June 27, 1961 J. H. McCAULEY 2,990,061

INDICATOR TUBE

Original Filed June 11, 1957 2 Sheets-Sheet 1

Fig. 1.

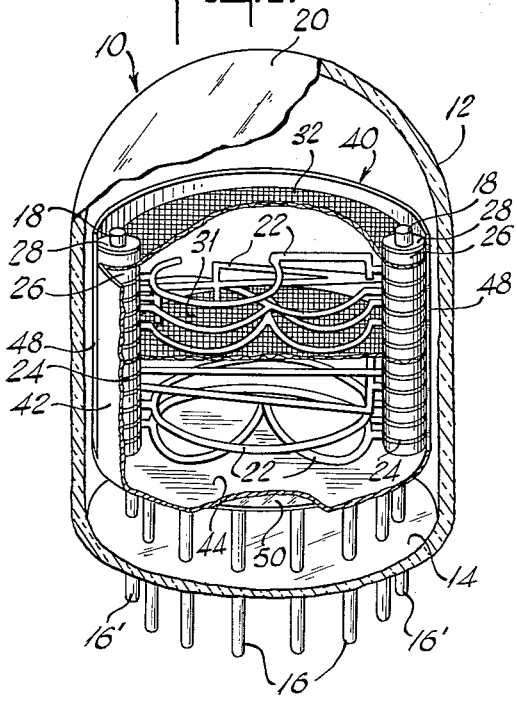

Fig. 2.

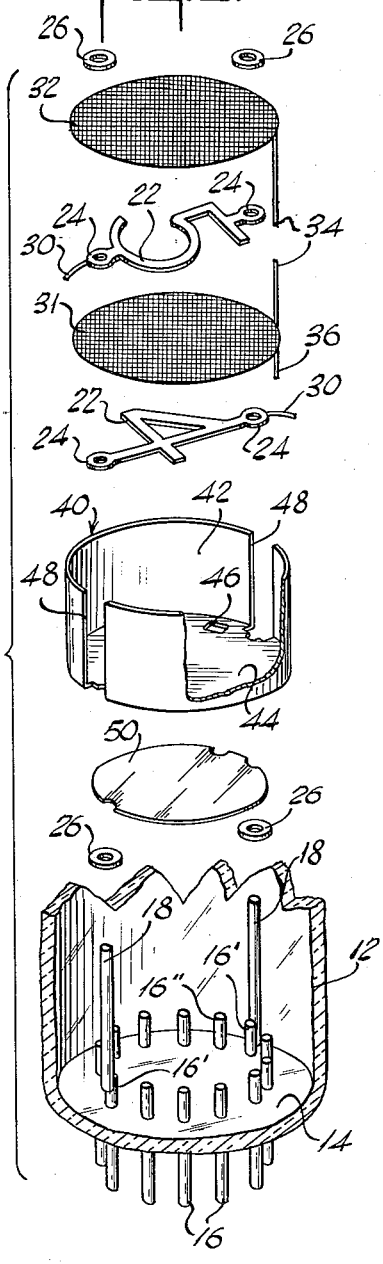

Fig. 3.

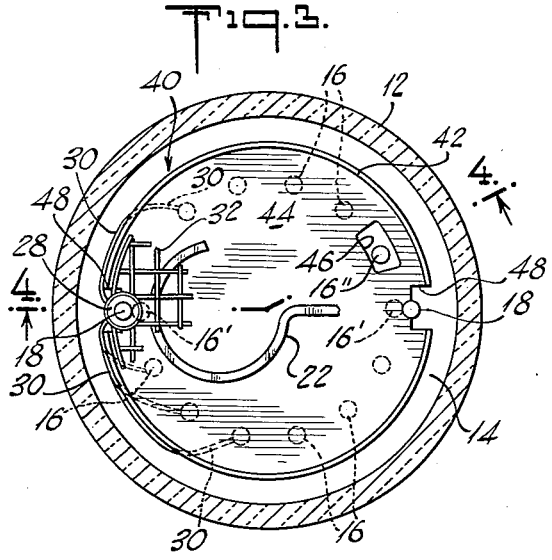

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FIG. 4.

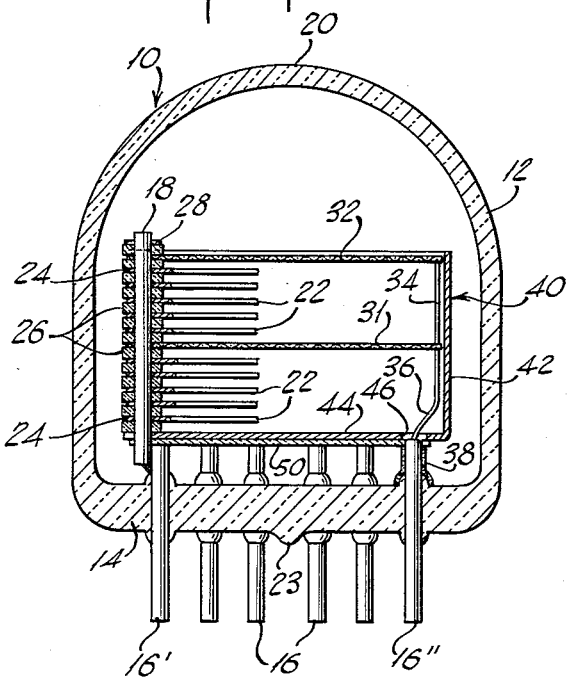


FIG. 6.

