Dec. 4, 1962 T. D. PETERSON 3,067,354

INDICATOR TUBE

Filed March 8, 1960

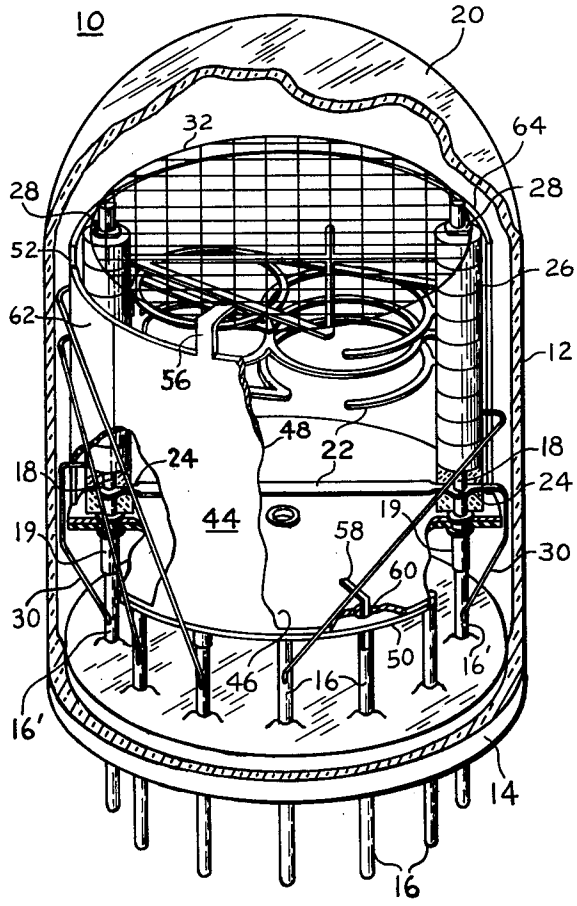


Fig. 1

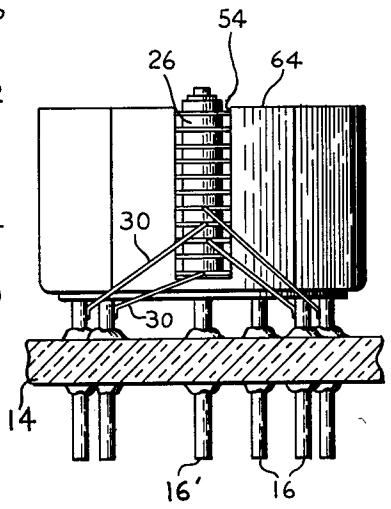


Fig. 2

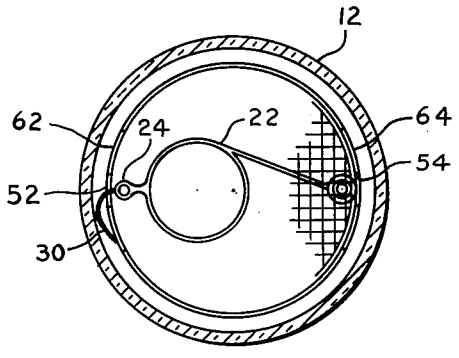


Fig. 3

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United States Patent Office 3,067,354 Patented Dec. 4, 1962

3,067,354

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Filed Mar. 8, 1960, Ser. No. 13,477
5 Claims. (Cl. 313—210)

This invention relates generally to indicating devices and particularly to cold cathode gaseous glow tubes for selectively displaying a plurality of cathode indicator electrodes.

Gaseous glow tubes are known in the prior art and generally include one or more cathode indicator electrodes and an anode electrode mounted in a gas-filled envelope. When a suitable electrical potential is applied between the anode and one of the cathode electrodes, the cathode glows, that is a sheath of gas surrounding the cathode glows, and space current flows through the gas from the cathode to the anode. Generally, the indicator cathodes each include a main body portion, in the form of an indicator character, and an electrically conductive lead which is connected to a tube pin. The main body portion may be in the form of a number or letter or other symbol and is intended to glow, and the lead, by which an electrical potential is applied to the cathode, is intended not to glow in normal tube operation.

In the past, cathode glow tubes of this type have been subject to spurious glow from metal parts other than the main body portions of the cathodes. The cathode leads and the tube pins to which they were connected have been particularly subject to spurious glow.

In addition, in the smallest indicator tubes, a problem exists as to the proper orientation of tube parts to avoid short circuits in use. In particular, the filamentary electrode leads must be carefully arranged to avoid short circuits both between the leads themselves and between the leads and other tube parts.

The purposes and objects of the invention are concerned with the provision of an improved construction for a cold cathode gaseous indicator tube in which spurious glow of tube parts is substantially prevented and in which the problem of short circuiting of tube parts is minimized. Various shielding arrangements have been employed to solve the problem of spurious glow, and while some of these have been quite satisfactory, the present invention provides a construction which has certain advantages not found in these other arrangements.

