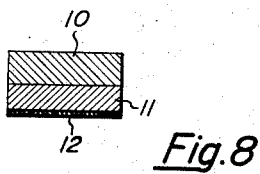
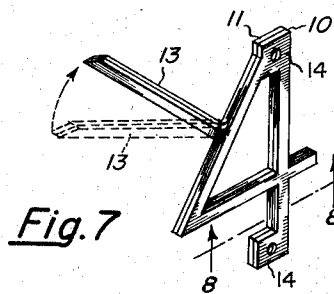
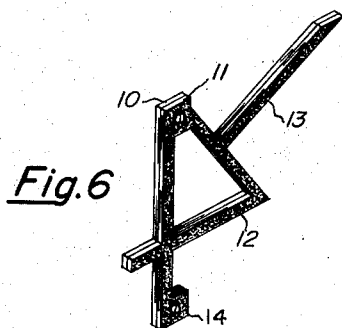
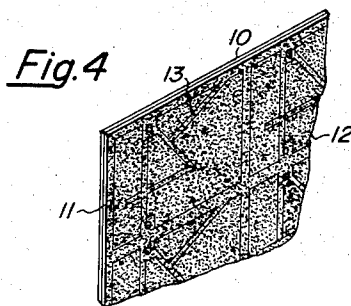
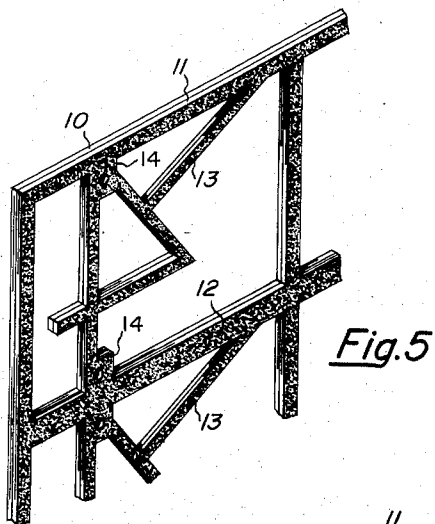
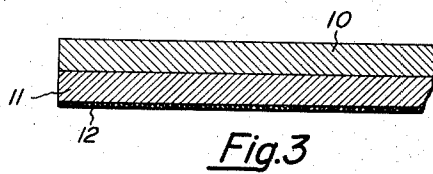
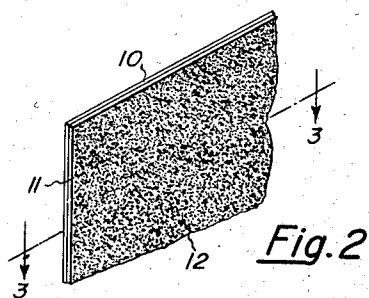
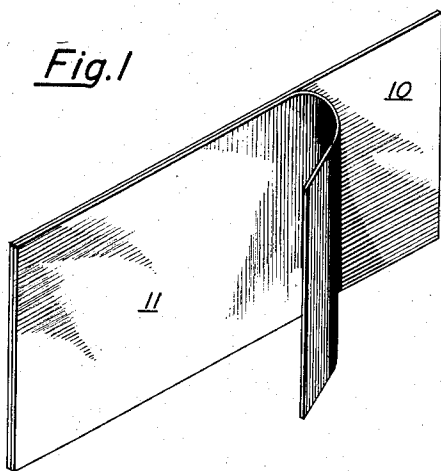


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T. A. HADDAD
GLOW TUBE CATHODE
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2,891,184



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2,891,184

GLOW TUBE CATHODE

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3 Claims. (Cl. 313—109.5)

The present invention relates to glow lamp indicating devices and more particularly to a novel cathode for assembly as a stacked pattern of cathode numbers with the respective cathodes insulated one from another.

In such cathode assemblies it has heretofore been proposed to etch character letters or numbers from a single thickness sheet of conducting material with each such character having a conducting lead as an integral part thereof. To insulate one cathode character from an adjacent cathode character it is coated on one side with glass, Alundum or other insulating coating material, while the lead thereof is coated on both sides with like insulation to prevent unwanted glow as will be understood. Where Alundum or other coating is applied it has been found extremely difficult to prevent the coating from straying to the conducting side of the number. Another disadvantage resides in lack of uniform thickness of the coating. These disadvantages are minimized by spraying a coating of glass on one side of the number and upon both sides of the lead but even so the baking of the glass introduces the chance of varying thickness of the coating instead of the desired uniform thickness.

An important object of the present invention is to provide an improved cathode for use in a glow type gas indicating tube wherein the foregoing disadvantages are overcome.

Another important object is to provide a cathode formed from a bimetallic sheet of material.

Another important object is to provide a bimetallic cathode having an insulating backing in the form of an anodized surface.

Another important object is to provide a cathode having an insulated surface of substantially uniform thickness.

A still further important object is to provide a cathode for indicating purposes in a glow tube, wherein the glow indication is confined to the front face of the cathode and functions without attendant stray glow and disturbing reflections.

