May 30, 1967 J. P. FIORE 3,322,990

CONVERGENCE SUBASSEMBLY WITH INDEXING PROVISIONS IN CYLINDRICAL SUPPORT FOR ELECTRON GUNS

Original Filed June 22, 1964

FIG. 5

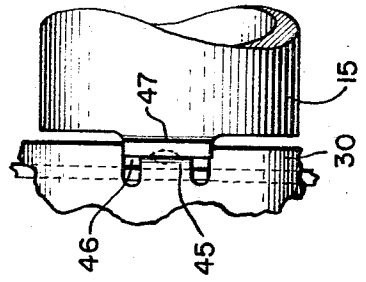


FIG. 2

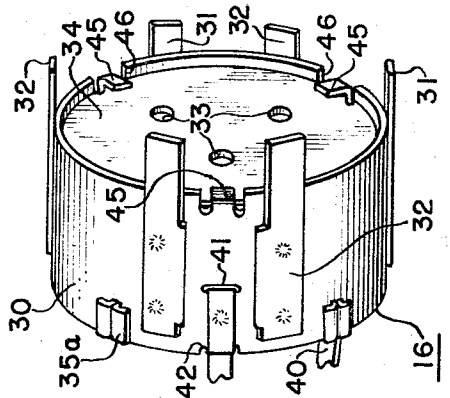


FIG. 1

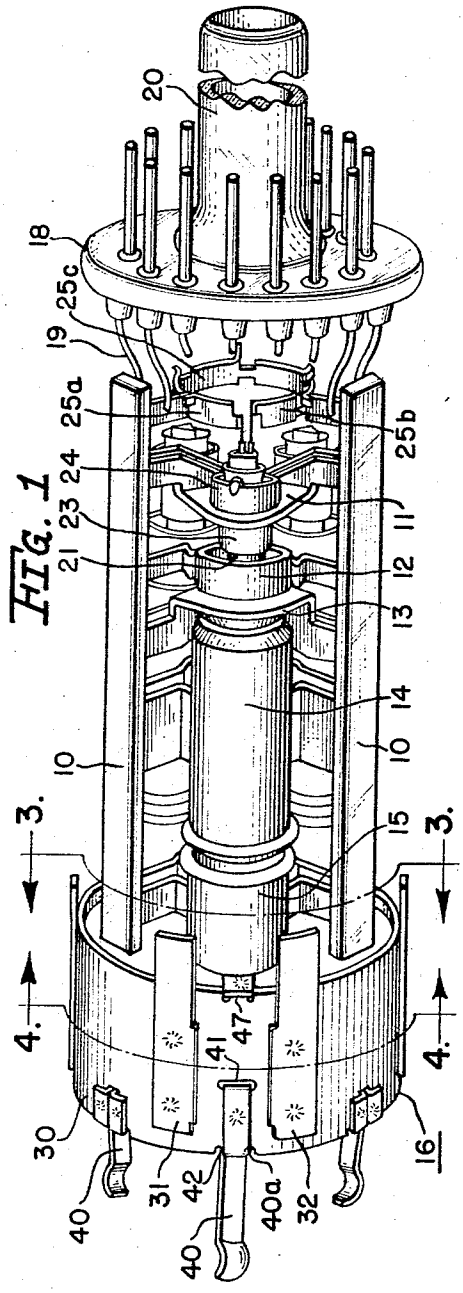


FIG. 4

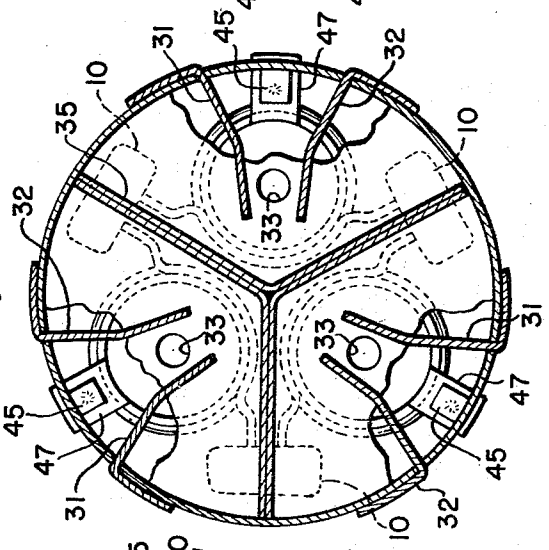
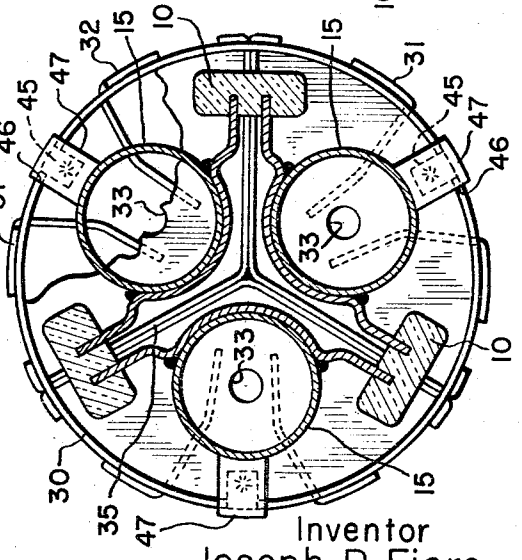


