Dec. 11, 1951 D. S. PECK 2,578,370

GASEOUS DISCHARGE DEVICE

Filed April 25, 1950

FIG. 1

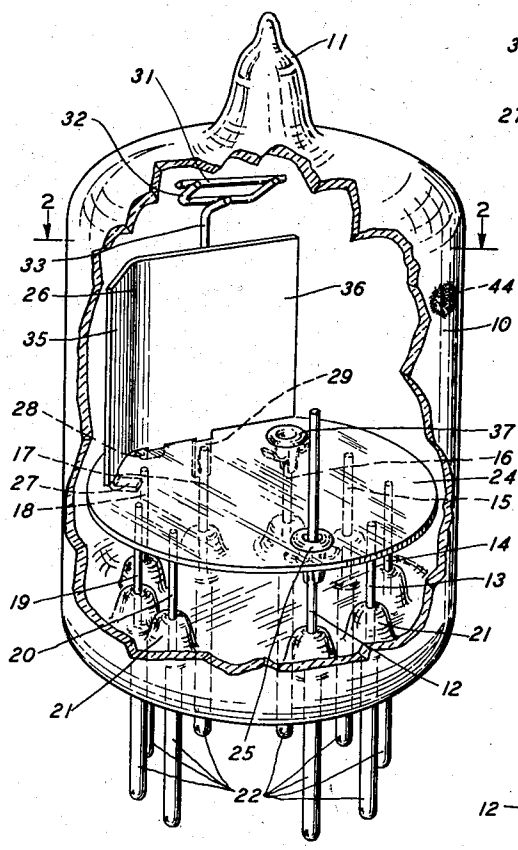


FIG. 2

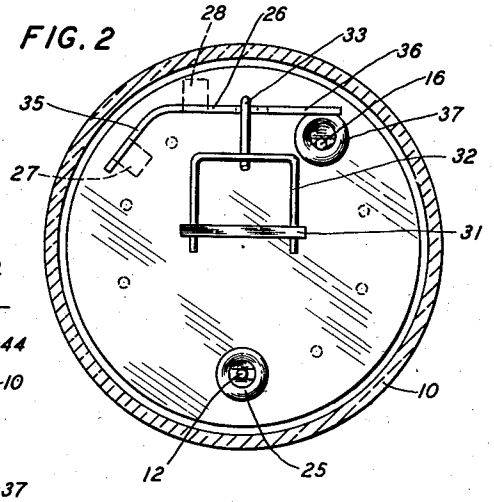


FIG. 3

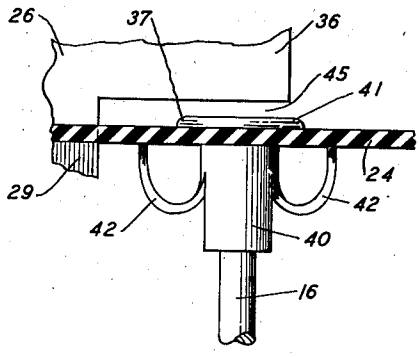
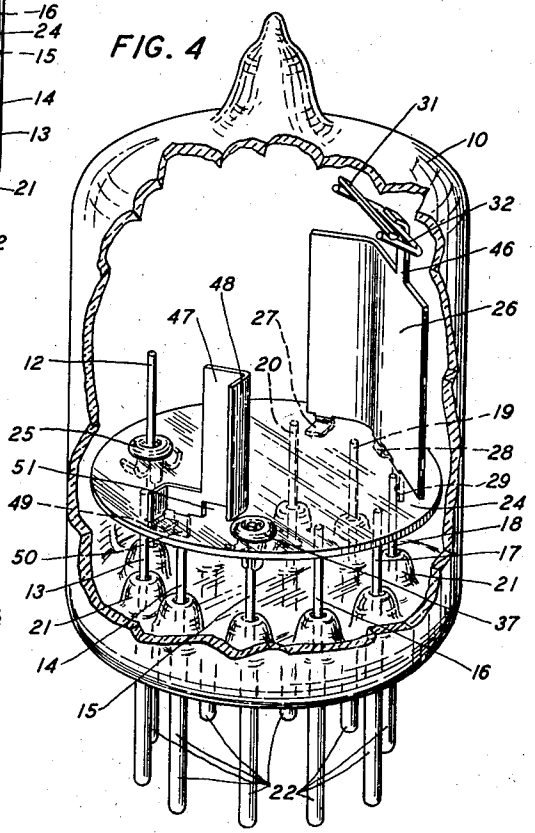


FIG. 4



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Patented Dec. 11, 1951

2,578,370

UNITED STATES PATENT OFFICE

2,578,370

GASEOUS DISCHARGE DEVICE

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Application April 25, 1950, Serial No. 157,897

9 Claims. (Cl. 313—198)

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This invention relates to gaseous discharge devices and more particularly to such devices including a starter electrode.

