July 28, 1959 T. JENSEN 2,897,390

MAGNETIC CONVERGENCE ASSEMBLY

Filed Dec. 23, 1955

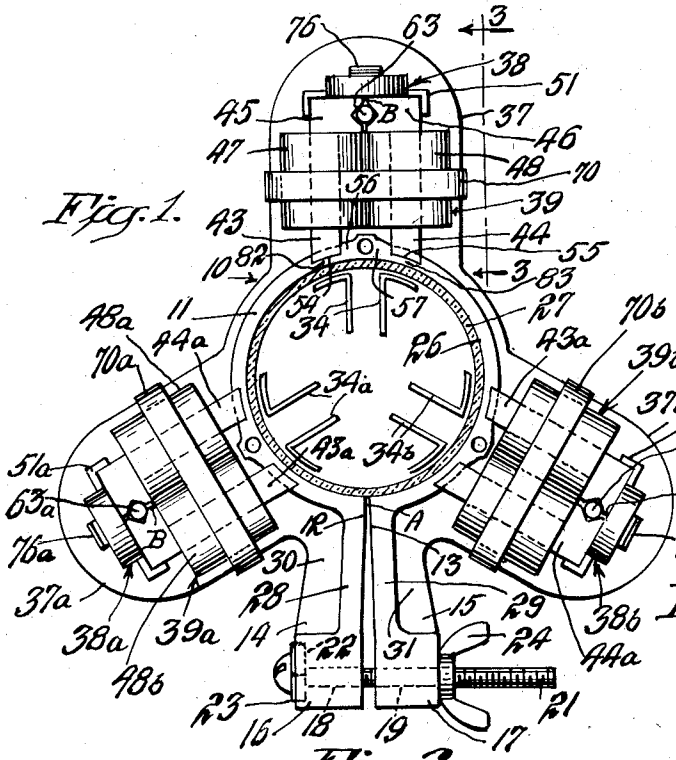


Fig. 1.

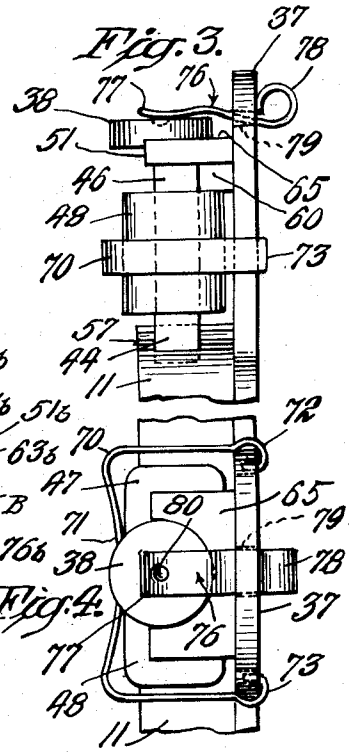


Fig. 3.

Fig. 4.

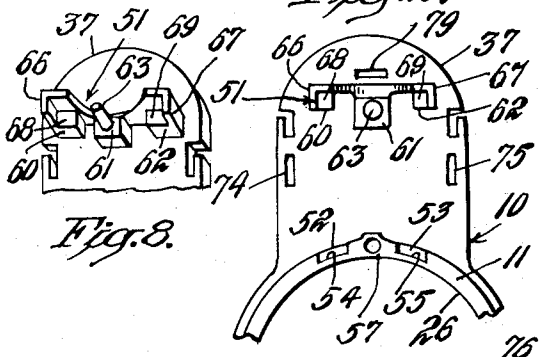


Fig. 2.

Fig. 8.

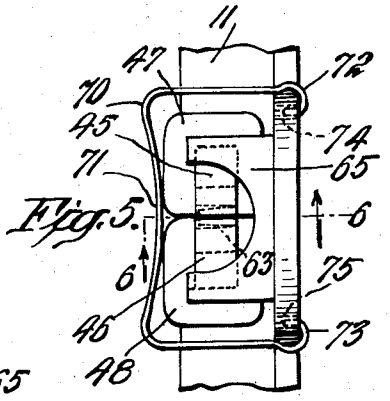


Fig. 5.

