Jan. 13, 1948. L. C. WERNER 2,434,529

FILAMENT TENSIONING MEANS IN ELECTRON DISCHARGE DEVICE

Filed June 1, 1944

Fig. 1.

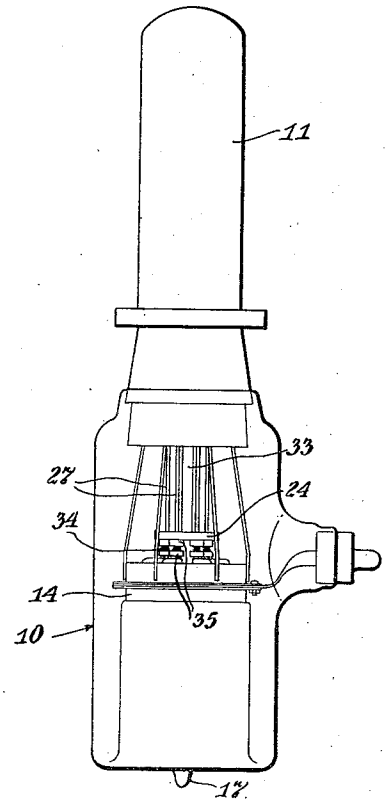


Fig. 3.

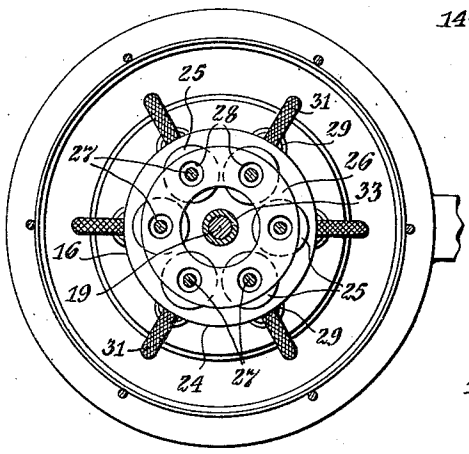
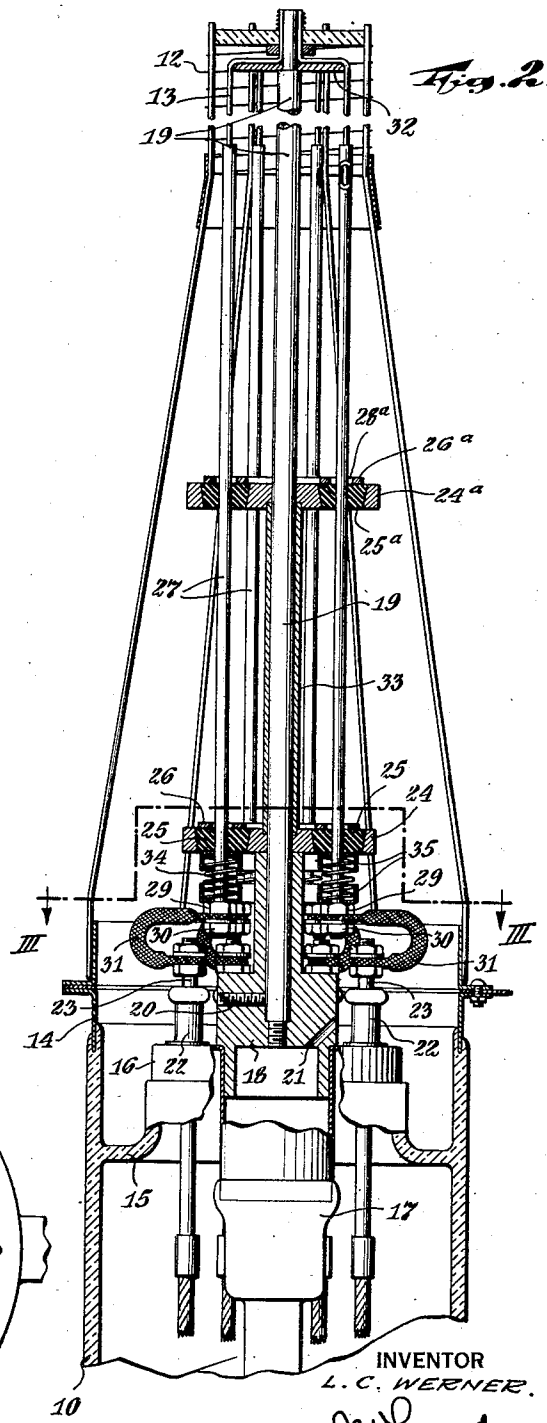


Fig. 2.



