March 3, 1959 L. R. LANDREY 2,876,385

MATRIX GLOW TUBE INDICATOR

Filed Dec. 28, 1955

Fig. 1

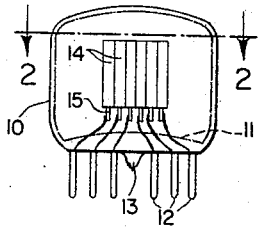


Fig. 2

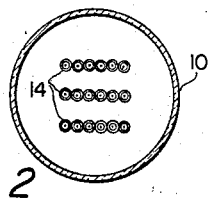


Fig. 3

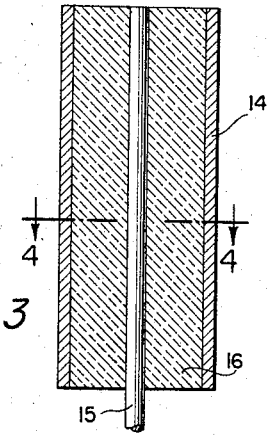


Fig. 6

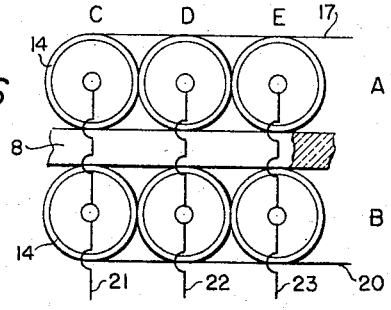


Fig. 4

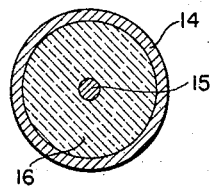


Fig. 5

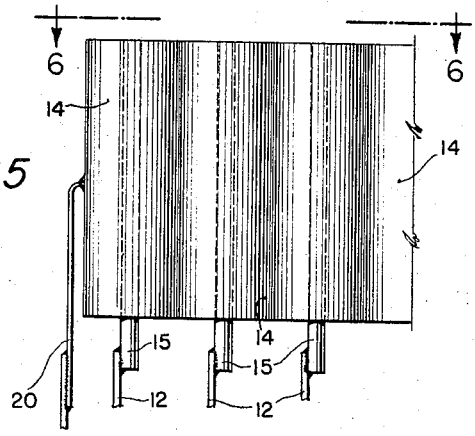
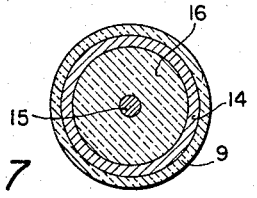


Fig. 7



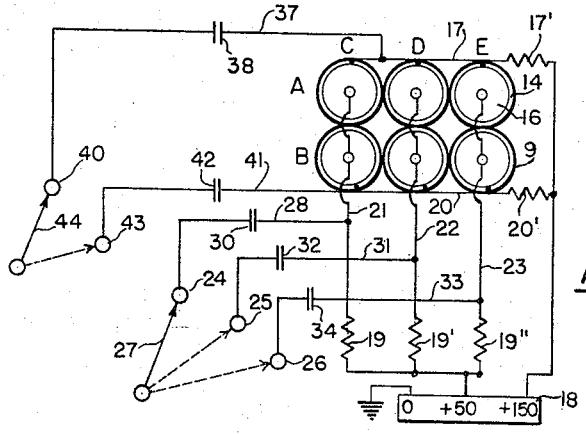


Fig. 9

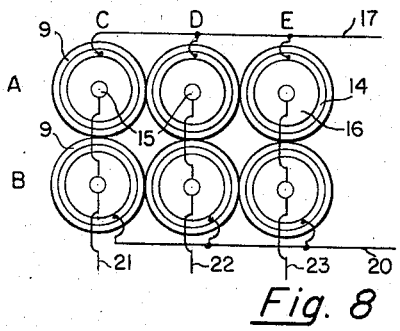


Fig. 8

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MATRIX GLOW TUBE INDICATOR

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3 Claims. (Cl. 315—169)

The present invention relates to indicating devices and more particularly to glow lamp gas tubes operating in selective fashion to visibly indicate a live circuit or circuits by one or more discrete glow units or patterns of different intelligible characters in a matrix of such glow units.

Selective glow lamp indicators, as heretofore constructed, are complicated, costly to manufacture and uncertain in breakdown characteristics. Furthermore such indicators are subject to wandering or spreading of the glow either in the cathode surface or to adjacent cathode surfaces so that the resulting glow is weak and difficult to distinguish. Also there are variations in the potential difference between the anode-cathode space which are insufficient to cause breakdown or to support ionization after breakdown.

An object of the invention is to provide a glow gas tube having a plurality of glow units providing a simple anode and cathode construction which is easy to assemble and of low cost fabrication.