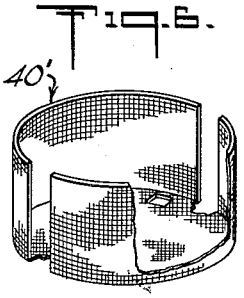


FIG. 5.

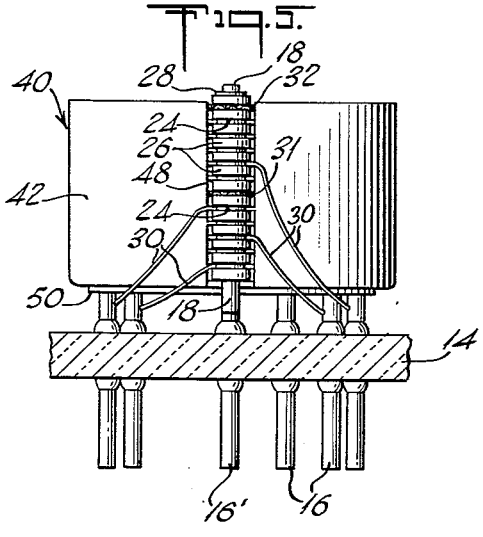
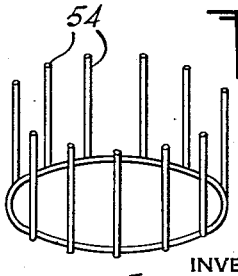


FIG. 7.



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2,990,061

INDICATOR TUBE

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Continuation of application Ser. No. 664,949, June 11, 1957. This application May 20, 1960, Ser. No. 34,599

28 Claims. (Cl. 313—109.5)

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

This application is a continuation of application Serial No. 664,949, filed June 11, 1957, now abandoned.

Gaseous glow tubes are known in the prior art and generally include one or more cathode indicator elements and an anode in a gas-filled envelope. When a suitable electrical potential is applied between the anode and one of the cathode elements, the cathode element glows and space current flows through the gas from the cathode to the anode. Glow tubes of this type often exhibit spurious glow from electrode portions other than the cathode indicator elements. In addition, such tubes often have undesirably short life due to sublimation of metal from the cathode elements onto other tube parts while the cathode elements are glowing. The sublimed metal generally deposits upon both the viewing areas of the tube envelope and on the connecting electrical leads to the individual cathode elements and on the pins which are sealed in the tube envelope. This sublimed metal causes both clouding of the viewing areas of the envelope and provides current leakage paths between the tube leads and pins which themselves often glow spuriously. This spurious glow interferes with the viewability of the cathode elements themselves and is generally considered to render a tube inoperative.

The problems of spurious glow and those resulting from the sublimation of metal from the cathode elements have been solved to a certain extent by providing insulating coatings on all exposed electrode parts on which sublimed metal might deposit and which might, as a result, provide spurious glow. However, the application of such insulating coatings is undesirably expensive and time consuming and the resulting tubes still do not reach a desired maximum efficiency.

An object of the invention is to provide an improved gaseous glow tube.

Another object of the invention is to provide an improved gaseous glow tube in which spurious glow is substantially eliminated and which is characterized by improved visibility of the glowing cathode indicator elements.

A further object of the invention is to provide an improved gaseous glow tube which may be made more economically than in the past.

In brief, in accordance with the invention, a gaseous glow tube is provided which includes a gas-filled envelope having a transparent or translucent viewing window. A plurality of separately energizable cathode indicator glow elements or electrodes are provided and these are mounted in a stack in alignment with the viewing window. An anode means is also provided in the envelope. Each of the cathode elements 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. The invention allows the leads and pins connected to the glow cathodes to be uninsulated.

According to the invention, the tube includes means for providing cathode glow while inhibiting the glow of the lead wires and tube pins which are connected to the cathodes. This means comprises a barrier or shield

which may be, but need not be, at least a portion of the tube anode means. The barrier, effectively, isolates the cathodes from the lead wires and tube pins which are connected to them. The barrier thus sets apart and shields the current flow paths between the cathodes and the tube anode means. In addition, the barrier serves to intercept sputtered cathode metal which is thereby prevented from depositing on the tube envelope, on the electrode leads and pins, and on other tube parts.

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 exploded perspective view of portions of the tube of FIG. 1;

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

FIG. 4 is a sectional view along the line 4—4 in FIG. 3.

FIG. 5 is a side elevational view of portions of the tube shown in FIG. 4;

FIG. 6 is a perspective view of a first modification of an electrode shown in the tube of FIG. 1; and

FIG. 7 is a perspective view of a modification of the electrode shown in FIG. 6.

