United States Patent

[11] 3,629,752

[72] Inventor **Albert M. Anthony**
Conneaut, Ohio

[21] Appl. No. **8,485**
[22] Filed **Feb. 4, 1970**
[45] Patented **Dec. 21, 1971**

[73] Assignee **Tractor, Inc.**
Austin, Tex.

[54] CONVERGENCE UNIT FOR COLOR TELEVISION PICTURE TUBE

15 Claims, 14 Drawing Figs.

[52] **U.S. Cl.** **335/212,** 313/77
[51] **Int. Cl.** **H01f 1/00**
[50] **Field of Search** ..... 335/210, 212; 313/69 C, 70 C, 77

[56] **References Cited**

UNITED STATES PATENTS

3,308,328	3/1967	Rennick	335/210 X
3,363,127	1/1968	Rennick	313/77

Primary Examiner—George Harris
Attorney—Burmeister, Palmatier & Hamby

ABSTRACT: The unit comprises a rear supporting ring with a pair of purity-adjusting ring magnets mounted thereon. A pair of diametrically opposite arms project forwardly from the supporting ring and are formed with clips to hold two rod magnets, one for blue lateral and the other for radial convergence adjustment. The arms are formed with lugs which are slidably received in slots formed in the housings of diametrically opposite dynamic convergence units. The front sides of the housings are formed with lugs slidably received in slots formed in a front supporting member having a central aperture. A split ring clamp is mounted around arcuate clamping elements on the housings.

