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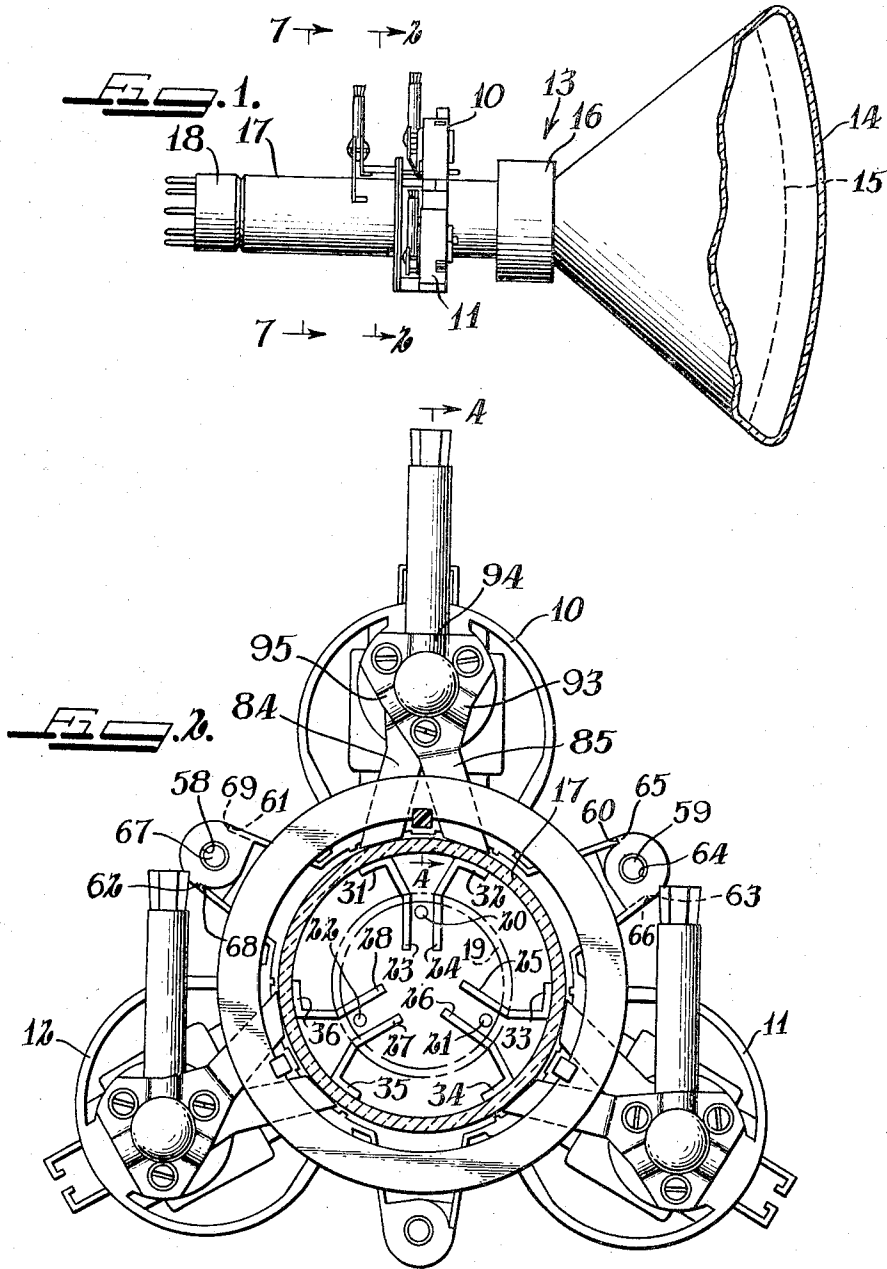
L. V. BABCOCK ET AL

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CONVERGENCE YOKE ASSEMBLY WITH BLUE PURITY MAGNET AND
CONVERGE MAGNETS ADJUSTABLE FROM ONE DIRECTION

