

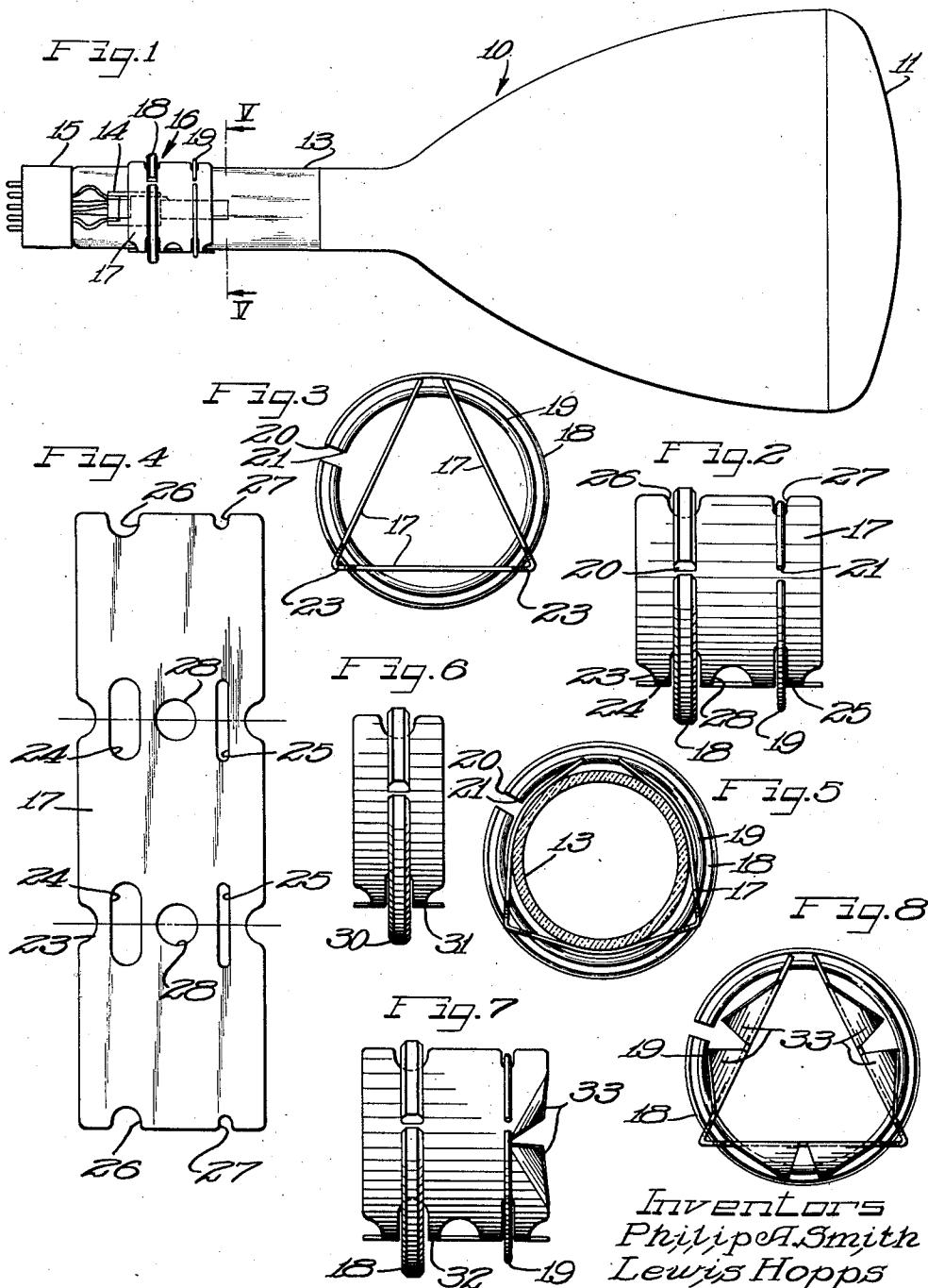
May 22, 1951

P. A. SMITH ET AL

2,553,792

ION TRAP AND CENTERING MAGNET ASSEMBLY

Filed Oct. 1, 1949



Inventors
Philip A. Smith
Lewis Hopps

By *The Firm of Charles H. Miller & Co.* Attys

UNITED STATES PATENT OFFICE

2,553,792

ION TRAP AND CENTERING MAGNET
ASSEMBLY

Philip A. Smith, Pelham Manor, N. Y., and Lewis
Hopps, Darien, Conn., assignors to The Indiana
Steel Products Company, Chicago, Ill., a corpo-
ration of Illinois

Application October 1, 1949, Serial No. 119,133

6 Claims. (Cl. 250—156)

1

This invention relates to a field structure assembly for cathode ray tubes and more particularly to an ion trap magnet assembly for cathode ray tubes of television receiving sets in which the magnets may be adjusted for different field effects.

One difficulty frequently experienced in modern deflection systems for cathode ray tubes of television sets is that they do not inherently eliminate the formation of an ion spot upon the viewing screen. When no provision is made for elimination of the ion spot in a particular television set, the ion spot normally appears very early in the life of the tube as a dark area in the center of the picture. This has a detrimental effect on the life of the tube. Ions exist within the tube by reason of electron collision with residual gases in the tube. These ions are formed into a beam by the focusing forces acting on the tube and tend to be focused in the same manner as the electrons. In a magnetic deflection system, however, the ions are not deflected to the same degree as the electrons but are deflected to a much smaller degree because of their greater mass. As a result, the scanning pattern of the ions covers a very small area near the center of the picture, resulting in an area of decreased fluorescence, which is termed an ion spot.

Ion spots are eliminated almost universally in modern television sets by means of ion traps. These ion traps are devices which develop transverse magnetic fields and cause the electrons, which had been previously deflected at an angle from the axis of the gun, to be brought back to the axis of the gun. Although the field deflects the electron beam, it has substantially no effect on the ion beam, owing to their greater mass. Consequently, the different charges follow separate paths. An obstacle in the form of a metal disc is placed in the path of the ion beam, thereby preventing the ions from reaching the tube screen, while an aperture is provided in the disc to permit the electrons to pass through in their path to the screen. In this way the ions are trapped and do not reach the luminescent screen, and the dark spot which would otherwise show up in the picture is eliminated.

