March 17, 1953 R. D. HANCOCK 2,632,128

GLOW TUBE CATHODE SUPPORT

Filed Jan. 9, 1951

Fig. 1

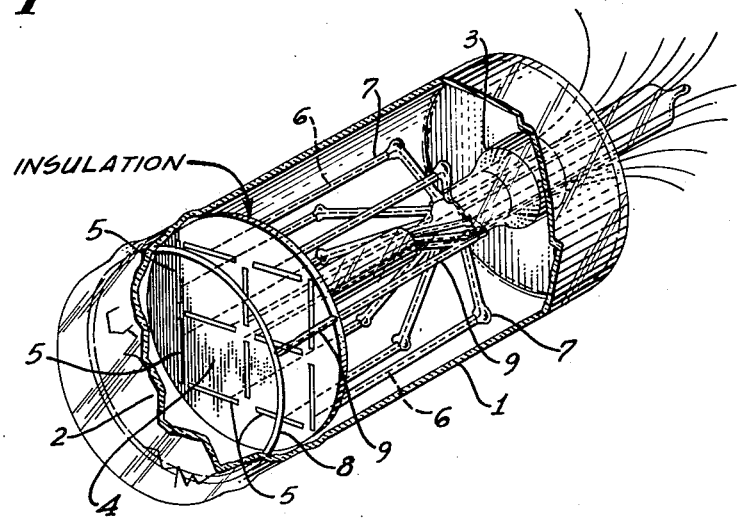


Fig. 2

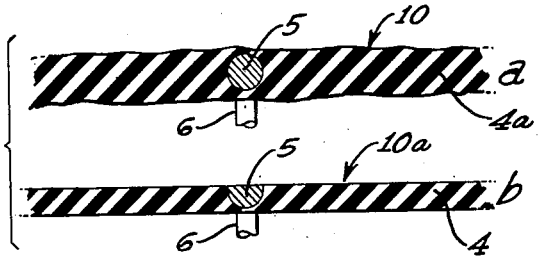


Fig. 3

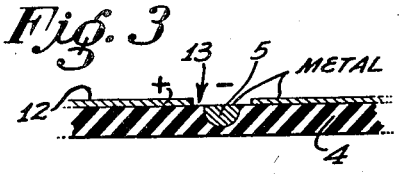
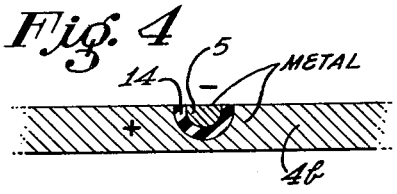


Fig. 4



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GLOW TUBE CATHODE SUPPORT

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4 Claims. (Cl. 313—188)

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This invention refers to ionic glow tubes, especially glow tubes wherein a plurality of cathodes are employed to render an indication of a condition of an external circuit.

Multi-cathode ionic glow tubes lend themselves readily to indicator applications wherein the condition or change in condition of an external circuit is desired and is so indicated by causing a selected group of cathodes, that are in the configuration of a desired symbol, to be energized. Such tubes are known as "read-out" tubes. If the cathodes are suspended in the gaseous medium by lead wires or special suspension wires, the tube is susceptible to damage due to bending or breaking of the cathodes resulting from high accelerations.

It is, accordingly, an object of the present invention to provide a multi-cathode ionic glow tube wherein the cathodes are rigidly maintained in a desired spatial relationship.

It is another object of the present invention to provide a means and method of confining a cathode glow, in a glow tube, to that portion of a cathode that is visible from one direction.

Briefly, the tube of the present invention may be constructed in the following ways: (*a*) The electrodes can be formed of bars of a conducting material with suitable lead wires attached thereto, these bars being cast in an insulating material to form a solid block, thereby rigidly maintaining the electrodes in a desired position and electrically insulated from each other. (*b*) The cathodes can be formed of bars of conducting material, with a coating of insulating material thereon, the cathodes then being cast in a block of conducting material, a part of each cathode being exposed. In this latter case the conducting material matrix may be employed as an anode for the embedded cathodes.

In the drawings,

Figure 1 is a perspective view of a tube embodying the present invention.

Figure 2 is a cross sectional fragmentary view of two steps in the embedding of a cathode.

Figure 3 is a cross sectional fragmentary view of a modification of my invention.

Figure 4 is a cross sectional fragmentary view of another modification of my invention.

