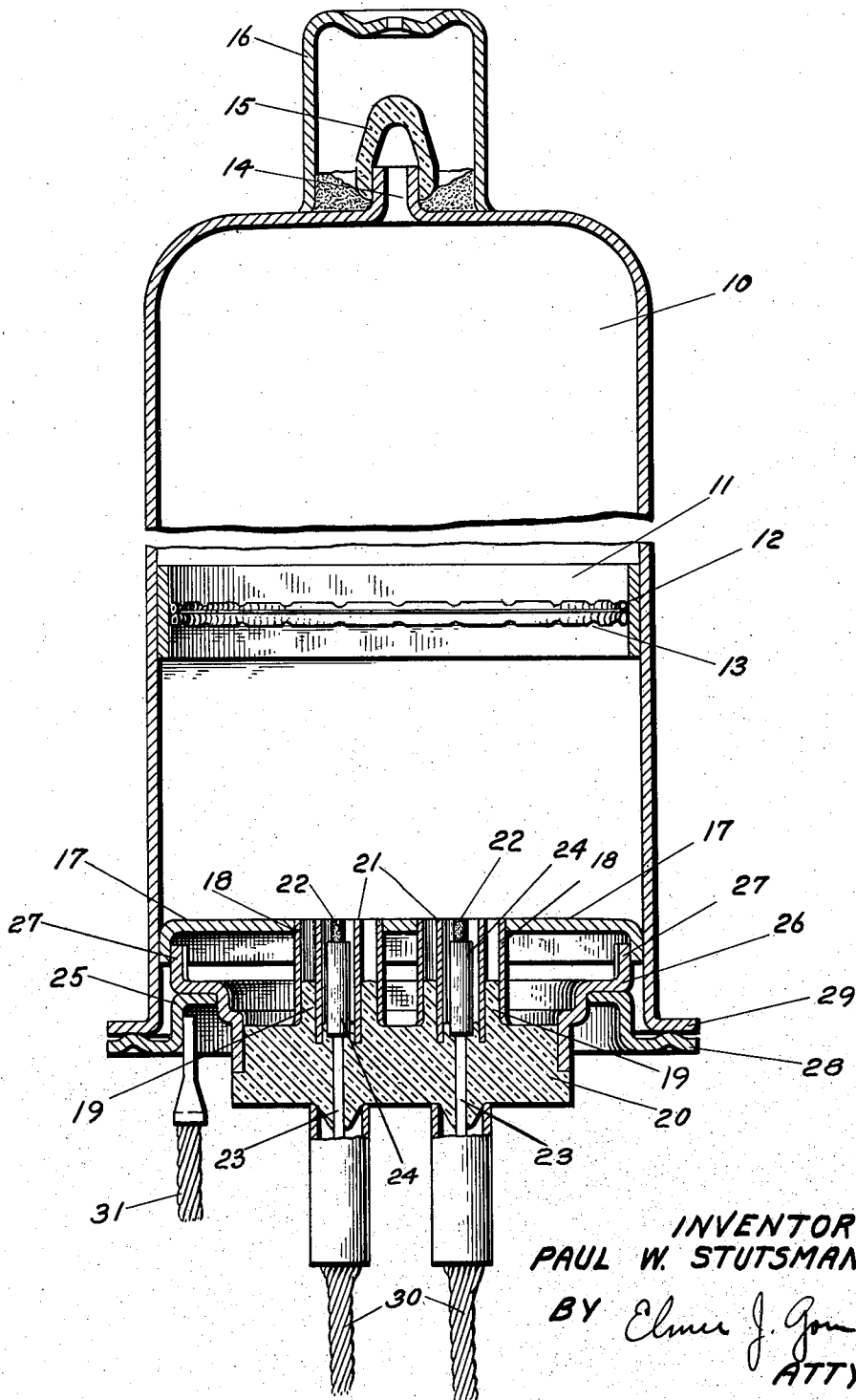


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GASEOUS DISCHARGE DEVICE
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GASEOUS DISCHARGE DEVICE

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This invention relates to gaseous discharge devices, and more particularly to such devices known as glow discharge rectifiers.

Many devices of the type described have been conceived and adapted to ignition systems to overcome burning and disintegration of mechanically operated contacts and breakers of high tension current. The use of such devices, in connection with internal combustion motors employed in automobiles and other types of ground vehicles, has attained a certain degree of success. However, attempts to use such devices for aircraft motors have met with failure. The reason for this resides in the inability of the device to withstand the tremendous vibrations associated with aircraft motors.