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 insulted extension posts **18** within the envelope and thus are longer than the other pins and are adapted to receive and support the various electrode elements of the tube. The envelope **12** also includes a transparent viewing window **20** through which glowing indicating elements **22** are viewed. In the tube **10**, the viewing window may be plane or curved and is oriented substantially transversely to the vertical or longitudinal axis of the tube. A sealed-off exhaust tubulation **23** is provided in the stem **14**.

The indicating elements **22** of the tube are known as cathodes. The cathodes 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. In the tube **10**, there are ten cathode indicator elements **22** and they are in the form of numerals "0" to "9." 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 elements are provided with integral diametrically oposed apertured tabs **24** (FIG. 2) by means of which they are mounted and supported on the extension posts **18** of the pins **16'**. The cathode elements **22** are arranged overlapping one another in stacked relationship on the posts **18** one above the other with their surfaces oriented parallel to each other transverse to the vertical axis of the tube and facing the viewing end of the envelope. The cathode elements are mounted with suitable insulating spacers **26** between them, the spacers being larger than the tabs and having sufficient surface area to cover and insulate the cathode tabs to prevent them from glowing. The cathode elements are so shaped and they are stacked in such order that each one is completely and clearly visible when glowing and is not shadowed by any of the other cathodes. The stack is locked on the posts by mica rings **28**.

Each cathode indicator element is provided with a fine wire connecting lead **30**, which may be integral with the cathode 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 numbers, or they may be of tungsten or any other suitable material. The leads are

preferably connected to the numbers so that any two consecutive numbers have their leads extending from diametrically opposed tabs as shown in FIG. 2. In addition, referring to FIG. 5, the leads which are secured to cathode tabs which are on the same corresponding sides of the cathode numbers alternately extend to the left and to the right to their respective pins. This arrangement reduces the possibility of electrical leakage and simplifies the making of the necessary lead-to-pin connections.

An anode assembly is provided in the tube **10**. The anode assembly is preferably mounted in the stack of cathode elements and may take many forms. In the tube **10** shown in FIG. 1, the anode comprises two comparatively fine mesh screens **31** and **32**, one of which **32** is mounted at the top of the stack of numbers and the other of which **31** is disposed between two cathode elements at about the middle of the stack. The two screens are insulated from the cathodes by washers or spacers **26** just as the cathodes are insulated from each other. However, the anode screens are electrically connected together by a fine wire lead **34** (FIGS. 2 and 4) which extends ventically between them and is secured to each of them without touching a cathode. The anode assembly is electrically connected to one of the pins **16''** by a lead **36** (FIG. 4). The upper portion of anode pin **16''** and the portion of the anode connecting lead **36** immediately adjacent thereto are coated with a layer **38** of a suitable insulating material, such as aluminum oxide, a glass frit, or the like, to insulate them from the other leads and pins.

According to the invention, means are provided for limiting the cathode glow to the main viewable body portions of the cathode numbers themselves and for preventing the cathode pins and wire connecting leads from glowing spuriously and from having metal sublimed thereon. This means comprises a barrier or shield **40** disposed between the anode assembly and all portions of the tube **10** except the cathode numerals. These portions of the tube which are thus shielded include all connecting leads **30** and pins **16** to the cathode elements and portions of the tube envelope external to the barrier. As will be seen from the following description, the barrier, effectively, isolates the cathodes from the lead wires and tube pins which are connected to them. The barrier thus sets apart and shields the current flow paths between the cathodes and the tube anode means. In addition, the barrier serves to intercept sputtered cathode metal which is thereby prevented from depositing on the tube envelope, on the electrode leads and pins, and on other tube parts.

The shield **40**, in one embodiment, comprises a solid, generally cup-shaped electrode which includes a peripheral wall **42** and a base **44**. The base **44** is oriented transverse to the longitudinal axis of the tube **10** and is imperforate except for a small opening **46** which is aligned with the pin **16''** and through which the anode lead **36** passes to its connection with the pin **16''**. The wall **42** of the cup **40** is cylindrical in configuration (i.e., all longitudinal surfaces through it are parallel to each other) and preferably, it is circular in cross section (i.e., circularly cylindrical) as shown in FIG. 5. This wall extends longitudinally from the base **44** toward the viewing window **20** of the envelope and gives depth to the cup. The peripheral wall **42** is provided with two diametrically opposed longitudinal slots **48** which are as narrow as possible to insure optimum shielding between the elements inside the cup and those outside the cup and are only wide enough to permit access to the leads **30** which extend from the posts **18** to their respective pins **16**. Thus, the edges of the slots **48** abut the insulating spacers **26** on the posts **18** and the side wall **42** may actually touch these washers. The slots **48** extend into the base of the cup (FIG. 2) sufficiently to insulate the cup from the posts **18**. The leads **30** extend from their respective cathode tabs on the posts **18** to their respective pins in the space between the wall of the cup and the wall of the tube envelope (FIG. 3). The leads do not pass parallel to the axis of the stack of cathodes but extend for some distance about the side periphery of the stack so as to connect to respective pins **16**. As can be seen clearly in FIG. 3, the cathode leads **30** pass along the exterior of the side wall **42** of cup **40** and lie close to such outer wall and are thus positioned closer to the cup than are the main body portions of the cathodes within the cup. This arrangement appears to aid the glow of the main body portions of the cathodes and to inhibit cathode lead glow.

