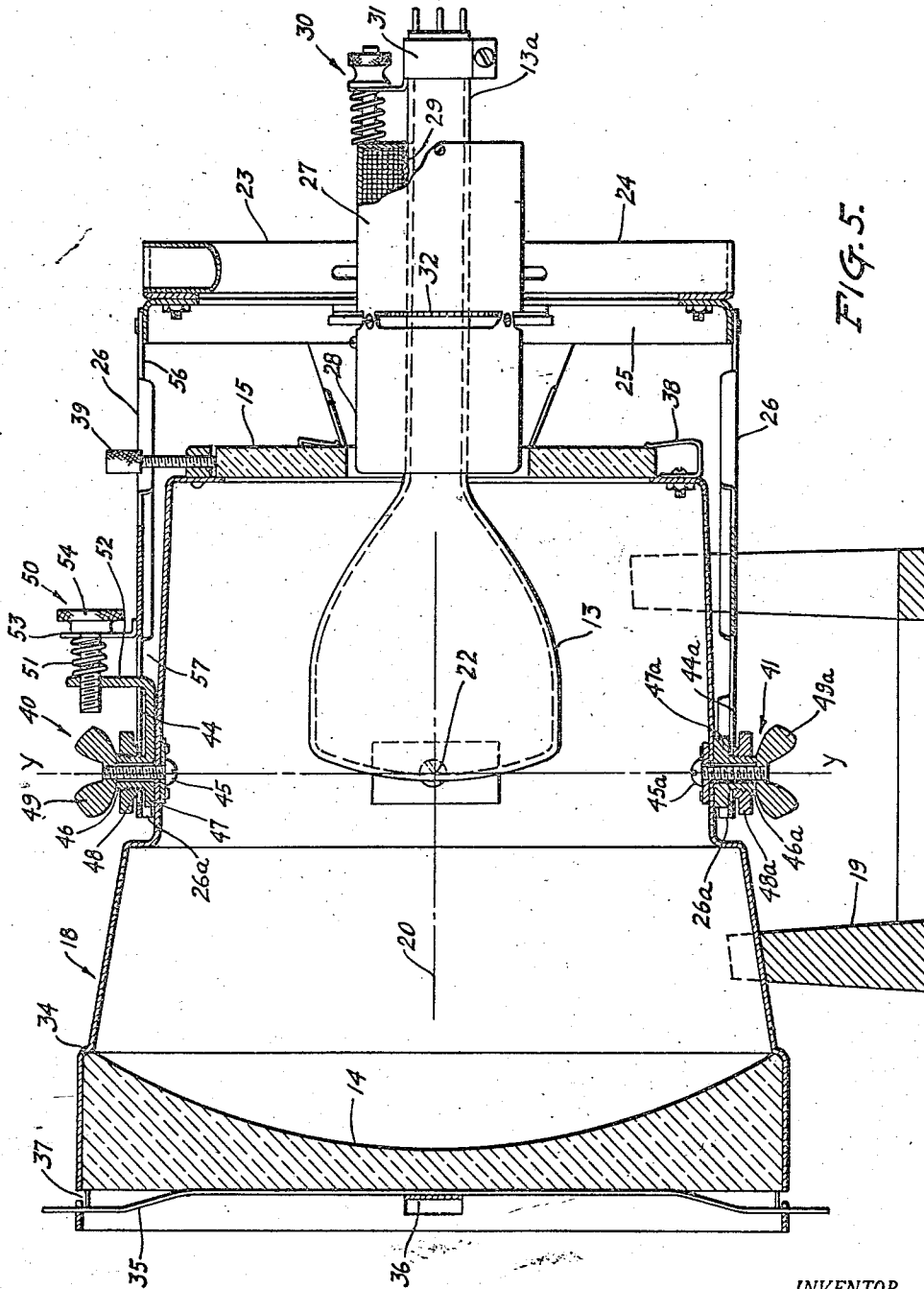


FIG. 5.

