Nov. 18, 1952 R. D. HANCOCK ET AL 2,618,760

GLOW TUBE ANODE CONSTRUCTION

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Fig. 2

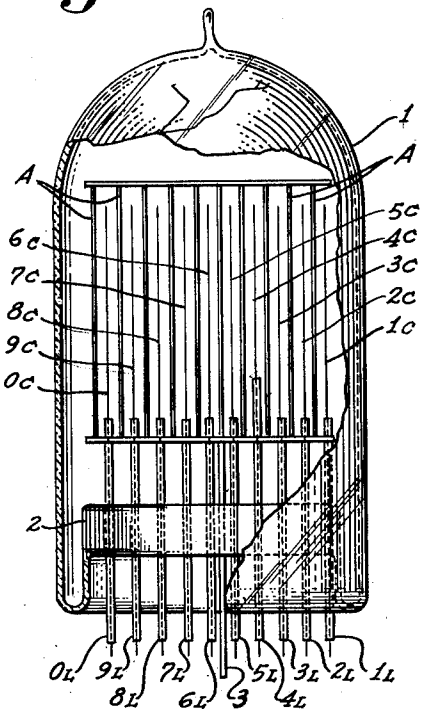
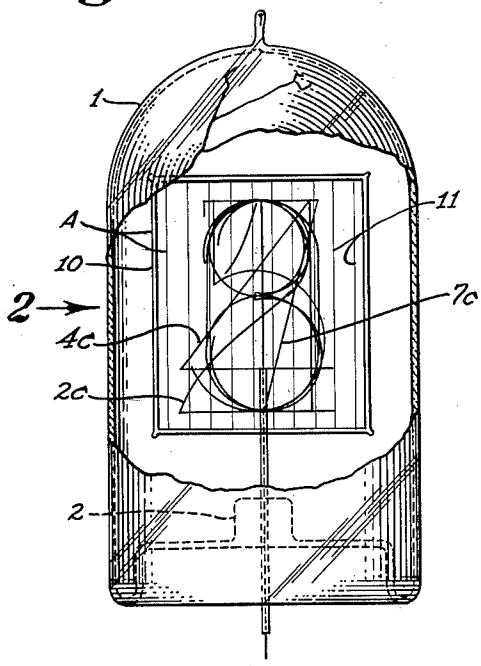


Fig. 1



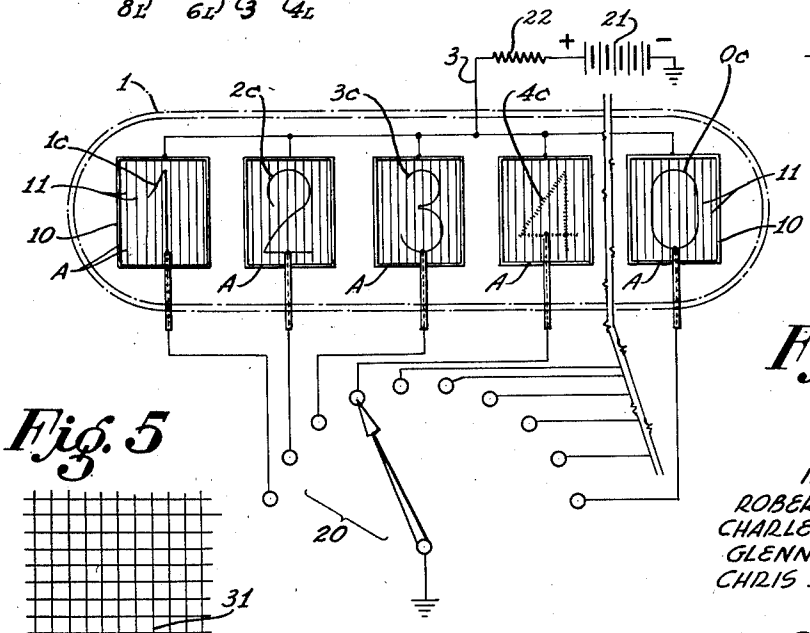


Fig. 4

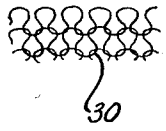
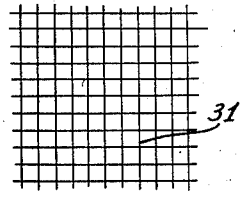


Fig. 3

Fig. 5



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GLOW TUBE ANODE CONSTRUCTION

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9 Claims. (Cl. 313—109.5)

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This invention relates to ionic glow tubes, and, more particularly, to a multiple cathode, multiple anode glow tube suitable for application as an indicator device.

Heretofore, indicator glow tubes have been devised, employing a multiplicity of stacked cathodes, whose configuration and spatial relationships are such that an indication of a condition of an external circuit will be given by the glow of a single cathode. These tubes are known as "read-out" tubes and are shown, described and claimed in the Hagen application, Serial No. 139,819, filed January 21, 1950. Prior read-out tubes have usually employed a single anode, or means whereby one of the cathodes may be employed as an anode.

