June 4, 1968 J. L. KRANER ETAL 3,387,166

HEATER SUPPORT FOR PLURAL GUN CATHODE-RAY TUBE

Filed May 18, 1967

FIG. 1

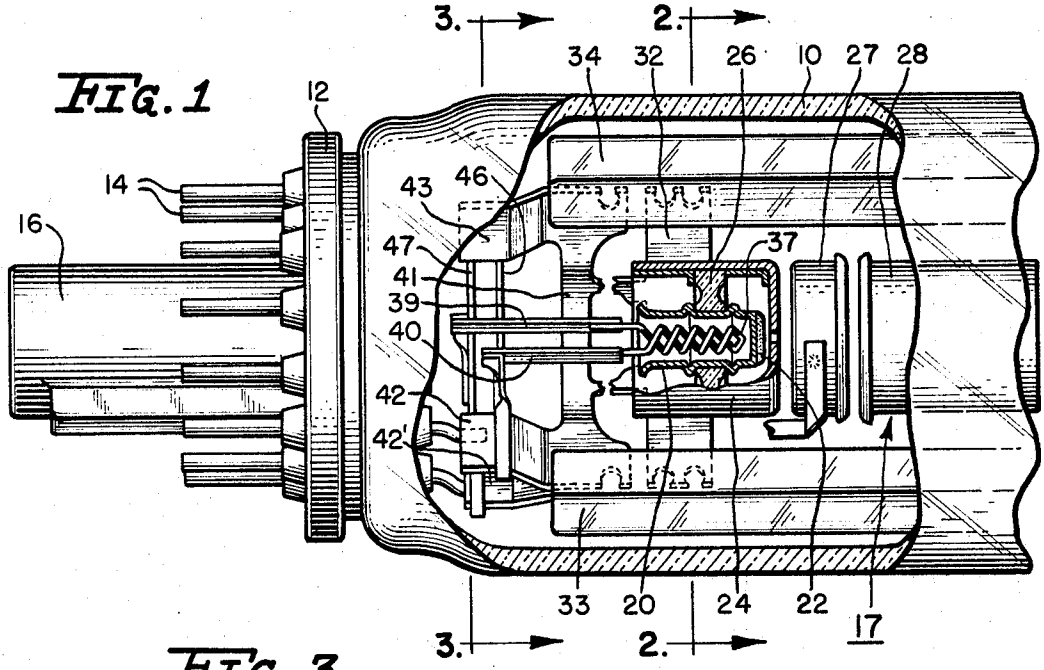


FIG. 3

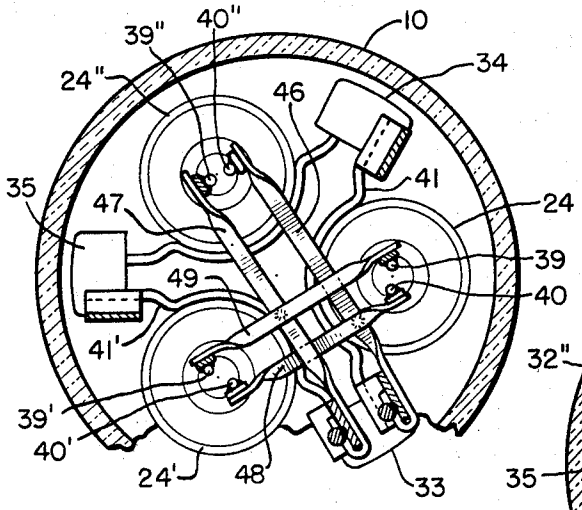
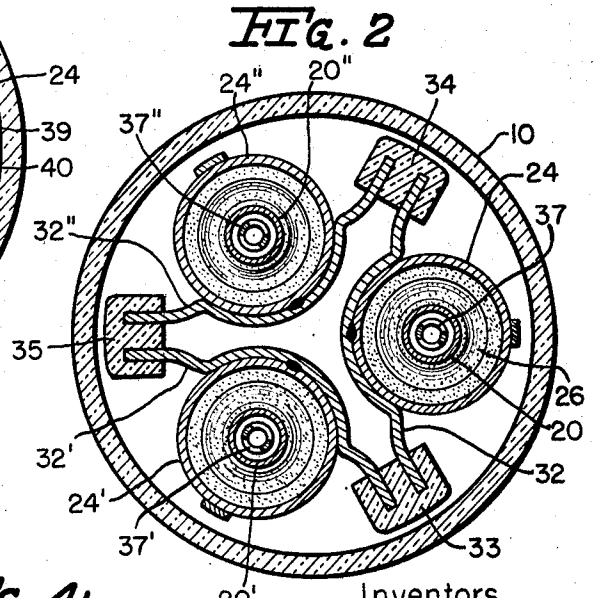