Referring to Figure 1, an envelope 1 is provided at least with an end window 2 of transparent material, such as glass, and at the opposite end with a re-entrant stem 3. In this embodiment, a ceramic plate 4 is positioned in the envelope 1 parallel to the window 2, this plate 4 having embedded therein a plurality of

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electrically separate cathode sections 5, each having a portion exposed to the gas in the envelope. This gas is preferably a noble gas at glow discharge pressure, such as for example, neon at 20 mm. Hg pressure.

Each of the cathode sections 5 is connected by a lead 6 to the outside of the tube through stem 3, and each lead is covered with glass tubing or ceramic paint 7 to prevent a glow discharge from occurring thereon. The plate 4 is firmly supported by the leads 6.

A ring anode 8 is also supported from stem 3 and plate 4 by anode lead 9 and is positioned between the plate 4 and window 2, being sufficiently large in diameter so that view of the cathode sections 5 through window 2 is not obscured.

One preferred manner by which plate 4 is made is shown diagrammatically in Figure 2. Cathode sections 5 are of wire, and are cast into an insulating material 4*a* such as glass or ceramic as shown in Figure 2*a*, preferably with leads 6 already attached to the cathode sections 5. The casting surface 10 opposite the leads 6 is then ground or otherwise processed to form a flat surface 10*a* to expose a portion of each cathode section 5 as shown in Figure 2*b*. The cast plate is then mounted in the tube as shown in Figure 1.

When a potential source is connected to selected groups of cathode sections, these sections will glow, and, in accordance with the cathode section pattern used, various intelligible symbols, such as numerals and letters, will be made visible. The particular cathode pattern shown in Figure 1 will permit all the numerals and many letters to be formed. The present invention, however, is not to be limited to use in any particular cathode section pattern.

As it may be advantageous in some instances to have the anode of the tube equi-distant from all parts of the cathode sections, in order to obtain a uniform glow along any energized cathode section, the anode can be in the form of a thin conductive sheet 12 positioned on the ground surface 10 of the plate 4, as shown in Figure 3, with openings 13 therein, through which the cathode sections 5 are exposed. The edges of the openings 13 are spaced from the cathode sections so that no short circuit can occur when the tube is energized. The opening edges are also preferably uniformly spaced from the cathode sections to insure uniform glow thereon.

As shown in Figure 4, the same condition can

also be obtained by first coating the cathode sections 5 with insulating material 14 and then casting these coated sections in metal to form a metal plate 4b, this plate then being faced off to expose the cathode sections. The metal plate 4b is then mounted in the envelope 1 in place of plate 4, with the cast metal connected as the tube anode. The insulating material 14 then forms both the insulation between cathode and anode and the means to hold the cathode sections in place in the anode.

In any case, the cathode sections are firmly held in place, with only the face thereof to be viewed exposed to the gas in the tube. In this way, only the cathode area to be viewed need be energized to produce a glow thereon. Current drain in the tube is thereby reduced.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise a preferred form of putting the invention into effect, and the invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed is:

1. In a glow tube having an envelope including a transparent window, said envelope being filled with a gas at cathode glow discharge pressure, an anode in said envelope, a plate having a planar surface facing said window, a plurality of cold cathodes having their longest dimension extending in the plane of said surface, said cathodes being insulated from each other with each cathode embedded in said plate with a surface corresponding to said longest dimension exposed to said gas and positioned to planar with the surface of said plate, leads from said cathodes extending through said plate on the opposite side thereof from said exposed cathode surfaces and insulated from each other, the exposed surfaces of said cathodes being arranged in a pattern such that when selected groups of said cathodes are energized as cathodes, intelligible symbols such as numbers and letters will be visible through said window by the combination of cathode glows on the exposed surfaces of the cathodes in the groups energized.

2. Apparatus in accordance with claim 1 wherein said plate is entirely of insulating material.

3. Apparatus in accordance with claim 1 wherein said plate is entirely of insulating material and wherein said anode is a conductive layer mounted on said planar plate surface and having edges adjacent but spaced from the exposed surfaces of said cathodes.

4. Apparatus in accordance with claim 1 wherein said plate is of conductive material and wherein a layer of insulating material is positioned between the embedded portion of each cathode and the lead therefrom and the conductive material of said plate, said plate having an external lead seal through said envelope whereby said plate can be connected as an anode.

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