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3 Sheets-Sheet 1



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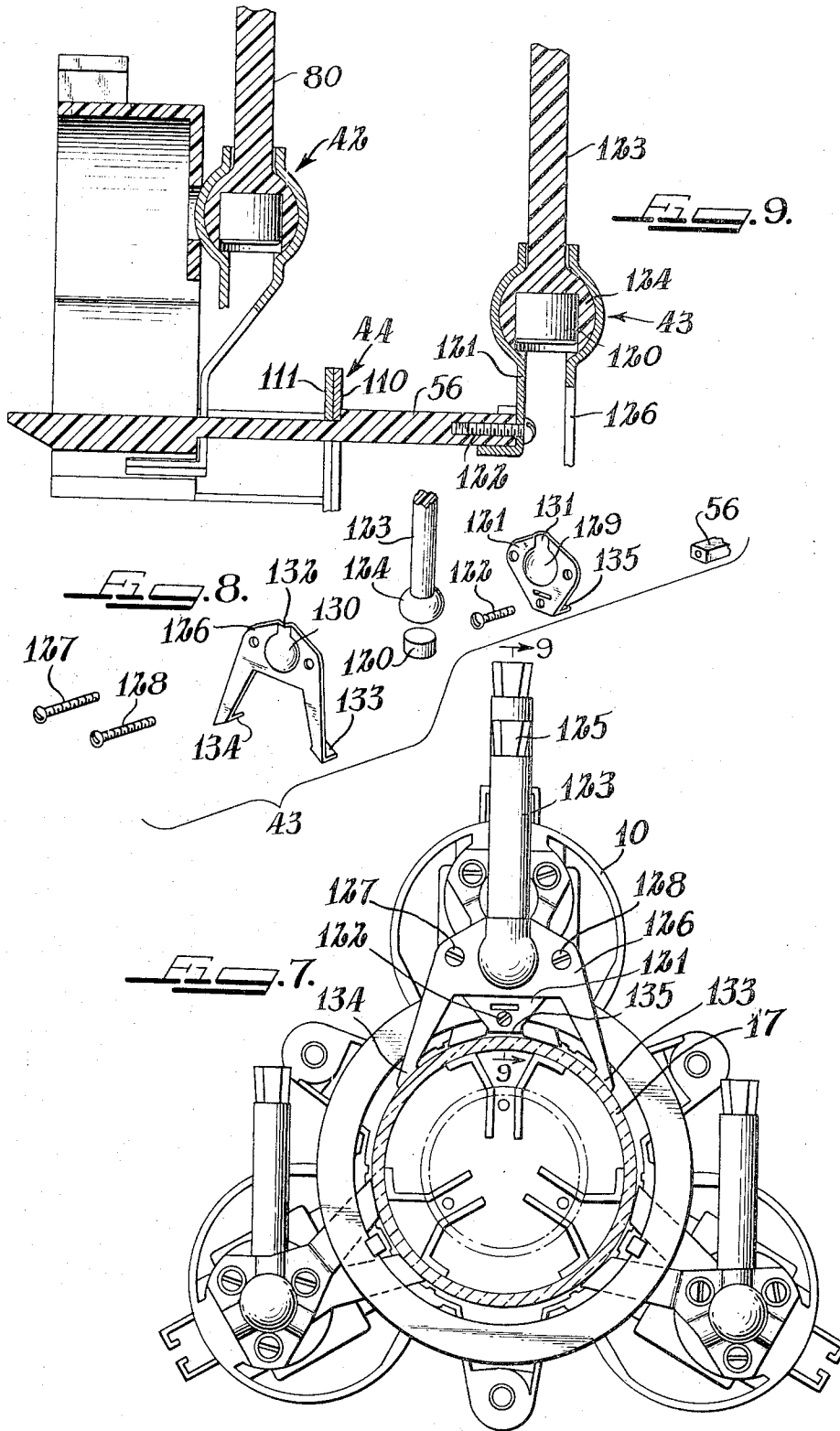
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The present invention refers to a convergence assembly for color television picture tubes, and more particularly to a convergence assembly which has a blue lateral magnet and a purifying magnet combined into a single yoke assembly.

