March 13, 1934. J. D. FORNEY 1,951,141

ELECTRIC DISCHARGE DEVICE AND ELECTRODE THEREFOR

Filed March 7, 1929

Fig. 1

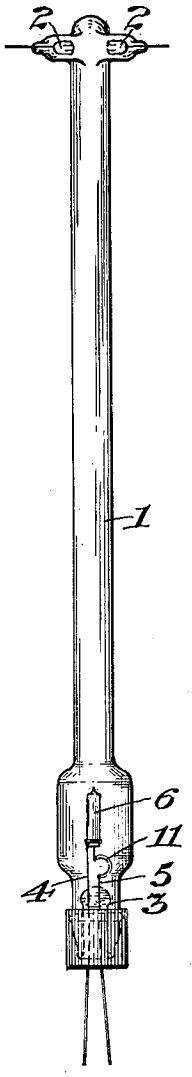


Fig. 2

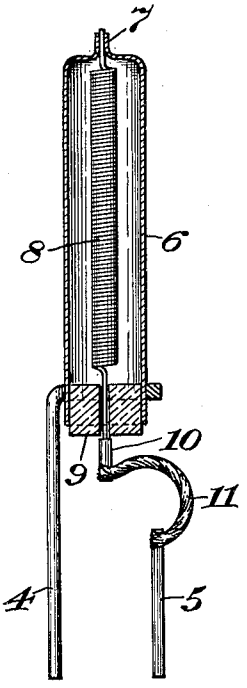


Fig. 3

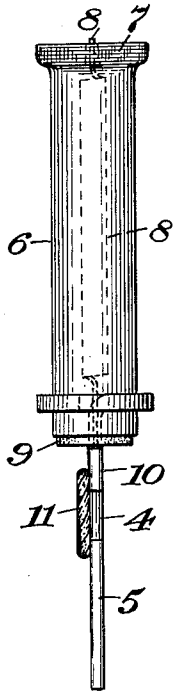
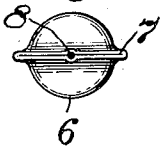


Fig. 4



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ELECTRIC DISCHARGE DEVICE AND ELECTRODE THEREFOR

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10 Claims. (Cl. 250—27.5)

The present invention relates to electric discharge devices and particularly to electrodes therefor and to the method of making these electrodes.

A particular object of the invention is to provide an electrode of the indirect heater type which will have a long life and which will be simple in construction. Another object is to provide a method of manufacturing such an electrode. Other objects and advantages of the invention will be obvious from the following detailed description of one embodiment thereof or from an inspection of the accompanying drawing. The invention consists in certain new and novel features of construction and arrangements of parts and in certain novel steps in the manufacture thereof, as hereinafter set forth and claimed.

Electrodes which are of the indirect heater type are commonly constructed in the form of a cylinder with a filamentary heater concentrically positioned therein. For certain purposes, as in gaseous conduction lamps, the cylinder has been of metal such as nickel, and the filament has been arc welded to a cap which had in turn been arc welded on one end of the metal cylinder. The other end of the filament was spaced from the walls of the cylinder by a suitable insulating bushing, and was supported by a rigid inlead. With such a construction the assembly of the parts was extremely tedious due to the amount of arc welding required, and while the resulting structure gave satisfactory results on continuous operation, under intermittent service conditions many failures occurred due to the filament becoming bowed in shape as a result of the repeated temperature variations until it came into contact with the metallic sheath, thus short circuiting a portion of the filament and causing a heavy flow of current through the remaining portion which destroyed the electrode. I have found that this difficulty can be overcome by providing for expansion of the filamentary heater, or the expansion and contraction thereof, in a direction of movement which will maintain it in the desired form and position with relation to other members of the electrode structure, and that by a slight modification of the electrode structure the constructional difficulties may also be greatly decreased.

For purposes of illustration several views of a cathode for a low voltage gaseous conduction device in which my invention is embodied are shown in the accompanying drawing, in which

Fig. 1 is an elevational view of a low voltage alternating current type neon lamp, showing the electrode of my invention incorporated therein,

Fig. 2 is an elevational view, partly in section of the electrode structure,

Fig. 3 is a side elevation of the electrode, and

Fig. 4 is a top view of the electrode of Fig. 3.

In the drawing the lamp envelope 1 has sealed into one end thereof the usual anodes 2, while at the other end rigid inleads 4 and 5 are sealed through the reentrant stem 3. At its inner end the inlead 4 is bent to form a circle at right angles thereto within which is welded one end of the metal cylinder 6 which forms the active electrode. This cylinder is preferably of nickel and is coated with a material such as barium or strontium or the oxides thereof, and may also have a small quantity of magnesium or other suitable material attached thereto for securing and maintaining cathode activity and gas purity in the lamp.