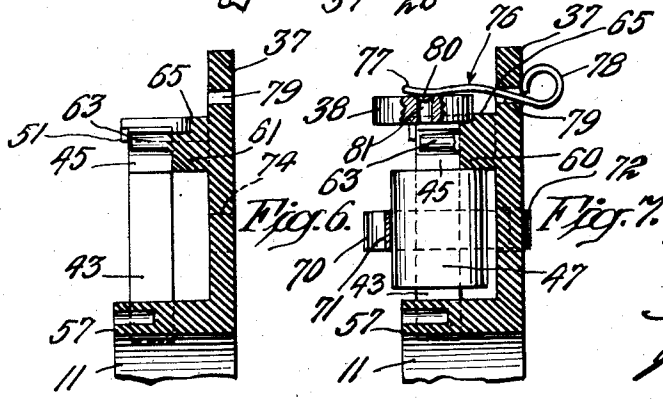


Fig. 6.

Fig. 7.

INVENTOR.
Theodore Jensen
BY
Frank A. Bowen
ATTORNEY

United States Patent Office 2,897,390 Patented July 28, 1959

2,897,390

MAGNETIC CONVERGENCE ASSEMBLY

Theodore Jensen, Westfield, N.J., assignor to Glaser-Steers Corporation, a corporation of New Jersey

Application December 23, 1955, Serial No. 554,972

5 Claims. (Cl. 313—77)

This invention relates to a magnetic convergence device for converging the multiple electron beams of a cathode ray tube. It is directed particularly to the mounting means for supporting the magnetic and electrical components of a convergence device and to the relationship of the magnetic members to one another.

In color television the cathode ray tube receiver receives signals, each corresponding to the colors transmitted. These signals are transmitted to separate electron guns projected as separate electron beams circumferentially spaced. Along the neck of the tube a magnetic means is provided for converging the electron beams so that the beams will strike the fluorescent screen within a given small area. Each portion of the screen will be energized in accordance with the combined signal of the converged electron beams and a spot of combined colors will be produced of the same hue and intensity as the corresponding portions of the televised object.

In order to produce a clear and proper colored picture over the entire area of the fluorescent screen, a steady magnetic field is required to converge the beams over the mid-area of the screen and an additional dynamic field is required to converge the beams in the surrounding fringe area. The steady flux may be provided by electromagnetic coils having a direct current pass therethrough or permanent magnets positioned around the tube to provide a field in the tube adjacent the electron beam.

An object of the invention is to provide a mounting member for holding the magnetic and electrical components of a convergence device that is easily mounted on the neck of the cathode ray tube.

Another object of the invention is to provide a convergence device that is easily assembled and inexpensive to manufacture.

A still further object of the invention is a convergence device that accurately and uniformly controls the convergence of multiple electron beams.

Other and further objects and advantages of the invention will be apparent from the following description taken in connection with the drawings in which:

Fig. 1 is a front view of the convergence device;

Fig. 2 is a fragmentary view of the associated mounting view of the magnetic assembly;

Fig. 3 is a side view of the magnetic assembly and associated mounting means taken along lines 3—3 of Fig. 1;

Fig. 4 is a top view of the magnetic assembly and associated mounting means shown in Fig. 3;

Fig. 5 is a top view of Fig. 3 without the permanent magnet;

Fig. 6 is a sectional view of the fragmentary portion along lines 6—6 of Fig. 5 without the electromagnetic coils; and

Fig. 7 is an enlarged fragmentary sectional view of the permanent magnet and associated mounting means.

Referring to Figs. 1 and 2 of the drawing a mounting frame **10** is made of a non-magnetic material preferably a plastic material. The mounting plate **10** has a tubular member **11**, split longitudinally to separate the member to form a space A between the ends **12** and **13**. At respective ends are handles **14** and **15** integral with

the tubular member and extending preferably normal thereto to the handles providing means for conveniently clamping the tubular member on the neck of a cathode ray tube. Blocks **16** and **17** at the end of the handles **14** and **15** have bores **18** and **19** extending therethrough and in alignment to pass a threaded bolt **21**. The block **16** has a recess **22** with angularly shaped walls for receiving the hexagonal head **23** of the bolt. A nut **24** is threaded on the bolt to engage block **17** and force the tubular member closed. The tubular member **11** has a cylindrical surface **26** for fitting around the outer surface of the tube **27**. The handles **14** and **15** have ribs **28, 29** extending between the tubular member and the blocks **14** and **15** to form with the panels **30** and **31** a rigid structure for pulling the ends **12** and **13** together. Instead of the bolt and winged nut, a cam or spring device may be used that is turned to draw the ends together.

