May 28, 1935. S. P. SASHOFF 2,003,012

GRID GLOW TUBE STRUCTURE

Filed May 27, 1933

Fig. 1.

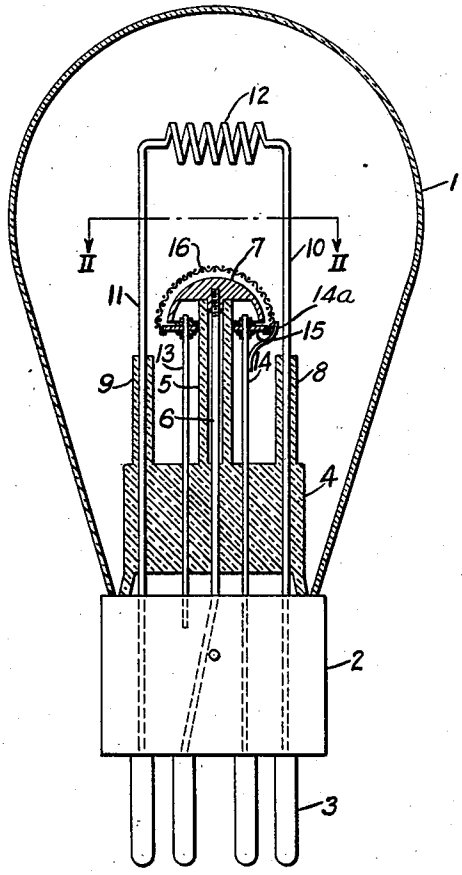
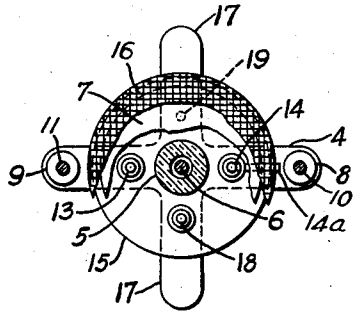


Fig. 2.



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GRID GLOW TUBE STRUCTURE

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Application May 27, 1933, Serial No. 673,221

3 Claims. (Cl. 250—27.5)

My invention relates to an electrical discharge device and particularly to a hot-cathode gaseous discharge tube.

An object of my invention is to provide an electric discharge tube, that shall be capable of direct use as a relay utilizing commercial voltages and currents.

Another object of my invention is to provide a grid controlled discharge tube, operable as a relay without moving parts.

A still further object of my invention is to provide an anode structure for a discharge tube that is rugged in character, which is simple and economical to manufacture, as well as effective and reliable in operation.

Further objects of my invention will become apparent from the following description when taken in connection with the accompanying drawing; in which,

Figure 1 is a view in vertical sectional elevation of a space discharge device embodying my invention, and

Fig. 2 is an enlarged view, partly in section, looking down from the line II—II of Fig. 1.

The tube shown in Fig. 1 comprises the usual bulb or container 1 supported on a conventional base member 2 from which project the usual prongs 3 for the exterior connections of the tube. A press and seal 4 of conventional form supports the connection from the exterior prongs 3 to the interior elements of the tube. In the center of the glass press 4 is an upward projecting refractory insulating sleeve 5 which may be integral with the glass press 4. The upward projecting sleeve 5 is adapted to surround the connection 6 to the anode 7 for the purpose of increasing the ohmic resistance between the supports of the various electrodes of the tube. The sleeve 5 has preferably an exterior cylindrical surface.

The anode 7 may be of any suitable material, such as nickel, iron or molybdenum, and is preferably made in the form of a segment of a spherical surface. This anode may be screw-threaded to the top of the connection 6 or otherwise secured thereto.

Sleeves 8 and 9 of refractory insulating material also project upwardly from the press 4 to surround the metallic connections 10 and 11 which project to the upper part of the tube from two of the prongs 3. When desired sleeves 5, 8 and 9 may be non-integral with the press 4. A conventional thermo-emissive cathode 12, which may be of tungsten or of a nickel-cobalt alloy such as Konal, coated with electron-emissive oxide, is connected across these two connections and is adapted to be heated to an electron-emissive state by current passed through from the connections 10 and 11.

Projecting upward through the press 4 are two metallic standards 13, 14, one of which is connected to the prong of the base 2 constituting the grid terminal. At their upper ends they support a number of members 15 of insulating material, such, for example, as quartz, which may be in the form of an annular disc with a hole at its center closely fitting the sleeve 5. The insulating member 15 may be supported on the standards 13, 14 by suitable collars above and below it, which may, if desired, be screw-threaded or pinched on the standards 13, 14. The insulating member 15 is preferably so positioned that it fits against the lower edge of the spherical anode 7 and projects to form a ledge or rim extending radially outward at the lower edge of said anode.