In brief, in accordnace with the invention, a gaseous glow tube is provided which includes a gas-filled envelope having a transparent viewing window. A plurality of separately energizable cathode indicator glow electrodes are provided and these are mounted in a stack in alignment with the transparent viewing window. An anode is also provided in the envelope. Each of the cathode electrodes and the anode are connected through suitable connecting leads or wires to conductive pins which are sealed in the envelope and by means of which electrical connections are made between the electrodes inside the tube and circuit elements outside the tube.

A cup-shaped electrode is provided and the stack of cathode electrodes is mounted within the cup. The leads to the cathode electrodes extend from the cathodes through suitable slots in the cup to the tube pins. Thus, the cathode indicator electrodes lie inside the cup, and the cathode leads and pins lie outside of and spaced from the cup, and the cup, in effect, is a barrier between the cathodes and the cathode leads and pins. In order to simplify tube construction and tube assembly operations, the portion of the cup in the vicinity of the slots, through which the cathode leads extend, is made of an insulating material such as glass or ceramic. The remainder of

the cup is made of a conductive material so that the cup may be operated as the tube anode, if desired. This cup construction eliminates the need for critical positioning of the cathode leads to insure that they are always spaced from the cup.

The invention is described in greater detail by reference to the drawing wherein:

FIG. 1 is a perspective view, partly in section, of a gaseous glow tube embodying the invention;

FIG. 2 is an elevational view, partly in section, of the tube of FIG. 1; and

FIG. 3 is a plan view, partly in section, of the tube of FIG. 1.

Referring to the drawings, a gaseous indicator glow tube **10** embodying the invention includes an envelope **12** which has been evacuated of air and filled with a gas such as neon or the like. The envelope includes a base portion or stem **14** through which metal base pins **16** extend and by means of which electrical connection is made to suitable external electrical circuit elements. Two diametrically opposed pins **16'** are provided with insulated support posts **18** within the envelope which are adapted to receive and support the various electrode elements of the tube. The support posts **18** may be secured to the pins **16'** in any suitable fashion, for example, by welding, or by means of tubular connecting eyelets **19**. The envelope **12** also includes a transparent viewing window **20** through which glowing cathode indicator electrodes **22** are viewed. A sealed-off exhaust tubulation (not shown) is provided in the stem **14**.

The indicator cathodes **22** of the tube **10** may take substantially any desired shape and they may be as few in number as desired or as many as is practical for the size of the tube. Usually ten cathode numerals are employed. Fewer than ten cathodes are shown in order to simplify the drawing. The cathodes **22** are made of any suitable metal, for example, aluminum, Nichrome, molybdenum, or the like, and they may be made in any suitable fashion, for example by etching, stamping or the like. The cathode electrodes are provided with diametrically opposed apertured tabs **24** by means of which they are mounted and supported on the posts **18** with their surfaces oriented parallel to each other facing the viewing window **20** of the envelope. The cathode electrodes are insulated from each other by means of insulating spacers **26**, or ceramic or the like, mounted between them, the spacers being larger than the tabs **24** and having sufficient surface area to cover the cathode tabs to prevent them from glowing. The stack of electrodes is locked on the posts **18** by mica rings **28** or by any other suitable means.

Each cathode indicator electrode is provided with a fine wire connecting lead **30** which extends from the tab **24** and is welded or otherwise secured at its free end to one of the pins **16**. The leads **30** may be of the same material as the cathode numbers **22** or they may be of tungsten or any other suitable material. The leads are preferably connected to the cathodes in such a way that any two adjacent cathodes have their leads extending from diametrically opposed tabs as shown in FIG. 1. In addition, referring to FIG. 2, the leads which are secured to cathode tabs which are on the same corresponding side of the cathode numbers alternately extend to the left and to the right to their respective pins **16**. This arrangement, in part, reduces the possibility of electrical leakage plus short circuiting between leads and between leads and other tube parts.

An anode assembly is also provided in the tube **10**. The anode assembly includes a fine mesh screen **32** mounted at the top of the stack of cathode electrodes **22** and insulated therefrom by spacers **26**, just as the cathodes are insulated from each other. The anode assembly also includes a cup-shaped electrode **44** which encloses the

stack of cathode electrodes. The cup **44** includes a base **46** and a peripheral wall **48** and is supported on the pins **16** with an intervening insulating spacer disk **50** of mica or the like between the base of the cup and the pins **16**. The wall **48** of the cup includes two longitudinal slots **52** and **54** aligned with the posts **18** and through which the cathode leads **30** extend. The screen **32** is electrically connected to the cup **44** by means of a conductive tab **56** and the base of the cup is electrically connected to one of the pins **16** by means of a metal tab **58** which extends through a suitable aperture **60** in the base of the cup. If it is desired to use only the screen **32** as the anode, then the tab **56** is not connected to the cup **44** but to one of the pins **16**.