The cup electrode **40** has a diameter slightly larger than the width of the cathode elements **22** and anode screens **31** and **32** and is of sufficient depth to receive and shield the entire stack of cathode elements and the anode assembly. The base **44** of the cup rests on the pins **16** and is insulated therefrom by an insulating disk **50** of mica or the like having a diameter substantially equal to the diameter of the base of the cup. The cup is preferably made of iron and coated with a layer of aluminum which is oxidized to provide a black, matte aluminum oxide surface. The cup may also be made of an insulating material such as mica, ceramic, or the like.

In operation of the tube **10**, the barrier cup electrode **40** may be held electrically neutral or it may be coupled to the anode assembly so that it operates as part of the anode assembly. In the latter arrangement, which is the preferred mode of operation, the center anode screen **31** may be omitted.

In another embodiment of the invention shown in FIG. 6, the barrier electrode may be in the form of a wire mesh basket **40'** or as shown in FIG. 7, it may have a solid or fine mesh base or any other suitable base from which a plurality of closely spaced substantially parallel rods or posts **54** extend perpendicularly.

The mica disk **50** which insulates the base of the shield electrode from the pins **16** may also have a greater diameter than the base of the cup so that it extends radially beyond the periphery of the cup. In such a construction, the mica disk assists in holding the cathode connecting leads **30** spaced from and out of contact with the wall of the cup.

Certain features of interest with respect to the cup-shaped barrier electrode will now be pointed out. First, since the cup completely surrounds the stack of cathode elements and the anode assembly, a substantially unobstructed space current flow path is provided between the cathodes and the anode within the cup. This construction appears to optimize the relationship between the anode and cathodes so that all sizes of tubes have a favorable breakdown voltage. This advantage of the invention is particularly apparent in large size indicator tubes in which the cathode indicator electrodes are of the order of three inches in length. In tubes of this size which do not have a cup substantially enveloping the cathodes, the glow cathode operating voltages are in the range of 200 to 225 volts. In the same tubes having an enveloping cup, the cathode operating voltages are all about 170 volts, which is the same operating voltage for tubes of smaller size. Thus, a favorable uniformity is achieved. As an auxiliary advantage, the cup electrode also allows tubes to operate with lower currents than without the cup. In addition, the cup and the top anode screen **32** substantially prevent the sputtering of metal from the cathodes onto the tube envelope or onto any of the connecting leads or pins. Also, the provision of the opening **46** in the base **44** of the cup allows the anode to be connected by the shortest and most direct path to its pin **16''**.

To summarize, the present invention provides an indicator tube construction in which, at normal operating voltage and current, a cathode electrode inside the cup electrode glows and the lead wire and pin connected to the cathode but lying outside the cup do not glow. This desirable result is achieved even when the cup is operated as the tube anode. At the present time, there are several theories available to explain the operation of the inven-

tion, but none seems to be conclusive, and it is difficult to determine whether one or all apply. For one thing, it seems that the cup enveloping the glow cathodes concentrates the electric field inside the cup in such a way that a cathode electrode inside the cup tends to glow rather than the lead wire and pin outside the cup.

In addition, apparently once a cathode has begun to glow, the current flow path established between the cathode and the anode is shielded from the cathode lead and pin, and thus the lead and pin are prevented from glowing. This is illustrated by the fact that, if the wall of the cup is apertured so that a lead can "see" its cathode and a current flow path between a lead and its cathode is provided, then the lead glows as well as the cathode number. Apparently, ions from the main anode-to-cathode current flow path reach the lead and cause lead glow.

Another, but apparently less likely theory, is derived from Paschen's Law and says that the cathode leads and pins are too close to the anode cup to glow and that the cathode electrodes inside the cup are at the optimum distance from the anode to glow. At the present time, there is insufficient experimental evidence to completely substantiate this theory.

A cold cathode gaseous indicator tube embodying the invention has many advantages over gaseous glow tubes of the prior art in addition to the advantages already described. For example, in eliminating the insulating coating on the cathode pins and on the cathode leads, considerable time and expense are saved. In addition, the dark, matte surface of the cup provides a favorably contrasting background for the glowing cathode elements, the viewability of which is thereby enhanced. The cup also enhances the viewability of the cathode elements by preventing reflection of glow light from the base and wall of the tube envelope.

The present invention thus provides a gaseous glow tube which has high efficiency, provides optimum light output and viewability, and is economical to make.