FIG. 2



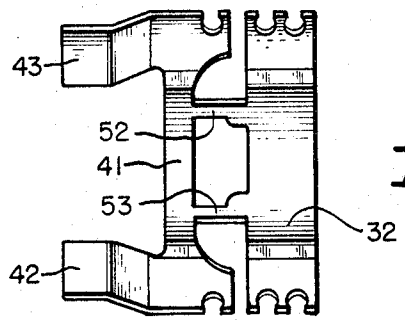


FIG. 4

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HEATER SUPPORT FOR PLURAL GUN CATHODE-RAY TUBE

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3 Claims. (Cl. 313—272)

ABSTRACT OF THE DISCLOSURE

A tri-color gun mount for a color television picture tube includes three rigid metal support straps each supported by and extending between two of the three parallel ceramic support rods, and two of the support straps are each provided with a depending integral ear. A pair of flat conductive strip connectors extend from the depending ears to the terminals of the heater element of one of the electron guns, and another pair of flat conductive connectors are respectively welded to the first pair and extend between corresponding terminals of the other two heater elements of the tri-color gun mount.

Background of the invention

The present invention is directed to plural beam cathode-ray tubes of the type having separate thermionic cathodes and associated heaters for each of a plurality of electron guns. More specifically, the invention is directed to a new and improved heater support assembly for such cathode-ray tubes and to a method of manufacturing such heater assemblies.

In a conventional tri-color television picture tube, three separate electron beams are simultaneously projected through an aperture mask or shadow mask toward a mosaic type of phosphor screen where they impinge on corresponding ones of three elemental phosphor areas. The three beams originate from respectively different electron guns located in the tube neck, each of the guns being equally spaced from the geometrical axis of the tube in what may be considered a triangular or delta array. Each electron gun is provided with a thermionic cathode and an associated individual heater element. The heaters must be mechanically supported closely adjacent their respective cathodes and must be provided with a suitable electrical heating current.

Conventionally, the tri-gun assembly is formed as a single mechanical unit. The electrode series of each gun is disposed on a respective one of three mandrels which are spaced in the desired delta configuration. Each of the electrodes is provided with a mounting strap and the stacked electrodes are rotated to align these straps after which three insulative support elements or glass pillars are heated to their softening temperature and then impaled on respective groupings of the support straps. The foregoing procedure has been found to be an efficient and precise method of assembling the gun complex. Unfortunately, however, the individual heater elements of the electron guns are not readily suited to a jigging operation and, therefore, it is quite difficult to precisely mount the heaters within their associated cathodes.

Brief description of the invention

It is therefore a principal object of the present invention to provide a new and improved tri-color gun mount and associated heater support assembly for a plural beam color cathode-ray tube.

It is a further object of the present invention to provide a relatively simple and mechanically rugged heater support assembly which derives its ultimate support from the same insulative support elements as the gun electrodes.

According to the invention, a new and improved tri-color gun mount for a color television picture tube comprises electron guns disposed in a triangular array and including three substantially parallel ceramic support rods. Three filamentary heater elements are respectively included in the electron guns and each has a pair of terminals. There are three rigid metal support straps each supported by and extending between a pair of the ceramic support rods, and two of the support straps are each provided with a depending integral ear. Rigid metal connector strap means affixed to the ears and to the terminals of each of the heater elements are provided for supporting the heater elements while electrically connecting them in parallel. A pair of lead-in wires are respectively connected to the two support straps with the depending integral ears.

Brief description of the drawings

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, partly in section, of the neck portion of a plural beam cathode-ray tube containing an electron gun complex embodying the present invention;

FIGURE 2 is a cross-sectional view taken along line 2—2 of FIGURE 1;

FIGURE 3 is a cross-sectional view taken along line 3—3 of FIGURE 1; and

FIGURE 4 is a perspective view of a metal stamping used in making the support assembly of the invention.