The magnetic field of the ion trap may be provided by means of electro-magnets. Permanent magnets, however, have proven more desirable for the function because of their greater economy, versatility of use, and ease of application. In the present invention such permanent magnets take the form of ring-shaped magnets having their opposite magnetic poles disposed

2

diametrically across from each other. The diameters of these magnets are arranged to be such that they will easily surround the neck of a cathode ray tube with which they are associated.

Ion traps of the prior art were rigidly supported with respect to their mounting means and, as so mounted, the independent magnets of these devices could not be moved with respect to each other in order to effect adjustment of the magnetic field acting on the tube. Furthermore, the assemblies were found to require additional means beside the magnet support means for clamping the assemblies to the necks of cathode ray tubes.

With a view to improving over these devices, it is a principal object of the present invention to simplify the means for mounting or supporting ion trap magnet assemblies on cathode ray tubes and at the same time make the assemblies readily adaptable to greater versatility of use.

It is another object of the present invention to provide a novel ion trap supporting means which is capable of effecting a resilient mounting around the neck of a conventional type cathode ray tube.

Still another object of the present invention is to provide a novel ion trap in which the field structure support serves both as an assembly means and also a tube clamping means, and at the same time permits greater versatility of use by enabling independent movement or adjustment of the individual field sources associated therewith.

A still further object of the present invention is to provide a novel ion trap assembly designed especially to enable easy application to cathode ray tubes.

Another and still further object of the present invention is to provide a novel ion trap assembly having a minimum number of parts of easy construction and assembly and which may be easily applied to cathode ray tubes, resiliently supported thereon and readily adjusted for elimination of ion spots, as well as the centering of scanning areas on the screens thereof.