What is claimed is:

1. A gaseous glow indicator tube comprising a gas-filled envelope, a transparent viewing window comprising an end portion of said envelope, a stack of electrodes including cathode viewing elements and an anode assembly, a plurality of pins extending through said envelope, said stack of electrodes being mounted and supported on at least two of said pins, a cup-shaped electrode having a base and a side wall supported by but insulated from said pins, the wall of said cup having a pair of slots for receiving said two of said pins, an electrical lead extending from each of the electrodes in said stack to one of said pins whereby electrical potentials may be applied thereto, said leads being partially positioned between said cup and the side wall of said envelope.

2. A gaseous glow indicator tube comprising a gas-filled envelope, a transparent viewing window comprising a portion of said envelope, a stack of electrodes including cathode viewing elements and a pair of anode screens, a plurality of pins extending through said envelope, said stack of electrodes being mounted and supported on two of said pins, an insulating plate resting on a plurality of said pins, a cup-shaped member having a base and a side wall surrounding said stack of electrodes, said base resting on said insulating plate whereby it is supported by said pins while being insulated therefrom, the wall of said cup having a pair of slots for receiving said two support pins, a plurality of leads each extending from one of the electrodes in said stack to one of said pins whereby electrical potentials may be applied thereto, said leads being positioned between said cup and the wall of said envelope, the base of said cup being provided with an aperture disposed in alignment with one of said pins, an anode lead from said anode screens extending through said aperture into contact with said last-mentioned one of said pins, and a layer of insulating material covering at least a portion of said last mentioned pin and covering a portion of said anode lead in contact therewith.

3. An 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 tube pins sealed in said envelope, a plurality of metallic indicator electrodes in the form of characters adapted to be operated as cathodes and to glow and mounted in a stack facing said viewing window, an electrode lead connected between each of said character electrodes and a tube pin, and a cup-shaped electrode having a side wall substantially completely surrounding and enclosing said stack of metallic electrodes and having a base lying between said cathodes and said tube pins, each said electrode lead lying substantially completely outside of said cup-shaped electrode remote from said indicator electrodes whereby said metallic electrodes tend to glow preferentially when a voltage is applied thereto and said leads tend not to glow.

4. A cold cathode gaseous indicator tube comprising an envelope having a viewing window therein, a plurality of cathode glow indicator electrodes in the form of characters, each of said electrodes having a pair of oppositely disposed mounting tabs, lead wires secured to said cathodes, support means engaging said tabs for supporting said electrodes overlapping one another in a stack opposite said window, and shield means including a conductive shield electrode proximately disposed with respect to said cathode indicator electrodes, said shield electrode having a translucent portion interposed between said indicator electrodes and said window to prevent material emitted from said indicator electrodes from depositing on said window, said shield electrode having another portion extending along the side periphery of said stack interposed between said indicator electrodes and said lead wires to prevent said wires from glowing, said shield electrode being operated as an anode at a potential sufficient for initiating a glow discharge in the region of said cathode electrodes.

5. A cold cathode gaseous indicator tube comprising an envelope having a viewing window therein, a plurality of cathode glow indicator electrodes in the form of characters, each of said electrodes having a pair of oppositely disposed mounting tabs and a lead wire secured to one of said tabs, support means engaging said tabs for supporting said electrodes overlapping one another in a stack opposite said window, and shield means including a conductive shield electrode proximately disposed with respect to said cathode indicator electrodes, said shield electrode having a screen interposed between said indicator electrodes and said window to prevent material emitted from said indicator electrodes from depositing on said window, said shield electrode having another cup-shaped portion enclosing said indicator electrodes and interposed between said indicator electrodes and said lead wires to prevent said wires from glowing, said shield electrode being operated as an anode at a potential sufficient for initiating a glow discharge in the region of said cathode electrodes.

6. An indicator tube including an envelope containing a gas suitable for sustaining cathode glow, an electrode assembly in said envelope, said electrode assembly including a plurality of glow cathode electrodes and a cup-shaped anode electrode for initiating a glow discharge contiguous said cathode electrodes, said cathodes each including a main body portion which is adapted to glow and a lead which does not glow during normal tube operation, said glow portions of said cathodes being arranged to overlap one another in stacked relationship within said cup and said lead portions being connected to said cathodes through an apertured portion of said anode, the lead portion of said cathode extending for at least a portion of its length along the exterior surface of said anode in close proximity thereto and the glow portion of said cath-

ode being displaced from said anode by distance substantially greater than said lead to anode spacing.

7. An indicator tube including a sealed envelope containing a gas suitable for sustaining cathode glow, a cup-shaped barrier member positioned within said envelope, a plurality of cathode glow electrodes spaced apart and overlapping one another in a stack within said cup-shaped barrier member, each of said cathode glow electrodes being configured in the shape of a desired character, a plurality of electrical leads connected to said glow cathodes for applying an electrical potential to said cathodes sufficient to create a cathode glow along the configured surface of said cathode, an anode element within said envelope positioned in operating relation with said cathodes to provide a path between it and each of said cathodes capable of initiating a cathode glow discharge adjacent the surface of a selected one of said cathodes when a predetermined operating potential is established between said anode element and the selected cathode, and also positioned to provide no path between it and each of said cathode electrical leads capable of initiating a cathode glow discharge adjacent the surface of any of said cathode leads when said predetermined potential is established between said anode element and the selected cathode, said electrical leads extending through the side wall of said cup-shaped barrier and along the exterior surface of said barrier, said barrier member being disposed between said cathode glow electrodes and said leads, whereby the initiation and spread of a glow to said leads is inhibited.

