July 18, 1950 R. L. VANCE 2,515,361

ELECTRIC DISCHARGE DEVICE

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FIG. 1

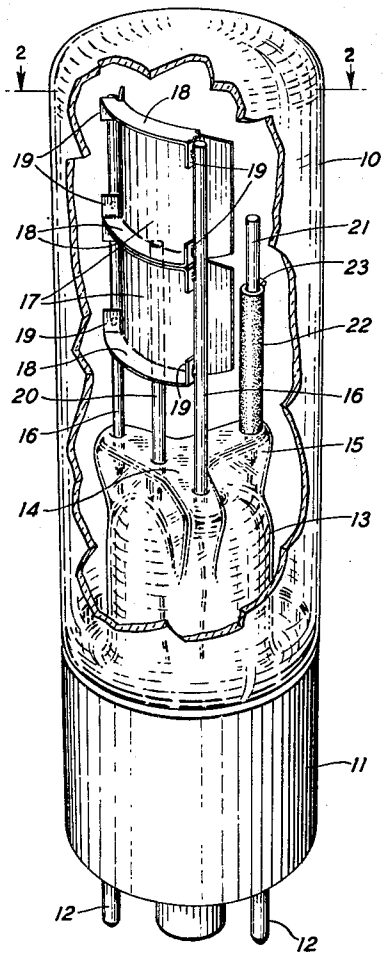
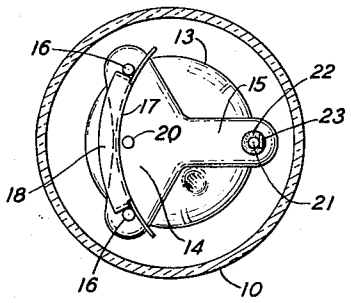


FIG. 2



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ELECTRIC DISCHARGE DEVICE

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4 Claims. (Cl. 250—27.5)

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This invention relates to electric discharge devices and more particularly to gaseous discharge devices of the trigger control type.

Trigger control type gaseous discharge devices comprise, basically, a cathode, a work or output anode and a control electrode or anode, in an ionizable atmosphere. In operation of such a device, a fixed potential, below the breakdown voltage of the cathode to work anode gap but sufficient to sustain a discharge across this gap, is impressed between the cathode and work anode, and the device is rendered conductive by impressing a triggering voltage between the cathode and control anode to initiate a discharge across the gap between these electrodes. When the control gap breaks down, the main or work gap is broken down and the discharge transfers to the work or output anode.

The minimum potential at which a discharge between the cathode and control anode will be initiated is critically dependent upon the length of the control gap. It is eminently desirable, therefore, in order that such devices may meet prescribed operating requirements accurately, that the control gap be of exact specified length and that this length be maintained even despite rough physical handling or use of the device.

One object of this invention is to facilitate the realization and maintenance of an exact prescribed control gap length in gaseous discharge devices of the trigger control type.

Another object of this invention is to attain such control gap in a simple, readily fabricable and rugged construction.

A further object of this invention is to obtain uniform heating of a relatively large area cold cathode of an electronic discharge device during the processing of the device.

In accordance with one feature of this invention, the cathode and control anode of an electric discharge device are supported from a stem and are so constructed and arranged that when they are assembled with the stem, the spacing between these electrodes is automatically and accurately fixed, whereby a control gap exactly meeting preassigned length requirements is realized.

In accordance with another feature of this invention, the cathode is constructed of two or more arcuate sheet members having transverse edge flanges, juxtaposed flanges on adjacent members being joined together, and the several flanges being provided with integral mounting lugs. The cathode thus constitutes a rugged unit and, because of the flanges, uniform heating of the cathode is realized during the processing of the device.

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The invention and the above noted and other features thereof will be understood more clearly and fully from the following detailed description with reference to the accompanying drawing in which:

Fig. 1 is an elevational view in perspective of a trigger control type of gaseous discharge device illustrative of one embodiment of this invention, a portion of the enclosing vessel being broken away to show the internal structure; and

Fig. 2 is a cross-sectional view of the device taken along plane 2—2 of Fig. 1.

Referring now to the drawing, the electric discharge device therein illustrated comprises a vitreous enclosing vessel 10 having an ionizable atmosphere, for example spectroscopically pure argon at a cold pressure of 11.5 millimeters of mercury, therein. Joined to the vessel 10 is an insulating base 11 carrying terminals 12 to which the electrodes of the device are connected. The enclosing vessel 10 has therein a stem 13 which terminates at its inner end in a press having a generally triangular or bi-winged portion 14 and an arm 15 extending from the apical part of the portion 14 and having its medial plane coincident with that of the portion 14.