Another object is to provide a glow lamp gas tube giving improved stability of breakdown voltage.

Another object is to provide a selective anode and cathode assembly wherein the discrete glow of a selected glow unit is maintained substantially constant.

Another object is to provide a glow tube which has low current operation with cathode sputtering reduced to a minimum.

A further object is to provide a glow tube wherein an accurate, permanent cathode to anode spacing is obtained without use of spacers, jigs or other fixtures.

A further object is to provide a matrix indicating system formed of a plurality of similarly constructed self-contained glow units each comprising a tubular electrode and an internal electrode with a dielectric material separating the two electrodes.

A still further object is to provide a glow tube wherein a cathode-anode assembly is such that the glow of an ignited cathode is visible only from one end of a selected glow unit.

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

Fig. 1 is an elevation view of a glow tube embodying one form of the present invention;

Fig. 2 is a top plan view of the same;

Fig. 3 is a medial sectional view of any one of the glow units, the same being on an enlarged scale;

Fig. 4 is a cross sectional view on line 4—4 of Fig. 3;

Fig. 5 is an illustrated side elevation view of an assembled row of units;

Fig. 6 is a top plan view of the glow unit assembly of Fig. 5;

Fig. 7 is a transverse sectional view of a modified form of glow unit;

Fig. 8 is a top plan view of an assembly of units of the type shown in Fig. 7; and

Fig. 9 is a circuit diagram for the glow unit assembly.

Referring to the drawings, one form of the present invention is shown as assembled in an evacuated gas filled transparent envelope 10 having a vitreous base 11 through which project a plurality of base prongs 12 leading respectively from the anodes and cathodes in the envelope for connection to certain external switching selection controls. A vacuum seal 13 is preferably provided in the base of the envelope as will be understood in order to leave the top end of the envelope unobstructed for viewing purposes. The envelope 10 is filled with a suitable gas such as neon for effective operation.

The envelope-housed glow producing assembly comprises a plurality of glow units, each in the form of a tubular anode 14 surrounding an axially disposed rod-like cathode 15, but spaced therefrom by a body of dielectric material 16. The relation of the parts of the unit is such that by applying an igniting potential to the cathode 15 it will be caused to glow and produce a discrete indication at one end of the cathode. Preferably each unit is formed by insulated-conductor tubing of anode material which can be readily cut to required lengths with the cathode 15 embedded in the insulation material 16, and the latter filling the interior of the anode 14. By assembling a plurality of these cathode-anode units in the envelope 10 it is possible by an associated switching circuit to select any unit or a combination of units for glow indication in response to received pulses or signals from a network to be tested or otherwise.

In the present instance six such glow units are illustratively arranged in two juxtaposed rows, three units to a row, with the exposed cathode ends lying in the same plane which, as here shown, is transverse to the axis of the envelope. The rows can be spaced apart for insulation, or spaced by suitable dielectric material 8 or, as here preferred, with the outer surfaces of the anodes sprayed with a coating of dielectric material 9 as shown in Figs. 7 and 8. This spraying construction is advantageous because it permits a compact assembly of many more units than could otherwise be accommodated in the envelope space available. While only six glow units are shown it will be understood that many more may be used in practice to form a larger matrix system in which the glow units can be selectively caused to glow.

A control system for energizing a matrix of the units is shown in Fig. 9. The anodes of row A of the matrix have a common conductor 17 and resistor 17' leading to the positive side of a source of voltage 18, while the anodes 14 of row B have a common conductor 20 and resistor 20' leading to the voltage source 18. Illustratively the source of voltage supplies a bias positive voltage of +150 volts to the two rows of anodes 14 and +50 volts to cathodes 15. The three columns C, D and E of cathodes 15 respectively have conductors 21, 22 and 23 commonly joined through resistances 19, 19', etc., to the +50 volt tap of the source of voltage 18. Resistances 17', 20', 19, 19', etc., are chosen to permit pulses applied to particular rows of anodes and to particular columns of anodes to increase the potential difference across these particular anodes and cathodes without affecting the potentials of other electrodes.