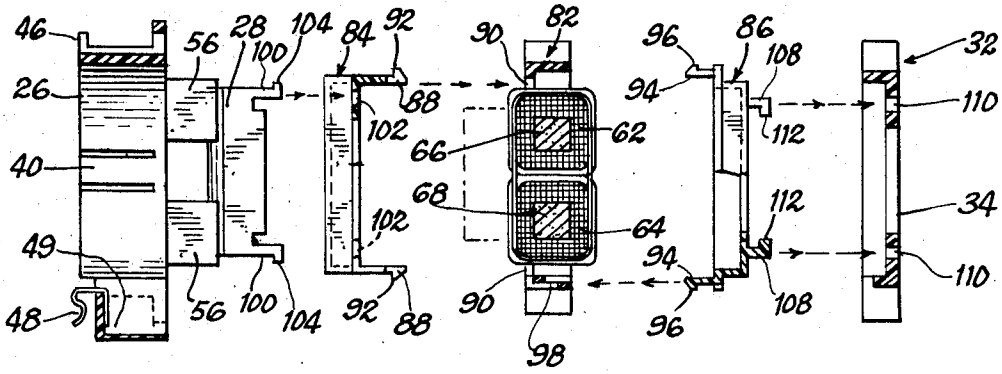


FIG. 1

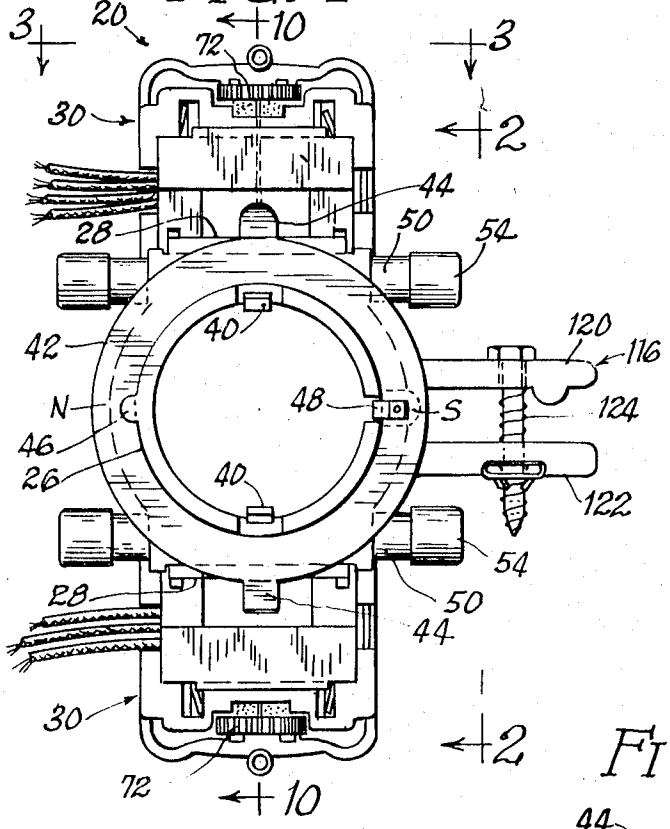


FIG. 4

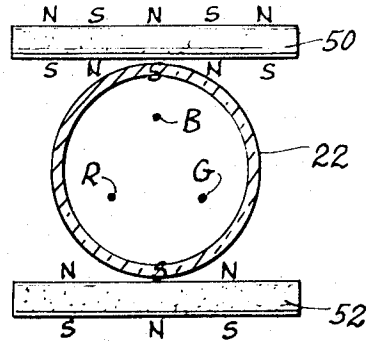


FIG. 3

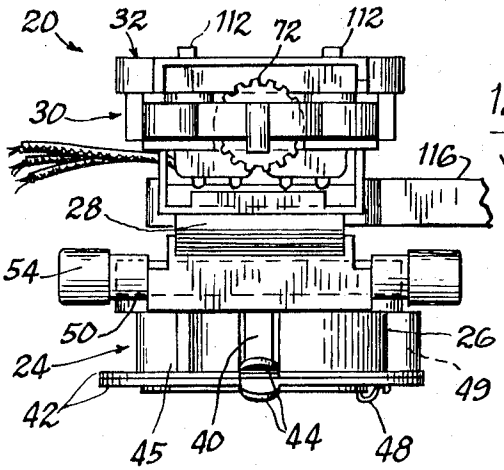
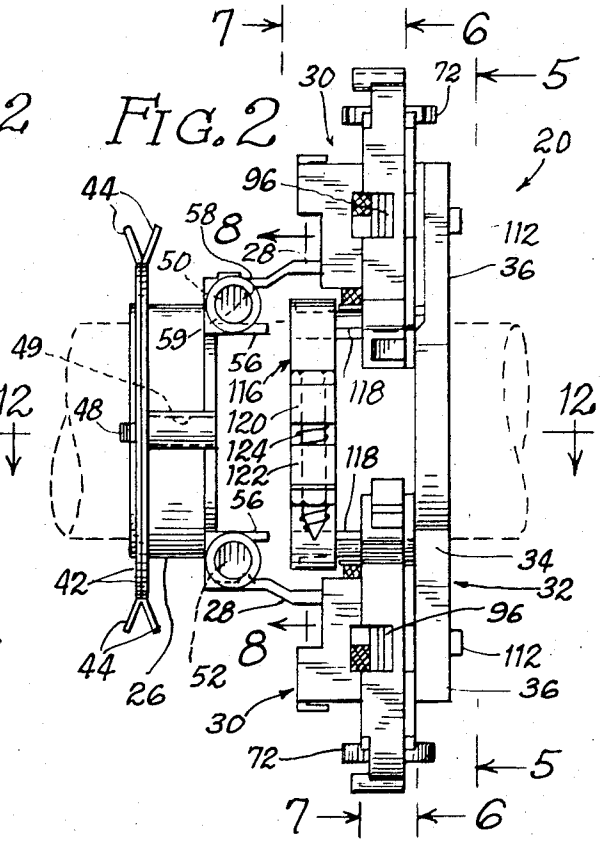