The novel features which we believe to be characteristic of our invention are set forth with particularity in the appended claims. Our invention, however, as to its organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawing, in which:

3

Figure 1 is a side elevational view of a conventional type cathode ray tube with an ion trap embodying the principles of the present invention;

Figure 2 is a side elevational view of the ion trap assembly of the present invention as it appears when removed from the neck of the cathode ray tube;

Figure 3 is a front elevational view of the ion trap assembly as it appears when removed from the neck of the cathode ray tube;

Figure 4 is a lay-out view of the magnet support member of the foregoing figure as it appears in un-folded relation;

Figure 5 is a cross-sectional view of the neck of the tube and the ion trap assembly shown in Figure 1, as taken on line V—V;

Figure 6 is another embodiment of the present invention in which the ion trap assembly includes only one magnet ring;

Figure 7 is a side elevational view of still another embodiment of the present invention in which the ion trap magnet support element is shaped to permit its easy application to a cathode ray tube; and

Figure 8 is a front elevational view of the ion trap assembly shown in Figure 7.

As shown on the drawings:

Referring to the drawings in further detail, Figure 1 illustrates somewhat diagrammatically a cathode ray tube 10 of a type in general use for television reception purposes, having an enlarged bulbular fan-shaped portion on which a viewing screen 11 is provided, while the remainder of the tube comprises a relatively long narrow neck portion 13 enclosing an electron gun 14. Electrical connection of the tube with other apparatus is made by means of a plug 15 at the end of the tube neck which has the same diameter as the neck 13. An ion trap assembly 16 of the type embodying the principles of the present invention is shown in its mounted relation on the neck 13 of the tube 10 by means of a resilient triangular magnet support and holding member 17. A pair of ring type magnets 18 and 19 are held thereon in rigidly spaced concentric relation about the tube neck.

Details of construction of the ion trap assembly 16 may be more readily seen in Figures 2, 3 and 4 from which it will be apparent that the permanent ring magnets 18 and 19 have the same inside diameter, which is slightly larger than the outside diameter of the neck 13 of the tube 10. The permanent magnet 18 is made slightly larger in cross-sectional area than the permanent magnet 19, thereby making it possible for the magnet 18 to provide the greatest portion of the effective field of the ion trap assembly. Each of the magnets 18 and 19 is made of suitable magnet material, such as "Cunife," which is a copper, nickel, iron composition covered by the Dahl et al. Patent No. 2,196,824, and is formed into the shape of a ring with confronting ends defining gaps 20 and 21 respectively. Each of the rings is then permanently magnetized across its diameter with unlike poles at opposite sides of the ring.

In mounting the magnets 18 and 19 on the neck of the tube with which they are associated, it is normally desired that they be held a set distance apart from each other. It is also desirable that they be movable along the length of the tube neck while still maintaining their fixed spaced relation with respect to each other. To accomplish these purposes the ring magnets 18 and

4

19 are supported by the holding member 17 of equilateral triangular shape. The holding member 17 is formed from a strip of non-magnetic material of spring characteristic, such as brass, which is substantially divided into three parts along its length. The length of the strip is such that the equal-sided triangle into which it is shaped has an altitude substantially equal to the circular neck portion on which it is to be resiliently mounted. At one-third the distance from each end of the strip a series of apertures are provided therein across its width so that the holder may more readily be formed into its triangular shape along lines passing through the center of these apertures and also to provide means for holding the magnets of the assembly as subsequently explained. Semi-circular notches 23 are also provided on the lateral edges of the strip in alignment with the apertures in order to further facilitate bending the strip into the desired triangular shape.