FIG. 3



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CONVERGENCE SUBASSEMBLY WITH INDEXING PROVISIONS IN CYLINDRICAL SUPPORT FOR ELECTRON GUNS

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Original application June 22, 1964, Ser. No. 376,829. Divided and this application Oct. 17, 1966, Ser. No. 587,108

6 Claims. (Cl. 313—70)

This application is a division of application Ser. No. 376,829, filed June 22, 1964, now abandoned.

The present invention is directed to the gun-mount assembly of a multi-beam cathode-ray tube and, while of general application, it is especially suited for inclusion in a tri-color tube of the shadow-mask variety and will be described in that environment.

In its present commercial form, the tri-color shadow-mask tube features a delta array of three electron guns which develop three electron beams for selectively energizing a phosphor screen composed of interlaced patterns of phosphor elements which, when excited, emit light of the three primary colors. It is well understood that the three beams must be properly converged upon the screen at all points in the scanning raster to attain optimum color reproduction. Since the degree of misconvergence tends to vary as a functon of deflection angle, it is common practice to employ dynamic convergence to maintain the beams converged independently of scanning angle.

Dynamic convergence is usually accomplished electromagnetically and to that end it has been proposed that the gun-mount assembly of the picture tube terminate in a convergence subassembly which houses the internal pole pieces required for converging the beams. While this approach has performed satisfactorily from the electrical standpoint, it has heretofore presented difficult problems of fabrication, requiring costly and intricate jigs and fixtures for integrating the convergence subassembly with the remainder of the gun-mount in proper longitudinal and angular position.

Accordingly, it is an object of the present invention to provide an improved gun-mount assembly for a multi-beam cathode-ray tube which avoids or minimizes such difficulties of production.

It is a specific object of the invention to provide a convergence subassembly for the gun-mount arrangement of a multi-beam cathode-ray tube that may be assembled into the gun-mount without requiring extensive jigs and fixtures for assuring the proper axial and angular orientation of the convergence subassembly relative to the remainder of the mount.

A gun-mount assembly for a multi-beam cathode-ray tube embodying the present invention comprises a plurality of electron guns disposed in a predetermined array, individually having a cathode and a plurality of electrodes, for developing a plurality of electron beams that are directed generally along the axis of the tube. A convergence subassembly is disposed across the paths of the beams in juxtaposition to the final electrodes of the electron guns. This subassembly includes a cylindrical support member of non-magnetic material for positioning beam convergence elements for the electron beams and having indexing provisions located about the periphery of the cylindrical support in an array corresponding to that of the electron guns. Indexing provisions are also made on the final electrodes of the electron guns for engagement with the indexing provisions of the support member to orient the convergence subassembly relative to the electron guns.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, 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 the several figures of which like reference numerals identify like elements, and in which:

FIGURE 1 is a perspective view of an electron gun-mount assembly for a color television picture tube embodying the present invention;

FIGURE 2 is a perspective view of the convergence subassembly;

FIGURES 3 and 4 are sectional views taken along section lines **3—3** and **4—4**, respectively, of FIGURE 1; and

FIGURE 5 is a detail illustrating certain indexing provisions of the gun-mount assembly.