One end of the cylinder 6 is closed to support an end of the filamentary heater 8. The closed end of the cylinder 6 is preferably produced in the following manner. A piece of nickel tubing, or sheet metal fabricated into a tube, is placed upon a mandrel which makes a good fit therewith, with an end of the tubing extending beyond the end of the mandrel. The walls of the protruding end are then pinched together, drawing the metal in to form a closed end for the tube with a central flangelike section 7 formed by the adjacent flattened sides of the tube 6. These edges are left sufficiently apart to permit insertion therebetween of the end of filament 8, which is welded in place by a spot welding process. With this construction not only are the difficult arc welding problems of prior constructions eliminated, but the cylinder and its filament supporting end are now integral, instead of being composed of two or more parts arc welded together as has been the case in previous structures. The method of construction is thus greatly simplified, and a more rugged product is obtained. In addition this construction permits of a simple and inexpensive spot welding of the filament to the cylinder, which has been found to eliminate the brittleness produced in the filament by the arc welding which has heretofore been necessary. At its other end the filament 8 freely passes through a bushing 9 of lavite, porcelain, or other suitable insulating material, below which it is welded to a nickel lead wire 10. Said lead 10 has a diameter greater than that of the opening through the bushing 9, so that said bushing is supported by the end of said lead. The bushing 9 is so constructed as

to freely slide in the cylinder 6, so as to allow free expansion and contraction of the filament 8. A flexible stranded lead 11 is welded to the lead 10 at one end, and to the inlead 5 at the other end, and preferably is made in the form of a loop to allow considerable freedom of movement to the lead 10, and hence the filament 8. In this manner free expansion and contraction of the filament 8 during heating and cooling is provided for, preventing stresses forming therein which would deform the filament. If desired the flexible lead 11 may be welded directly to the filament 8.

While I have illustrated my invention as applied to a definite type of lamp, it is to be understood that my new construction is generally useful in the art. Likewise various changes, substitutions, and omissions in the form and details or in the steps of the process may be made by those skilled in the art without departing from the spirit of my invention.

I claim:

1. In combination, an electrode comprising a metal sheath, a filamentary heater within said sheath, one end of said heater being attached to said sheath, a conductive support for said sheath and a conductive support for the free end of said heater, one of said supports having a freely flexible loop therein between said filament and a portion thereof which is in fixed relation to the other of said supports to allow free expansion and contraction of said heater.

2. In combination, an electrode comprising a metal sheath, a filamentary heater within said sheath, one end of said heater being attached to said sheath, means for spacing the other end of said heater from said sheath, said spacing means allowing free longitudinal movement of said heater, a conductive support for said sheath and a conductive support for the free end of said heater, one of said supports being freely flexible.

3. In combination, an electrode comprising a tubular sheath, a filamentary heater concentrically located within said sheath, one end of said sheath being closed to form a support for an end of said heater, means for spacing the other end of said heater from said sheath, said spacing means allowing free longitudinal movement of said heater, a conductive support for said sheath and a conductive support for the free end of said heater, one of said supports being freely flexible.

4. In combination, an electrode comprising a tubular sheath, a filamentary heater concentrically located within said sheath, one end of said sheath being closed to form a support for an end of said heater, means for spacing the other end of said heater from said sheath, said spacing means being slidable in said sheath, a conductive support for said sheath, and a flexible lead to the free end of said heater.

5. In an electric discharge device, a sealed container having electrodes sealed therein, one of said electrodes comprising a metal sheath, a filamentary heater within said sheath, one end of said heater being attached to said sheath, a conductive support for said sheath and a conductive support for the free end of said heater, one of said supports having a freely flexible loop therein between said electrode and a point of fixed support to allow free expansion and contraction of said heater.

6. In combination, a filament and electrical conductors therefor, one of said conductors having a freely flexible loop therein between a free end of said filament and a portion of said conductor which is in fixed relation to the other of said conductors to allow free expansion and contraction of said filament.

7. In combination, a filament, and electrical conductors therefor, one of said conductors being rigid and the other having a freely flexible loop theerin between a free end of said filament and a portion of said conductor which is in fixed relation to said rigid conductor to allow free expansion and contraction of said filament.

8. In combination, a helically wound filament and conductive supports therefor, one of said supports having a flexible loop therein between a free end of said filament and a portion of said support which is in fixed relation to the other of said supports to allow free expansion and contraction of said filament.

9. In an electric discharge device, a sealed container having electrodes sealed therein, one of said electrodes comprising a filament and conductors therefor, one of said conductors having a freely flexible loop therein between a free end of said filament and a portion of said conductor which is in fixed relation to the other of said conductors to allow free expansion and contraction of said filament.

10. In combination, a filament and electrical conductors therefor, one of said conductors having a stranded flexible loop therein between a free end of said filament and a point of fixed support to allow freedom of expansion and contraction of said filament.

JOHN D. FORNEY.