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ELECTRON-DISCHARGE DEVICES

Original Filed June 22, 1964

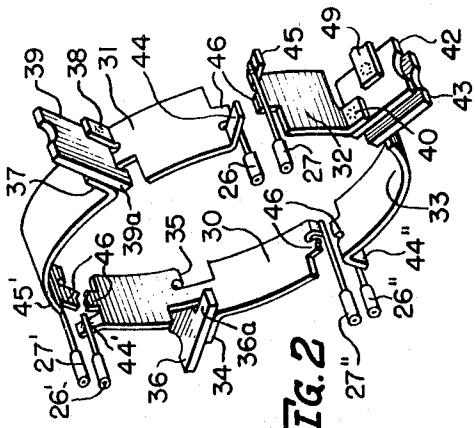

FIG. 2

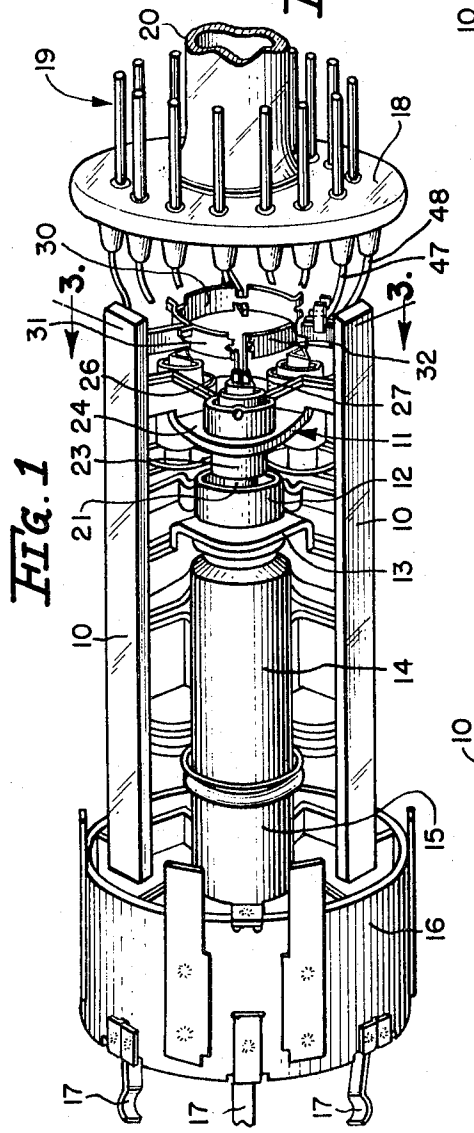

FIG. 1

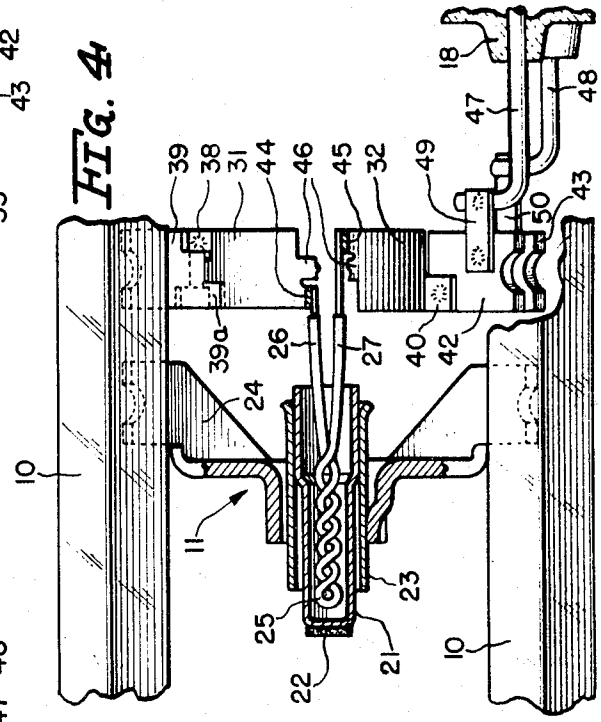

FIG. 4

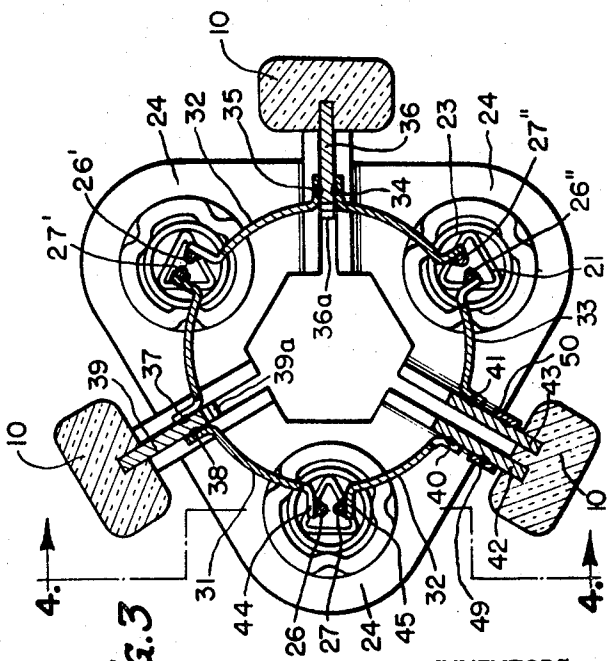

FIG. 3

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ELECTRON-DISCHARGE DEVICES

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Original application June 22, 1964, Ser. No. 376,828. Divided and this application June 20, 1966, Ser. No. 558,977

Int. Cl. H01j 9/18, 9/36

U.S. Cl. 29—25.16 2 Claims

ABSTRACT OF THE DISCLOSURE

A method for establishing a series electrical circuit between the three heaters of a tri-gun cathode-ray tube. A metallic strip is formed into a closed loop, and pairs of heater terminals are struck from the strip at spaced intervals corresponding to the relative locations of the three-guns of the tube. Support tabs are struck from the portion of the strip intervening between the relative locations of the three guns, and these are fixed to insulating support elements within the tube to hold the loop assembly in position. After connecting the heaters across respective ones of the heater terminal pairs, the metallic strip is severed between the terminals to establish a mechanically rugged series electrical connection between the three heaters. The method involves only the use of simple and economical punching and forming techniques and is readily adapted to application with automatic equipment.

This application is a division of copending U.S. application Ser. No. 376,828, filed June 22, 1964, by the present applicants.

This invention relates to electron-discharge devices and more particularly to plural-beam cathode-ray tubes of the type having a plurality of electron guns assembled in a predetermined array by means including a plurality of insulating support elements. More specifically, the invention is directed 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 onto a mosaic type of phosphor screen. To this end, three separate electron guns, one for each of the primary colors, are provided in the 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 having an associated resistance heater element, and means must be provided to pass electric current through the heater elements in order to achieve the required thermionic emission.