A pair of rigid parallel rods or wires 16, equally spaced from the median plane noted and aligned normal thereto, are embedded in the press portion 14, one of the rods or wires being connected to one of the terminals 12 and constituting a part of the lead in system for the cathode 17. The cathode, which is arcuate in transverse section as shown in Fig. 2, advantageously is formed of sheet metal, for example nickel, and is constructed of two or more sections. Each section is provided with integral flanges 18 at opposite ends, and the adjacent flanges are secured together, as by welding. The ends of each of the flanges are bent to form mounting lugs 19, which are affixed, as by welding, to the rods or wires 16. Because of the lugs 19, when the cathode is mounted on the wires or rods 16 it is fixed in a predetermined position with respect to the rods or wires 16 and is securely anchored.

The concave surface of the cathode is coated with an electron emissive material, for example alkaline earth oxides. The convex surface of the cathode may be calorized.

Also embedded in the press portion 14 and centrally aligned with the cathode and the arm 15 is a rigid, rectilinear wire or rod 20, which extends parallel to the cathode, is connected to one

of the terminals 12 and constitutes the control electrode or anode of the device. For reasons which will appear presently, the control anode 20 is parallel to and in alignment with the cathode supports 16 and is positioned midway therebetween.

A fourth rigid, rectilinear rod or wire 21, connected to one of the terminal prongs 12 and constituting the work or output anode of the device, is embedded in the arm 15, is aligned with the control anode 20, extends parallel thereto and is at the center of curvature of the cathode so that radial symmetry of the work anode and cathode emissive surface obtains. A portion of the work anode 21 is encased in an insulating sleeve 22, which rests upon the arm 15 and is locked in position by a wire stub 23 affixed, e. g. welded, to the anode 21.

In the fabrication of the device, the several rigid rods or wires 16, 20 and 21 are mounted in parallel and preassigned spaced relation in a suitable jig or fixture and the press 14, 15 is formed about these wires to seal them thereto. The cathode, which is preformed to have a preassigned curvature, then is affixed to the support rods 16. It will be appreciated that inasmuch as the control anode 20 is midway between and aligned with the cathode support rods 16 any desired control gap length can be obtained by proper curvature of the cathode and that the desired control gap length is realized when the cathode is mounted upon its supports. Any desired cathode curvature is simply obtained by forming of the cathode, so that a desired control gap length is readily obtained, in effect, by a simple, accurately controllable mechanical operation.

Additionally, it will be appreciated that the cathode supports 16 together with the flanges 18 and tabs or lugs 19 constitute a rigidly braced rugged structure. Consequently, the cathode is rigidly mounted and the requisite control gap is maintained despite shocks to which the device may be subjected during handling and operation.

As noted heretofore, the concave surface of the cathode is coated with an electron emissive material such as alkaline earth oxides. Such oxides, as is known, may be obtained by coating the cathode surface with a mixture of alkaline earth carbonates and subjecting the latter to an activation process to decompose the carbonates and effect a conversion thereof to the oxides. The activation process comprises, in one form, induction heating of the cathode to convert the carbonates to the oxides and, after evacuation of the device and introduction of the desired gas into the vessel 10, a high frequency treatment by the application of a high frequency voltage between the cathode and work anode and then between the cathode and the control anode.

The flanges 18 assure a good coupling to the field during the induction heating and additionally, assure a uniform heating of the cathode whereby uniform activation of the entire cathode emissive surface is obtained.

Although a specific embodiment of this invention has been shown and described, it will be understood that it is but illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. An electric discharge device comprising a gas-filled enclosing vessel having a stem, a pair of parallel, rigid linear supports embedded in said stem, an arcuate cathode extending between said supports, parallel thereto, and mounted thereon, a linear rod control anode embedded in said stem and parallel to, midway between and aligned with said supports, and a work anode opposite the concave face of said cathode, said cathode comprising integral transverse flanges at opposite ends thereof, extending between and substantially normal to said supports and affixed thereto.

2. An electric discharge device comprising an enclosing vessel having a gaseous filling and having also a stem which terminates at its inner end in a bi-winged portion and an arm extending from said portion, a linear rod control anode embedded in said portion adjacent the center thereof and in alignment with said arm, a linear rod work anode embedded in said arm and parallel to said control anode, a pair of rigid supports embedded in said portion, extending parallel to said control anode, aligned therewith and equally spaced on opposite sides thereof, and an arcuate sheet cathode mounted on and between said supports and having its concave face centrally aligned with said control and work anodes.

3. An electric discharge device comprising an enclosing vessel having a gaseous filling, a pair of rigid parallel supports extending from one end of said vessel, a sheet cathode extending between said supports and parallel thereto, said cathode including spaced, transverse flanges extending between said supports and having lugs at opposite ends, said lugs being affixed to said supports, and an electrode opposite said cathode.

4. An electric discharge device comprising an enclosing vessel having an ionizable medium therein and having also a stem, a pair of rigid, parallel supports extending from said stem, a linear rod control anode extending from said stem, parallel to said supports, midway therebetween and in alignment therewith, a cathode mounted on said supports and extending parallel thereto, said cathode having a concave emissive face opposite and centrally aligned with said control anode, and a work anode opposite said face.

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