In order to selectively operate the glow units of the matrix, the cathode conductors 21, 22 and 23 are connected respectively to three fixed contacts 24, 25 and 26 of a selecting switch of which the pivoted arm 27 is the contactor form an associated network. The conductor 21 has a lead 28, including a condenser 30 and terminates at the contact 24. Similarly, the conductor 22 has a lead 31, including a condenser 32 and terminates at the contact 25. Likewise, the conductor 23 has a lead 33, including a condenser 34, and terminates at the contact 26. Likewise the anode conductor

17 of row A has a lead 37, including a condenser 38, connected to a fixed contact 40, while the anode conductor 20 of row B has a lead 41, including a condenser 42, connected to a second fixed contact 43. The two contacts 40 and 43 are part of a selecting switch of which the pivoted arm 44 is a contactor connected to its associated network. The network output, in the form of a pulse or signal, is arranged to supply a positive voltage to the anode switch contactor 44 and a negative voltage to the cathode switch contactor 27. In the present illustrative arrangement these two voltages are equal, being respectively +50 volts and −50 volts. As so applied in association with the +150 volts on the anodes and a +50 volts bias voltage on the cathodes a potential drop of 200 volts is obtained across any selected glow unit for an effective breakdown. With the contactors 27 and 44 positioned as shown in Fig. 9 an output pulse from the associated network will cause the glow unit in the upper left hand corner of the matrix identified at A.-C. to give the desired discrete glow.

In the form of the invention shown in Figs. 7 and 8, the glow units of rows A and B are arranged in contact relation for compact assembly by coating the outer circumferential surfaces of the anodes with the dielectric 9. In this way a closely packed pattern is obtained to thereby permit an appreciably greater number of units to be mounted in an envelope space than herebefore possible with prior assemblies.

From the foregoing it will be apparent that a novel indicating glow tube has been devised formed of a transparent envelope housing a plurality of glow units arranged in a compact pattern assembly wherein any unit or combination of such units can be caused to glow in response to a signal or signals from a network under test or otherwise. Such compact assembly is made possible by providing individual glow units each formed by a tubular anode encircling an axially disposed cathode embedded in a dielectric material. This glow unit construction makes it possible to confine the glow to the exposed end of a cathode which eliminates the wandering or spreading of the glow commonly present in cathodes depending upon a lengthwise glow.

By providing switch contacts corresponding in number to the number of glow units it is possible to selectively cause one or more units to glow, in the latter case enabling specific decimals, letters or other characters to be rendered visible by glowing units.

Furthermore, by the provision of self-contained glow units it is possible to form a closely packed assembly, preferably in a matrix pattern, which permits an appreciably greater number of units to be arranged in a given envelope space than has been possible in prior assemblies. As a result of this invention envelopes have been reduced to a size not heretofore feasible for commercial applications.

Thus illustratively Fig. 1 of the drawings gives an approximate overall size of a tube constructed according to the invention and housing electrodes of like small dimensions. In order that no misconception be formed as to the size of parts because of the enlarged dimensions of Figs. 4 to 9, it is pointed out that in operating embodiments of the invention the anode may have an overall diameter of approximately 0.060 inch, the anode wall thickness being approximately 0.005 inch; the insulating coating may be approximately 0.002 inch; and the diameter of the cathode may be in the order of 0.020 inch, the length of the cathode being approximately ½ inch. These relatively minute dimensions contribute to the successful matrix assembly of the invention, a result not herebefore attained in glow tube construction.

What is claimed is:

1. An indicating tube of the glow type comprising a gas filled transparent envelope, a plurality of glow units in said envelope exposed to said gas for individual ionization and arranged in a pattern of rows and columns, said rows being formed respectively of tubular anodes in contact relation one with another, said columns being formed respectively of cathodes and positioned within extending lengthwise of said anodes and coaxial therewith, dielectric material between each anode and each cathode to leave the cathode ends exposed, means insulating each row of anodes from an adjacent row, and leads respectively from each anode and one end of each cathode to the exterior of said envelope.

2. An indicating tube of the glow type comprising a gas filled transparent envelope, a plurality of glow units in said envelope exposed to said gas for individual ionization and arranged in a pattern of rows and columns, said rows being formed respectively of tubular anodes in contact relation one with another, said columns being formed respectively of cathodes positioned within and extending lengthwise of said anodes and coaxial therewith, dielectric material between each anode and each cathode to leave the cathode ends exposed, means insulating each row of anodes from an adjacent row, and leads respectively from each anode and one end of each cathode to the exterior of said envelope, said insulating means comprising a coating of dielectric material on the outer face of each anode.

3. In a glow type matrix system the combination of a gas filled transparent envelope, a plurality of glow units in said envelope exposed to said gas for selective ionization, control circuits for said units, said units being arranged in contact relation one with another and in rows and columns, each of said units comprising a tubular anode, a cathode extending lengthwise therein, a dielectric between said anode and said cathode arranged to leave the cathode ends exposed, means in said control system for maintaining a positive bias voltage on each unit row, means for maintaining a positive voltage on each unit column less than said row voltage, and pulse means for increasing the potential difference between anode-cathode spaces for breakdown purposes.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,876,385 March 3, 1959

Leo R. Landrey

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, line 65, for "form" read -- from --; column 4, line 14, for "cathodes and positioned within" read -- cathodes positioned within and --.

Signed and sealed this 14th day of July 1959.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON

Commissioner of Patents