INVENTOR.
INGO L. STEPHAN
BY
Carl H. Symmes
AGENT

UNITED STATES PATENT OFFICE

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ADJUSTABLE MOUNTING

Ingo L. Stephan, Delanco, N. J., assignor to
Philco Corporation, Philadelphia, Pa., a cor-
poration of Pennsylvania

Application May 31, 1946, Serial No. 673,337

15 Claims. (Cl. 250—141)

1 The invention hereinafter described and claimed relates to projection type image-forming optical systems and is especially concerned with apparatus adapted to adjustably support cathode-ray tubes used in projection television receivers.

In such receivers, as well as certain other projection apparatus to which the concepts of the invention are applicable, it is necessary to effect precisely controlled relative movement between the cathode-ray tube (or other device upon which a primary image exists) and certain optical elements which define an optical axis. Such movement is required in the achievement of proper focus upon a viewing surface or screen.

It has been recognized that the more desirable way to accomplish such focusing is to move the cathode-ray tube, rather than moving one or more of the optical elements, but, heretofore, no apparatus has been available by means of which such focusing movements could be both readily and accurately effected. Universal-type tube mountings have been utilized heretofore, but these have been unstable during adjustment, and have been almost inaccessible.

While the present invention is of broader applicability, it is particularly useful in projection television receivers utilizing a "Schmidt"-type reflective optical system, that is, receivers which include a mirror and a correcting plate between which is arranged a cathode-ray tube, said mirror and plate defining an optical axis. A television receiver of this general type, to which the invention is particularly applicable, is disclosed and claimed in the copending application of Ernest H. Traub, Serial No. 649,359, filed February 21, 1946, and assigned to the assignee of the present invention. For purposes of illustration, the accompanying drawings and the following description are directed to exposition of the invention as embodied in such a television receiver.

It is a primary object of the present invention to provide a mounting for cathode-ray tubes—or other devices having a primary image screen—by the use of which mounting said tubes may be readily and precisely oriented with respect to an optical axis, whereby to accomplish necessary focus adjustments.

More particularly, the invention has as an object the provision of Schmidt-type projection apparatus, including a cathode-ray tube enclosed within a dust resistant housing, in which apparatus the tube screen may be given any three-dimensional angular adjustment, within defined limits, all adjustment movements taking place

2 about a predetermined point lying substantially in the plane of the tube screen, and in which all adjustments may be made from points exterior to the housing.

To the foregoing general ends, the invention provides apparatus for rotationally adjusting the tube, preferably about the geometrical center of the tube screen, whereby properly to orient said screen with respect to an optical axis, said apparatus comprising: a movable frame member carrying said tube and mounted for rotation about a pair of rotational axes passing through said point in substantially right-angularly related directions, means normally restraining said frame against rotation about said axes and being releasable to provide for rotation of the frame—and consequent adjustment of said tube—about either axis selectively, and means effective to produce rotation about the axis selected. A third axis, the longitudinal axis of the tube, is generally perpendicular to both the tube screen and the pair of axes aforesaid, and also passes through the geometrical center of the tube screen or other predetermined point selected. Axial movement of the tube may be effected along this latter axis. By individually adjusting the frame member about the above-described axes—and thereby pivoting, or rotating the tube about the center of its screen—it is possible to achieve resultant components of adjustment movement of the tube screen in all planes, that is, universal or three-dimensional adjustment of the tube screen is provided.

It is a special feature of this invention that the axes are individually defined and the above-mentioned restraining means prevents loss of adjustment about one axis, while adjustment is being made about the other.

It is also an object of the present invention to provide apparatus in accordance with the foregoing, in which the focus adjustments may be readily and accurately made in the field, the simplicity of the adjustment operations being such as to obviate the necessity for highly skilled handling.