It is, therefore, the main object of this invention to provide a device of the type described which can be used in connection with all types of internal combustion motors.

Another object is to provide a device which can remain operative over substantial periods of time under vibrations which result in accelerations as high as 1,000 gravities.

A further object is to provide a device of the type described in which the envelope thereof constitutes a cathode.

These objects are attained, in accordance with the general aspect of the invention, by providing a device, the envelope of which constitutes a cathode of cold rolled steel, for example, the entire structure when assembled resulting in a very rigid device.

With the above and other objects in view, the embodiment of the invention will be best understood by reference to the following specification and illustration in the accompanying drawing, in which the single figure is a cross-sectional view of the invention.

Referring now more particularly to said figure, the device comprises a metallic envelope or cathode 10, which can be of cold rolled steel, for example, or other equally refractory metal. Said envelope or cathode contains an ionizable gas, which may be helium at a pressure of the order of 3 centimeters. Attached to the inner wall of said cathode 10 is a relatively thin metallic strip 11, which may be composed of nickel for example. Attached to said strip 11 is one or more hollow iron wires 12 containing therein an electron emissive material which may be metallic barium. Apertures 13 are provided in said wires 12 whereby the active material therein may be readily released.

Means for evacuating the cathode 10 is pro-

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vided by the opening 14 in the uppermost end of said cathode, to which is attached a vitreous tubulation (not shown), said tubulation being sealed off to form an airtight vitreous material-to-metal seal 15. As added protection for said seal 15, a cap 16 is placed over said seal and affixed to the cathode 10.

In order to confine the discharge within the cathode, a disk member 17 has its edge turned down and attached to the cathode 10 to form a hollow chamber with the inner wall of said cathode. Extending away from the inside of cathode 10 is a pair of tubular members 18 attached to said member 17, the members 18 surrounding, with a snug fit, a pair of extended vitreous tubular members 19. Said members 19 may be integral with or fused to an electrode supporting member or button 20, said supporting member being composed of vitreous or other insulating material. Positioned within the tubular members 19 and in intimate contact therewith are metallic anode shielding members 21, said last-named members being imbedded in said electrode supporting member 20. In the center of the shielding members 19 are anodes 22, said anodes being preferably composed of carbon, and being connected to lead wires 23 through the medium of metallic sleeves 24. Lead wires 23 are imbedded in the electrode supporting member 20.

Anodes 22 are spaced from the shielding members 21 a distance which is sufficiently small so that a discharge will not ordinarily occur in the space between them.

Tubular members 18, tubular shielding members 21 and electrodes 22 are so positioned that the upper ends thereof are substantially flush with the upper surface of member 17. The distance required between the outer surfaces of shielding members 21 and the inner surfaces of tubular members 18 and the height of tubular members 19 surrounding said shielding members 21 will be explained further along.

An annular member 25 is firmly attached, as for example, by welding, to a second annular member 26. Member 26 in turn is fused to the vitreous electrode supporting member 20 which is in the form of a button molded within the annular member 26, and a flange 27 formed on the member 26 is welded within the flange formed on the disk 17. The foregoing arrangement of the parts just described provide a very rigid assembly. To insure further rigidity, especially of the electrodes 22 and electrode shields 21, said elements are made short enough and are so imbedded in member 20 that vibrations of such intensity and

periodicity as are encountered in aircraft motors will not deform or destroy them. In addition to the foregoing arrangement for insuring rigidity of the electrodes, the turned down edge of disk member 17 is firmly attached, for example, by welding, to the lower open portion of the cathode 10. The tubular extensions 18, which are attached to member 17, further reinforce the rigidity of the structure by their intimate contact with members 19 which in turn reinforce members 21. Now, when the cathode 10 is slipped over the aforementioned group of elements, a flange 29 formed on said envelope is welded to a flange 28 formed on the member 25. The result is a compact, rigid unitary structure. Lead wires 23 are attached by soldering or other means to a pair of flexible electrically conductive wires 30. Another flexible lead 31 is soldered or otherwise affixed to annular member 25 to provide means for the conduction of electrical current to the cathode 10. The use of electrically conductive flexible leads is desirable, since the present device is not intended to be mounted in a supporting socket as is ordinarily done in connection with non-vibrating equipment.