FIGURE 1 illustrates the neck portion of a tri-color cathode-ray tube having three electron guns disposed therein to project separate electron beams to a mosaic-type phosphor screen (not shown). It is to be understood that except for the invention to be described the entire color picture tube may be of any construction well-known to the art. The tube neck comprises a cylindrical glass envelope section **10** closed at its base by a glass press **12**. As is conventional, a number of lead-in pins **14** are arranged about a central indexing post **16** and project into the envelope through press **12** to provide electrical connections for the various elements therein.

The three electron guns are identical in construction and are arranged in a delta or triangular configuration in the tube neck; only one of these guns **17** is visible in the drawing. Gun **17** comprises a cathode assembly comprising a tubular sleeve member **20** on the closed end of which is deposited a thermionically emissive coating **22** of barium oxide or the like. Cathode sleeve **20** is held with its emissive surface adjacent the central aperture of a first grid electrode **24** by a ceramic washer **26**. Washer **26** is fixed within grid cylinder **24** by peripheral flange members located on opposite sides of the washer in conventional fashion. Gun **17** includes several other serially aligned electrodes of which only a screen grid or first anode **27** and a first focusing electrode **28** are shown in the drawing. These electrodes are held in a predetermined fixed spatial relation by individual mounting straps (not shown) having central sections spot-welded to the electrode and end portions embedded in predetermined ones of three glass support pillars. For clarity, only support strap **32** for control grid **24** is illustrated in the drawing, although it will be understood that the other gun electrodes are similarly mounted. The end portions of strap **32** are embedded in glass pillars **33**, **34**, as denoted by the dashed lines in the

drawing, and have a conventional claw-like configuration to insure a good mechanical connection therewith.

A better view of the manner in which the grid electrodes are supported is provided in FIGURE 2. Before proceeding, it should be noted that in the ensuing description single and double primed reference numerals will be employed to designate the corresponding elements of the other two electron guns not visible in FIGURE 1. Grid straps **32**, **32'** and **32''** are spot-welded to corresponding control grid cylinders and each strap extends between an indicated pair of glass pillars **33**, **34**, and **35**, pillar **35** being not visible in FIGURE 1.

As previously stated, the individual cathodes of the three electron guns are of the thermionic type and for this reason an individual resistance heater element **37** (see FIGURE 1) is disposed within each cathode sleeve **20**. Heater **37** is of a conventional coil construction and is located with its coils closely adjacent the end wall of sleeve **20** on which is deposited the emissive coating. The lower ends of coil **37** project from the open end of the cathode sleeve and are provided with respective flat terminal connectors **39** and **40**.

In accordance with the invention, the several heaters are precisely yet ruggedly held in juxtaposition to an associated cathode by a support assembly comprising a pair of elongated conductive support members, only one of which members **41** is fully visible in FIGURE 1. Member **41** includes a depending integral ear portion **42** near one of its extremities and may optionally include a second such ear portion **43** at its opposite end to provide symmetry to the piece and obviate any indexing problems during construction. The depending ear portions **42** and **42'** of members **41** and **41'** can be seen in FIGURE 1 and it will be observed that the ears are formed to contact adjacent lead-in pins **14**. Pre-forming of the support members in this manner facilitates construction of the gun complex.

Support member **41** and its companion support member **41'** are both visible in FIGURE 3. As shown, both have one end affixed in pillar **33**, while their opposite ends are affixed in pillars **34** and **35**, respectively. Also most clearly visible in FIGURE 3 are four flat, elongated conductive strips **46–49**, each of which has its opposite end portions twisted to form respective predetermined angles (ninety degrees as shown) with its planar central portion. Strips **46** and **47** each have one end wrapped around a respective depending ear of support straps **41** and **41'** and, of course, also welded thereto while their opposite ends are spot-welded to flat heater connecting terminals **39''** and **40''** respectively. Conductive strips **48** and **49** are oriented transverse to strips **46** and **47** and have their opposite end portions spot-welded to corresponding terminals of heaters **37** and **37'**. The central portions of strips **47**, **49** and **46**, **48** are likewise spot-welded to one another as indicated schematically in the drawing; the strip pairs that are welded together are axially spaced from each other, as seen in FIGURE 1, a sufficient distance to avoid possible electrical shorts therebetween. The interconnection of the conductive strips in this manner effects a parallel electrical circuit connection to the several heaters from a pair of lead-in pins. The twists which are provided in all of the conductive strips assure a planar meeting of surfaces at all of the affixation points to provide an optimum welding condition creating a mechanically rugged and dependable connection with a low electrical resistance between the elements.