8. A tube as defined in claim 7 wherein said envelope includes a bulb portion which is substantially circular in cross section and a base portion having conductive pins therethrough for connection to an electrical circuit external to said envelope, and wherein said cup-shaped barrier member is located within said envelope substantially coaxially with the bulb portion thereof to provide an annular space therebetween, and said electrical leads connected to the cathode glow electrodes pass through said cup-shaped barrier member into the annular space between said barrier member and said envelope, and then through said annular space to the conductive pins at the base of said envelope.

9. A gaseous glow indicator tube comprising a sealed envelope containing gas suitable for sustaining a cathode glow, a viewing window forming a portion of said envelope, a plurality of cathode glow electrodes disposed spaced apart in substantially parallel planes and overlapping one another in a stack, said cathode electrodes being aligned with said viewing window so that the glow of each, when it appears, is visible through said window, a plurality of electrical leads connected to said cathode electrodes and extending therefrom toward the end of said stack away from said viewing window, an anode element within said envelope positioned in operating relation with said cathode electrodes to provide a path between it and each of said cathode electrodes capable of initiating a cathode glow discharge adjacent the surface of a selected one of said cathode electrodes when a predetermined operating potential is established between said anode element and the selected cathode electrode, and also positioned to provide no path between it and each of said cathode electrical leads capable of initiating a cathode glow discharge adjacent the surface of any of said cathode leads when said predetermined potential is established between said anode element and the selected cathode electrode, said electrical leads passing through a region which extends peripherally along the side of said stack a substantial distance measured in the plane of said cathode electrodes, and a barrier member along the major portion of the height of said cathode stack, said barrier member being located in the region surrounding said stack intermediate said stack and said leads and extending a greater distance than said substantial peripheral distance covered by said leads, said electrical leads being spaced from said barrier member and lying on the opposite side of said barrier member from said cathode elements to be completely shielded physically from said cathode elements, whereby minimum interaction between said electrical leads and cathodes is achieved and, at a selected operating voltage, a cathode electrode glows but its electrical lead does not glow.

10. A gaseous glow indicator tube as defined in claim 9 further including a pair of support members spaced on opposite sides of the cathode glow electrodes of said stack and supporting said cathode glow electrodes, wherein the plurality of electrical leads extends from said cathode electrodes in the area of at least one of said support members, and wherein said barrier member includes two portions in the region of said one support member, the two portions of said barrier adjacent such one support member being positioned on opposite sides of such support member and extending outwardly from such support member a greater distance than said substantial peripheral region occupied by the electrical leads.

11. An indicator tube as defined in claim 9 wherein said electrical leads pass outwardly through said barrier and then pass along the exterior surface of said barrier, and wherein insulating material is provided in the region where said leads pass through said barrier, such insulating material serving to space apart successive cathode electrodes in said stack and being dimensioned to extend beyond the edge surface of the leads in a direction normal to the leads.

12. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow, an electrode assembly in said envelope, said electrode assembly including a plurality of cathode glow electrodes spaced apart from and overlapping one another in a stack and an anode to be operated at a potential sufficient to initiate a glow discharge along each of said cathode glow electrodes, a plurality of conductive leads connected to said cathode glow electrodes and extending therefrom toward one end of said stack along the side periphery of said stack, said anode being positioned adjacent the side periphery of said cathode stack intermediate said cathode electrodes and said conductive leads and extending along the height of said stack and throughout the region of said conductive leads to physically shield said leads from substantially all portions of said cathode electrodes.

13. A tube as defined in claim 12 wherein said anode is a substantially cup-shaped member surrounding said stack of cathode glow electrodes.

14. A tube as defined in claim 13 wherein said envelope includes a bulb portion which is substantially circular in cross section and a base portion having conductive pins therethrough for connection to an electrical circuit external to said envelope, and wherein said cup-shaped anode member is located within said envelope substantially coaxially with the bulb portion thereof to provide an annular space therebetween, and said electrical leads connected to the cathode glow electrodes pass through said cup-shaped anode member into the annular space between said anode member and said envelope, and then through said annular space to the conductive pins at the base of said envelope.

15. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow, a plurality of character-shaped cathode glow electrodes spaced apart in substantially parallel planes within said envelope and overlapping one another in a stack, an anode in operative relation to said cathode electrodes to initiate a glow discharge along each of said character-shaped cathode electrodes, a plurality of conductive leads connected to said cathode electrodes and extending therefrom within said envelope along the side periphery of said stack, said leads passing through a region which extends peripherally along the side of said stack a predetermined distance measured in the plane of said cathode glow elec-

trodes, and said anode being positioned adjacent the side periphery of said cathode stack intermediate said cathode electrodes and said leads and extending along the height of said stack over said predetermined peripheral region of said conductive leads to physically shield said leads from substantially all portions of said cathode electrodes.

