May 15, 1956 R. L. BREADNER ET AL 2,745,982

TERMINAL STRUCTURE FOR ELECTRIC LAMP OR SIMILAR DEVICE

Filed March 25, 1953

Fig. 1

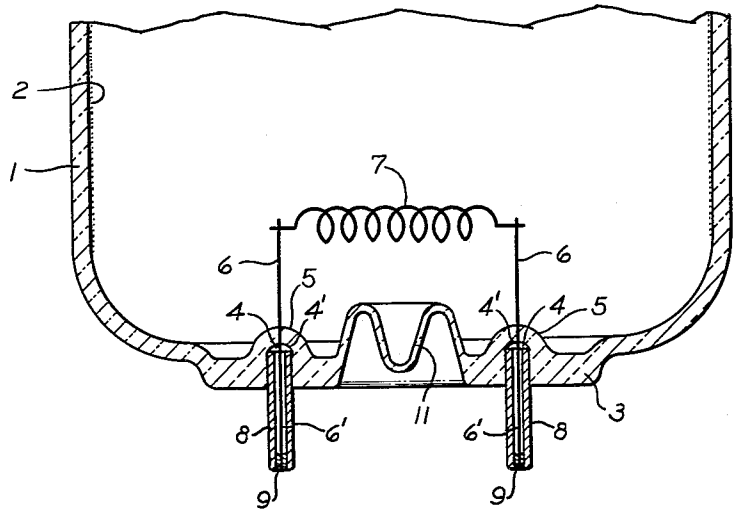


Fig. 3

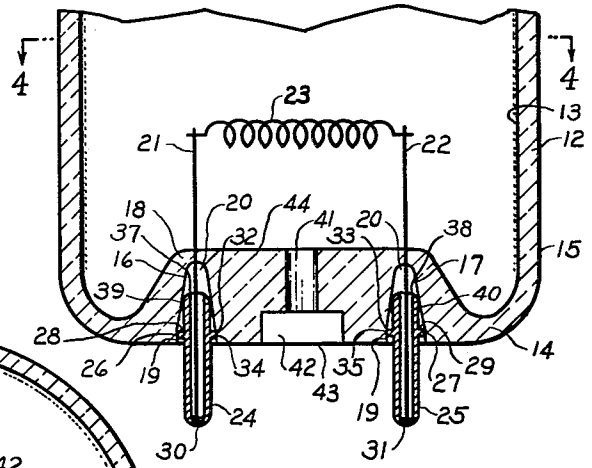


Fig. 2

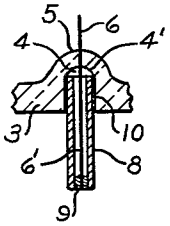
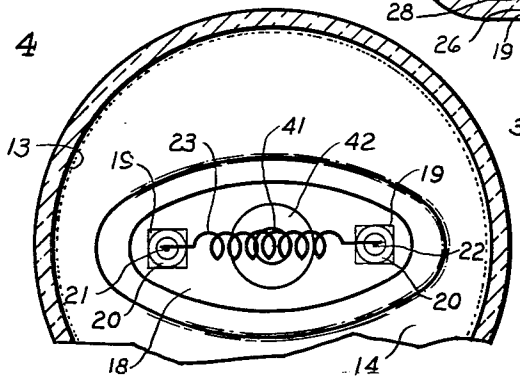


Fig. 4



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TERMINAL STRUCTURE FOR ELECTRIC LAMP OR SIMILAR DEVICE

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5 Claims. (Cl. 313—271)

This invention relates to electrical devices of the kind comprising electrical energy consuming means mounted within a sealed envelope, which envelope is closed by the sealing into an aperture thereof of an insulating end closure member through which are sealed a number of electrically conducting leads to said energy consuming means, and which closure member carries on its outer side (i. e., the side away from the interior of the envelope) a number of rigid electrically conducting terminal pins each connected to one of said leads. The invention is especialy, though not exclusively, concerned with electrical devices such as electric discharge lamps (especially low pressure fluorescent lamps) and thermionic valves wherein the electrical energy consuming means consists of or includes means for producing an electronic discharge within the envelope.

In known devices of the kind referred to above, the terminal pins must usually have either been carried by a separate base or cap fitted over the end closure member and attached to the envelope, or have been sealed directly through the end closure member so that the pins themselves serve as the electrically conducting leads. The object of the present invention is to provide an alternative arrangement that may be more convenient or advantageous in some cases.