The electron beams of the cathode ray tube are circumferentially spaced 120° apart and pass between internal pole pieces **34**, **34***a*, **34***b* respectively also spaced circumferentially 120° apart. The pole pieces confine the magnetic field and restrict the effect of the field to the electron beam passing therebetween. The beams are therefore independently adjustable and the convergence of the beam is determined by the magnetic assemblies **37**, **37***a*, **37***b*. The assemblies **37**, **37***a*, **37***b* are positioned externally to the cathode ray tube and adjacent the internal pole pieces. The assemblies create a flux that is supplied to a respective internal pole piece inside of the cathode ray tube to deflect a respective cathode ray beam. Each assembly comprises a permanent magnet **38** and a dynamic electromagnet **39**. Since each is identical in structure the description of assembly **37** will suffice and is applicable to each assembly except for the addition of the reference letters *a* and *b* for the corresponding elements of a respective assembly.

The dynamic electromagnet **39** has a powdered U-shaped iron core with two legs **43**, **44** and a cross-piece divided into a portion **45** connected to leg **43** and a portion **46** connected to leg **44**. Coils **47**, **48** on legs **43**, **44** respectively pass an alternating current in the order of 1500 kc. to create an alternating flux in addition to the steady flux of the permanent magnet **38**.

The powdered iron core is spaced from the mounting plate **10** by means of the support **51** and the shoulders **52** and **53** of the grooves **54**, **55** in the tubular member **11**. The grooves **54**, **55** extend longitudinally substantially half of the length of the member and are circumferentially separated by a spacer **56** which has a bottomed bore **47** therein between the legs **43**, **44**. The flux density of the magnetic assembly may be readily measured by inserting an electrical instrument probe in the bore. The ends of the legs fit in the groove and seat against the shoulders **52**, **53**. The support **51** has posts **60**, **61** and **62** spacing the iron core from the mounting plate **10** the same distance as the shoulders **52** and **53**. The post **61** has a stud **63** extending between the ends of the cross piece portions **45**, **46**. V-shaped longitudinal grooves are formed in the ends of the cross piece portions to fit around the stud **63** and position the ends of the cross piece together but provide a gap B between the ends. A panel **65** and side strips **66**, **67** form grooves **68**, **69** which retain the powdered iron core in the grooves **54**, **55**. The powdered iron core is rectangular in shape with square edges so that the core readily fits in the grooves **68**, **69** and on the flat surfaces of the posts **60**, **61**, **62**. The grooves **52**, **53** and the grooves **68**, **69** are of a length to recess the iron core so that the edges of the mounting member protect the iron core. The windings or coils **47**, **48** are designed for a hyperbolic wave shape having a frequency in the order of 1500 kc. The iron core is spaced from the mounting plate to a

distance to accommodate the coils. The coils are formed and the legs of the iron core fitted in the windings and the magnetic assembly positioned on the mounting member by sliding the core in the grooves.

A U-shaped resilient non-magnetic metal strap **70** has a bowed mid-portion **71** pressing against the coils and hooked ends **72, 73** fitting into slots or grooves **74, 75** in the mounting member **10**. Thus the magnetic assembly is securely held on the mounting member.

In the panel **65** a semi-circular hole is formed in which the disc-shaped permanent magnet **38** is fitted. The permanent magnet rests on the cross-piece portions **45, 46** and is held in place by a resilient clip **76** having a rectangular finger **77** and rolled portion **78**. The finger **77** passes through a slot **79** positioned slightly below the exposed surface of the permanent magnet. The finger **77** is slightly curved in shape and is held under stress between the surface of the magnet and the edge of the slot. The finger **77** has knob **80** which fits into a bore or recess **81** in the magnet to lock the magnet in place. The rolled portion provides a grip for inserting and removing the clip and extends the curved shape of the finger to hold the clip under stress.

The magnetic assemblies **37, 37*a*, 37*b*** are circumferentially spaced 120° to one another. The ends of the legs of the iron cores are positioned adjacent to the internal pole pieces to provide the shortest flux path. The strength of the permanent or steady field may be adjusted by rotation of the permanent magnet. Increase in the field between the pole pieces deflects the beam radially inward or outward. The flux from the magnet assembly varies rapidly in synchronism with the sweep of the electron beam to vary the converging influence at the ends of the sweep.