The invention further contemplates certain novel constructional features and arrangements hereinafter described and illustrated in the attached drawings, in which:

Figure 1 is a somewhat diagrammatic vertical sectional view illustrating a television receiver constructed in accordance with the copending application above-identified and embodying the apparatus of the present invention;

Figure 2 is a view in perspective, on a larger

scale, illustrating the adjustable tube support of the invention, together with certain associated structure;

Figure 3 is a diagrammatic view illustrating the manner in which the tube is adjusted about the several axes referred to above;

Figure 4 is a rear elevational view of the apparatus illustrated in Figure 2; and

Figure 5 is a sectional view taken along the line 5—5 of Figure 4.

Referring first to Figure 1, there is shown a picture projection system for television receivers constructed in accordance with the above-identified copending application, the parts of which receiver are housed within a cabinet shown in general outline at 10, and having a lid 11 hinged to the cabinet along the rear wall thereof, as indicated at 12. The projection system includes a cathode-ray picture tube 13 having a fluorescent screen or target area in the forward face thereof, a spherical mirror 14, an aspherically configured correction plate 15, a plane reflector 16 supported upon the upper inside surface of the front portion of the cabinet, and a viewing screen 17. The tube, correction plate and mirror, are arranged as a unitary assembly (see particularly Figure 2) enclosed in a dust-resistant housing indicated, generally, at 18. The housing 18 is carried by a mounting standard 19, it being understood that any convenient structure may be employed to support the assembly within the cabinet.

In the use of such apparatus a small primary image is formed on the tube screen, which image is projected by the optical system and resolved as a magnified image on the viewing screen 17, carried by lid 11. The correction element or plate 15 compensates for the spherical aberration introduced by mirror 14, said correction plate being positioned substantially at the center of curvature of the mirror. The mirror and plate define an optical axis, indicated at 20, while a pair of representative limiting rays projected from this apparatus are shown at 21—21.

Since the Schmidt system is well known in optics, and since the invention is concerned with such system only insofar as it cooperates with the apparatus of the present invention, further detailed description of the system is not necessary herein. However, if further description of the projection television apparatus is desired, reference may be had to the above-identified disclosure of Ernest H. Traub, which includes dimensions of a representative embodiment which has proved highly satisfactory.

In such a television receiver, the cathode-ray tube screen must be properly oriented with respect to the optical axis 20 defined by mirror 14 and correction plate 15, in order that all portions of the projected image may focus properly upon the viewing screen 17. Also, in the particular embodiment illustrated, the viewing screen is angled with respect to the optical axis of the Schmidt system illustrated, which would normally introduce a further out-of-focus effect.

In particular accordance with the present invention, both the general focus requirements, and correction for the out-of-focus effect introduced by the angularity of the screen, are taken care of by a novel mounting providing for ready and accurate three-dimensional adjustment of the tube screen with respect to the optical axis 20. In the particular embodiment under consideration, the latter correction requires rotation of the tube about the center of the tube screen

(as a center of rotation) in an amount equal to an angular displacement of $4^{\circ}51'$ with respect to the optical axis 20. Such angular displacement is indicated at β in Figure 1 and takes place in a plane perpendicular to the general plane of the viewing screen 17.

To provide for the general focus requirements aforesaid, and to make the correction necessitated by the angularity of the viewing screen with respect to the optical axis 20, the tube 13 is mounted for rotational movement about a pair of axes passing, in substantially right-angularly related directions, through a predetermined point which preferably coincides with the geometrical center of the fluorescent screen of the tube. This point clearly appears in Figure 5, and bears the reference character 22; while the aforesaid pair of axes is represented at X—X and Y—Y in Figure 3. A Z-axis, coinciding with the longitudinal axis of the tube, also appears in Figure 3 and as will be brought out hereinafter means is provided to effect movement of the tube along this latter axis whereby to insure that pivotal movements of the tube about either the X or Y-axis will take place about a point lying in the tube screen.

Now making reference to Figures 2, 4 and 5, it will be observed that the neck portion 13a of the tube extends out of the housing 18 through the central aperture in correction plate 15.