In accordance with the method of the invention, the grid and heater support straps **32** and **41** are originally manufactured as a unitary structure. A perspective view of the integral structure, which is preferably formed by a conventional metal stamping process, is seen in FIGURE 4. As shown, the assembly comprises first and second elongated sections **32** and **41**, respectively, which are interconnected by a relatively narrow intermediate section **52**; a second similar intermediate section **53**, spaced from portion **52**, is provided to give added strength to the interconnection without undue thickness. A pair of bands like that illustrated in FIGURE 4 are employed in the inventive construction. Specifically, the first sections of these bands **32** and **32'**, as shown in FIGURE 2, are affixed to respective first grid electrodes **24** and **24'** by spot-welding at their mid-portion; the lower sections **41** and **41'** are not physically attached to any electrode but, of course, are held in a fixed spatial relation to the grid electrodes by virtue of the intermediate connecting sections **52**, **53**.

All of the remaining electrodes of the several electron guns are provided with conventional support straps and, as previously stated, the electrodes are serially threaded in proper order over adjacent mandrels which are disposed to correspond with the desired spacing of the gun complex. The electrodes are oriented to properly align their support straps, and glass insulating pillars **33**, **34** and **35** are forced onto the supporting straps after having been heated to their softening temperature. Upon cooling of the pillars, all of the electrodes of the three guns are permanently held in the selected orientation and relative spacing. Heater support sections **41** and **41'** are likewise fixed in the pillars with a proper axial and rotational alignment by virtue of their interconnection to grid straps **32** and **32'**.

Now that the intermediate connecting sections of the stampings have performed their locating function for the heater support members, the connections between the control grid straps and these members is severed. The severing is most simply done by applying a sufficient electrical current through the narrow intermediate sections to cause them to be melted by resistance heating, although mechanical severing to remove portions of the intermediate connecting strips may be employed if desired. Conductive strips **46** and **47** are spot-welded together and attached to the depending ear portions **42** and **42'**, and the heater terminals are welded to strips **46** and **47** as shown. The heater electrodes of the several electron guns are now very firmly supported within their respective cathode elements, and they receive ultimate support from the same glass pillars which retain all of the gun electrodes.

The new and improved method of manufacturing a heater support assembly described herein is particularly claimed in a divisional copending application of James L. Kraner and Nicholas P. Pappadis, Ser. No. 681,541, filed Nov. 8, 1967 and assigned to the present assignee.

While particular embodiments of the invention have 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.

We claim:

1. A tri-color gun mount for a color television picture tube comprising:

three electron guns disposed in a triangular array and including three substantially parallel ceramic support rods;

three filamentary heater elements respectively included in said electron guns and each having a pair of terminals;

three rigid metal support straps each supported by and extending between a pair of said support rods, two of said support straps each having a depending integral ear;

rigid metal connector strap means affixed to said ears and to the terminals of each of said heater elements for supporting said heater elements while electrically connecting them in parallel;

and a pair of lead-in wires respectively connected to said two support straps.

2. A tri-color gun mount according to claim **1**, in which said connector strap means comprise a first pair of rigid metal straps respectively extending from said ears

to the terminals of one of said heater elements, and a pair of additional rigid metal straps each affixed to one of said first pair and each extending between corresponding terminals of the remaining two heater elements.

3. A heater support assembly for a color cathode-ray tube having a base through which a pair of lead-in pins project and having a trio of electron guns assembled in a predetermined array by means including three insulative support elements, said assembly comprising:

a pair of elongated conductive support members both having one end affixed in a first one of said insulative support elements and each having its remaining end affixed in a different one of said remaining insulative support elements, said conductive members each including a depending integral ear portion connected to a respective one of said pair of lead-in pins;

three cathode heaters each having a pair of flat terminal connectors;

four flat, elongated conductive strips each having its opposite end portions twisted to form respective pre-

determined angles with the planar, central portion of said strip;

means for affixing said end portions of said strips to different individual ones of said flat heater connecting terminals and said depending ear portions and for affixing said central portions of two of said strips to said central portions of respective ones of the remaining two of said strips to effect a parallel electrical circuit connection to said heaters from said lead-in pins, said twists in said strips providing planar meeting of surfaces at all affixations points.

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