According to the invention, the relationship between the cup **44** and the cathodes **22** and their leads **30** is optimized electrically and mechanically by forming the wall of the cup of metal except for diametrically opposed generally U-shaped portions **62** and **64** which include the slots **50** and **52**, the portions **62** and **64** being made of insulating material such as glass, ceramic or the like. The edges of the ceramic portions are sealed to the metal portions of the wall and base of the cup **44** according to well known techniques.

One of the advantages of this cup construction is that the desired shielding or barrier action between the cathodes and their leads is achieved so that the cathodes glow without their leads glowing. Another advantage results from the presence of the insulating portions in the cup electrode. Since the cathode leads may contact these insulating portions, time need not be spent during tube assembly in critical alignment of these leads.

What is claimed is:

1. A gaseous glow tube comprising a gas-filled envelope, a transparent viewing window comprising a portion of said envelope, a plurality of cathode indicator electrodes arranged in a stack and aligned with said viewing window so that each is visible through said window when it glows, an anode assembly in operative relation with said cathode electrode with a space current flow path between said anode and each of said cathodes, electrical leads to each of said cathodes whereby electrical potentials may be applied thereto, and a cup-shaped barrier electrode enclosing said stack of cathode electrodes and having opposed slots in the wall thereof and extending along the stack of cathodes, said cathodes lying inside said cup and said electrical leads extending from said cathodes through said slots to positions outside said cup, insulating means insulating said cathodes from each other and positioned in said slots in said cup-shaped barrier, said cup having wall portions of insulating material in the vicinity of the areas of connection of said leads to said cathodes, said wall portions extending along the length of the stack of cathodes adjacent to said insulating means and lying between said cathodes and the leads thereto.

2. A gaseous glow tube comprising a gas-filled envelope, a transparent viewing window comprising a portion of said envelope, a plurality of cathode indicator elements arranged in a stack and aligned with said viewing window so that each is visible through said window, said cathode elements being insulated from each other, an anode assembly in said stack with a space current flow path present between said anode and each of said elements, a plurality of metal pins extending through said envelope, electrical connections from each of said cathode elements and said anode assembly to one of said pins whereby electrical potentials may be applied thereto, a

cup-shaped electrode having a base and a peripheral wall extending therefrom, an insulating disk resting on said pins with the base of said cup resting on said insulating disk, said stack of cathode elements and said anode assembly being disposed within said cup and said electrical connections to said cathodes lying substantially completely outside said cup, said cup having slots through which said electrical connections to said cathodes extend, insulating means disposed substantially within said slots and extending along the length thereof and insulating said cathodes from each other, and insulating wall portions in said peripheral wall of said cup adjacent to said slots, said insulating wall portions extending along the length of said stack adjacent to said insulating means and between said cathodes and said leads.

3. A cold cathode gaseous indicator tube comprising an envelope having a transparent portion constituting a viewing window, and including a gas suitable for sustaining cathode glow, a plurality of metallic electrodes in the form of characters adapted to be operated as cathodes and to glow and mounted in a stack facing said viewing window, each of said electrodes having a pair of oppositely disposed mounting tabs and a lead wire secured to one of said tabs, a pair of support posts engaging said tabs for supporting said electrodes in said stack, a pair of barriers oppositely disposed adjacent to said support posts, each barrier having a slot extending along the length of said stack through which selected ones of said leads extend so that said cathode electrodes lie on one side of each barrier and said leads lie on the opposite side thereof, insulating washers mounted on said support posts between cathode electrodes, said washers lying substantially in said slots, and an insulating wall portion integral with each of said barriers in the vicinity of the slot therein, said wall portions extending along the lentgh of said stack and lying closely adjacent to said insulating washers with said cathodes and said leads lying on opposite sides thereof.

4. A cold cathode gaseous indicator tube comprising an envelope having a transparent portion constituting a viewing window, and including a gas suitable for sustaining cathode glow, a plurality of metallic electrodes in the form of characters adapted to be operated as cathodes and to glow and mounted in a stack facing said viewing window, each of said electrodes having a pair of oppositely disposed mounting tabs and a lead wire secured to one of said tabs, a pair of support posts engaging said tabs for supporting said electrodes in said stack, a cup-shaped electrode enclosing said stack of metallic electrodes and having a pair of oppositely disposed slots through which selected ones of said leads extend so that said cathode electrodes lie on one side of said cup and said leads lie on the opopsite side thereof, and a pair of insulating wall portions oppositely disposed and integral with said cup, said insulating wall portions including said slots and extending away from said slots on both sides thereof, said insulating wall portions extending along the length of the stack of cathodes and lying between said cathodes and the leads thereto.

5. The tube defined in claim 4 wherein said cup also includes metallic wall portions coupled to said insulating wall portions.

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