According to one aspect of the invention, in an electrical device of the kind referred to above the insulating end closure member is formed on its outer side with a plurality of recesses through the bottom of each of which is sealed a relatively thin lead-in wire or conductor and into each of which is fitted a relatively thick and rigid terminal pin, each recess being so deep and fitting its inserted pin so closely that the pin is firmly supported by the walls of the recess against lateral displacement or rocking, and the lead-in conductors being drawn taut and attached to the respective pins so as to prevent longitudinal withdrawal of the pins from the recesses.

Preferably, each rigid terminal pin which fits within a recess in the insulating end closure member is formed with a portion of non-circular cross section which fits snugly within an outer end portion of the recess of similar non-circular cross section for preventing rotation of the pin about its axis. For example, the pin may be formed with a square flange which fits snugly within an enlarged square-shaped portion of the recess formed at the mouth thereof, and preferably the depth of the square-shaped portion of the recess is such that the outer face of the non-circular portion of the pin lies within the recess either below the level of the outer side of the insulating end closure member or flush with the said side.

Usually it will be convenient for the pin to be circular in cross section except for a square flange, and then may be conveniently formed from an elongated piece of metal of square cross section, having an axial hole therethrough, by turning down the metal to cylindrical shape on either side of the portion where the flange is required. Alternatively, in some cases a square flange

may be formed on a cylindrical metal tube by upsetting the latter.

In some cases the ends of the pins fitting within the recesses, and the sides of the non-circular portions if provided, may advantageously be coated with a suitable adhesive or filler, such as a thermoplastic cement, for reinforcing the seating of the pins and/or for avoiding any tendency of the pins to rattle, which might in some cases arise from improper manufacturing tolerances such as result in excessive clearances between the walls of the recesses and the inserted pins.

Preferably, each terminal pin is hollow and the lead-in conductor is threaded through the pin and suitably attached thereto while stretched taut therein, for example by soldering, at the end remote from the recess.

In electrical devices of the kind referred to, the envelope is usually made of glass, and the insulating end closure member is then preferably made of glass also and may conveniently be formed with suitable pin-supporting recesses by pressing the end closure member in a suitable mold. Alternatively, the end closure member may be formed of a ceramic material which may readily be molded to a suitable shape before firing. The thermal expansion of the end closure member must, of course, be suitably matched to that of the glass envelope for sealing thereto, and it will in general be necessary for the end closure member to be gas-tight.

In some cases the end closure member may also carry a sealed-off glass exhaust tube which, prior to the sealing off thereof, served for the evacuation and/or gas filling of the envelope of the device.

Further objects and features of the invention will appear from the following detailed description of species thereof and from the accompanying drawing in which:

Fig. 1 is an axial section through one end of a fluorescent electric discharge lamp provided with a base end or terminal structure according to the invention;

Fig. 2 is a fragmentary sectional view of a modified form of terminal structure;

Fig. 3 is an axial section through one end of a fluorescent electric discharge lamp provided with another modified form of terminal structure according to the invention; and

Fig. 4 is a fragmentary sectional view taken on the line 4—4 of Fig. 3.

Referring to the drawing, the invention is there shown as applied to a tubular fluorescent lamp of the conventional type in general use at present and comprising a tubular glass envelope or bulb 1 the inner surface of which is provided with a coating 2 of fluorescent material such as is ordinarily used in such lamps. The opposite ends of the tubular envelope 1 are each closed by the sealing thereto of a pressed glass end closure member or base 3 which is preformed on its outer side with a plurality of tubular and preferably cylindrical recesses 4 set into bosses 5 molded on the inner side of the end closure member, the recesses 4 entering the bosses from the outer side of the closure member.

Sealed through the wall of the end closure member 3, so as to extend through the domes of the respective recesses 4 and project thereinto, are a plurality of lead-in wires or conductors 6 which are connected at their inner ends to one of the electrodes or other electrical energy translation elements 7 of the lamp. The electrode 7 may be of the usual type comprising a single or multiply coiled wire of tungsten or other refractory metal coated with a suitable electron emissive material such as one or more alkaline earth oxides, for instance. The lead-in conductors 6 are electrically connected, externally of the envelope 1, to tubular and preferably cylindricial hollow terminal or contact pins 8 inserted into and snugly fitting within respective ones of the recesses 4

in the end closure member 3. The lead-in conductors 6 are sufficiently stout to support the electrode 7 mounted thereon, but are relatively thin compared to the terminal pins 8 which are preferably formed of relatively thick wall section so as to be rigid.