The gun-mount assembly of FIGURE 1 is particularly useful in a tri-color television picture tube of the shadow-mask type. The assembly comprises three electron guns arranged in a triangle or delta array although only one gun is clearly visible in the figure. The guns are maintained in their desired array by means including three longitudinally extending insulating support members or pillars **10**, two of which appear in FIGURE 1. Structurally, the electron guns are identical and each includes a thermionic cathode assembly **11**, a first control grid **12**, a screen grid or first anode **13** and a pair of focusing electrodes **14** and **15**. Beyond electrode **15** is a convergence subassembly **16** which is to be described in detail hereafter. The various electrodes of each gun are provided with transversely extending tabs which are received by pillars **10** in order to integrate the various components into the gun structure. The triple gun-mount is supported on a glass press **18** which is provided with a plurality of lead-in conductors **19** for the various electrodes as well as an exhaust tubulation **20**. As thus far described, the individual gun electrodes, the support arrangement and the press may all be of conventional construction although particularly advantageous cathode and heater arrangements are described and claimed in copending applications assigned to the same assignee as the present invention. The cathode assembly is the subject of application Ser. No. 376,799, filed June 22, 1964, now issued as Patent No. 3,265,920, on Aug. 9, 1966, in the name of Joseph P. Fiore, while the heater is the subject of application Ser. No. 376,828, filed June 22, 1964, in the name of Charles A. Lowery and Mark J. Videka, and a divisional application thereof, Ser. No. 558,977, filed June 20, 1966.

The preferred cathode assembly **11** of each of the electron guns includes a cathode cylinder **21** which bears an electron emissive coating at one end. The cathode cylinder is disposed in nested concentric relation with a radiation-shield cylinder **23** and this subassembly is connected with a support **24** which in turn connects with pillars **10**. As described in the copending Fiore application, limited-area contacts are made between cathode cylinder **21** and shield cylinder **23** on the one hand and between shield cylinder **23** and support **24** on the other in order that thermally conductive paths extending from the cathode cylinder to the support shall be of the high impedance type to preserve heater efficiency.

The heater arrangement is one in which three conductive arcuate segments **25***a*, **25***b* and **25***c* connect the heater elements of the three guns in a simple series circuit. This is accomplished by connecting one end of each such segment to a heater lead of one of the guns and connecting the opposite end of the same segment to a heater lead to the next gun in the array. The segments **25** also have tabs

or flanges received by pillars **10** to mechanically support the heater structure.

More particular consideration will now be given to the convergence subassembly and the manner in which it is integrated into the gun-mount accurately positioned both axially and angularly with respect to the mount and its electron guns. The convergence subassembly is constructed with particular regard to the array of the electron guns which, for the tube illustrated in the drawing, is the triangular or delta configuration in which the guns develop three electron beams and direct them generally along the central axis of the tube. The convergence subassembly is disposed across the paths of the electron beams in juxtaposition to the final electrodes **15** of the guns. This subassembly includes a cylindrical support member **30** of non-magnetic material which serves to support similar beam-convergence elements for the several electron beams and to position these elements properly with respect to the several beam paths when the subassembly has connected into the gun-mount. As shown in FIGURE 4, the beam convergence elements of this subassembly are pairs of internal pole pieces **31, 32.** The expression "internal" is here used in the sense that these elements are included within the tube structure. The pole pieces are formed of magnetic sheet or strip material and cylinder **30** has pairs of longitudinally extending slots through which the pole pieces extend as shown in FIGURE 4. The terminal portion of each pole piece which is external of cylinder **30** is folded thereover and welded in place as indicated by the legend in FIGURE 2. The slots which receive the pole pieces are so located that the pole pieces are symmetrically disposed on opposite sides of the path of the beam each such pair is to control. These paths are represented by the circles **33** of FIGURE 4. Actually, cylinder **30** terminates in an end cap **34** in which apertures **33** are provided to admit the beams issued by the electron guns. The convergence-field-defining portions of the pole pieces extend radially of the cylindrical axis of the convergence subassembly.

The external diameter of cylinder **30** is as close as practicable to the internal diameter of the neck of the tube into which the gun-mount is to be secured. It is preferred that the terminal portions of pole structures **31** and **32** which are folded over the external periphery of cylinder **30** have a distinctly longer axial dimension than the radially directed portions thereof as indicated in FIGURE 2. The reason for extending these terminal portions of the pole pieces is one of sensitivity of the convergence system. It is customary to position electromagnets around the external periphery of the tube and to have their fields penetrate the walls of the envelope to enter the internal magnetic structure. The use of elongated terminal sections for the internal structure permits more latitude and tolerance in the positioning of the convergence magnets and increases sensitivity.