In accordance with conventional practice, the three electron guns and all of their electrode elements are preassembled in a unitary gun mount by means including a plurality of support elements, usually in the form of three longitudinally extending glass or ceramic support pillars. The gun-mount must be preassembled with a high degree of precision, and should be as compact as possible to permit the use of a relatively small neck diameter to avoid unnecessary complication in the associated deflection and conversion yoke assemblies, which, in use in a color television receiver, are mounted externally on the neck.

It is an object of the present invention to provide a new and improved method of forming a heater assembly for a plural-beam cathode-ray tube such as a color television picture tube.

In accordance with the invention, a new and improved method of manufacturing a heater assembly for a plural-beam cathode-ray tube having a trio of electron guns assembled in a predetermined array by means including a plurality of insulating support elements, comprises forming a strip of conductive material in a substantially closed loop adapted to be encompassed by the array of insulating support elements, striking at spaced portions of the strip corresponding to the relative spaced locations of the three guns of the cathode-ray tube a plurality of pairs of heater terminals, one pair for each of the guns, striking from each of the portions of the strip intervening between the relative spaced locations of the electron guns at least one tab for connection to an assigned one of the support elements, fixing the tabs to the support elements, connecting across each pair of heater terminals a heater for one of the guns, and severing the strip between each pair of heater terminals to connect the heaters in series-circuit relationship.