A feature of this invention is the use of the metallic envelope 19 as a cathode. It was found that devices of the type herein described, when comprising an envelope containing a cathode supported in the usual manner and used in connection with ignition systems mounted on aircraft motors, were unable to withstand the tremendous vibrations generated by said aircraft motor. If the cathode were supported within a glass envelope, said cathode would invariably burst through the envelope. Attempts to use a metal envelope only resulted in the destruction of the cathode, when supported in a like manner within said envelope. However, the rigid construction of the present device as described herein provides an assembly well able to withstand vibrations resulting in accelerations of the order of 1,000 gravities.

Another feature of this invention is the spacing of the anode shields 21 with respect to the tubular extensions 18 of the member 17 and the height of the vitreous tubular members 19 with respect to the surface of said member 17. In order to prevent the accumulation of electron emissive particles from building up a short circuit path between the anode shields 21 and the tubular extensions 18, the distance between these elements is less than the mean free path of said particles. Hence, a particle entering the spaces between the elements 18 and 21 will suffer insufficient elastic collisions with gas molecules to enable it to reach the member 19 before depositing upon either of said elements. However, the distance between the tops of the vitreous tubular members 19 and the effective surfaces of member 17 is at least twice the distance between members 18 and 21, said last-named spacing allowing the particles, should any of them fall into the space between members 18 and 21, to be attracted to the inner surface of either of said last-named members before they can fall to the bottom of the recess formed by the members 18, 19 and 21. This arrangement of the electrodes prevents a short circuit due to the deposition of particles between the anode shielding members 21 and the cathode tubular members 18.

While one embodiment of this invention has been described and illustrated, it is of course understood that many modifications and alterations may be made wherein the relation of var-

ious electrodes may be altered to achieve the primary concepts of this invention; therefore, the constructional limits of the invention are to be confined within the scope of the appended claims.

What is claimed is:

1. A gaseous discharge device comprising an envelope containing an ionizable gas, at least one electrode supported within said envelope, means for supporting an electron-emissive material within said envelope, shielding means electrically insulated from and surrounding said electrode, insulating means surrounding said shielding means, and electrically conductive means surrounding said insulating means, said insulating means being shorter than said shielding and conductive means to provide an annular space between said last-named means which is less than the mean free path of the particles of said electron-emissive material, said insulating means being terminated a distance from the effective ends of said shielding and conductive means which is at least twice the distance between said last-named means.

2. An electrode assembly comprising an electrode imbedded in a button of insulating material, an electrically-conductive annular member fused to the outer periphery of said button and extending upwardly therefrom, a second electrically-conductive annular member flanged at its edge and welded to the upwardly extending portion of said first-named annular member, an electrically-conductive tubular member surrounding said electrode and insulatedly spaced therefrom by said button, and a second electrically-conductive tubular member surrounding said first-named tubular member and being insulatedly spaced from the latter by said button.

3. A gaseous discharge device comprising an electron-emissive envelope, said envelope having an open end terminating in a flange, at least one electrode imbedded in a button of insulating material, an electrically-conductive annular member fused to the outer periphery of said button and extending upwardly therefrom, a second electrically-conductive annular member flanged at one edge thereof and welded to the upwardly extending portion of said first-named annular member, an electrically-conductive disk having an aperture in register with the effective end of said electrode and being welded within the open end of said envelope, an electrically-conductive tubular member having one end thereof welded to the aperture in said disk and the other end resting on said button, said tubular member being electrically insulated from and surrounding said electrode, a second electrically-conductive tubular member disposed between said last-named insulating means and electrically insulated from said electrode, said second conductive tubular member being supported at one end thereof by said button, and said envelope being welded at the flange thereof to the flange of said second annular member to form a rigid unitary structure.

4. A gaseous discharge device comprising an electron-emissive envelope, said envelope having an open end terminating in a flange, at least one electrode imbedded in a button of insulating material, an electrically-conductive annular member fused to the outer periphery of said button and extending upwardly therefrom, a second electrically-conductive annular member flanged at one edge thereof and welded to the upwardly extending portion of said first-named annular member, an electrically-conductive disk

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having an aperture in register with the effective end of said electrode and being welded within the open end of said envelope, an electrically-conductive tubular member having one end thereof welded to the aperture in said disk and the other end resting on said button, an insulating tubular member integral with and extending upwardly from said button, said last-named insulating member fitting snugly within said first-named conductive tubular member, a second electrically-conductive tubular member disposed between said last-named insulating means and said electrode, said second conductive tubular member being supported at one end thereof by said button and fitting snugly within said insulating tubular member, and said envelope being welded

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at the flange thereof to the flange of said second annular member to form a rigid unitary structure.

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