June 18, 1968 A. H. ANDREWS 3,389,284

ELECTRON GUN STRUCTURE HAVING SUPPORTING TABS THEREFOR

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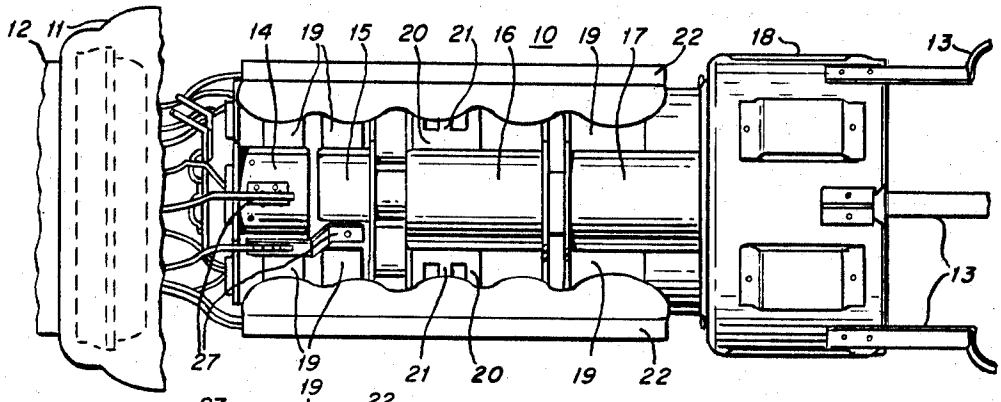


Fig. 1.

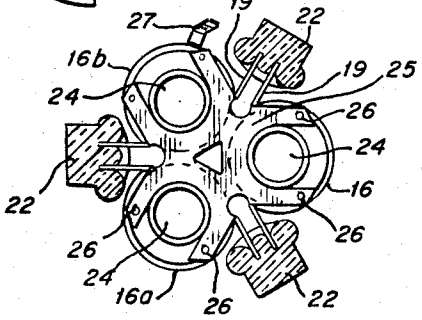


Fig. 2.
PRIOR ART

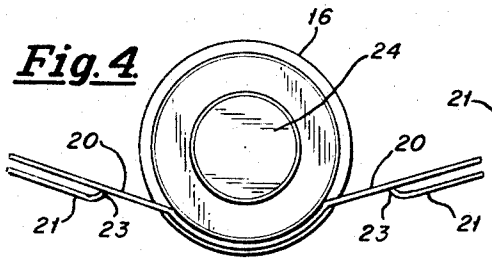


Fig. 4.

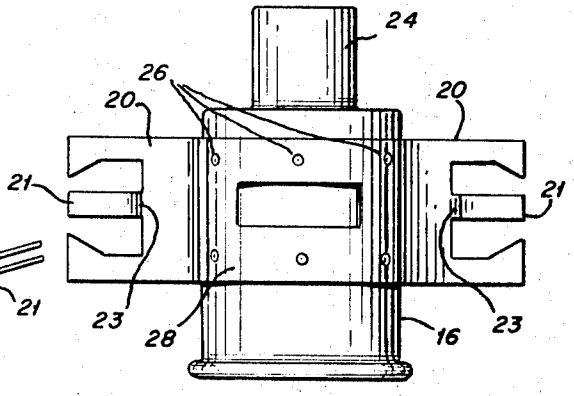


Fig. 3.

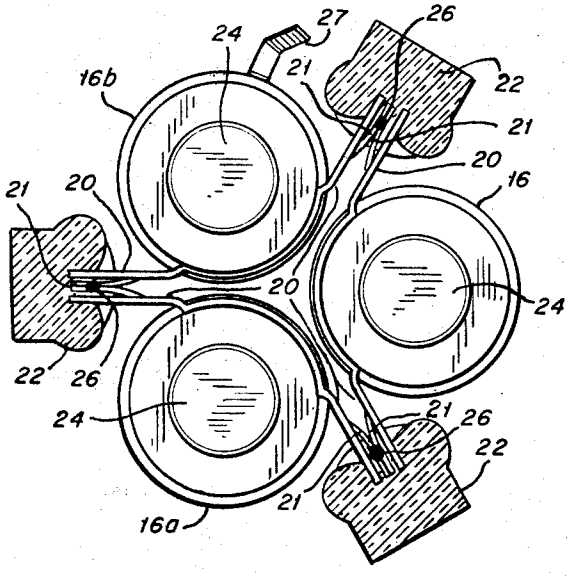


Fig. 5.

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ELECTRON GUN STRUCTURE HAVING SUPPORTING TABS THEREFOR

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This invention relates to electron beam forming structures, hereinafter referred to as electron guns, for three gun cathode ray color tubes.