FIG. 2



INVENTOR
Albert M. Anthony
by Burmeister, Palmatier
and Hamby Attys

FIG. 5

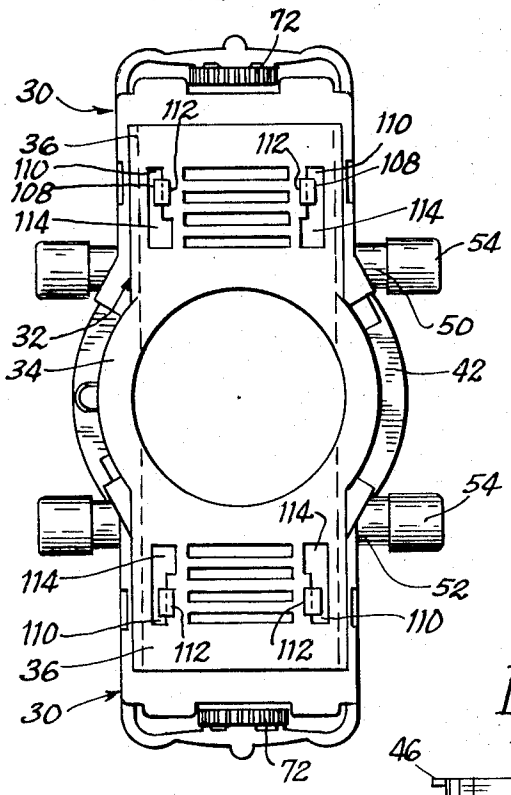


FIG. 6

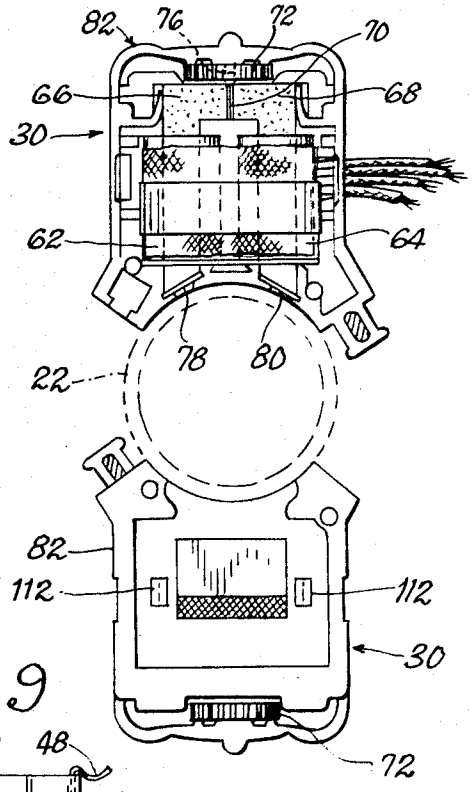


FIG. 9

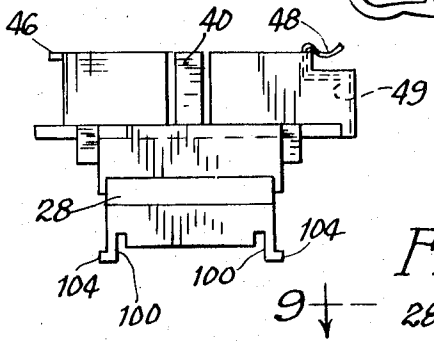


FIG. 7

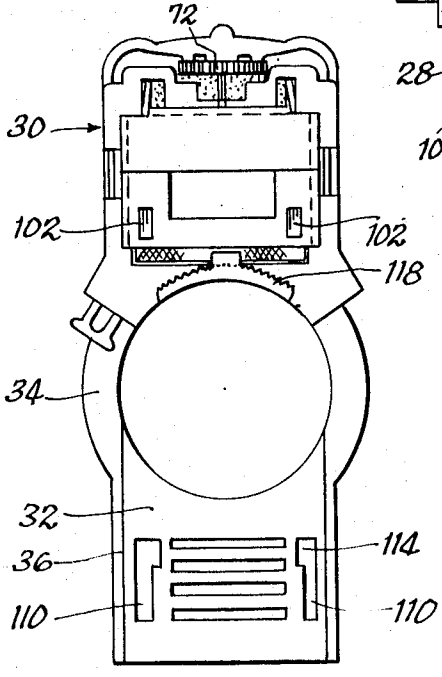


FIG. 8

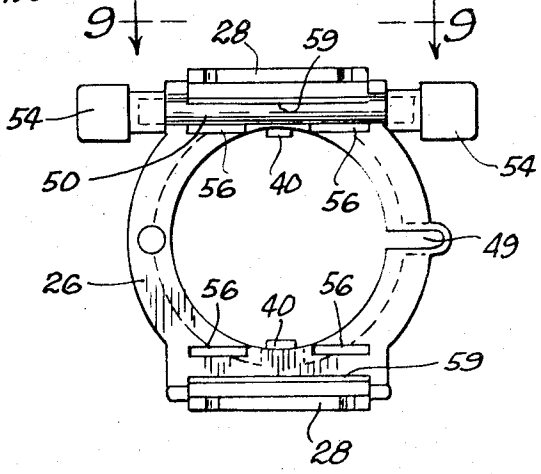


FIG. 10

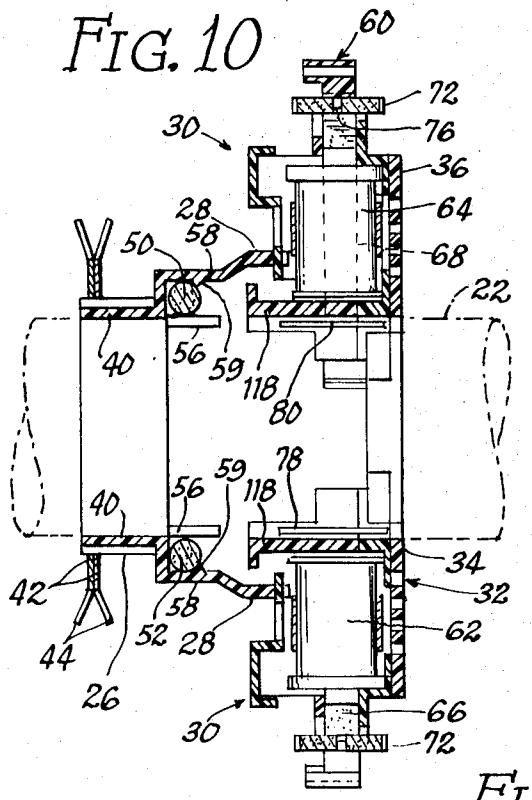


FIG. 11

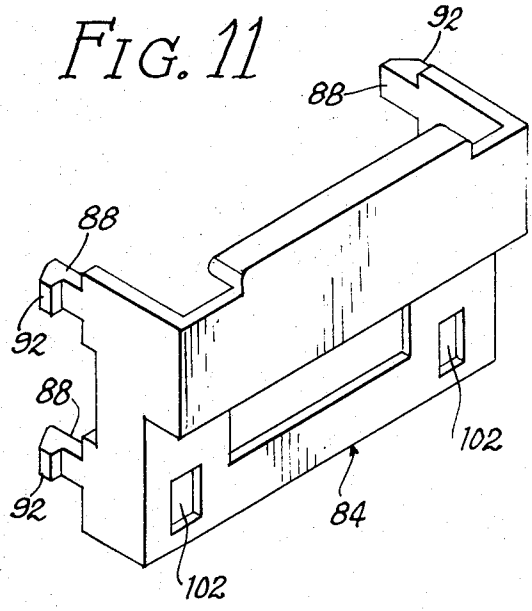


FIG. 12

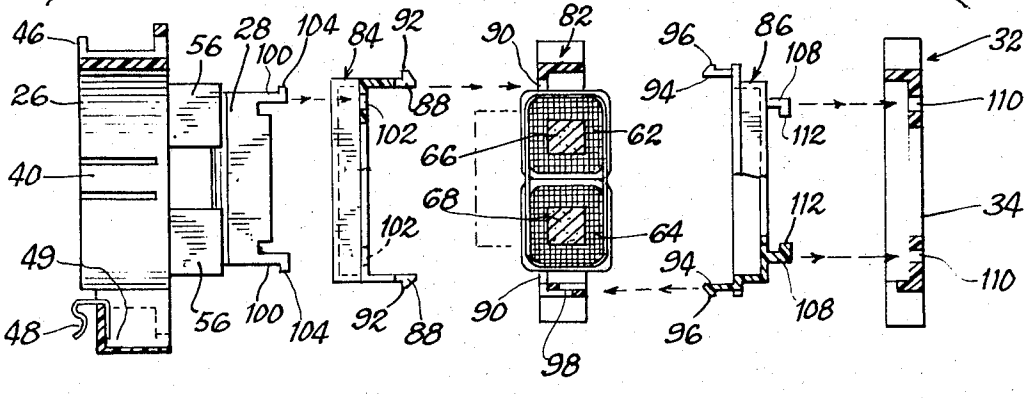


FIG. 13

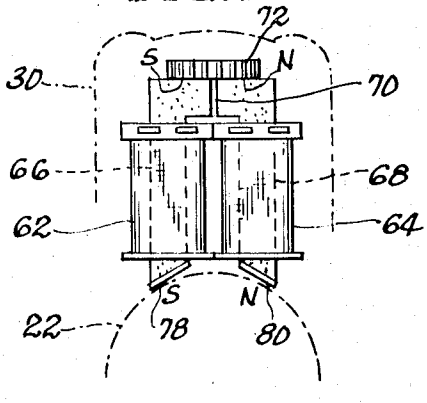
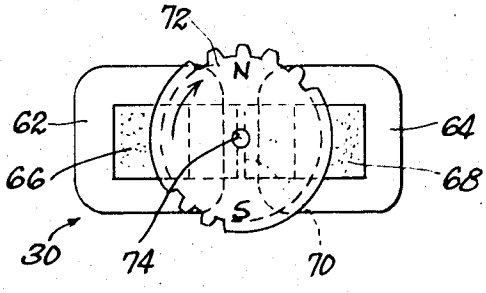


FIG. 14



CONVERGENCE UNIT FOR COLOR TELEVISION PICTURE TUBE

This invention relates to a convergence unit adapted to be mounted around the neck of a color television cathode-ray picture tube. The unit of the present invention is adapted to combine the static and dynamic convergence units, as well as the purity adjusting unit, which are needed in connection with the color television cathode-ray tube.

Color cathode-ray picture tubes have three electron guns in spaced relation to the axis of the tube, and the beam of each gun is directed to illuminate phosphor dots of a certain color on the screen of the tube. The phosphor dots are usually arranged in arrays for each color, and the electron beam from each gun passes through an aperture screen or shadow mask which has a single set of holes in the same geometric configuration as each array of dots. When the electron beam travels its intended course, it illuminates only those dots