In devices of this general type, it is desirable that the spacing in the starter gap be maintained accurately to minimize variations in the starter breakdown voltage between different discharge devices of the same structure. It is also desirable that the transfer current be kept at a minimum. This may be attained in one way by providing that the main anode has an unobstructed view of the starter gap and, therefore, the starter discharge. It is further advantageous in such devices that these desiderata of consistent starter breakdown voltage and minimum transfer current be achieved in a structure which is inexpensive both as to the cost of its components and as to the cost of assembling them in accurate spatial relation.

Such devices may be employed for use in relay, voltage regulator, or rectifier circuits. A three-electrode gaseous discharge device may be especially suitable for use in control circuits, such as in triggering, counting, or switching apparatus. Thus, such a device may advantageously be employed in telephone sets for selective ringing party line service or for switching and signalling purposes, as required where one telephone set has access to several lines. As each such set includes a gaseous discharge device mounted in an appropriate terminal block within the set and electrically connected to the other elements of the set, it is apparent that economies achieved because of the inexpensiveness of the component parts and the ease of assembling them are greatly multiplied and amount to considerable savings for the large number of such devices continually being produced.

Similarly, a four-electrode gaseous discharge device may advantageously be employed as a relay. One such use may be in telephone circuits and, specifically, as a ringing control in telephone systems. Such an application of a four-electrode discharge device as a ringing control in four-party line telephone systems is disclosed in Patent No. 2,518,319, issued August 8, 1950, to V. L. Holdaway.

An improved gaseous discharge device is, therefore, one object of this invention.

A further object of this invention is to improve the starter gap characteristics of gaseous discharge devices and to achieve accurate spacing of the starter gap.

A still further object of this invention is to reduce the cost of the fabrication of the gaseous discharge devices.

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A further object of this invention is to enable the starter gap to be expediently fabricated.

In one illustrative embodiment of this invention, whereby the above noted and other objects are realized, a gaseous discharge device comprises a plate cathode secured to an insulator spacer and extending perpendicular thereto. The starter electrode comprises an eyelet staked in the insulator spacer adjacent and just beneath a cut-out portion in one edge of the cathode. The spacing of the cathode edge in the cut-out portion with respect to the eyelet determines the length of the starter gap. The eyelet electrode may be staked in the spacer adjacent a cut-out portion in the main cathode or an auxiliary cathode.

It is, therefore, one feature of this invention that the starter electrode be an eyelet staked directly into an insulator spacer.

It is a further feature of this invention that the eyelet be spaced adjacent and beneath a cathode which has a cut-out portion exactly determining the spacing of the starter gap between the eyelet and the cathode.

It is a still further feature of this invention that the anode of the gaseous discharge device may be a single wire extending through a second eyelet identical with the starter electrode eyelet whereby an economy is achieved by the reduction in the individual piece parts required. In addition, both the main anode eyelet and the starter electrode, which itself may be secured to a lead-in wire extending into the eyelet starter electrode, support the insulator spacer.

A more complete understanding of the invention and the features thereof may be gained from consideration of the following detailed description and the accompanying drawing, in which:

Fig. 1 is a perspective view of a gaseous discharge device illustrating one embodiment of this invention, a portion of the glass envelope being broken away to show the internal elements of the device;

Fig. 2 is a plan view along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged detail view showing the starter electrode and adjacent cut-out portion of the cathode; and

Fig. 4 is a perspective view of a gaseous discharge device illustrating another embodiment of this invention, a portion of the glass envelope being broken away to show the internal elements of the device.

Referring now to the drawing, the glow discharge device illustrated in Fig. 1 comprises a vessel 10, which may be of glass and which has an exhaust tubulation 11 at one end. A plurality of leads 12 through 20 extend through the base of

the vessel 10 and are sealed thereto by seals 21. The leads advantageously extend into terminals pins 22 external to the vessel to which they are attached. An insulating spacer 24, which may advantageously be of mica, rests on certain of the leads, such as 13, 14, 15, 17, 18, 19, and 20, and is supported by the other leads, as discussed below.

Lead 12 extends through an aperture in the spacer 24 and comprises an anode for the glow discharge device, the lead being secured to the spacer by an eyelet 25. A plate cathode 26 extends opposite the anode 12 and parallel thereto. Tabs 27, 28, and 29 extend from the cathode 26 through apertures in the spacer 24, the tabs 27 and 28 being bent over to position the cathode in place and the tab 29 being secured to the lead 17.