Unless the distance between the anode and the cathode is very nearly uniform throughout the entire length of the cathode, the glow discharge to the cathode may, under certain operating conditions, be confined to small portions of the cathode, resulting in an incomplete and sometimes erroneous indication of the condition of the external circuit.

It is, therefore, an object of the present invention to provide a means whereby the distance between the cathode and anode of a multiple cathode ionic glow tube of the the read-out type is maintained nearly uniform, over the entire length of the cathode, and for all of the cathodes.

It is a further object of the present invention to provide a multiplicity of anodes within a multiple cathode indicator glow tube, such that the anodes will not interfere with the visual indication resulting from the glow discharge when the cathodes are stacked in superimposed relation.

Briefly, the present invention provides a tube having an anode comprised of fine wires for each cathode of a multiple stacked cathode ionic glow tube and interposed between said cathodes. The invention will be more fully understood by reference to the drawings, in which:

Figure 1 is a front view, with the envelope cut away, of a preferred read-out tube containing the digits 1–0, inclusive, embodying the present invention.

Figure 2 is a side view, envelope cut away, of the tube of Figure 1 taken as indicated by arrow 2 in Figure 1.

Figure 3 is a circuit diagram showing how the cathodes and anodes of the tube of Figures 1 and 2 can be energized. The cathodes are shown side by side for clarity of illustration.

Figures 4 and 5 are plan views of anode screens suitable for use in the tube of Figures 1 and 2.

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Referring first to Figures 1 and 2, an envelope 1 is provided with an end seal 2 through which eleven leads are sealed, an anode lead 3 and cathode leads 1L and 0L, inclusive. Inside envelope 1 cathodes 1C to 0C, inclusive, are mounted in their respective cathode leads 1L to 0L. Cathodes 1C to 0C are in the form of the digit 1 to 0, inclusive, and are formed of fine wire and positioned in close parallel relation, one in front of the other, so that the digits form a single stack. Between each cathode C and the adjacent cathode C is positioned an anode A. The anodes A, 10 in number, are formed from an edge frame 10 of relatively heavy wire on which a grid of parallel fine wires 11 is welded. Tungsten wires of one mil diameter or less are satisfactory. The frames 10 are substantially larger than the extent of the digits so that when the grid wires 11 of each anode are sufficiently close, the grid has the electrical effect of a flat plate. Thus all parts of each cathode C are equally distant from a cooperating adjacent anode A, irrespective of the cathode shape. Envelope 1 is filled with a gas at a glow discharge pressure wherein a visible cathode glow is produced when the cathode is energized. In this manner, when a cathode digit and an adjacent anode are energized with the cathode negative, a negative glow will always be produced over the entire extent of the cathode, thus insuring accurate delineation of the desired digit. The cathode wires and the anode grid wires are sufficiently small in diameter that digits deep in the stack, when glowing, are readily seen and identified when the stack is viewed from the front end of the stack.

Various circuits may be used to energize the individual cathodes and anodes, a simple circuit being shown in Figure 3. Here a ten point switch 20 is used to connect the individual cathodes C to the negative pole of a D. C. source 21. All anodes A are connected together and to the positive pole of source 21 through a regulating resistance 22. Operation of switch 20 will then cause a selected cathode to glow.

While the tube of Figures 1 and 2 utilizes a parallel wire grid as an anode, other types of anode having fine wires and a large void to wire ratio are equally satisfactory, such as, for example, a knitted wire fabric 30 as shown in Figure 4, or a metal net 31 as shown in Figure 5. Such fine screen structures are well known in the art, being commonly utilized in electron multipliers and television pickup tubes. In some instances such grids are formed of such fine wire as to be almost invisible to the naked eye.

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 the preferred form of several modes 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 read-out tube having a plurality of stacked, spaced, adjacent and parallel fine wire cathodes of differing symbol shape mounted one in front of another from a viewer's standpoint in an envelope having a filling of gas at glow discharge pressure, a plurality of anodes in said envelope equal in number to said cathodes, with an anode positioned between adjacent cathodes and equally spaced from all parts of said cathodes, each of said anodes being formed from electrically connected wires spaced and sized to have an optimum flat plate anode effect, electrically, consistent with good viewing of any glowing cathode through one or more anodes and cathodes in said envelope, each of said anodes enclosing a larger plane area than does the superimposed extent of its adjacent cathode.

2. In a read-out tube having a plurality of stacked, spaced, adjacent and parallel fine wire cathodes of differing symbol shape mounted one in front of another from a viewer's standpoint, in an envelope having a filling of gas at glow discharge pressure, a plurality of anodes in said envelope with an anode positioned between adjacent cathodes and equally spaced from all parts of said cathodes, each of said anodes being electrically connected and comprising a grid of fine parallel wires spaced sufficiently close to be the electrical equivalent of a flat plate and from wire sufficiently fine as to not substantially interfere with the view of a particular cathode when viewed through one or more anodes and cathodes in said stack, the described area of each of said anodes being larger than the described area of an adjacent cathode.