which produce the intended color represented by the gun which originated that electron beam. The electron beams from the guns are aimed to converge upon the holes in the mask, and thereafter the beams diverge as they pass through the holes and arrive at the screen as three individual beams.

By means of static convergence adjustments, the beams may be aimed to converge on the center of the mask, but problems arise when the beams sweep from side to side and up and down. The convergent point of the beams sweeps in an arc which moves it away from the mask at points other than the center of the mask. Convergence coil assemblies have been devised and are used to meet this problem. The beams must converge on the mask so that all three beams pass through the same hole in the mask at correct angles to strike the corresponding phosphor dots on the screen. Dynamic convergence coils correct for variations in length from the deflection point to the apertured mask as the beams travel from the center to the edge of the mask. Each of the coils is generally in the shape of a horseshoe, or may be a unit having two ferrite pieces. Each piece has a coil wrapped around it, and the vertical and horizontal convergence currents pass through the coils to control the convergence at the mask during the sweep of the beams.

One of the principal objects of the present invention is to provide a convergence unit which combines the elements need for static convergence adjustment and dynamic convergence correction.

Another object is to provide such a convergence unit which can be assembled very easily and economically, and which can be mounted expeditiously, yet with a high degree of precision around the neck of a picture tube.

A further object is to provide such a convergence unit which also incorporates the necessary purity-adjusting elements.

Another object is to provide such a convergence unit in which the dynamic convergence elements are slidable radially so that they may be clamped against the neck of the picture tube.

In accordance with the present invention, the convergence unit preferably comprises a rear supporting ring with a pair of supporting arms projecting forwardly therefrom. The housings of the dynamic convergence units are slidably joined to the front end portions of the arms. In front of the dynamic convergence units, the housings are slidably connected to the outer portions of a front supporting member, preferably comprising a central ring portion adapted to be mounted around the neck of the picture tube. The arms are preferably formed with clips in which cylindrical convergence magnets are rotatably adjustable to provide static convergence adjustments. Purity-adjusting ring magnets are preferably mounted on the rear supporting ring for rotary adjustment. It is preferred to provide lug and slot elements between the dynamic convergence units and the supporting arms, and also between the dynamic convergence units and the front supporting member. Means are provided for removably retaining the lugs in the slots.