A tricolor cathode ray tube such as may be used as a picture tube in a color television receiver has three electron guns mounted as a unit inside the neck of the picture tube. Each of the three guns is tilted toward a central axis of the tube so that the three beams from the guns will converge at a shadow mask. Each of the electron guns is flanked by a pair of internal magnetic pole pieces. These direct magnetic convergence fields to the area directly in front of the guns and minimize interaction between the guns. In addition, a separate internal pole piece, known as the blue lateral pole piece, is supplied for the blue gun. In all there are four internal magnetic pole pieces in the electron gun assembly, one each for the red and green guns, and two for the blue gun.

On the external surface of the neck of a color television picture tube is normally mounted a convergence assembly which consists of a yoke which holds three combination permanent and electromagnets. The permanent magnets are adjusted for a condition of static convergence; and the currents through electromagnets are adjusted for dynamic convergence. Each electromagnet has a U-shaped core with legs positioned directly over the internal pole pieces of one of the electron guns. When the convergence magnets are correctly positioned over the pole pieces, the field of each may be adjusted for proper convergence of its associated beam without seriously affecting the other two beams.

A blue lateral adjusting magnet is normally secured to the external surface of the neck of the picture tube over the blue lateral magnetic pole piece. This magnet is used in conjunction with the permanent magnets of the convergence assembly for adjusting static convergence.

The present color picture tubes also have a purity magnet mounted externally on the neck. This is a permanent magnet which produces a field that affects all three electron beams equally and is adjusted for a strength and a direction which will cause the emitted beams to pass through their "centers of deflection." The purity magnet comprises a pair of magnetized rings surrounding the neck which can be rotated relative to each other to adjust the field strength of the magnet. The direction of such magnetic field is adjusted by rotating the entire assembly around the neck of the tube.

Thus, to mount a convergence assembly, a blue lateral magnet and a purifying magnet on the neck of a colored television picture tube, it has been necessary to have three completely different mounting assemblies. By use of the present invention, the number of separate assemblies required can be reduced to two or even one, with a resulting saving in manufacturing and servicing costs. One form of yoke presently used for convergence assemblies consists of three sectors which form a unitary ring. Such unitary rings have resilient spring means to force the respective sectors against the surface of the tubes, so that the cores of the magnets will be held close to the surface of the neck of the tube. Since these yokes must be enlarged against the resistance of the resilient springs to a

point that they can be slid over the end of a picture tube and onto the neck, an assembly operation is required which normally is manually performed with the assistance of special tools to expand the yokes while they are being placed onto the neck of the tubes. Other forms of yoke have one or more pieces held together by springs, clips, bolts, or the like. The present invention makes it possible to mount a convergence yoke on the neck of a tube without the use of special tools and without the necessity of first expanding the yoke and then passing it over the end of the tube. It makes it possible to merely place a yoke consisting of three separate sectors around a tube neck and slip a pintle into a bore to complete the mounting operation. No auxiliary hardware is used. Thus, the cost of special tools, components and labor for the mounting of convergence yokes on the neck of tubes is substantially reduced.

Therefore, it is an object of the present invention to provide a new and improved convergence assembly for color television picture tubes.

Another object is to provide a yoke in a convergence assembly which can be placed on the neck of a color television tube by passing sectors around the neck and connecting them rather than by expanding the yoke to pass it over the end of the neck.

A further object is to provide a single yoke which will resiliently grip the neck of a color television picture tube and provide a single collar structure for mounting any or all of the magnets which are mounted on the surface of the neck of a picture tube to adjust the convergence of multiple electron beams.

A principal object of the present invention is to provide a convergence assembly wherein the positioning control shaft of the respective permanent magnets are selectively positioned for greater accessibility during adjustment of the permanent magnets in each combination permanent and electromagnet.

Still another object is to provide three mounting brackets, each having cooperating connecting means integrally formed therein for connecting to the other two brackets, to form a collar structure that is adapted to engagingly surround a neck of a cathode ray tube.

A still further object is to provide three mounting brackets, as aforementioned in the previous objects, which do not require separate spring or resilient means in addition to the brackets themselves to provide the spring action required to urge the respective brackets into engagement around the neck of a cathode ray tube.