The aligned apertures include slots 24 which have the center of their lengths spaced a distance apart substantially equal to one-third the length of the strip 17. Each of these apertures or slots 24 is slightly wider than the thickness of the ring magnet 18. Similarly, a pair of slots 25 of a width slightly greater than the thickness of the ring magnet 19 are aligned and spaced an equal distance apart. A pair of semi-circular notches 26 are also provided in the ends of the strip 17 in alignment with the slots 24 and equal in width to such slots. A pair of similar but smaller notches 27 equal in width to the slots 25 are also provided in the ends of the strip 17 in alignment with the slots 25. Thus, it can be readily seen that when the strip 17 is bent into its triangular shape as a holder, the slots 24 and 25 form notches in the bends of the triangular holder for supporting the magnets 18 and 19, respectively. Since the strip 17 is of resilient material, the ends thereof may be made to spring outwardly against the inner surface of the magnet so that the notches 26 and 27 in the ends of the strip will engage the magnet in supporting relation. The remaining apertures in the strip 17 comprise a pair of circular apertures 28 in alignment between the slots 24 and 25 and having the sole purpose of making it easier to bend the strip 17 into the triangular shape.

In order to mount the magnets 18 and 19 on the holder 17, the strip 17 is first folded over into thirds by bending one side over flat and then the other. The strip is then placed within the rings 18 and 19 so that the notches formed by the slots 24 and 25 each engages the inner edges of the magnets 18 and 19. The top folded portion of the holder is then released and then the remaining folded portion is released so that each of the magnets is engaged in supporting relation by the ends of the holder as well as the notches 26 and 25. It will be noted that six points of support are provided for each of the magnets by such an arrangement, since the ends of the slots 24 and 25 each provides a point contact while each of the two pairs of notches 26 and 27 provides two points of contact.

By reason of the fact that the holder 17 is of resilient material, its sides may be bent outwardly to enable it to be resiliently clamped about the glass neck 13 of the tube 10 as shown in Figure 5. Even though the holder is thus deformed into a configuration having bowed sides, the supporting relation provided by the point contacts which each of the magnets 18 and 19 is not affected.

Thus, the magnets are resiliently mounted on the neck of the tube which relation permits the entire magnet assembly to be easily slid along the neck of the tube to the position where it will provide the most desirable results. In addition, the resilient supporting relation provided for the magnets 18 and 19 permits each to be rotated independently within its plane of support. It will be noted that the entire assembly is of symmetrical construction, which is highly advantageous because of its equal distribution of weight and forces around the tube neck. Thus, no tendency exists for either the magnets or the entire assembly to rotate of their own accord because of improper force distribution.

Figure 6 shows a second embodiment of the present invention in which but a single permanent magnet 30 is provided in the ion trap assembly. This assembly has a holder 31 of substantially half the width of the holder 17 in the double-ring assembly and may actually be made by dividing the strip 17 medially along its length. Thus, it is apparent that the manner of formation and the assembly and operation of this embodiment is substantially the same as that of the embodiment of the foregoing figures but has the added advantage of permitting independent longitudinal positioning of each magnet associated therewith, that is, aside from any other structure that may be associated with the magnet or assembled on the neck 13 of the tube 10. Thus, a series of magnets embodied in assemblies of this type may be placed on the tube neck 13 immediately adjacent each other or spaced different distances apart along the neck of the tube. Each magnet would thus be independently rotatable as well as independently positionable along the length of the tube neck.

Figures 7 and 8 illustrate still another embodiment of the present invention which is somewhat similar to that shown in Figures 2, 3 and 4, and accordingly similar numerals are used to identify similar parts. In this embodiment the leading edges of the sides of a holder 32 are each provided with a slit across the width of the holder for a distance usually no greater than the distance between the edge of the holder 32 and the plane in which the magnet 19 is disposed. The corners thus formed by the slit in each of the leading edges of the holder 32 are bent diagonally outward to form a pair of flared-out flanges 33 in the leading edge of each side of the triangular holder 32. Each of these flanges 33 extends in a different direction—that is, each extends in a direction diagonally away from the immediately adjacent flange. Thus, when the entire assembly is being applied to a tube neck, each pair of flanges 33 becomes associated with the bottom of the cathode ray tube socket to bend their respective sides to a bow-shaped configuration as the assembly is pushed onto the neck. This permits the assembly to be mounted without requiring tools or without requiring any cumbersome manipulation in order to slip it into place.