Further objects, advantages and features of the present invention will appear from the following description, taken with the accompanying drawings, in which:

FIG. 1 is a rear elevation of a convergence unit to be described as an illustrative embodiment of the present invention.

FIG. 2 is a side elevation, taken generally as indicated by the line 2—2 in FIG. 1.

FIG. 3 is a top plan view, taken generally as indicated by the line 3—3 in FIG. 1.

FIG. 4 is a diagrammatic vertical section showing the arrangement of the rod magnets employed for static convergence adjustment.

FIG. 5 is a front elevation, taken generally along the line 5—5 in FIG. 2.

FIG. 6 is a front elevation taken with the front supporting member removed, generally as indicated by the line 6—6 in FIG. 2.

FIG. 7 is a rear elevation taken with the rear supporting member and one dynamic convergence unit removed, generally as indicated by the line 7—7 in FIG. 2.

FIG. 8 is a front view of the rear supporting member, taken generally along the line 8—8 in FIG. 2.

FIG. 9 is a top view of the rear supporting member, taken generally as indicated by the line 9—9 in FIG. 8.

FIG. 10 is a vertical longitudinal section, taken along the line 10—10 in FIG. 1.

FIG. 11 is a perspective view of one of the housing parts for one of the dynamic convergence units.

FIG. 12 is an exploded plan view, partly in horizontal section, along the line 12—12 in FIG. 2.

FIG. 13 is a diagrammatic elevational view of one of the dynamic convergence units.

FIG. 14 is a diagrammatic plan view of one of the dynamic convergence units.

As previously indicated, the drawings illustrate a convergence unit or assembly 20 which combines the elements necessary for static convergence adjustment, dynamic correction, and purity adjustment. The unit 20 is adapted to be mounted around the neck 22 of a color television cathode-ray tube.

It will be seen that the convergence unit 20 comprises a rear supporting member 24, including a supporting ring 26 and a pair of arms 28 projecting forwardly therefrom. Dynamic convergence units 30 are slidably mounted on the front end portions of the arms 28. It will be seen that the dynamic convergence units 30 are of the in-line type. Thus, the units are positioned diametrically opposite each other. The upper dynamic convergence unit is aligned with the blue electron gun and is adapted to provide dynamic convergence correction for the blue beam, indicated diagrammatically as B in FIG. 4. The lower dynamic convergence unit affords the necessary dynamic convergence correction for the green and red beams, designated G and R in FIG. 4.

The front portions of the dynamic convergence units 30 are slidably connected to a front supporting member 32, preferably comprising a central ring portion 34 and a pair of outwardly projecting wing portions 36.

Preferably, the supporting parts for the convergence unit 20 are molded or otherwise formed from suitable resinous plastics materials. In this way, the supporting parts can be intricately formed at low cost, yet with a high degree of precision. Moreover, these supporting parts are resilient and somewhat flexible so that they can be assembled easily.

It will be seen from FIG. 1 that the rear supporting ring 26 is formed with a pair of diametrically opposite spring fingers 40, slanting inwardly and adapted to engage the neck 22 of the picture tube. The fingers 40 assist in maintaining the ring 26 in a centered relationship to the picture tube.

The rear supporting ring 26 is also preferably employed to support a pair of purity-adjusting rings 42 having outwardly projecting tabs 44 which serve as handles. Each ring 42 has a pair of diametrically opposite magnetic poles, designated N and S in FIG. 1. As illustrated, the rings 42 are mounted for rotary adjustment around the rear end portion of the supporting ring 26. The front ring is slidably engaged with a plurality of bosses or abutments 45 projecting outwardly from the ring 26.

As shown, the rear ring **42** is retained by an outwardly projecting tab **46** and a diametrically opposite clip **48**, received in a slot **49** (FIG. **12**). It will be understood that the purity adjustment is achieved by rotating the two rings **42**. In this way, the orientation of the magnetic field can be changed. Moreover, the effective magnitude of the magnetic field can be changed by adjusting the relative positions of the two rings, so that their individual magnetic fields either aid or buck each other.

The arms **28** preferably provide support for convergence adjusting magnets **50** and **52**, illustrated as being in the form of cylindrical rods made of ferrite or other suitable materials. The rod magnets **50** and **52** are preferably provided with end caps **54**, adapted to serve as handles and to limit the endwise movement of the magnets.