Further objects and advantages will become apparent from the following detailed description taken in connection with accompanying drawings, in which:

FIGURE 1 is a side elevational view of an embodiment of the present invention mounted on a multiple electron gun cathode ray tube;

FIGURE 2 is a sectional elevational view of the embodiment of the invention mounted on a cathode ray tube taken along the line 2-2 in FIGURE 1;

FIGURE 3 is an exploded view of a portion of the embodiment of the invention illustrated in FIGURES 1 and 2;

FIGURE 4 is a sectional view of a portion of the embodiment of the invention illustrated in FIGURE 2 taken along the line 4-4 in FIGURE 2;

FIGURE 5 is a sectional elevational view of the portion of the embodiment of the invention illustrated in FIGURES 1 to 4, taken along the line 5-5 in FIGURE 4;

FIGURE 6 is a bottom view of the portion of the embodiment of the invention illustrated in FIGURE 5;

FIGURE 7 is a vertical sectional view of the embodiment of the invention mounted on a cathode ray tube taken along the line 7-7 in FIGURE 1;

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FIGURE 8 is an exploded view of a portion of the embodiment of the invention illustrated in FIGURES 1 and 7; and

FIGURE 9 is a sectional view of a portion of the embodiment of the invention illustrated in FIGURE 7 taken along the line 9-9 in FIGURE 7.

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail an embodiment of the invention with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention, and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

As will presently be described in greater detail, the present invention has reduced the number of parts required for a convergence assembly, a lateral blue magnet assembly and a purifying magnet assembly, by not only making it possible to mount all of the magnets associated with these three assemblies on a single collar structure, but by also reducing the number of parts required in a convergence assembly alone. Thus, the present invention has made it possible to substantially reduce the cost of these three assemblies by providing a single structure which includes them all and contains a greatly reduced number of component parts. The present invention reduces the cost of mounting the single assembly upon the neck of a picture tube by eliminating the need for special tools to expand a collar structure so that it can pass over the end of a television picture tube and by reducing the time required to place a collar structure around the picture tube. The present invention makes it possible to assemble a collar structure around the neck of the tube by taking a set of three brackets which have quick acting connecting devices to attach one to another, connecting the three together, placing them around the tube, and snapping the final connection together.

In addition to the aforementioned advantages, the present invention provides means for selecting the direction in which the adjustment shaft for the convergence assembly permanent magnets is positioned. Thus, these shafts can always be positioned in a direction for easy accessibility of adjustment regardless of the particular picture tube upon which the collar structure is mounted and regardless of the method by which the picture tube is mounted in relation to a chassis and other adjacent structure. Therefore, the present invention provides for an improved design of convergence, blue lateral magnet and purifying magnet assemblies, an improvement in their ability to be mounted on the neck of a picture tube, and the accessibility for servicing.

Referring now to FIGURES 1 and 2, three mounting brackets, 10, 11 and 12, are joined to form a collar structure which resiliently engages the neck of a multi-gun cathode ray tube generally indicated at 13. The cathode ray tube 13 shown in the figures is designed as a television receiver picture tube having a conventional red, green and blue phosphor dot face plate 14, a shadow mask 15, a deflection coil yoke 16, a tube neck 17 and a base 18.

Referring now more particularly to FIGURE 2, a multi-electron beam gun structure indicated at 19 produces three electron beams 20, 21 and 22. A pair of pole pieces 23 and 24 are positioned on opposite sides of the beam 20; a pair of pole pieces 25 and 26 are positioned on opposite sides of beam 21; and a pair of pole pieces 27 and 28 are positioned on opposite sides of beam 22. Each pair of pole pieces has parallel portions between which the respective electron beams pass. Each pole piece has a portion extending away from the parallel portion and along the wall of the tube neck 17. These neck adjoining portions are designated 31, 32, 33, 34, 35 and 36, respectively.

Since the three brackets 10, 11 and 12 are almost identical in construction, only bracket 10 will be described

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in detail and the variances of the other brackets 11 and 12 from bracket 10 will be indicated. Referring to FIGURES 3 to 6, the individual components of the bracket 10 are more clearly illustrated in detail than in FIGURES 1 and 2. The mounting bracket 10 consists of a plastic bracket assembly 40, an electromagnet assembly 41, a permanent magnet assembly 42, a blue lateral magnet assembly 43 and a purifying magnet assembly 44.