Insofar as the present invention is concerned, mirror 14 and correction plate 15 may be mounted in any manner suitable to coaxially align the same. As shown, (see Figures 2 and 4), the housing 18 is provided with an annular seat 34 against which the mirror rests, said mirror being maintained in proper position by a pair of crossed resilient members 35 and 36, the ends of which are received within bayonet slots 37. A plurality of spring clips 38 are secured to a flange extending inwardly around the smaller end of the housing 18, which clips serve to support the correction plate 15. The plate may be coaxially aligned with the mirror, by means of adjustable screw members shown at 39. As will be understood, the distance from the center of the mirror 14 to the center of the fluorescent screen of tube 13, (which is one of the conjugate distances of the optical system, the other being measured from the center of said mirror back to the center of the viewing screen 17), may be adjusted by effecting slight axial movement of the tube, under the influence of a spring assembly presently to be described.

The tube 13 is supported by upwardly and downwardly extending bracket members 23 and 24, respectively, which members are hollow, to accommodate the conductors extending to the focusing and deflecting coils. The bracket members are, in turn, carried by a rectangular frame 25 pivotally secured to housing 18 through the intermediation of four arms 26 extending forwardly to the plane containing the fluorescent screen. The usual focusing and deflecting coils, shown at 27 and 28, respectively, surround the neck of the tube, and support of the tube within the housing may most conveniently be provided (as shown) by securing brackets 23 and 24 to one of the coil housings, in this instance housing 27. As best appears in Figure 5, the coil housing 27 includes an inner cylindrical wall 29 of such diameter as to firmly support the tube 13 with freedom for axial movements (that is, movements along the Z-axis) under the influence of a spring and nut assembly

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30, reacting between said coil housing and a collar 31 fixedly secured to the outermost portion of the tube. In accordance with known practice, movable quadrants 32 and 33 project outwardly beyond the coil housings and are adapted to effect centering of the raster upon the fluorescent screen.

As brought out supra, the arms 26 are each releasably secured to the housing 18, to accommodate rocking movements of the frame 25 about the X and Y axes, selectively. This construction will be most clearly understood by reference to Figures 2 and 5 of the drawings, it being borne in mind that pivotation of one pair of arms about one of the axes, requires sliding movement of the oppositely disposed pair of arms with respect to the points defining the other axis. Each of the arms is provided with a pivot assembly adapted to secure it to the housing structure in the general plane of the fluorescent screen of the tube 13. Upper and lower assemblies 40 and 41, respectively, provide such pivotal securement for the vertically spaced pair of arms 26 and define the rotational axis Y—Y (Figure 3). Similarly, the laterally spaced pair of arms is secured to the housing by means of pivot assemblies 42 and 43. Since pivot assembly 40 is of the same construction as assembly 42, and since pivot assembly 41 is a counterpart of assembly 43, detailed description will be confined to the vertically arranged pair which defines the Y-axis, i. e., assemblies 40 and 41.

As is shown in Figure 2, each of the arms 26 is provided with a slotted portion 44 through which passes a securing stud and an externally threaded sleeve. In the upper pivot assembly 40 (Figure 5) the stud is represented at 45 and the sleeve at 46. The assemblies 40 and 41 differ in only one respect (assembly 40 including an adjusting device not present in assembly 41) and, accordingly, the reference characters applied to the upper assembly 40 are also applied to the pivot structure 41, with the addition, in each instance, of the subscript *a*, and a single description will suffice.

Sleeve 46 has a block portion formed integrally therewith and bearing against the outside surface of the housing 18. This block, which is rectangular in form, is shown at 47 and underlies the outer free end of the associated arm 26; the arms are of channel form to increase the rigidity thereof, one side wall of the channel being shown at 26*a* in both Figure 2 and Figure 5. These side channels are spaced a distance just sufficient to span the width of block 47, whereby to accommodate guided sliding movement of the arm 25 with respect to the rectangular block. Above the plane of the arms 26 each of the assemblies 40 and 41 is provided with a knurled nut (see 48 and 48*a*) by means of which the slotted end of arm 26 may be drawn up tightly against the upper surface of block 47. A wing nut 49 is in threaded engagement with the upper end of stud 45 and, as will be apparent from reference to the assembly 40 (Figure 5), tightening of the wing nut serves to bring the under surface of block 47 into tight engagement with the adjacent upper surface of the housing 18.