The rod magnets **50** and **52** are preferably mounted for rotary adjustment on the arms **28**. For this purpose, the arms **28** are preferably provided with supporting clips **56**. As shown in FIG. **2**, the clips **56** take the form of flanges projecting forwardly from the ring **26** and spaced inwardly from wall elements **58** of the arms **28**. As shown in FIGS. **2** and **10**, ridge elements **59** are provided to detain the rod magnets **50** and **52** in the clips **56**. The illustrated ridge elements **59** are formed on the arms **28** but they could be formed on the clips **56**. It will be evident that the rod magnets **50** and **52** are mounted on the arms by pressing the rod magnets rearwardly into the clips **56**. The rod magnets **50** and **52** are snugly retained but can be rotated to achieve the desired convergence adjustments.

The rod magnets **50** and **52** can be magnetized to provide various arrangements of the magnetic poles. As shown in FIG. **4**, the upper rod magnet **50** is preferably magnetized with five pairs of diametrically opposite magnetic poles, spaced along the length of the magnet, as indicated by the letters N and S. The poles may be of different strengths, as disclosed and claimed in the applicant's copending application, Ser. No. 816,652, filed Apr. 16, 1969, now U.S. Pat. No. 3,512,023. The rotation of the magnet **50** provides a blue lateral adjustment. Thus, the blue beam can be shifted laterally in either direction by the necessary amount to achieve static convergence.

As indicated in FIG. **4**, the lower rod magnet **52** is formed with three pairs of magnetic poles, arranged as indicated by the letters N and S. This arrangement provides for radial adjustment of the red and green beams.

Each of the dynamic convergence units **30** comprises a housing **60**. As shown in FIGS. **12–14**, two coils **62** and **64** are mounted in the housing **60**. The coils **62** and **64** are mounted on L-shaped magnetic cores **66** and **68**, made of ferrite or some other suitable material. As shown in FIG. **13**, the L-shaped cores **66** and **68** are clamped or otherwise secured together, with a nonmagnetic spacer **70** therebetween. When thus joined together, the cores **66** and **68** form a U-shaped magnetic structure.

To provide for a static convergence adjustment, each unit **30** preferably comprises an adjustable permanent magnet **72** mounted across the gap formed by the nonmagnetic material **70**. As illustrated, each permanent magnet **72** is in the form of a rotatable disc having a pair of diametrically opposite magnetic poles, indicated by the letters N and S in FIGS. **13** and **14**. The disc magnet **72** is formed with a central opening **74** which is rotatably mounted on a pivot **76**, as shown to best advantage in FIG. **10**. The pivot **76** is formed on the housing **60**. Preferably, pole pieces **78** and **80** are mounted against the inner ends of the cores **66** and **68**.

As illustrated, the housing **60** is formed in three parts, as shown to best advantage in FIG. **12**. These parts comprise a central frame element **82** and two side pieces **84** and **86**. All three parts are preferably molded from a suitable plastic material.

As illustrated, the three parts **82**, **84** and **86** are arranged to snap together for ease of assembly. Thus, the rear side piece **84** is formed with a pair of tabs **88** which are insertable through slots **90** in the central piece **82**. The tabs **88** are formed with flanges or barbs **92**, adapted to spring outwardly after passing through the slots **90**, so as to retain the tabs **88** in the slots **90**.

Similarly, the front side piece **86** is formed with tabs **94** having outwardly projecting flanges or barbs **96**, adapted to snap into slots **98** in the central piece **82**. As previously indicated, each of the dynamic convergence units **30** is slidably connected to the arms **28**. The joints between the arms **28** and the housings **60** of the units **30** preferably utilize lugs which are slidable in slots. As illustrated to best advantage in FIGS. **10** and **12**, such lugs **100** are formed on the arms **28** and are slidably receivable in slots **102**, formed in the rear housing piece **84**. Flanges **104** are preferably formed on the lugs **100** to retain them in the slots **102**. The lugs **100** are preferably arranged to be sufficiently flexible and resilient to provide for insertion of the flanges **104** through the slots **102**, by applying inward pressure to the lugs **100**. After the flanges **104** have been inserted through the slots **102**, the lugs **100** are allowed to spring outwardly so that the flanges will retain the lugs in the slots. As shown in FIGS. **10** and **11**, the slots **102** are sufficiently long to provide for radial movement of the dynamic convergence units **30**, so that the units can be clamped against the neck **22** of the cathode-ray tube.