The bracket assembly 40 consists of a unitary molded plastic form which has an arc-shaped base portion 50, a looped portion 51 above the base portion 50, base extension portions 52 and 53 extending from the base portion 50, a pair of hooks 54 and 55, an arm portion 56 and a disc portion 57 attached to the looped portion 51 and extending downwardly therefrom. The base extensions 52 and 53 are sufficiently thin that they are resilient and can be bent when force is employed. As will be presently described in detail, the resiliency of the base extensions 52 and 53 provide the resilient force which urges the arc-shaped base portion 50 against the neck of a cathode ray tube 17. An aperture 58 is provided on the base extension 52 and a pintle 59 is provided on the base extension 53. The aperture 58 is tapered and the pintle 59 is tapered at its end so that the pintle of an adjoining bracket will slide into the aperture 58 easily and an aperture in an opposite adjoining bracket will easily slide onto the pintle 59. An abutment 60 is provided on the base extension 53 and an abutment 61 is established on the base extension 52. An additional pair of abutments 62 and 63 are provided on the base extensions 52 and 53.

Referring to FIGURE 2, when a pintle such as 59 is slid into an aperture such as 64 of the bracket 11, the abutment 60 engages an abutment 65 of the bracket 11 which corresponds to the abutment 62 on the bracket 10. At the same time the abutment 63 engages an abutment 66 on the bracket 11. Similarly, a pintle 57 of the bracket 12 fits into the aperture 58 of the bracket 10. The abutment 62 is then engaged by an abutment 68 of the bracket assembly 12 and the abutment 61 engages an abutment 69 of the bracket assembly 12. In like manner the other base extensions of the brackets 11 and 12 are connected.

The various aforementioned abutments are so positioned that the respective base extensions are under tension to cause the base portions such as 50 of the brackets 40 to positively engage the surface of the wall of the neck 17. Therefore, the combination of the abutments and the resiliency of the base extensions provide the force necessary to guarantee a positive engagement of the base portions of the brackets with the wall of the neck 17. No additional springs or mechanical resilient members are required to force the base portions into positive engagement with the neck wall.

The electromagnet assembly 41 is composed of a U-shaped core piece 70 upon which is wound an electrical coil 71. The top corners of the core piece 70 fit into a pair of apertures 72 and 73 in the looped portion 51 of the bracket 40 and the ends of the core piece 70 fit into a pair of recesses 74 and 75 of the base portion 50, as may be most clearly seen in FIGURE 5.

The permanent magnet assembly 42 includes a shaft 80 having a semi-spherical portion 81 at one end with a permanent magnet 82 mounted therein and a hexagonal portion 83 at its other end. The permanent magnet assembly also includes a pair of magnetic members 84 and 85 having semi-spherical portions 86 and 87 formed therein to rotatably secure the semi-spherical shaft end portion 81 between them. Each one of the members has a respective extremity 88 and 89 which is located underneath the base portion 50 of the bracket assembly 40, as indicated in FIGURE 6. These extremities 88 and 89 are aligned with the ends of the magnetic core 70.

A set of arc-shaped grooves 90, 91 and 92 are formed in the ferromagnetic member 84 radially outwardly from the semi-spherical portion 86 and three grooves 93, 94 and 95 are formed in the ferromagnetic member 85 ra-

dially outwardly from the semi-spherical portion 87. When the permanent magnet assembly 42 is secured to the bracket assembly 40, the shaft 80 may be placed either between the grooves 90-93, 91-94 or 92-95. Thus, each bracket has such a selection of directions for positioning the shaft 80. A direction leading away from the ferromagnetic members can almost always be found which will allow for accessibility to the hexagon portion 83 for adjusting the position of the permanent magnet 82. As shown in FIGURE 2, the bracket 10 has its shaft 80 extending upwardly between the grooves 91 and 94. The bracket 11 has a shaft 97 which, as shown in FIGURE 2, also extends upwardly even though the bracket 11 is in quite a different position from bracket 10 by passing the shaft 97 between grooves which correspond to the grooves 92 and 95. In like manner, a shaft 98 of a bracket 12 also extends upwardly as shown in FIGURE 2 by being placed between grooves which correspond to grooves 90 and 93 of bracket 10.