The mounting plate **10** and tubular member **11** along with the various posts, supports and panels may be molded as a single piece made of plastic. The posts **60, 61, 62** provide a secure base and firm connection for the panel **65** and strips **63, 64** with the mounting plate **10**. The tubular member provides a spaced support for the ends of the iron core as well as added strength for the necessary flexure of the frame to clamp the neck of the cathode ray tube. The plastic material is non-magnetic and the grooves **54, 55** are deep. The portions **82, 83** that hold the magnet assembly in place are thin to provide a short flux path between the iron core and the internal pole pieces.

The stud **63** between the cross-piece portions **45, 46** is slightly tapered to spread the cross-piece portions against the strips **66, 67** to snugly hold the core pieces in position. The diameter of the stud **63** determines the length of the gap between the cross-piece portions. The wedging action between the stub and side strips accurately positions the core pieces so that the air gap between the magnetic poles provides optimum relative performance of the permanent flux and dynamic flux.

An advantage of the convergence device hereinbefore described is that the clamping means are the only mounting means required to hold the device on the neck of the tube. The unit can be positioned and tightened in place independently of any other support members. The device is easily assembled by hand. The legs **43, 44** are inserted in the pre-wound coils **47, 48** to form the magnet assembly. The assembly is mounted on the plate **10** by sliding the ends of the legs **43, 44** in grooves **54, 55** and the corners of the legs between the strips **66, 67** and panel **65**. The square notches slide over the stud **63** to properly space the air gap. The permanent magnet is set on the cross pieces **45, 46** as the clip **76** is inserted through the slot **79** and the two members slid and locked in position. The clip **76** presses the permanent magnet against the core to maintain the permeability of the flux path constant. The permanent magnet is held from side motion by the panel **65** and from dropping from the positions by the clips **76**.

The convergence device is particularly applicable to the color television cathode ray tubes for converging the three electron beams each varying in intensity with a respective primary color to converge the beams so that each electron beam strikes the portion of the screen corresponding to the color intensities it is transmitting.

The convergence unit accurately and uniformly provides for proper convergence over the entire screen to produce a clear picture with exact color reproductions.

Various modifications and changes may be made in the embodiment described herein without departing from the invention as set forth in the appended claims.

I claim:

1. A colored television convergence device comprising a U-shaped ferromagnetic core having leg portions and a connecting cross portion adapted to pass flux therethrough, a permanent magnet on said cross piece to provide a permanent flux through and across the open ends of said legs, an electromagnetic coil wound on said legs, a tubular member positionable immediately adjacent to the neck of a cathode ray tube, a radially extending mounting plate secured to said tubular member and having a panel spaced from said tubular member extending lateral to said plate and generally parallel to said tubular member, said ferromagnetic core fitting snugly between said panel and said tubular member to hold said core from radial and circumferential movement and said panel and tubular member formed in a space to axially position said core and electromagnet against said plate, and means secured to said plate holding said core against said plate to prevent axial movement of said core and electromagnet so that said core and electromagnet are firmly fixed in position.

2. A colored television convergence device as claimed in claim 1 wherein a permanent magnet is provided and said panel has a recess adjacent to said connecting cross piece to rotatably hold said permanent magnet, said permanent magnet permanently positioned in said recess and leaf-spring means extending through said mounting plate resiliently pressing against said permanent magnet to hold said magnet against said cross piece and rotatably holding said magnet to provide an adjustment of the permanent flux passed to said core.

3. A convergence device as claimed in claim 1 wherein said core comprises two pieces, and a stub is mounted on said mounting plate to space adjacent ends of said pieces to adjust the permeability of said core.

4. A covergence device as claimed in claim 2 wherein said mounting panel has a slot to the rear of said permanent magnet and slightly below the plane of said permanent magnet and said spring means is a resilient strip slightly bowed through the central portion and fitting through said slot and over the top to engage said permanent magnet, and the other end of said strip being formed to hold said strip in said slot.

5. A convergence device as claimed in claim 2 wherein a pair of grooves are provided through the outer wall of said tubular member for receiving the ends of a respective core to securely hold said core and winding in place.

References Cited in the file of this patent

UNITED STATES PATENTS

2,500,455	Fisher	Mar. 14, 1950
2,500,623	Babbs	Mar. 14, 1950
2,574,039	Ingle et al.	Nov. 6, 1951
2,718,606	Zuerker	Sept. 20, 1955
2,743,389	Giuffrida	Apr. 24, 1956
2,752,520	Morrell	June 26, 1956
2,766,393	Casey	Oct. 9, 1956
2,791,709	Landes et al.	May 7, 1957

FOREIGN PATENTS

642,719	Great Britain	Sept. 13, 1950