In general, the criteria for manufacturing electron guns for cathode ray tubes are substantially the same regardless of whether the gun is to be used for monochrome or color. The major difference is that in the commercially popular three gun color tube, the individual guns must be accurately positioned with respect to each other along converging axes. Also the positioning of the gun structure within the tube neck is more critical.

In both types of guns, the individual gun elements (grids) are mounted in proper axial and radial alignment with respect to each other by means of mounting tabs embedded in a rigid nonconductive material, such as elongated glass or ceramic beads. In practice, fixtures are provided for holding the grids in proper spatial relationship while seating the mounting tabs of the individual grids into the heat-softened glass beads.

A conventional type plastic or phenolic tube base is used in conjunction with a socket for connecting the picture tube gun elements to appropriate external circuitry.

The internal gun elements are connected to corresponding pins in the base by welded internal connecting straps. Each grid element of grids 1 and 2 has a separate connection to a respective pin in the tube base. The focus control electrodes or grids, commonly called the G–3 electrodes, operate at the same potential as do the G–4 electrodes which are connected to the convergence assembly. Consequently, an internal interconnection system is used for the G–3 electrodes. The present invention is directed to the supports for these elements which include means providing for their interconnection in a simple, economical manner.

As is well known, the various grid elements are rigid cup shaped cylinders with different diameter holes depending upon their particular function. A mounting strap partially encircles the grid element (and is spot welded thereto) and terminates in a pair of mounting tabs. While the grid and mounting structure are relatively rigid, they may be distorted by undue pressure. Especially when the units are being maintained in proper alignment preparatory to "beading," must they be protected from abnormal forces. In conventional gun manufacturing systems, a beading capsule is employed which includes means for maintaining the gun parts in proper juxtaposed relationship with their mounting tabs aligned, and means for moving the heat-softened glass beads into simultaneous engagement with the adjacent mounting tabs of respective guns, forming a rigid trigun assembly upon cooling. Quite obviously, the heated glass beads must be firm enough to be capable of retaining their shape, and consequently, substantial force is required to imbed the mounting tabs therein. For this reason, the mounting tabs must present a minimum of resistance to insertion in the glass beads which will obviate undue stress in the gun parts themselves.

A primary object of this invention is to provide an improved electron gun structure for a trigun color television picture tube.

A further object of this invention is to provide such an electron gun which is simpler and more economical to manufacture.

Other objects and advantages will become apparent upon reading the specification in conjunction with the drawing in which:

FIG. 1 is a general showing of an electron gun structure of a trigun cathode ray tube;

FIG. 2 is an end view of the G–3 control elements and mounting structures utilized in prior art gun structures;

FIG. 3 is an enlarged elevation view of a single G–3 electrode and mounting strap constructed in accordance with the teachings of the invention;

FIG. 4 is a plan view of the electrode of FIG. 3; and

FIG. 5 is an end view of the G–3 elements of FIGS. 4 and 5 assembled in accordance with the teachings of the invention.

In FIG. 1 an electron gun structure **10** is shown mounted to the base **11** of a partially shown picture tube neck. The internal connections to the separate gun elements are brought out through appropriate connecting pins (not shown) in a base **12** affixed to neck **11**. These connections are generally made by strap connectors **27** communicating between the pins and the gun electrodes.

In general, the parts of each electron gun comprise cup shaped electrodes having apertures of differing sizes therethrough. The electrodes are coaxially arranged and together with a heater and cathode structure (partially shown) and various conventional external voltage sources (not shown) coact to produce a stream of electrons moving at high velocity. Such details of gun design and operation are well known and will not be gone into here.

The gun structure **10** includes three similar electron guns radially spaced about the axis of the picture tube neck. The foremost electron gun in FIG. 1 includes a control grid **14**, an accelerating grid **15**, a focus grid **16** (G–3) and another accelerating grid **17**. The cathode and heater structures (partially shown) are nested in control grid **14**. Accelerating grid **17** is part of a large diameter convergence assembly **18** (common to all three guns) which is connected by a plurality of spring snubbers **13** to the inside conductive coating of the picture tube (not shown). Snubbers **13** also serve to center and support gun structure **10** within the tube neck. Those familiar with the picture tube art realize that the inner conductive coating is in communication with the second "anode button" and therefore is at a very high potential with respect to the other elements in the tube or circuit.

Each of the grids **14**, **15** and **17** has a pair of mounting tabs **19** protruding therefrom at a tangential included angle of approximately 120°. The G–3 grid (**16**) has a similar pair of mounting tabs **20**, which also include tines **21**, protruding therefrom. As mentioned above, the gun structure **10** includes three electron guns having groups of elements similar to those just described. These three guns are symmetrically arranged about the axis of the tube neck along longitudinal axes which converge at the picture tube aperture mask (not shown).