Three internally threaded studs 96, 97 and 98 are an integral part of the disc portion 57 of the bracket assembly 40. An aperture 99 is provided in the disc 57 to receive the semi-spherical portion 86 of the ferromagnetic member 84 when the ferromagnetic member 85 is secured to the studs 96-98, with the permanent magnet 82 therebetween by a set of screws 100-102. This assembly is most clearly illustrated in FIGURE 3.

The purity magnet assembly 44 consists of a pair of magnetized disc-type rings 110 and 111, secured on the respective arms, such as 56, which extend from each of the three brackets.

The bracket assembly 10 differs from the bracket assembly 11 and 12 in that the blue lateral magnet assembly 43 is mounted on the arm 56 of the bracket assembly 40. This holds a blue lateral magnet 120 which is only required in conjunction with the beam 20 from a designated blue electron gun.

Since the brackets 11 and 12 do not carry a blue lateral magnet assembly 43, the arms which correspond to arm 56 of bracket 10 are terminated as indicated by the dashed line 112 in FIGURE 4. However, since bracket 10 does have a blue lateral magnet assembly 43, its arm 56 extends as illustrated in FIGURE 9. Referring now to FIGURES 7 and 8 in addition to FIGURE 9, the blue lateral magnet assembly 43 consists of a ferromagnetic member 121 which is secured to the end of the arm 56 by a screw 122, a shaft 123 having a semi-spherical portion 124 holding the blue lateral magnet 120 and a hexagon portion 125 at its other end, and a ferromagnetic member 126 which is secured to the ferromagnetic member 121 by a pair of screws 127 and 128. The ferromagnetic members 121 and 126 have respective semi-spherical portions 129 and 130 which are joined by grooves 131 and 132, respectively. The semi-spherical shaft end portion 124 is rotatably held between the hemispherical portions 129 and 130 while the shaft is rotatably secured by the grooves 131 and 132. The ferromagnetic member 126 has a pair of foot portions 133 and 134 which bear against the outside surface of the neck 17 and the ferromagnetic member 121 has a foot portion 135 which also bears against the outside of the neck 17.

The assembly of the embodiment of the present invention illustrated in the drawings will now be described in greater detail. The extremities, such as 88 and 89 of each bracket, must be placed over the corresponding pole piece portions, such as 31-32, 33-34, and 35-36. The blue lateral magnet is placed in bracket 10 and the position of the shaft 80 is chosen before the ferromagnetic members 84 and 85 are secured to the bracket assembly 40. In like manner, the locations of the shafts 94, 97 and 98 are selected and the respective ferromagnetic members are assembled. In the embodiment illustrated, it has been determined that the most feasible direction from which to adjust each of the permanent magnets in each of the respective brackets is from the top. Therefore, all three

brackets 10-12 have been assembled so that the shafts 80-97-98 point upwardly. The arc base portions and the loops are sufficiently pliable that the electromagnetic assembly 41 can be slipped into place and the lead wires (not shown) carried up through the hooks 54 and 55. The set of brackets 10-12 are then ready for mounting by forming a collar on the neck 17. The pintles of these brackets are then slipped into the bore of the adjoining bracket, the last of these being connected as the brackets are placed around the neck 17. The base extensions with their respective abutments will then maintain the base portions of the respective brackets against the outer surface of the tube neck 17. The collar is slid about the neck of the tube until positioned as shown in FIGURE 2 with the extremities of the ferromagnetic members over the respective flat portions of the pole pieces. The purity rings 110 and 111 are then slipped onto the arms, such as 56 of the brackets, as shown in FIGURES 1 and 4.