Other objects, advantages and meritorious features of the invention will become more fully apparent from the following specification, appended claims and accompanying drawings wherein:

Fig. 1 is a perspective view of a bimetal sheet of material, as initially prepared, the thickness of the sheets being exaggerated in all figures for purpose of clarity;

Fig. 2 is a fragmentary perspective on an enlarged scale of the sheet of Fig. 1 with an anodized surface applied thereto;

Fig. 3 is an enlarged sectional view on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary perspective view similar to Fig. 2 showing the initial etching step;

Fig. 5 is a similar view on a larger scale showing the completed number frame as completely etched;

Fig. 6 is a perspective view of a character removed from its etched frame ready for bending its lead to proper conducting position;

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Fig. 7 is a perspective view of the completed character turned to expose the cathode discharge face thereof; and Fig. 8 is a cross sectional view on line 8—8 of Fig. 7.

Referring to the drawings, one form of the present invention comprises a novel etching and insulating process having as one use the fabrication of cathodes for incorporation in glow tube indicators wherein such cathodes are in stacked relation. Reference is made to the pending patent application of Herbert J. Hampel, Serial No. 552,748, filed December 13, 1955, and assigned to the same assignee as this application, wherein a glow type tube indicating device capable of employing the present invention is described and claimed. Other uses of the invention, however, are contemplated.

Initially a strip of conducting base metal material 10, preferably a copper-nickel alloy, has one face thereof coated with aluminum 11 by any well known method, such as evaporation, cladding, plating or other bonding. As so united this bimetal piece is subjected to an anodizing treatment to form an anodized surface 12 on the aluminum layer 11, as shown in Fig. 2. The so-formed composite material is now ready for etching as one means to obtain the final product of a unitary character, which, in the present instance, is a number, of conducting material having an insulating face and serving as a cathode for use in a glow lamp indicator.

According to the present invention the etching may be accomplished by a photo-mechanical process described in United States Patents Nos. 2,536,383; 2,710,591; 2,710,814; and 2,720,146, which comprises coating both faces of the bimetal strip including its anodized surface with photo-sensitive material having the property of decreased solubility after exposure to high energy electromagnetic radiation, then irradiating the coated sheet with radiation in a pattern to produce a cathode of predetermined shape, dissolving the non-irradiated coating, and etching the sheet to remove the bared material where the coating has been removed.

Thus, in Fig. 4 of the drawings, the prepared composite sheet of Figs. 2 and 3 has been irradiated from opposite sides with a pattern made up of a plurality of characters, in this instance the numeral "4," from which the individual characters can be separated after etching. In Fig. 5 the unexposed areas of the composite sheet have been etched away and the coating on the exposed areas washed away leaving the selected patterns ready for separation into separate discrete numbers of which Fig. 6 is an example. In this Fig. 6 the integrally joined conducting lead 13 is shown in its position as etched but when the cathode is assembled in a tube this lead 13 may be bent substantially normal to the plane of the number, as shown in Fig. 7, in order to extend parallel to the axis of the tube for connection to a tube prong for circuit operation. In Fig. 8 the number separated from its frame shows the bimetal structure with its anodized surface, which latter is of the order of four thousandths of an inch. The characters are preferably provided with apertured mounting tabs 14 for assembly with similarly formed characters on supporting studs as described in the patent application of Herbert J. Hampel referred to hereinabove. The tabs may be etched out of the basic sheet material when the character is formed.

Since the lead 13 is insulated on one face only as a result of the foregoing process, it is important that the unanodized face thereof be provided with insulation because otherwise glow develops thereon to the detriment of a precise number glow identification. Therefore, prior to assembling the tube the leads 13 are sprayed with an insulating medium, preferably a glass solution, the front faces of the tabs 14 may be similarly treated. Thereafter the cathode characters are properly stacked and inserted in the tube envelope for evacuating and sealing.

Subsequent assembly of the tube envelope to the stem mount under heat develops the heat necessary to set this glass insulation so that in operation of the tube the glow discharge occurs at the selected cathode with no unwanted or stray glow from the cathode lead or tabs.

It will now be apparent that a novel cathode and process of making the same has been devised whereby glow indication of separate characters takes place with more accurate and precise shaping than heretofore, such result being made possible by etching the numbers from a bimetallic sheet including an insulating backing of infinitesimal thickness, namely of the order of four thousands of an inch. The overall thickness of each cathode is approximately 0.06 of an inch. Further, a plurality of electrodes are etched in the form of a frame from which each number can be removed as a separate cathode having a substantially integral backing of opaque, nonreflecting insulation. As pointed out in the foregoing, this non-reflecting backing eliminates disturbing reflections and limits glow to the front surfaces of the cathode from which light is desired. This construction limits operating current and provides a high ratio of light output-to-current.

What is claimed is:

1. In a glow indicating lamp, a cathode member formed in the shape of a character and arranged so that one side thereof is viewable from outside of the lamp, said cathode character being bi-metallic in cross section and constituted by a layer of electrically emissive material on the viewable side thereof and a layer of low

electrical conductive material on the opposite side thereof, and an electrolytically formed film on the exposed surface of the layer of low electrically conductive material and forming an electrical insulation thereover.

- 5 2. In a glow indicating lamp, a cathode in the shape of a character comprising a sheet of an electrically emissive metal, a second sheet of a non-emissive metal bonded to said first sheet, said second sheet having an exposed anodized surface.
- 10 3. In a glow indicating lamp including a sealed envelope having a gaseous atmosphere therein, a cathode in the envelope formed in the shape of a character and arranged so that one side thereof is viewable from the outside of the envelope, said cathode character being
- 15 constituted by a sheet of electrically emissive material on the viewable side thereof, and a second sheet of aluminium bonded to the non-viewable side of the first sheet, said second sheet having its exposed surface anodized to render it electrically insulated.

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