The purpose of each of the four pivot assemblies 40, 41, 42 and 43 is to provide for two different types of movement of the arms 26 and, therefore, rotation of the tube-carrying frame 25, about either of the two axes. Under one condition, the arms may be rotated about one axis while, under the other condition, each of the arms may be

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slid with respect to its associated pivot assembly, for a distance no greater than the length of the slot 44. For example, if the frame 25 is rocked downwardly about the X-axis, (as viewed in Figures 2 and 5), the lower frame support arm must slide forwardly along the block 47*a* of pivot assembly 41. Similarly, during such movement of the frame, the upper arm must slide rearwardly along the block 47 of assembly 40. As set forth hereinafter, such a rocking movement of the frame and tube is illustrated in Figure 3.

To effect accurate, controlled rotation of the frame 25, there is provided, in association with the upper assembly 40 and with the lateral assembly 42, vernier adjusting devices the upper of which is designated at 50. A spring 51 is arranged between an upwardly extending flange 52 (projecting through the slot 44 and secured to block 47) and a similar flange 53 carried by the arm 26 and positioned in confronting relation with respect to the flange 52. A screw 54 passes through spring 51 and is in threaded engagement with flange 52. As will be understood from Figures 2 and 5, rotation of the screw 54 results in sliding movement of the upper and lower arms with respect to the sleeves 46 and 46*a*, and causes the frame to rotate about the X-axis. The lateral vernier adjusting device is exactly similar to the device 50, just described, and when manipulated causes the frame and tube to rotate about the Y-axis.

Operation of the apparatus may be clearly understood from what follows, reference being made particularly to Figures 2, 3 and 5.

First, the tube screen is brought up to the plane of crossed axes X—X and Y—Y, by suitable manipulation of the axial adjusting device 30, which adjustment effects movement of the tube along the Z-axis shown in Figure 3. This position of the tube screen coincides closely with proper focus of the center of the image appearing on viewing screen 17 and the image on said screen 17 is observed during the making of the adjustment. When this position has been reached, all rotative movements of the tube take place about the geometrical center of the tube screen.

When the tube has thus been properly located, axially, the general focus requirements must be met, that is, the upper and lower edges and the right and left edges of the image must be brought into sharp focus upon the viewing screen 17. Considering first the adjustment of the tube necessary to bring the right and left edge portions into focus, the operator prepares to rotate the frame 25—and therefore the tube 13—about the Y-axis; by tightening the knurled nuts 48 and 48*a*. Such tightening movement prevents sliding of the arms 26 with respect to the pivot assemblies 40 and 41, and a slight loosening of the wing nuts 49 and 49*a* permits the blocks 47 and 47*a* to rotate with respect to the adjacent surface of housing 18. Along with these preliminary adjustments of the assemblies 40 and 41, the knurled nuts associated with assemblies 42 and 43 are loosened, thereby making it possible for the laterally spaced pair of arms to slide with respect to their associated pivot assemblies 42 and 43. The screw 55, associated with lateral pivot assembly 42, is then rotated and the frame member 25 is swung about the Y-axis until the right and left hand portions of the image appear in proper focus upon the viewing screen 17.

To accomplish proper focusing of the upper and lower edges of the image, on the other hand,

frame 25 is rotated about the X-axis, defined by pivot assemblies 42 and 43, during which movement the upper and lower pair of arms are slid with respect to their cooperating pivot assemblies 40 and 41. During such rotation about the X-axis the knurled adjusting nut 54 is utilized. As will be evident without further description, during this second focusing movement the knurled and wing nuts are so adjusted as to permit sliding movement of the upper and lower frame-support arms, and purely rotative movement of the laterally spaced arms.