The convergence assembly, consisting of the bracket assemblies, the electromagnetic assemblies, the permanent magnet assemblies, the lateral blue magnet and the purity magnet assembly, may now be adjusted in the conventional manner well-known to those skilled in the art. The permanent magnets, such as 82 in each of the respective permanent electromagnet combinations of the convergence assembly, are adjusted by merely rotating the hexagon ends of the shaft. The lateral blue magnet is adjusted by rotating the hexagon end 125 of shaft 123. The purity rings are adjusted for field strength by sliding one magnetized disc ring relative to the other. The direction of their field is adjusted by sliding them together on the arms of the brackets.

The magnetic characteristics of the material used in the pole pieces 84 and 85 associated with the static convergence magnets 82 and in pole pieces 133 and 134 associated with blue lateral magnet 120 are important for proper maintenance of the static adjustments over a period of time. During alignment and adjustment of the television receiver, the permanent magnets are rotated back and forth until the field strength is such that the proper effect on the beams is achieved. As a result of the retentivity of the pole pieces, a portion of the resulting magnetic field is provided by the remanent effect while the rest is contributed by the permanent magnet. This is not objectionable during adjustment of the magnets as it does not prevent establishing a proper static convergence condition. However, it has been found that after a period of operation of the set the static fields change. It is believed that this results from a degaussing effect caused by heat and the alternating fields of the dynamic convergence coils to which the pole pieces are subjected. With the remanent effect dissipated, proper static convergence conditions are no longer present.

To avoid this condition it is desirable to use a material with a low retentivity for the pole pieces. If there is no residual or remanent field present during adjustment, the degaussing action does not affect the static convergence settings. It has been found that pole pieces of a grain oriented steel are satisfactory for this purpose. More particularly, a steel of AISI grade M6 (American Iron and Steel Institute) has both the low retentivity and the physical characteristics which permit formation into the shapes desired for the pole pieces. The retentivity of similar steels of grades up to M15 is also satisfactory.

Although a preferred embodiment of the present invention has been illustrated in the drawings and herein described, those skilled in the art will recognize that a collar structure composed of separable substantially identical mounting brackets, which can be secured on the neck of a cathode ray tube, may be utilized for only a single assembly, such as the convergence assembly, a blue lateral magnet assembly, or a purity ring assembly, and further that such a collar structure may be used for any pair of any two of the three aforementioned assemblies.

All such modifications are intended to be within the scope of the appended claims.

We claim:

1. In a convergence assembly for a three color cathode ray display device having a neck, said assembly including a collar around the neck of said display device, static convergence means including three sets of magnetic pole pieces on said collar; a permanent magnet for each set of pole pieces, each magnet being adjustable in position with respect to the associated set of pole pieces; and means for manipulating each of said permanent magnets, including an elongated, self-supporting adjustment stem connected to and extending outwardly from each magnet for rotation of the associated magnet, said stems being in a plane at right angles to the neck of said display device and being substantially parallel with each other for manipulation from one side of said device, and accessible along parallel paths in said plane from substantially the same direction relative to the axis of the neck of said device.

2. The convergence assembly of claim 1 in which each stem terminates with a semi-spherical portion in which said permanent magnet is located and each set of pole pieces terminates in opposed semi-spherical surfaces between which the semi-spherical stem portion is rotatably received.

3. The convergence assembly of claim 2 wherein the opposed semi-spherical pole piece surfaces have outwardly extending flanges with three grooves therein, the adjusting stem of each magnet manipulating portion extending through one of the grooves of the associated set of pole pieces.

4. In a convergence assembly for a three color cathode

ray display device having a neck, said assembly including a collar around the neck of said display device, static convergence means including three sets of magnetic pole pieces on said collar and spaced around the neck; a permanent magnet for each set of pole pieces, each magnet having an axis about which it is rotatably adjustable in position with respect to the associated set of pole pieces; means for manipulating each of said permanent magnets, said manipulating means being aligned with the axis of rotation of each magnet and a positioning surface for each magnet, concentric with the axis of rotation thereof; means supporting each permanent magnet, said supporting means accommodating the positioning surface and the manipulating means in a plane at right angles to the axis of the neck of said display device and in a selected one of a plurality of positional relationships within said plane and at different angles with respect to the surface of the neck of said display device, including a positional relationship in which the three manipulating means are accessible along parallel paths and from the same direction within said plane.

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