16. A gaseous glow indicator tube comprising a sealed envelope containing a gas suitable for sustaining a cathode glow, a viewing window comprising a portion of said envelope, a plurality of cathode glow electrodes spaced apart from and overlapping one another in a stack and aligned with said viewing window so that the glow of each, when it appears, is visible through said window, a plurality of electrical leads connected to said cathode electrodes whereby electrical potentials may be applied to said electrodes, and an anode surrounding said cathode electrodes throughout a major portion of the side periphery of said stack and extending over the height of said stack, said anode being in operative relation with said cathode elements for establishing a gaseous current flow path between said anode and each of said cathode electrodes, the electrical leads to said cathodes spaced from said anode and lying on the opposite side of said anode remote from the cathodes to which they are connected, whereby glow on said leads is inhibited when their corresponding cathodes glow at normal operating voltages.

17. A tube as defined in claim 16 wherein a transparent conductive member, formed of a screen, is interposed intermediate said cathode stack and said viewing window and said screen is connected electrically with said anode.

18. A tube as defined in claim 17 wherein the cathode glow electrodes are disposed in parallel planes, further including a second transparent conductive member interposed within said cathode stack in a plane substantially parallel to said cathode electrodes and connected electrically with said anode.

19. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow, a plurality of cathode glow electrodes disposed within said envelope and spaced apart from and overlapping one another in a stack, a cylindrically-shaped anode electrode within said envelope surrounding said stack of cathode electrodes to initiate a glow discharge along the surface of each of said cathode electrodes, a plurality of conductive leads connected to said cathode glow electrodes and passing through an aperture in said anode electrode and extending within said envelope along the outer periphery of said cylindrically-shaped anode.

20. A tube as defined in claim 19 wherein said envelope includes a bulb portion which is substantially circular in cross section and a base portion having conductive pins therethrough for connection to an electrical circuit external to said envelope, and wherein said anode is a cup-shaped member located within said envelope substantially coaxially with the bulb portion thereof to provide an annular space therebetween, and said electrical leads connected to the cathode glow electrodes pass through said cup-shaped anode into the annular space between said anode and said envelope, and then through said annular space to the conductive pins at the base of said envelope.

21. A tube as defined in claim 19 wherein the cylindrically-shaped anode electrode is formed of a conductive wire mesh.

22. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow, a plurality of cathode glow electrodes each having at least a pair of mounting tabs at substantially opposite sides thereof, said cathode electrodes being mounted overlapping one another in a stack by said mounting tabs, a plurality of conductive leads connected to said cathode glow electrodes and extending therefrom along the side periphery of said stack toward one end thereof, and an anode for initiating a glow discharge along the surface of said cathode glow electrodes, said anode being positioned adjacent the side periphery of said cathode stack in the region where said conductive leads connect to said cathode glow electrodes intermediate said cathode glow electrodes and said conductive leads and having a portion thereof extending throughout the region of said conductive leads to physically separate and substantially completely shield said leads from said glow cathodes, and insulating material adjacent said conductive leads in the region where said conductive leads connect to said cathode electrodes, said insulating material extending laterally beyond the edges of said leads to inhibit the spread of glow from said cathode glow electrodes along said leads.

23. A tube as defined in claim 22 wherein said conductive leads are connected electrically to said cathode glow electrodes through said mounting tabs and wherein the insulation extends outwardly over the edges of said supporting tabs to shield said tabs from said anode.

24. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow and having a viewing window at one portion of the envelope and a plurality of conductive pins extending through a base portion of said envelope for connection to electrical circuits external to said envelope, a pair of support members disposed within said envelope supported by two of said pins, a plurality of character-shaped cathode glow electrodes each having a pair of mounting tabs at substantially opposite sides thereof and being mounted overlapping one another in a stacked relation on said support members by said mounting tabs, insulating material adjacent said support members for spacing successive ones of said cathode electrodes apart, said insulating material extending laterally beyond the edges of said mounting tabs to inhibit the spread of cathode glow from said character-shaped cathode glow electrodes, a plurality of electrical leads each connected electrically to one of said cathode glow electrodes through one of its mounting tabs and extending therefrom along the side periphery of said stack to one of said pins, an anode electrode for establishing a gaseous conduction path to each of said cathode electrodes and causing a glow along the surface of said electrodes, said anode including a conductive screen intermediate the top of said stack and said viewing window, a base surface intermediate the bottom of said stack and said conductive pins, and side-wall surfaces along the side periphery of said stack intermediate the cathode electrodes of said stack and said electrical leads, said side-wall surfaces including two portions in the region of each of said support members, the two portions of said side-wall surfaces adjacent each support member being positioned on opposite sides of said support member and extending outwardly from the insulating material adjacent said support member throughout the peripheral region of the electrical leads so as to separate each of said electrical leads from said cathode electrodes, and an insulator between said base surface of said anode and said pins for inhibiting the initiation of a glow discharge on said pins.