In assembly, the projecting outer end portion 6' of the lead-in conductors 6 are threaded through the contact pins 8 and the latter then inserted and pushed home into and seated against the bottoms 4' of the respective recesses 4, in which recesses the pins have a close but sliding fit. The lead-in conductors 6 are then drawn or pulled out taut through the pins 8 and, while thus held taut, are suitably fastened securely to the pins, for instance by crimping or by welding or soldering the outer ends of the conductors to the pins, as indicated at 9. The excess portions of the lead-in conductors 6 projecting outwardly beyond the terminal pins 8 are then cut off at the outer ends of the pins 8. The contact pins 8 are thereby held firmly in the end closure member 3, being supported against lateral displacement or wobbling movement by the walls of the recesses 4, and against longitudinal displacement by the taut conductors 6. The contact pins 8 are preferably fitted in position in the final stages of manufacture, after the envelope has been sealed off. If required, the ends of the contact pins 8 fitting within the recesses 4 may be coated, before insertion thereinto, with a suitable adhesive or filler, as shown at 10 in Fig. 2, such as an organic varnish or nitrocellulose lacquer, for instance.

The end cap member 3 may also be formed with a central aperture to the rim of which is sealed a re-entrant exhaust tube 11 which is tipped off in manufacture so as not to project beyond the outer side of the end closure member 3. The other end of the lamp may be similarly closed, except that in general an exhaust tube will not be required at such end.

In the embodiment of the invention shown in Figs. 3 and 4, the lamp envelope 12 is provided with an internal coating of fluorescent material 13 and each end of the envelope is closed by a pressed glass end closure member 14 sealed thereto. The pressed glass end closure member 14 at the end 15 of the envelope shown in the drawing is preformed with two recesses 16, 17 set in a boss 18 molded on the inner side of the end closure member, the recesses 16, 17 entering the boss from the outer side of the end closure member and being of square cross section 19 for a short distance into the boss and then becoming of conical shape 20.

Through the bottom of each recess is sealed a lead-in conductor 21 or 22 which support between them, within the lamp envelope, one of the filamentary electrodes 23 of the lamp. The outer end of the lead-in conductors 21, 22 are connected to hollow terminal pins 24, 25, respectively, which are of circular cross section throughout their length except for square flanges 26, 27, respectively, which flanges enter into and snugly fit within the square-shaped outer end portions 19 of the corresponding recesses 16, 17 so that the inner surface of the flanges abut or seat against the shoulders 28, 29, respectively, at the mouth of the conical portion 20 of the recess.

In the manufacture of the lamp according to Figs. 3 and 4, the lead-in conductors 21, 22 are threaded through the hollow pins 24, 25, respectively, and the pins are then pushed into the recesses 16, 17, respectively, so that the square flange 26 or 27 on each pin slides home into and snugly fits within the square portion 19 at the entrance of the corresponding recess, and the lead-in conductors are then drawn out taut through the respective pins 24, 25 and soldered to the ends 30, 31 thereof.

The terminal pins 24, 25 are thereby held firmly in the end closure member 14, being supported against twisting within the recesses by the abutment of the sides 32, 33 of their square flanged portions 26, 27 against the walls 34, 35, respectively, of the square outer end portions 19 of the recesses, and being supported against sideways rocking in the recesses by the abutment of the ends 37, 38 of the pins against the surrounding conical walls 39, 40, respectively, of the recesses. In addition, longitudinal withdrawal movement of the pins from the recesses is prevented by the soldering of the lead-in conductors 21, 22 to the ends 30, 31, respectively, of the pins 24, 25 while stretched taut therein.

The end closure member 14 is also formed with a cylindrical central aperture 41 in the boss 18 for evacuating and filling the lamp envelope, which aperture is shown sealed off in Fig. 3 by a plug or washer 42. The aperture 41 is of relatively large diameter at the outer surface 43 of the end closure member for a short distance into the boss and then, to provide a seating shoulder for the plug or washer 42, is stepped down to a smaller diameter through the remainder of the boss to the inner surface 44 thereof.