A getter 31 is secured across a U-shaped lead 32 which is supported from the top of the cathode 26 as by a wire 33, the getter 31 extending towards the exhaust tubulation 11. The front surface of the cathode 26 may advantageously be coated with an electron emitting material, such as barium and strontium oxides, and the rear surface coated with a glow inhibiting material to prevent the glow spreading to that surface. The cathode advantageously also has a bent portion 35 bent in a slight curve from the straight portion 36.

The starter electrode comprises an eyelet 37 extending through an aperture in the spacer 24 and staked into the spacer 24. The lead 16 extends into the eyelet 37 and is secured to it. The eyelet electrode 37, and the similar eyelet 25, each comprises a body 40, an upper rim 41 above the spacer 24, and two arms 42 extending from the body 40 and bearing against the under side of the spacer 24. The two eyelets 25 and 37 and the leads associated therewith, therefore, support and position the insulator spacer 24.

The vessel is advantageously filled with an inert gas, such as a mixture of 95 per cent neon and 5 per cent argon, at a pressure of 40 millimeters of mercury, though other gases and pressures may be employed. A spot 44 of radium bromide is also advantageously placed on the inner wall of the vessel 10, as is known in the art.

Referring now to Fig. 3, the cathode 26 has a cut-out portion 45 in its lower edge. The eyelet electrode 37 is positioned slightly in front of the cathode adjacent this cut-out portion 45, as best seen in Fig. 2. A starter gap is therefore provided between the edge of the cathode and the upper rim 41 of the eyelet electrode 37 which is directly beneath the cathode edge, the length of this starter gap being determined by the height of the cut-out portion. This may be accurately determined by the simple processes wherein the cathode is fabricated, the critical dimension being between the edge of the cathode resting on the spacer 24 and the edge of the cut-out portion 45. Further, the eyelet electrode itself is accurately and simply positioned by a staking operation, the height of the rim 41 above the spacer 24 being consistent from one eyelet to the next.

In one specific embodiment constructed in accordance with this invention, the eyelets were of nickel plated iron and the cathode of .010 inch nickel plate coated with a mixture of barium and strontium carbonates, which were treated with a high frequency current during the exhausting of the device to reduce the coating. The rear surface of the cathode was calorized. Motion of the cathode during the processing or under shock while in use is prevented by the bend in the cathode and the location of the tabs. The main anode 12 and other lead wires were of .020 inch nickel wire. An appreciation of the size of these elements in one embodiment may be had from the over-all dimension of the device which was, from the base to the exhaust tubulation, about one and a half inches.

Referring now to Fig. 4, there is shown another embodiment of this invention, similar elements of this embodiment being designated by the same numerals as those of the embodiment of Fig. 1. The gaseous discharge device thus comprises the vessel 10 having a gaseous filling therein, such as 90 per cent neon and 10 per cent argon at 45 millimeters of mercury, the insulator spacer 24 resting on leads 13, 14, 16, 17, 18, 19, and 20, and the cathode 26, which has tabs 27 and 28 extending through the spacer 24 and bent over against the under side of the spacer to accurately position the cathode. The lead 12 extends through the eyelet 25 which is staked into the spacer 24 and to which the lead is secured and comprises the main anode. The getter 31 is supported by the U-shaped wire 32 which may, however, be secured to a tab 46 integral with the cathode 36.

A starter cathode 47, which may have one side portion 48 bent back, has tabs 49 and 50 extending through the spacer 24, the tab 49 being bent over against the spacer and the tab 50 being connected to the lead 14. The starter cathode 47, which may also be of .010 inch nickel plate having an electron emitting coating on its front surface and a calorizing coating on its rear surface, has a cut-out portion 51 in its lower edge removed from the tabs 49 and 50 and in the side portion 48, which cut-out portion is similar to the cut-out portion 45 in cathode 36 of Fig. 1. The eyelet starter electrode 37 is positioned in the cut-out portion 51 and slightly in front of the side portion 48 so that the starter gap is provided between the rim 41 on the eyelet starter electrode 37 and the edge of the cathode 47 in the cut-out portion 51. The eyelet 37 is secured in the spacer 24, and lead 15 is connected to the eyelet as by welding.

As the eyelet is a relatively inexpensive part and may be expeditiously handled, the over-all cost of devices embodying such eyelets in accordance with this invention is reduced. It is further reduced by employing the eyelets to position and secure the insulator spacer 24. The cost is further reduced by using a stem lead as both an anode and a support for the spacer 24, thereby again reducing both the number of individual piece parts required and the number of connections, such as welds, that must be made in the fabrication of the device.