FIG. 2 represents a prior art construction of the G–3 control grid in a trigun structure. In particular, a Y-shaped metallic support piece **25** engages each G–3 grid element **16** and is further tack welded thereto at points **26**. The reference character **16** is used to indicate the prior art grid element since it is the same as that used in the invention. The difference resides in the mounting strap and tabs. It will be seen that support element **25** provides an electrical connection between the individual grids **16** since it is spot welded to each of them. A single connecting strap **27** may be used to connect the elements to a base pin. This figure also shows how the mounting tabs **19** are imbedded in the glass beads **22** for maintaining the elements in position.

In FIGS. 3 and 4 there is shown a modified form of the G–3 element and supporting strap. The G–3 grid element is unchanged from prior art G–3 grid elements. The

mounting strap 28 is different, however. It will be seen that mounting tabs 20 have tines 21 formed therein. The mounting tab is affixed to the cup-shaped G–3 element by spot welding as shown at points 26 as in prior art structures. While in the prior art the spot welding was done to assure a secure mechanical connection, in the invention the fact that a good electrical connection is also assured is utilized to advantage.

As shown in the figures, tines 21 are centrally disposed in tabs 20 and cantilevered from the base at an area 23. In the preferred form of the invention areas 23 are preferably "weakened." In the fabrication process, tines 21 are also preferably parallelly predeflected out of the planes of mounting tabs 20 in a direction such that during assembly of the three G–3 grid elements, respective adjacent tines 21 of the different grids are in near touching contact with each other. The weakened areas 23 serve a very useful purpose in this structure. In practice, these weakened areas may be formed by an indenting die which effectively reduces the cross-sectional area of the tine at 23, thus making it more susceptible to further deflection at this point.

In assembling a gun structure utilizing the G–3 grids with the mounting tabs shown, the same procedure is utilized. However, when the fixture is loaded, that is when all of the individual parts are in alignment and ready for the glass beading process, the adjacent tines 21 of the G–3 elements 16 are nearly in contact. A spot welding operation is then performed whereby these adjacent tines 21 are joined together to make good electrical contact between the G–3 grid elements. It should be noted that during this welding operation it is necessary to further deflect adjacent pairs of tines 21 into engagement. This is accomplished without noticeable stress being transmitted to mounting tabs 20 (and consequently to the G–3 grid elements 16) because the additional deflection occurs at the weakened areas 23. Thereafter the heat-softened glass beads 22 are forced into mechanical engagement with tabs 20 and tines 21 and, upon cooling, produce a rigid structure in which the G–3 grid elements are electrically connected together. A single lead 27 is now spot welded to one of the G–3 elements to provide for external connection to a base pin.

With the invention, it is thus seen that not only is a part eliminated from a conventional trigun structure (also saving an assembly step), but a number of tack welding operations are eliminated. The resultant structure has proved to be equally rigid, simpler to assemble and, of course, more economical.

What has been described is a novel G–3 grid mounting structure which lends itself readily to incorporation in conventional trigun structures for color picture tubes. It is recognized that modifications and departures from the described embodiments of the invention will be apparent to those skilled in the art, and, therefore, the scope of the invention is to be limited only as defined in the claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An electron gun structure comprising three similar groups of coaxial substantially cup-shaped elements symmetrically spaced from each other on longitudinally converging axes for forming three distinct converging electron beams; support means including a pair of support tabs for each said element; the support tabs for each group being formed to lie adjacent corresponding support tabs of the other groups; said support means also including three elongate glass beads adapted, when heated, for deformably engaging said support tabs and rigidly supporting said tabs when cooled; the support tabs of at least one corresponding element of each group having tines, corresponding ones of which are offset from the planes of their respective tabs in substantially touching contact with corresponding adjacent offset tines of said other elements to facilitate electrical connection thereof.

2. The electron gun of claim 1 wherein said corresponding tabs are disposed in substantially parallel planes to facilitate entry into said glass beads and wherein said corresponding tines are constructed to allow slight distortion thereof without imparting substantial stress to their respective tabs.

3. The electron gun of claim 2 further including a weakened area where said corresponding tines are joined to the body of said tabs to allow slight distortion thereof without stressing the tabs.

4. The electron gun of claim 1 including additionally: fixture means maintaining said elements in alignment with adjacent support tabs lying in substantially parallel planes; said tines being of slender construction and cantilevered from their respective tabs; means spot welding the adjacent tines of corresponding groups; and means moving said glass beads into deformable engagement with said support tabs and said tines in a direction substantially perpendicular to said planes whereby said welded tines and said support tabs are embedded in said glass beads with a minimum of stress being transmitted to said elements.

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