The end closure member closing the other end of the lamp, not shown in the drawings, is similar to the end closure member 14, and is similarly provided with terminal pins, lead-in conductors, and an electrode, but is not provided with the exhaust aperture 41, the boss being solid in this region.

The plug or washer 42 may be fixed in position during the processing and filling of the lamp envelope by arranging that the envelope is brought into abutment with the wall of an exhaust chamber, connected to an exhaust pump, so that the exhaust aperture in the envelope registers with an aperture in the wall of the exhaust chamber, a gas-tight gasket being provided between the abutting surfaces around said apertures, the device then being heated for degassing whilst being exhausted through said exhaust aperture, and after the introduction of the envelope filling, if any, the plug or washer being applied to the exhaust aperture so as to provide an hermetic closure thereof.

The plug or washer may, for example, be carried on a movable member, within the exhaust chamber, which can be operated to apply the plug or washer to the exhaust aperture when the envelope processing has been completed; thus the movable member may be provided with a magnetic armature which is arranged to cooperate with a solenoid mounted outside the exhaust chamber, so that when the solenoid is energized, the said member is operated to apply the plug or washer to the exhaust aperture. The plug or washer may be of a material, such as a non-porous rubber, sufficiently deformable, or so coated with a wax or grease, as to seal firmly and hermetically in or over the exhaust aperture under the external pressure resulting from the low filling pressure within the envelope, or the plug or washer may be sealed to the envelope by means of an adhesive; alternatively, and preferably, the plug or washer may consist of or be coated with a thermo-plastic material such as polymerized ethylene and be applied to the exhaust aperture while the envelope is still hot, so that the thermo-plastic material softens or fuses under the heat communicated to it from the envelope, and unites the plug or washer to the envelope to seal the exhaust aperture.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical device comprising a sealed envelope provided with a vitreous end closure member having a plurality of tubular recesses in its outer side, lead-in conductors sealed through the wall of said end closure member and extending into the said recesses therein, an electrical energy translation element disposed within said envelope and electrically connected to said lead-in conductors, and tubular terminal contact pins snugly fitting within and seated against the walls of respective ones of said recesses and projecting outwardly thereof, said recesses being proportioned to accommodate said pins to a depth substantially in excess of their diameter, the external portions of said lead-in wires being securely fastened

to said terminal pins and extending taut between their respective points of attachment to the end closure member and the terminal pins so as to hold the latter in place in said recesses against endwise withdrawal movement therefrom.

2. An electrical device comprising a sealed envelope provided with a pressed glass end closure member having a pair of cylindrical recesses in its outer side, a pair of lead-in conductors sealed through the wall of said end closure member in alignment with and extending into the said recesses, an electrical energy translation element disposed within said envelope and electrically connected to said lead-in conductors, and a pair of hollow cylindrical terminal contact pins snugly fitting within and seated against the walls of respective ones of said recesses and projecting outwardly thereof, said recesses being proportioned to accommodate said pins to a depth substantially in excess of their diameter, the external portions of said lead-in conductors extending through the hollow interior of and being securely fastened to said terminal pins and extending taut between their respective points of attachment to the end closure member and the terminal pins so as to hold the latter in place in said recesses against endwise withdrawal movement therefrom.

3. An electrical device as set forth in claim 1 wherein the said terminal contact pins are secured to the walls of said recesses by an intermediate layer of an adhesive material.

4. An electrical device as set forth in claim 1 wherein

each of the said recesses is provided with an enlarged outer end portion of non-circular cross section and each of said terminal pins is formed with an outward flange portion of non-circular cross section corresponding to and snugly fitting within the said outer end portion of the associated recess to prevent rotation of the pin about its axis.

5. An electrical device as set forth in claim 1 wherein each of the said recesses is provided with an enlarged outer end portion of non-circular cross section and each of said terminal pins is formed with an outward flange portion of non-circular cross section corresponding to and snugly fitting within the said outer end portion of the recess to prevent rotation of the pin about its axis, the depth of the said non-circular outer end portion of the recess being at least equal to the thickness of said flange portion so that the latter lies wholly within the recess and its outer face is at least flush with the outer side of the insulating end closure member, and said recesses are of generally conical longitudinal section tapering inwardly from the outer face of said end closure member whereby to engage firmly the inner ends of said terminal pins to prevent sideways rocking thereof.

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