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COLOR CODED TUBE AND METHOD

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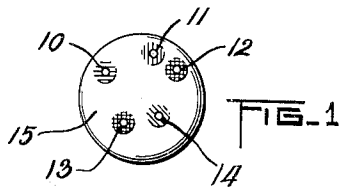


FIG. 1

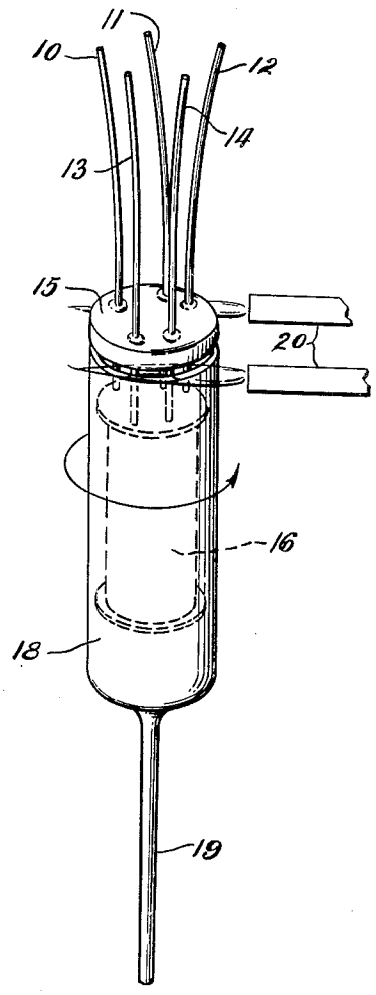


FIG. 2

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COLOR CODED TUBE AND METHOD

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The present invention relates to electron discharge devices, and especially to miniature types where the terminals are so close to each other as to make difficult the quick identification of each terminal with the connected internal electrode. The invention is directed to miniature devices each having plural identified closely spaced terminals, and to a method of achieving that identification.

In large tubes, receiving as well as transmitting, it has been comparatively simple to identify the various terminals that extend through the envelope to internal electrodes. Where the tube size is great the relative locations of the terminals are readily noted and utilized. One common practice with receiver types is to use a circular array of evenly spaced pins and to omit one pin or to enlarge certain pins so that the tube will fit into an appropriate socket in only the correct position. Another common practice is to use a circular pin array and a central rod having a lateral key to insure proper insertion of the tube into the socket. The bayonet form of tube and socket construction has also been extensively used previously, requiring a slight turn of the tube after inserting it into the socket.

In the case of miniature glass-envelope tubes, of the order of 3/8 of an inch in diameter, the problem of identifying the several terminals by their relative location is a difficult one. Terminals of diversified gauges of wire are undesirable. This problem is more difficult where many terminals emerge very close to each other from one end or header of a tube as long, flexible leads. The leads are mutually positioned in an arbitrary, often non-geometric array as determined by the construction and arrangement of the electrodes within the tube envelope.

Coatings of various colors have been in use for identification of the several leads, somewhat as in the case of multiple wires in a cable. To permit the tubes to be soldered into their utilization circuits without scraping the leads, volatile coatings have been used, with the result that the color code is often obliterated during circuit assembly. Subsequent tracing of the circuits is greatly complicated, and this factor is a threat to the commercial acceptance of this type of tube.

The problem of coding the terminals of miniature tubes has vexed the tube industry for several years. According to my invention a permanent coded identification is provided on miniature tubes by fusing colored vitreous frit to the envelope where the leads emerge, a distinctive

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color for each element. The simplicity and effectiveness of this solution are its principal recommendation. The invention will perhaps be better appreciated with its further features from the following detailed description of a preferred embodiment and from the drawings in which

Fig. 1 is the enlarged end view of a novel color-coded miniature tube; and

Fig. 2 is an enlarged lateral perspective view of a tube during manufacture.

Referring now to Fig. 1 there are shown five leads 10, 11, 12, 13 and 14 emerging from the bottom or header 15 of a sub-miniature electron discharge device. Header 15 is of glass and is sealed to the leads. The several elements represented in Fig. 2 by mount 16, but not shown individually, are connected to leads 10 to 14. Because of the fact that header 15 is small in diameter, of the order of 3/8 of an inch in outside diameter, the leads are quite close together. They are normally difficult to identify with their respective internal elements either by tracing them through the transparent glass envelope, or by studying their relative arrangement. In many types of tubes of this small size, the point where each lead emerges from the header is determined by the internal construction of the tube, the shapes and arrangement of the elements that form mount 16. Furthermore the leads are desirably arranged to provide the mount with a wide-based support for resisting vibration and microphonics, and do not ordinarily lie on a straight line.

In order to identify the elements permanently as an aid in circuit-tracing and to insure correct and simple replacement of tubes, especially where leads 10 to 14 are directly soldered into the utilization circuit, I have been successful in color-coding leads 10 to 14 by applying frit of distinctive colors to the header where the various leads emerge, and fusing that frit to form a permanent bond with the header if not also to the leads.