25. An indicator tube including a sealed envelope containing gas suitable for sustaining a cathode glow and having a viewing window at one portion of the envelope and a plurality of conductive pins extending through a base portion of said envelope for connection to electrical circuits external to said envelope, a plurality of character-shaped cathode glow electrodes each having at least a pair of mounting tabs at separated points thereof and being mounted overlapping one another in a stacked relation by said mounting tabs, insulating material adjacent said support members for spacing successive one of said cathode electrodes apart, said insulating material extending laterally beyond the edges of said mounting tabs to inhibit the spread of cathode glow from the character-shaped portions of said cathode glow electrodes, a plu-

rality of electrical leads connected electrically to said cathode electrodes through the mounting tabs of the respective electrodes and extending therefrom to said pins, an anode electrode for establishing a gaseous conduction path to each of said cathode electrodes and causing a glow along the surface of said electrodes, said anode including a conductive screen positioned intermediate said stack and said viewing window contiguous the end of said stack, and side-wall surfaces extending along the major portion of the side periphery of said stack but spaced from said support members, said conductive screen and side-wall surfaces being electrically connected and serving as the anode for all of said cathode electrodes.

26. A gaseous glow indicator tube comprising a sealed envelope containing a gas suitable for sustaining a cathode glow, a viewing window comprising a portion of said envelope, a plurality of character-shaped cathode glow elements spaced apart from and overlapping one another in a stack aligned with said viewing window so that the glow of each, when it appears, is visible through said window, the height of said stack extending in a direction normal to said window, a plurality of electrical leads connected to said cathode elements whereby electrical potential may be applied to said elements, and an anode encircling said stack in operative relation with said cathode elements for establishing a gaseous current flow path between said anode and each of said cathode elements, said anode comprising a first grid-formed conductive surface adjacent one end of said stack of elements between said stack and said viewing window, a second conductive surface along the end of said stack remote from said viewing window, a third conductive surface connected to said first and second conductive surfaces and extending in the direction of the height of said stack of cathode elements at one side thereof, and a fourth conductive surface connected to said first and second conductive surfaces and extending in the direction of the height of said stack of elements at the side thereof opposite said third conductive surface, said third and fourth conductive surfaces extending substantially the full height of said stack and covering the major portion of the periphery around the sides of said stack.

27. A gaseous glow indicator tube comprising a sealed envelope containing a gas suitable for sustaining a cathode glow, a viewing window comprising a portion of said envelope, a plurality of character-shaped cathode glow elements spaced apart from and overlapping one another in a stack aligned with said viewing window so that the glow of each, when it appears, is visible through said window, the height of said stack extending in a direction normal to said window, an insulation barrier extending along substantially the full length of said stack, a plurality of electrical leads connected to said cathode elements whereby electrical potential may be applied to said elements, said electrical leads extending from said cathode elements through said insulation barrier for inhibiting the spread of cathode glow from said cathode elements past the point of said barrier, and an anode encircling said stack in operative relation with said cathode elements for establishing a gaseous current flow path between said anode and each of said cathode elements, said anode comprising a first grid-formed conductive surface adjacent one end of said stack of elements between said stack and said viewing window, a second conductive surface along the end of said stack remote from said viewing window, a third conductive surface connected to said first and second conductive surfaces and extending substantially the full height of said stack of cathode elements at one side thereof, and a fourth conductive surface connected to said first and second conductive surfaces and extending substantially the full height of said stack of elements at the side thereof opposite said third conductive surfaces, said third and fourth conductive surfaces extending outwardly from the region of said insulation barrier and covering the major portion of the periphery around the sides of the stack.

28. A gaseous glow indicator tube comprising a sealed envelope having a viewing window and a base portion and containing gas suitable for sustaining a cathode glow, an electrode assembly within said tube including a plurality of character-shaped cathode glow electrodes spaced apart and overlapping one another in a stack for establishing a cathode glow discharge in the shape of such characters and a pair of mounting tabs at substantially opposite sides of each said cathode glow electrode, a plurality of conductive pins outside said assembly and extending through said base portion for connection to electrical circuits external to said envelope, a plurality of conductive leads extending outside of said electrode assembly and interconnecting one of the mounting tabs of each said cathode electrode of said stack with one of said pins, said electrode assembly further including a pair of support members for supporting said cathode glow electrodes in a stack by their respective mounting tabs, insulating material adjacent said support members for spacing successive ones of said cathode electrodes apart in said stack, said insulating material extending laterally beyond the edges of said mounting tabs to inhibit the spread of cathode glow from said character-shaped cathode electrodes, and an anode electrode surrounding said stack of cathode electrodes, said anode including a surface contiguous the end of said stack remote from said viewing screen, a conductive screen interposed between said stack and said viewing window, said conductive screen being transparent to permit viewing of the glow from said cathode electrodes through said window, and an intermediate surface interconnecting said end surface and said conductive screen and extending along the side periphery of said stack, said intermediate surface encircling the major portion of the side periphery of said stack but being apertured in the region of said support members and insulating material.

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