It is also preferred to provide slidable joint elements in the form of lugs and slots between the housings **60** and the front supporting member **32**. As shown in FIG. **12**, such lugs **108** are formed on the front housing piece **86** and are adapted to be inserted through slots **110** in the wing portions **36** of the front supporting member **32**. The illustrated lugs **108** are formed with inwardly projecting flanges **112**. In this case, the slots **110** are formed with widened or enlarged end portions **114** to provide for insertion of the flanges **112** through the slots **110**. After the flanges **112** have been inserted, the lugs **108** are moved into the narrower portions of the slots **110** so that the flanges **112** will retain the lugs in the slots.

Means are provided to clamp the dynamic convergence units **30** against the neck **22** of the picture tube. This is preferably accomplished by means of a ring clamp **116** which is engageable with arcuate inner flanges **118** on the central pieces **82** of the housings **60**. The ring clamp **116** is split and is provided with outwardly projecting arms **120** and **122**, adapted to be drawn together by a screw **124**.

It will be evident that the dynamic convergence units **30** are securely supported yet are slidably movable in a radial direction to provide for clamping of the dynamic convergence units against the neck **22** of the picture tube. The lug and slot connections between the dynamic convergence units **30** and supporting members **28** and **32** make it easy to assemble the convergence units on the supporting members.

Various modifications, alterative constructions and equivalents may be employed, as will be understood by those skilled in the art.

I claim:

1. A convergence unit for a color television picture tube,
comprising a supporting ring,
a pair of arms projecting forwardly from said ring,
a pair of dynamic convergence units,
first joint elements mounting said dynamic convergence units on said arms for radial sliding movement,
a supporting member having a central ring portion and outwardly projecting wing portions,
and second joint elements slidably connecting said dynamic convergence units to said wing portions.

2. A unit according to claim **1**,
in which said first joint elements comprise a first joint member having a slot therein,
and a first lug slidably received in said slot.

3. A unit according to claim **1**,
in which said dynamic convergence units are formed with housings,
said first joint elements comprising a slot formed in each housing,
and a lug formed on each of said arms and slidably received in the corresponding slot.

4. A unit according to claim **3**,

in which each lug comprises means for removably retaining the lug in the corresponding slot.

5. A unit according to claim 3,
in which each lug comprises a flange for removably retaining the lug in the corresponding slot.

6. A unit according to claim 5,
in which each lug is resiliently flexible to provide for insertion and removal of the lug from the corresponding slot.

7. A unit according to claim 1,
in which said second joint elements comprise a member having a slot therein,
and a lug slidably received in said slot.

8. A unit according to claim 1,
in which said second joint elements comprise a slot formed in each of said wing portions,
and a lug formed on each of said dynamic convergence units and slidably received in said slot.

9. A unit according to claim 8,
in which each lug comprises a flange for retaining the lug in the corresponding slot.

10. A unit according to claim 9,
in which each slot comprises an enlarged portion to provide for insertion and removal of the corresponding lug.

11. A unit according to claim 1,
in which said second joint elements comprise a radially elongated slot formed in each of said wing portions,
and a lug projecting from each of said dynamic convergence units and slidably received in the corresponding slot,
each lug having a flange for retaining the lug in the corresponding slot,
each slot having a widened portion at one end for receiving the corresponding flange to provide for insertion and removal of the corresponding lug.

12. A unit according to claim 1,
including a pair of purity-adjusting ring magnets,
and means mounting said ring magnets on said supporting ring for rotary adjustment.

13. A unit according to claim 1,
in which at least one of said arms is formed with a clip element,
said unit comprising a generally cylindrical magnet received in said clip element for rotary adjustment.

14. A unit according to claim 13,
in which said clip element comprises resiliently flexible flange means extending along the arm.

15. A unit according to claim 13,
in which said clip comprises a portion of said arm and flange means mounted along said arm and spaced away from said portion.

* * * * *