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 a heater assembly employed in the gun-mount assembly of FIGURE 1 and embodying the invention;

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

FIGURE 4 is a fragmentary cross-sectional view, taken along the line 4—4 of FIGURE 3.

The gun-mount assembly of FIGURE 1, for use in a tri-color television picture tube, comprises three electron guns assembled in a triangular or delta array, only one of the guns being visible in the view of FIGURE 1, by means including three longitudinally extending insulating support members for pillars **10**, of which only two are visible in the view of FIGURE 1. Each of the electron guns includes a thermionic cathode assembly **11**, a first control grid (G_1) **12**, a screen grid or first anode (G_2) **13**, and a pair of focusing electrodes **14** and **15**. A common convergence subassembly **16**, common to all three electron guns, is also provided at the output end of the gun-mount assembly and is provided with spring contacts for connection to the final anode (not shown). The preassembled triple gun-mount is supported on a glass press **18** which is provided with a plurality of lead-in conductors **19** and an exhaust tubulation **20** in conventional manner. The individual gun electrodes, the support arangement, and the press may all be of conventional construction, although certain features of the illustrated cathode assembly **11** and of the convergence electrode **16** and its assembly to the remaining elements of the gun-mount are described and claimed in the two copending applications of Joseph P. Fiore, filed concurrently herewith, entitled "Electron-Discharge Devices" and "Cathode-Ray Tubes," respectively, and both assigned to the same assignee as the present application.

As best shown in FIGURE 4, the cathode assembly **11** for each of the electron guns includes a tubular cathode sleeve **21** on the end of which is provided a thermionic emissive coating **22**. Cathode assembly **11** further comprises a shield member **23** and a support flange **24** fixed

to insulating support elements **10**, as more particularly described and claimed in the above-mentioned Fiore application. Within each of the cathode sleeves **21**, there is provided a conventional resistance heater element **25** having a pair of heater leads **26** and **27**. In the ensuing description, corresponding single-primed and double-primed reference indicia will be employed to designate the corresponding elements of the other two electron guns not shown in FIGURE 1.

The heater assembly comprises a plurality of longitudinally aligned thin, flat metallic strips in an array corresponding to the electron gun array and generally defining a substantially closed loop, as best shown in FIGURE 2. The array of strips comprises a pair of intermediate sections **30** and **31** respectively extending between and interconnecting a lead of the heater element associated with one of the cathodes to a lead of the heater element associated with the next adjacent cathode. Specifically, intermediate section **30** extends between and interconnects heater lead **27''** and heater lead **26'**, while intermediate section **31** extends between and interconnects heater leads **27'** and **26**. The loop array of FIGURE 2 further comprises a pair of terminal half-sections **32** and **33** respectively connected to the remaining leads **27** and **26''** of an adjacent pair of heater elements.

Intermediate section **30** is provided with a pair of upstanding integral tabs **34** and **35** to which is affixed an outwardly projecting rigid extension member **36** adapted to be fixed to one of the insulating support elements **10**. Similarly, intermediate section **31** is provided with a pair of upstanding integral tabs **37** and **38** to which is affixed an outwardly projecting rigid extension member **39** adapted to be fixed to another of the insulating supporting elements **10**. Extension members **36** and **39** each include inwardly projecting abutments **36***a* and **39***a* which abut against intermediate sections **30** and **31** respectively to index the heater connection loop longitudinally during assembly. Terminal half-sections **32** and **33** are provided with integral upstanding end tabs **40** and **41** respectively, to which are affixed adjacent closely spaced outwardly projecting rigid extension members **42** and **43** respectively, and members **42** and **43** are fixed to the third insulating support element **10** (FIGURES 3 and 4).

To facilitate the connection of heater leads **26**, **27**, **26'**, **27'**, **26''** and **27''** to connection strips **30–33** inclusive, the strips are provided with a pair of integral marginal longitudinally spaced outwardly projecting heater connection tabs or terminals **44** and **45**, at opposite edges of the strip and each of a width less than half that of the strip, at each of three substantially equally spaced locations corresponding to those of heater elements **25** in the electron gun array. Heater leads **26** and **27** are spot welded to heater terminals **44** and **45**, a similar construction being employed for the correspondingly numbered primed and double-primed elements associated with the other two electron guns. Similarly, extension members **36**, **39**, **42** and **43** are spot welded to support tabs **34**, **35**, **37**, **38**, **40** and **41**.