In these illustrative embodiments, the spacing between the edge of the cathode in the cut-out portion and the insulator spacer 24 for either embodiment was .020 inch and the starter gap between that edge and the rim 41 of the starter electrode eyelet 37 approximately .012 inch. The starter gap is positioned in the device so that the main anode has a clear and unobstructed view of the gaseous discharge in this gap. Variations in the transfer characteristics may be attained by altering the position of the starter gap relative to the other electrodes and particularly relative to the main anode 12.

It is to be understood that the above-described arrangements are illustrative of the application of the principles of the invention. Numerous

other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A gaseous discharge device comprising a cathode, an insulating spacer adjacent said cathode and having an aperture therein, and an eyelet electrode extending through said aperture, the rim of said eyelet being against said spacer adjacent said cathode.

2. A gaseous discharge device comprising a cathode, an insulating spacer adjacent said cathode and having an aperture therein, said cathode having a cut-out portion in one edge adjacent said spacer, and an eyelet electrode extending through said aperture, secured to said spacer, and being adjacent said cut-out portion.

3. A gaseous discharge device comprising a plane cathode having a cut-out portion in one edge, an insulating spacer adjacent said edge and having apertures therein, a first eyelet secured in one of said apertures, an anode extending through said first eyelet and secured thereto, and a second eyelet secured in another of said apertures, said second eyelet being adjacent said cut-out portion and comprising a starter electrode for said discharge device.

4. A gaseous discharge device comprising a vessel, a plurality of leads extending through a wall of said vessel, an insulating spacer having apertures therein, a plane cathode having tabs extending through some of said apertures positioning said cathode, one of said leads being connected to one of said tabs, a first eyelet secured in one of said apertures, one of said leads extending through said first eyelet and secured thereto, said lead comprising an anode for said device, and a second eyelet secured in another of said apertures, said second eyelet having a rim adjacent said cathode and comprising a starter electrode for said device.

5. A gaseous discharge device comprising a vessel, a plurality of leads extending through a wall of said vessel, an insulating spacer having apertures therein and resting on some of said leads, a plane cathode having a cut-out portion in one edge adjacent said spacer and having tabs extending through some of said apertures positioning said cathode, one of said leads being connected to one of said tabs, a first eyelet secured in one of said apertures, one of said leads extending through said first eyelet and secured thereto, said lead comprising an anode for said device, and a second eyelet secured in another of said apertures, another of said leads extending into said eyelet and secured thereto, said second eyelet being adjacent said cut-out portion and comprising a starter electrode for said device.

6. A gaseous discharge device comprising a vessel, a plurality of leads extending through a wall of said vessel, an insulating spacer having apertures therein and resting on some of said leads, a plane cathode having a straight portion and a second portion bent in a slight curve from said straight portion, said straight portion having a cut-out portion in one edge adjacent said

spacer, tabs extending from said cathode through some of said apertures, some of said tabs being bent up against said spacer to position said cathode, one of said leads being secured to one of said tabs, a first eyelet extending through one of said apertures and secured to said spacer, one of said leads extending through said eyelet and being secured thereto, said lead comprising an anode for said discharge device, said anode being positioned opposite said cathode, and a second eyelet extending through another of said apertures and secured to said spacer, another of said leads extending into said second eyelet and being secured thereto, said second eyelet having a rim adjacent said cut-out portion and comprising a starter electrode for said discharge device.

7. A gaseous discharge device comprising an insulating spacer having an aperture therein, a main cathode, an anode, a starter cathode adjacent said spacer, and an eyelet electrode extending through said aperture and secured in said spacer adjacent said starter cathode.

8. A gaseous discharge device comprising an insulating spacer having a plurality of apertures therein, a main cathode, a starter cathode having a cut-out portion in one edge adjacent said spacer, a first eyelet extending through one of said apertures, a lead extending through said eyelet and secured thereto, said lead comprising a main anode for said discharge device, and a second eyelet extending through another of said apertures, said second eyelet being secured in said spacer adjacent said cut-out portion and comprising a starter anode for said discharge device.

9. A gaseous discharge device comprising a vessel, a plurality of leads extending into said vessel, an insulating spacer having apertures therein and resting on some of said leads, a main cathode having tabs extending through some of said apertures positioning said main cathode, one of said leads being connected to one of said tabs, a first eyelet secured to said spacer in one of said apertures, one of said leads extending through said first eyelet and secured thereto, said lead comprising an anode for said device, a starter cathode having tabs extending through some of said apertures positioning said starter cathode and having a cut-out portion in one edge adjacent said spacer, one of said tabs being connected to another of said leads, and a second eyelet secured to said spacer in another of said apertures, another of said leads extending into said eyelet and secured thereto, said second eyelet having a rim adjacent said cut-out portion and comprising a starter electrode for said device.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
2,271,685	Ekstrand	Feb. 3, 1942