It will be readily recognized by those familiar with the art that in this invention magnets of different sizes may be mounted on a resilient support of the type herein described and that the assembly is not necessarily limited only to use with ion traps but that the assembly may be used to mount ring-type permanent magnets on the necks of cathode ray tubes for any purpose desired. Thus, permanent ring magnets may be mounted by means of our invention on tube necks for the purpose of effecting centering of scanned

areas on the screens of such tubes. Since the magnets may be independently rotated with respect to each other, the resultant strength direction of the field effecting the beam of the electrons passing from the electron gun to the screen may be easily adjusted to provide the desired effects.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

1. A permanent magnet assembly for cathode ray tubes comprising a pair of ring-shaped magnets, a resilient non-magnetic band support for said magnets, said support being of a self-sustained triangular shape with notches at the corners thereof within which said rings are disposed for functional support, the notches for each of said rings being aligned on the adjacent corners of said support to hold said rings in parallel spaced relation.

2. A permanent magnet assembly to be mounted on the neck portion of a cathode ray tube comprising a pair of ring-shaped magnets, and an elongated strip of resilient, non-magnetic, flat material transversely bent into a triangularly shaped support for said magnets, spaced slots in said strip forming notches at the corners of said triangular-shaped support for accommodation of the inner periphery of said rings, the free ends of said strip being arranged to spring outwardly against the inner surfaces of said rings to urge said notched portions into engaging relation with said magnets, thereby to support said rings within said notches.

3. A permanent magnet assembly capable of being mounted on an object of circular cross section, said assembly comprising an equi-sided triangular support member made of flat resilient non-magnetic material, and a pair of ring-shaped magnets supported for rotational adjustment at the corners of said support in parallel spaced relation, the altitude of said support member being substantially equal in dimension to the diameter of the object on which it is to be mounted.

4. A permanent magnet assembly arranged to be mounted on an object of circular cross section having at least one free end over which said assembly may be slipped to effect such mounting, said assembly comprising a substantially equi-sided triangular support member made of flat resilient non-magnetic material, a pair of ring-shaped magnets supported for rotational adjustment in parallel spaced relation by the corners of said support member, said triangular support member being of such size that the altitude thereof is substantially equal to the diameter of the object on which it is to be mounted, said triangular support having outwardly flared flange portions along one lateral edge to facilitate slipping said assembly over the end of the section of the object on which it is to be mounted.

5. A ring support assembly comprising at least one circular ring member and a resilient support member therefor, said support member comprising a flat strip bent into a triangular shape for insertion within the ring members of said assembly, said strip having apertures along the length thereof aligned on two lines across the width thereof on which said strip member is bent into its triangular shape, said apertures forming notches in the corners of said support mem-

ber to engage the inner peripheries of said rings, the free ends of said strips being provided with notches at the edges thereof to engage the inner peripheries of said rings, the free ends of said resilient support member being arranged to spring outwardly to cause engagement of said corner and end notches with said rings.

6. A permanent magnet assembly comprising a relatively thin, flexible, non-magnetic metallic strip bent into a triangularly shaped support, said strip having spaced slots at the vertices of the triangular support, and a ring-shaped magnet held within said slots in fixed axial position with respect to said support.

PHILIP A. SMITH.
LEWIS HOPPS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,102,421	Kuehni -----	Dec. 14, 1937
2,211,613	Bowie -----	Aug. 13, 1940
2,456,474	Wainwright -----	Dec. 14, 1948
2,460,609	Torsch -----	Feb. 1, 1949
2,496,127	Kelar -----	Jan. 31, 1950
2,498,354	Bocciarelli -----	Feb. 21, 1950
2,499,065	Heppner -----	Feb. 28, 1950
2,500,455	Fisher -----	Mar. 14, 1950
2,513,929	Gethmann -----	July 4, 1950