3. In a read-out tube having a plurality of stacked, spaced, adjacent and parallel fine wire cathodes of differing symbol shape mounted one in front of another from a viewer's standpoint, in an envelope having a filling of gas at glow discharge pressure, a plurality of anodes in said envelope with an anode positioned between adjacent cathodes and equally spaced from all parts of said cathodes, each of said anodes being electrically connected and comprising a wire net having the wires thereof spaced sufficiently close to be the electrical equivalent of a flat plate and from wire sufficiently fine as to not substantially interfere with the view of a particular cathode when viewed through one or more anodes and cathodes in said stack, the described area of each of said anodes being larger than the described area of an adjacent cathode.

4. In a read-out tube having a plurality of stacked, spaced, adjacent and parallel fine wire cathodes of differing symbol shape mounted one in front of another from a viewer's standpoint, in an envelope having a filling of gas at glow discharge pressure, a plurality of anodes in said envelope with an anode positioned between adjacent cathodes and equally spaced from all parts of said cathodes, each of said anodes being electrically connected and comprising a knitted wire fabric having the wires thereof spaced sufficiently close to be the electrical equivalent of a flat plate and from wire sufficiently fine as to not substantially interfere with the view of a particular cathode when viewed through one or more anodes and cathodes in said stack, the described area of each of said anodes being larger than the described area of an adjacent cathode.

5. A glow discharge tube having an envelope containing a filling of gas at glow discharge pressure, a cathode in said envelope shaped from fine wire to show as an intelligible symbol when viewed from a predetermined external position, an anode in said envelope positioned between said cathode and said external viewing position, said anode being formed from fine wire elements electrically connected and having a void-to-wire ratio producing an optimum flat plate anode effect consistent with clear viewing of said cathode, when glowing, through said anode, the area described by said anode being greater than that described by said cathode, all portions of said cathode being substantially equally spaced from the electrical plane of said anode.

6. A glow discharge tube having an envelope containing a filling of gas at glow discharge pressure, a cathode in said envelope shaped from fine wire to show as an intelligible symbol when viewed from a predetermined external position, an anode in said envelope positioned between said cathode and said external viewing position, said anode being formed from fine wire elements electrically connected and having a void-to-wire ratio producing an optimum flat plate anode effect consistent with clear viewing of said cathode, when glowing, through said anode, the area described by said anode being greater than that described by said cathode, means for applying a glow discharge potential between said anode and cathode with said cathode negative to create a glow thereon, all portions of said cathode being substantially equally spaced from the electrical plane of said anode to insure uniform glow coverage of said cathode.

7. A glow discharge tube having an envelope containing a filling of gas at glow discharge pressure, a cathode in said envelope shaped from fine wire to show as an intelligible symbol when viewed from a predetermined external position, an anode in said envelope positioned between said cathode and said external viewing position, said anode comprising a knitted metal wire fabric having a void-to-wire ratio sufficiently low to cause said anode to act electrically as a plate, and sufficiently high so that said cathode when glowing can be clearly seen through said anode, the area described by said anode being greater than that described by said cathode, and means for applying a glow discharge potential between said anode and cathode with said cathode negative to create a glow thereon, all portions of said cathode being substantially equally spaced from the electrical plane of said anode to insure uniform glow coverage of said cathode.

8. A glow discharge tube having an envelope containing a filling of gas at glow discharge pressure, a cathode in said envelope shaped from fine

wire to show as an intelligible symbol when viewed from a predetermined external position, an anode in said envelope positioned between said cathode and said external viewing position, said anode comprising a grid formed from parallel wires having a void-to-wire ratio sufficiently low to cause said anode to act electrically as a plate, and sufficiently high so that said cathode when glowing can be clearly seen through said anode, the area described by said anode being greater than that described by said cathode, and means for applying a glow discharge potential between said anode and cathode with said cathode negative to create a glow thereon, all portions of said cathode being substantially equally spaced from the electrical plane of said anode to insure uniform glow coverage of said cathode.

9. A glow discharge tube having an envelope containing a filling of gas at glow discharge pressure, a cathode in said envelope shaped from fine wire to show as an intelligible symbol when viewed from a predetermined external position, an anode in said envelope positioned between said cathode and said external viewing position, said anode comprising a square mesh wire screen having a void-to-wire ratio sufficiently low to cause said anode to act electrically as a plate, and sufficiently high so that said cathode when glowing can be clearly seen through said anode, the area described by said anode being greater than that described by said cathode, and means for applying a glow discharge potential between said anode and cathode with said cathode negative to create a glow thereon, all portions of said cathode being substantially equally spaced from the electrical plane of said anode to insure uniform glow coverage of said cathode.

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