After the above operations have been completed, the tube may be retrimmed, axially, (moved along the Z-axis), if such appears necessary to achieve the best possible focus of the center portion of the image.

The diagrammatic showings of Figure 3 serve to further clarify the manner in which the above adjustments are effected, it being understood that pivotation of the frame 25 is shown as having occurred about the X-axis. In this instance, the knurled nuts associated with assemblies 42 and 43 (said assemblies being omitted from the figure in the interest of clarity) have been tightened to prevent translational movement of the arms 26 with relation to said pivot assemblies, and the wing nuts have been loosened to permit rotation about the X-axis. Also, the knurled nuts associated with vertical assemblies have been loosened, and the frame 25 rotated downwardly thereby displacing the Y-axis to the position shown at Y'—Y'. Such movement of the frame will be seen to have carried the tube 13 from the position shown in heavy lines to the position represented by the light outline designation. It will be appreciated that this process may be repeated in a plane 90° removed from that of the movement just described, under which conditions rotation of the frame takes place about the Y-axis.

Correction for the aforementioned out-of-focus effect (see angle β) created by the angularity of the viewing screen 17 with respect to the optical axis 20 is, of course, taken care of during the above-described pivotation about the X-axis, since the screen angularity is such as to cause this out-of-focus effect to appear in the upper and lower edge portions of the projected image.

It will be recognized that rotational movement of one pair of frame-supporting arms results in bodily movement, of the arms of the opposite pair, out of the planes which they formerly occupied, and since the opposite end portions of each arm are fixed (either by attachment to the frame 25 or by the pressure of the knurled nut 48) some bending occurs in the arms so displaced. This bending could take place uniformly along the arm, but in accordance with a feature of this invention, freedom for such bending is provided without loss of the rigidity necessary in the frame assembly.

As best appears in Figures 2 and 5, the arm channel-flanges 26a are each cut-away, as shown at 56 and 57, and slight bending occurs at these points in each arm when it is moved translationally with respect to its associated pivot assembly.

From the foregoing description it is evident that the present invention provides adjustable mounting structure by means of which a cathode-ray tube, or other device having a primary image surface, may be given precise, three-dimensional orientation with respect to an optical axis. Further, the apparatus is of such a character that all of the focusing adjustments may be made without the necessity of gaining access to the housing

18 and, since the rotational axes are individually defined, the apparatus is extremely stable during such focus adjustments.

I claim:

1. For television apparatus and the like including a primary image screen, mechanism for angularly adjusting said screen about a predetermined point as a center of pivotation whereby properly to orient said screen with respect to an optical axis, said point lying substantially in said screen, said mechanism comprising, means providing a pair of individual rotational axes passing through said point in substantially right-angularly related directions and about which said screen may be adjusted selectively.
2. For television apparatus and the like including a cathode-ray tube having a face portion provided with an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising, means providing a pair of individual rotational axes passing through said point in substantially right-angularly related directions in general parallelism with the tube face and about which said tube may be adjusted selectively.
3. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a movable frame member carrying said tube and being mounted for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, and means for effecting rotation of said frame—and consequent adjustment of said tube—about said axes selectively.
4. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a movable frame member carrying said tube and being mounted for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, and means normally restraining said frame against rotation about either axis and being adjustably releasable to provide for rotation of the frame—and consequent adjustment of said tube—about either axis selectively.
5. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a movable frame member carrying said tube and being mounted for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, means normally restraining said frame against rotation about either axis and being adjustably releasable to provide for rotation of the frame—and consequent adjustment of said tube—about either axis selectively, and

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means effective to produce rotation about the axis selected.

6. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: fixed structure, a movable frame member carrying said tube and being mounted for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, and means reacting between said frame and said structure and adjustable to effect rotation about either of said axes.

7. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: fixed structure, a movable frame member carrying said tube and being mounted for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, means normally restraining said frame against rotation about either axis and being adjustably releasable to provide for rotation of the frame—and consequent adjustment of said tube—about either axis selectively, and means reacting between said frame and said structure and adjustable to effect rotation about the axis selected.

8. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a housing substantially enclosing said tube, a frame movably supporting the tube within said housing, said frame being pivotally mounted upon said housing with freedom for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, and means reacting between said frame and said housing and adjustable to effect rotation of said frame—and consequent adjustment of said tube—about either axis selectively.

9. For television apparatus and the like including a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a housing substantially enclosing said tube, a frame movably supporting the tube within said housing, said frame being pivotally mounted upon and exteriorly of said housing with freedom for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, and control means disposed exteriorly of said housing and positioned to react between said frame and housing, said control means being adjustable to effect rotation of said frame—and consequent adjustment of said tube—about either axis selectively.

10. For television apparatus and the like in-

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cluding a cathode-ray tube having an image screen, mechanism for angularly adjusting said tube about a predetermined point as a center of rotation whereby properly to orient said screen with respect to an optical axis, said point lying approximately in said screen, said mechanism comprising: a housing substantially enclosing said tube, a frame movably supporting the tube within said housing, said frame being pivotally mounted upon and exteriorly of said housing with freedom for rotation about a pair of individual rotational axes passing through said point in substantially right-angularly related directions, means normally restraining said frame against rotation about either axis, said restraining means being in a position readily accessible from the exterior of the housing and being adjustably releasable to permit rotation of the frame about either axis selectively, and control means readily accessible from the exterior of the housing and positioned to react between said frame and housing, said control means being adjustable to effect rotation of the frame—and consequent adjustment of said tube—about either axis selectively.

11. In combination with a cathode-ray tube having an image screen, a housing, apparatus supporting said tube within said housing with freedom for angular movements about a pair of rotational axes passing through the mid-point of the screen in substantially right-angularly related directions and in the general plane of the screen, and adjustable means disposed exteriorly of said housing and cooperative with said apparatus to effect angular movement of said tube about either axis.

12. In combination with a cathode-ray tube having an image screen, a housing, apparatus supporting said tube within said housing with freedom for angular movements about a pair of rotational axes passing through the mid-point of the screen in substantially right-angularly related directions and in the general plane of the screen, and means normally restraining said tube against rotation about either axis, said means being disposed exteriorly of the housing and being adjustably releasable to provide for angular movement of the tube about either axis selectively.

13. In combination with a cathode-ray tube having an image screen, a housing, apparatus supporting said tube within said housing with freedom for angular movements about a pair of rotational axes passing through the mid-point of the screen in substantially right-angularly related directions and in the general plane of the screen, means normally restraining said tube against rotation about either axis, said means being disposed exteriorly of the housing and being adjustably releasable to provide for angular movement of the tube about either axis selectively, and tube adjustment means disposed exteriorly of said housing and effective to produce angular movement about the axis selected.

14. In combination with a cathode-ray tube having an image screen, a housing, a frame supporting said tube with the major portion of the latter disposed within and enclosed by the housing, and means for angularly adjusting said tube about a predetermined point lying substantially in the screen, said means including: apparatus pivotally supporting said frame upon said housing with freedom for rotational movements about said point, and control means disposed exteriorly of said housing and adapted to effect rotation of

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said frame—and consequent angular adjustment of said tube—about said point.

15. In combination with a cathode-ray tube having an image screen, a housing, a frame supporting said tube with the major portion of the latter disposed within and enclosed by the housing, and means for angularly adjusting said tube about a predetermined point lying substantially in the screen, said means including: a pair of pivot structures each defining an axis, said axes passing through said predetermined point in substantially right-angularly related directions,

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means for coupling said frame to said pivot structures individually whereby to provide for angular adjustment of said tube about either axis selectively, and a connection providing for translational movement of a portion of said frame in the region of and with respect to the pivot structure not so coupled, said frame having flexibility permitting such translational movement during angular movement about either of said pivot assemblies.

INGO L. STEPHAN.