In accordance with the present invention, the heater connection assembly of FIGURE 2 is preferably formed initially of a single resilient thin flat metallic strip of substantially uniform width which is formed with its ends in adjacent closely spaced relation into a substantially closed loop. Support tabs **34**, **35**, **37**, **38**, **40** and **41**, as well as heater connection tabs or terminals **44**, **45**, **44'**, **45'**, **44''** and **45''**, are struck from the connection loop itself and bent outwardly, by conventional punching and forming techniques. Extension members **36**, **39**, **42** and **43** are fused into insulating support pillars **10**, following which the heater connection loop is slipped into position against abutments **36***a* and **39***a* in the manner illustrated in FIGURE 2 and extension members **36**, **39**, **42** and **43** are welded to their respective support tabs. Heater leads **26** and **27** (and the correspondingly numbered primed and double-primed heater leads of the other electron guns) are connected to the heater connection tabs or terminals **44** and **45** (and correspondingly numbered primed and double-primed tabs), after which the remaining narrow bridge sections **46** are severed, and an intermediate portion of bridge sections **46** preferably removed, to place the heater elements **25** in a single series circuit. A pair of lead-in conductors **47** and **48** extending through glass press **18** are respectively connected to extension members **42** and **43**, as by the use of the intermediate spot welded connection tabs **49** and **50** (FIGURE 4), to provide means for supplying electric current to heater elements **25** in series.

The fabrication of the heater connection assembly has been described in a preferred sequence of manufacturing steps, but other sequences may be employed without departing from the invention. For example, bridge sections **46** may be severed before connecting the heater leads to terminals **26** and **27**.

Thus the present invention provides a novel heater connection assembly for use in a plural-beam cathode-ray tube such as a tri-color television picture tube. The construction is inexpensive and simple to employ, and is readily adaptable to commercial production on a large scale. The method of assembling the heater connection assembly of the present invention is particularly attractive because it involves only the use of simple and economical punching and forming techniques and is readily adapted to application with automated equipment. The resulting construction is rugged and durable, both from the point of view of physical stability and continuity of the heater current circuit.

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.

We claim:

1. The method of manufacturing a heater assembly for a plural-beam cathode-ray tube having a trio of electron guns assembled in a predetermined array by means including a plurality of insulating support elements, which method comprises:

forming a strip of conductive material in a substantially closed loop adapted to be encompassed by said array of insulating support elements;

striking at spaced portions of said strip corresponding to the relative space locations of the three guns of said cathode-ray tube a plurality of pairs of heater terminals, one pair for each of said guns;

striking from each of the portions of said strip intervening between the relative space locations of said electron guns at least one tab for connection to an assigned one of said support elements;

fixing said tabs to said support elements;

connecting across each pair of heater terminals a heater for one of said guns;

and severing said strip between each pair of said heater terminals to cause said heaters to be interconnected in electrical series-circuit relationship by segments of said conductive supporting loop.

2. The method of manufacturing a heater assembly for a plural-beam cathode-ray tube having a trio of electron guns assembled by support elements arranged in a triangular array which comprises;

forming a thin flat strip of conductive material into a loop adapted to be accommodated within said array;

striking from the marginal edges of equi-spaced portions of said loop corresponding to the relative space locations of said electron guns a plurality of pairs of longitudinally spaced heater terminals, one pair for each of said guns and each terminal being of a width less than half that of said strip and each such pair of terminals being laterally separated by a bridge section of reduced width;

striking from each of the portions of said loop intervening between the relative spaced locations of said electron guns and corresponding to the location of said support elements in said array a plurality of tabs for connection to an assigned one of said support elements;

fixing said tabs to said support elements;

connecting across each pair of heater terminals a heater for one of said guns;

and severing said bridge sections between each of said pair of heater terminals to cause said heaters to be in electrical series-circuit relationship by segments of said conductive supporting loop.

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29—25.15