A control electrode 16, preferably in the form of a segment of a spherical surface of perforated metal or woven metal screen, is positioned to substantially cover the spherical surface of the anode 7 and may be uniformly spaced radially away therefrom. For gaseous discharge tubes, it will usually be desirable to make this radial spacing less than the mean free path of an electron in the gaseous atmosphere. The control electrode 16 may advantageously extend down to the edge of the insulating plate 15, and may preferably be bent over and clinched in place mechanically upon the edge of the plate 15. An electrical connection from the edge of the control electrode 16 may extend to the standard 14 which is to constitute the grid lead.

The discharge tube structure above described may be exhausted to a vacuum of such degree as to permit only a pure electron discharge at its intended operating voltage by methods well known in the art, such as those described in Langmuir Patent 1,558,436. Both the anode 7 and the control electrode 16 may, if desired, be carbonized in accordance with Upp Patent 1,852,865. While the above-described tube structure is useful for electron tubes operating by pure electron discharge, it has been found especially useful in tubes having a substantial gaseous atmosphere present, such as those described in Knowles application, Serial No. 149,290, filed November 19, 1926, assigned to the Westinghouse Electric & Manufacturing Company. Gaseous atmospheres, comprising the noble gases, or mercury vapor or mixtures thereof, at pressures ranging all the way from a magnitude of one

atmosphere down to vacuums which permit only pure electron discharge, are within the scope of my invention.

For many purposes, it will be found desirable to arrange the press **4** with two or more intersecting fins **17** like the cross indicated in the top view of the anode and control electrode structure shown in Fig. 2. With such an arrangement, it may be desirable to provide additional standards **18**, **19** set in the press **4** at the lower ends and supporting the plate **15**, in the same manner as standards **13** and **14** at their upper ends.

The structure above described has been found to be peculiarly valuable through its permanence, ruggedness, rigidity of structure, constancy of spacing and alignment, and ease and cheapness of manufacture. The insulating sleeves **5**, **8** and **9** will be seen to provide long insulating creepage distances between conductors likely to be at great differences of electrical potential and, accordingly, adapt tubes of the structure described to employment with higher voltages and power outputs than tubes of the prior art. The substantial area and heat-radiating surface of both the anode **7** and the control electrode **16**, together with the form of the cathode **12** which permits it to be of relatively large size and surface area, also facilitate the construction of tubes of relatively large current output.

In accordance with the patent statutes, I have described a particular embodiment of the broad principles of my invention, but these principles are capable of application in other ways which will be evident to those skilled in the art. I, accordingly, desire the following claims to be given the broadest interpretation of which their terms are susceptible in view of the prior art.

I claim as my invention:

1. An electrical discharge device comprising a vacuum-tight container, a press, a cathode supported on leads projecting above said press, insulating sleeves encasing said cathode leads for a substantial distance above said press, an inleading wire sealed through said press and projecting upward therefrom, a sleeve of insulating material about said wire, and an anode connected to the upper end of said wire adjacent the top of said insulating sleeve and substantially enclosing the top of said sleeve.

2. An electrical discharge device comprising a vacuum-tight container, a press, a cathode supported on leads projecting above said press, insulating sleeves encasing said cathode leads for a substantial distance above said press, an inleading wire sealed through said press and projecting upward therefrom, a sleeve of insulating material about said wire and an anode connected to the upper end of said wire, the last-named insulating sleeve covering substantially the entire length of said wire between said press and said anode, said anode having an annular edge portion extending a substantial distance below the upper end of the insulating sleeve last-named, a control electrode of perforated metal forming a surface of substantially uniform spacing away from the external surface of said anode, and an insulating plate adjacent the lower rim of said anode surface for supporting said control electrode in said spaced position.

3. An electrical discharge device comprising a vacuum-tight container, a cathode, an inleading wire sealed through said container, a sleeve of insulating material about said wire and an anode connected to the upper end of said wire, the said insulating sleeve covering substantially the entire length of said wire between said container and said anode, said anode having an annular edge portion extending a substantial distance below the upper end of the said insulating sleeve, a control electrode of perforated metal enclosing the external surface of said anode, and insulation adjacent the lower rim of said anode surface forming a barrier extending across the entire distance from said insulating sleeve to said control electrode.

STEPHAN P. SASHOFF.