It has been found desirable to isolate the convergence field of one beam from those of the other beams in the tube and this is accomplished by inserting a Y-shaped magnetic shield **35** into cylinder **30.** The end portion of cylinder **30** which faces away from the electron guns is notched or slotted and the terminations of shield **35** are provided with extensions **35***a* to be received in these slots and folded over cylinder **30** in much the same manner that the terminal portions of the pole pieces fold over their support. Spot welding suffices to mechanically lock the pole piece structures and the shield to support member **30.**

Snubber-springs **40** may also be accommodated by cylinder **30** of the convergence subassembly. For this purpose, spring receiving slots **41** are cut into the cylinder and an orienting notch **42** is cut from the end of the cylinder in alignment with each such slot as indicated in FIGURE 2. The snubbers are made of leaf spring stock with an offset **40***a* to serve as an index. The snubbers are positioned by inserting a free end into slot **41** of cylinder **30** and engaging its offset portion **40***a* with the aligned locating notch **42.** A simple weld retains the snubber in correct position in the subassembly.

The convergence subassembly, including the pairs of pole pieces **31, 32,** shield **35** and snubbers **40,** is conveniently put together as a structural unit to be added to the gun-mount. The arrangement under consideration facilitates adding this subassembly to the gun-mount through a very simple process requiring no complicated jigs or fixtures. This attribute of the arrangement is contributed, in part, by indexing provisions located about the periphery of support **30** in an array corresponding to that of the electron guns of the mount. As shown, a pluraility of tabs **45** are struck out of the edge of cylinder **30** which is to face the cathode end of the mount. In striking these tabs from the cylinder, a notch **46** is formed which may serve as an index properly to position the subassembly about the axis of the gunmount. Tabs **45** extend transversely of the cylindrical axis of support **30** and are employed in positioning the subassembly axially of the mount.

Indexing provisions on the final electrodes **15** of the several guns engage the indexing provisions of the convergence subassembly to establish the axial and angular orientation that is required. More particularly, each electrode **15** bears at its end facing away from the cathode a tab **47.** These three tabs, one from each of electrodes **15,** define the plane in which end cap **34** of the convergence subassembly is to rest. These same tabs **47** by reception within indexing notches **46** establish a desired angular orientation of the subassembly. Accordingly, the convergence structure may be readily connected into the gun-mount by bringing tabs **45** into engagement with tabs **47,** with the latter necessarily resting within notches **46** as shown in FIGURE 5. Spot welding locks the convergence subassembly in place. At the same time, each set of pole pieces **31, 32** shall have been properly positioned relative to the path of the beam it is to operate upon and snubbers **40** are located properly to contact the inner wall of the tube housing the gun-mount assembly.

While a particular embodiment of the invention has been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. A gun-mount assembly for a multi-beam cathode-ray tube comprising:

a plurality of electron guns disposed in a predetermined array, individually having a cathode and a plurality of electrodes, for developing a plurality of electron beams directed generally along the axis of the tube;

a convergence subassembly disposed across the paths of said beams in juxtaposition to the final electrodes of said electron guns, said subassembly including a cylindrical support member of non-magnetic material for positioning beam-convergence elements for said electron beams and having indexing provisions located about the periphery of said support in an array corresponding to that of said electron guns;

and indexing provisions on said electron guns for engagement with said indexing provisions of said support member to orient said convergence subassembly relative to said electron guns.

2. A gun-mount assembly in accordance with claim **1** in which said indexing provisions of said cylindrical support are tabs struck out of the periphery of said support to define notches and in which said indexing provisions of said electron guns are received in said notches.

3. A gun-mount assembly in accordance with claim 2 in which said index provisions of said electron guns are tabs extending from the final electrodes of said guns for reception within said index notches.

4. A gun-mount assembly in accordance with claim 3 in which said tabs of said electron guns are mechanically secured to said tabs of said support.

5. A convergence subassembly for the gun-mount assembly of a multi-beam cathode-ray tube having a plurality of electron guns disposed in a predetermined array, said subassembly comprising:

a cylindrical support member of non-magnetic material;

and a plurality of tabs struck out of said support at one end to provide indexing provisions located about the periphery of said support in an array corresponding to that of said electron guns, said tabs extending transversely of the cylindrical axis of said

support for mounting to said electron guns and a corresponding plurality of snubber-spring receiving slots and snubber-spring orienting notches provided at the opposite end of said support in longitudinal alignment with one another; and further in which a plurality of snubber-springs are individually received within an assigned one of said slots and its aligned notch.

6. A convergence subassembly in accordance with claim 5 in which said snubber springs have an offset section and in which said springs are assembled to said support with its offset section received within an assigned one of said orienting notches.

No references cited.

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