An excellent color-coding material for this purpose is a fine colored glass powder in a glycerine vehicle. The glass used is usually a mixture including a lower melting-point frit than the header. It is desirable that a different color be used for each lead except where plural leads are connected to a single electrode. The same color is used at the points where the leads 12 and 13 emerge from header 15, these leads being the terminals of a filamentary heater for a cathode. Other colors are used for identifying the other electrodes to which leads 10, 11 and 14 are con-

nected, and these in the present case are the plate, the control grid, and the cathode. Manifestly it is possible to use a transparent and colorless identification for one of the electrodes and in that event no frit need be applied. Similarly it is common for a single lead to emerge from the envelope at the end opposite the header. Considering such remote location of the lead, no additional identification is required.

In manufacturing miniature electron discharge devices of the type described, the mount assembly comprising mount 16 supported on leads 10 to 14 which are sealed to header 15 is assembled to shell 18 of transparent glass having exhaust tubulation 19. This assembly is rotated opposite a series of preheating burners (not shown) while there is a short space between the shell and the header; or, according to another technique, no space at all need be allowed. After this preheating interval, to relieve cracking stresses, an intense heat is applied to the edges of the shell and header which are to be sealed together by tangential burners 20. As a further preliminary to this operation I apply distinctively colored frits to the points where the several leads emerge from header 15. The frit is fused by heat from the sealing flames, its vehicle is vaporized, and it is permanently bonded to the header and the lead, as indicated. No additional heating is required. The resulting color code is brilliant and resistant to abrasion or other obliteration. Because of the excellent insulating characteristic of the fused frit and the restricted area of application it does not impair the required high resistance between the terminals normally afforded by the header.

What I claim is:

1. The method of coding closely spaced wire terminals of an electron-discharge tube comprising the steps of applying variously colored frit in discrete spots and at the junction of the various leads and the envelope of said tube, and fusing the frit to establish a permanent bond to the envelope.

2. The method of making an electron discharge device comprising the steps of assembling a shell to a stem having a vitreous header and closely spaced metal terminals sealed therethrough, applying variously colored identifying fusible materials to said header adjacent the respective terminals, and simultaneously heating said header for sealing it to said shell and fusing said materials to form a bond to said header.

3. An electron discharge device having an envelope, plural leads emerging at closely spaced points from said envelope, and distinctively colored fused frit bonded to said envelope where the several leads emerge.

4. An electron discharge device having a glass envelope and a number of leads emerging at closely spaced points from said envelope, and distinctively colored fused glass bonded to said envelope where each of the several leads emerge.

5. An electron discharge device having a glass envelope and a number of leads emerging at closely spaced points from said envelope, and distinctively colored glass fused to said envelope at, at least some of, each of the locations where the leads emerge.

6. The method of coding closely spaced wire terminals of an electron discharge tube having an evacuated vitreous envelope comprising the steps

of applying variously colored frit in discrete areas adjacent the junction of the various leads and said envelope, and fusing the frit to establish a permanent bond to the envelope.

7. The method of coding closely spaced wire terminals of an electron discharge tube having an evacuated vitreous envelope having said terminals extending through said envelope and comprising the steps of applying a spot of distinctively colored powdered glass adjacent the junction of each of at least some of said leads and said envelope, and fusing the colored glass to establish a permanent bond to said envelope.

8. The method of making an electron discharge device comprising the steps of assembling a shell to a stem having a vitreous header and closely spaced metal terminals sealed therethrough, applying small discrete spots of variously colored powdered glass to said header, one adjacent each of said terminals, and heating said header for simultaneously sealing it to said shell and fusing said powdered glass to form a bond to said header.

9. The method of making an electron discharge device comprising the steps of assembling a shell to a stem having a vitreous header and metal terminals sealed therethrough, applying discrete spots of variously colored powdered glass to said header, one adjacent each of a number of said terminals, and heating said header for simultaneously sealing it to said shell and for fusing said powdered glass to form a bond to said header.

10. An electron discharge device including an envelope having a glass portion through which a number of leads emerge at closely spaced points and a spot of distinctively colored fused glass bonded to said glass portion adjacent each of at least some of the locations where said leads emerge.

11. An electron discharge device including an envelope having a glass portion through which a number of leads emerge at closely spaced points and a spot of distinctively colored fused glass bonded to said glass portion adjacent each of the locations where said leads emerge.

12. An electron discharge device including an envelope having a glass portion through which a number of leads emerge at closely spaced points and a spot of distinctively colored fused glass bonded to said envelope adjacent each of at least some of the locations where said leads emerge.

13. An electron discharge device including an envelope having a glass portion through which a number of leads emerge at closely spaced points and a spot of distinctively colored fused glass bonded to said envelope adjacent each of the locations where said leads emerge.

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