INVENTOR
L. C. WERNER.

BY J. W. Greenlaw

ATTORNEY

Patented Jan. 13, 1948 2,434,529

UNITED STATES PATENT OFFICE

2,434,529

FILAMENT TENSIONING MEANS IN ELECTRON DISCHARGE DEVICE

Leo C. Werner, Bloomfield, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application June 1, 1944, Serial No. 538,237

3 Claims. (Cl. 250—27.5)

1

This invention relates to electron discharge devices and more especially to filament mounting and tensioning.

In electron discharge devices, and more especially those utilizing multistrand filaments, considerable difficulty has been experienced with sagging or bowing of some of the strands while others remain taut. While previous effort has been made to overcome sagging by applying tension to the common support for the multiple strands, the evil still exists and presents an ever increasing problem as requirement for larger power output places greater electrostatic deflecting moment on the strands and higher temperatures and expansion of the filament. The unequal expansion and contraction under temperature changes of some of the filament leads or rods, where those also are in multiple, has added to the unsymmetrical sagging of the filaments so that they get even more out of line and frequently short circuit.

In its general aspect, the present invention has the objective of overcoming the difficulties and defects of prior art constructions.

Another and general object is to provide an improved construction by which deformation tendencies of filaments and supports and effects of such deformations as may occur, are minimized in operation.

Another object of the invention is to maintain all strands of a multi-strand filament taut in use under varying conditions of temperature and of strand length.

A further object of the invention is to apply resilient tensioning means remote from the region affected by the high temperature in the vicinity of the filament.

A yet further object of the invention is to apply the resilient tension at the foot ends of the legs of hair pin filaments and at the same time provide for adequate electrical connection for said foot ends.

Other objects of the invention will appear to those skilled in the art to which it appertains as the description proceeds, both by direct recitation thereof and by implication from the context.

Referring to the accompanying drawing in which like numerals of reference indicate similar parts throughout the several views;

Figure 1 is an elevation of an electron discharge device embodying the invention;

Figure 2 is a longitudinal section of the grid and filament mount and showing filament strands and rods in elevation; and

Figure 3 is a cross-sectional view on line III—III of Fig. 2.

In the specific embodiment of the invention illustrated in said drawing, the reference numeral 10 designates a glass or other basal mount for the electrodes, namely anode 11, grid 12 and filament 13 of a triode electron discharge device. While a triode has been arbitrarily selected for illustrative purposes, the invention is not to be understood as restricted to employment with triodes only. The mount 10 is shown of a reentrant type, the upper outer margin being sealed to the rim of the anode and the reentrant inner margin being attached to a grid-supporting flanged collar 14. Adjacent this inner margin internal sealing is effected by a cross partition 15 that the interior of the anode and basal mount may be evacuated.

2

The said internal partition 15 is in turn sealed to a central metallic header 16, which has a hollow neck the edge whereof is in a direction away from the electrodes and in turn sealed to a glass tubulation 17, which passes out of the reentrant part of the basal mount 10. At the inner part of said neck of the header is a metallic pedestal 18, said pedestal projecting from the said header inwardly of the device coaxially with the electrodes and having a long coaxial rod-like support 19 projecting therefrom to the vicinity of the closed end of the anode. Said support 19 is shown as having a threaded connection with the pedestal and as locked against unscrewing by the provision of a laterally situated set screw 20 in the said pedestal. An opening 21 from the outside of the pedestal to the underside thereof provides exhaust connection from the interior of the device to the said tubulation.

In the inner end wall of the header 16 are a plurality of lead-in glass sealed eyelets 22 evenly arranged in a sequential circular series and preferably as many in number as filament legs to the filament. The present showing indicates six filament legs and six of said glass sealed eyelets 22. Through said glass sealed eyelets 22 are sealed, one for each eyelet, lead-in fixed and rigid posts 23, the inner ends of said posts being screw threaded and situated in the vicinity of but spaced from said pedestal. Said pedestal projects longitudinally beyond the level of the ends of said posts and has a metallic disc-shaped spacer 24 thereat which extends transverse to the pedestal and post axis.

Said spacer 24 has holes therethrough in corresponding number and same circular sequence as the lead-in posts but shown somewhat closer to the axis than said posts. Furthermore, said spacer is preferably held, as by welding, to the said pedestal and thereby fixed in its position within the device. The holes in said spacer are preferably frusto-conical or undercut so as to receive and retain insulating tapered washers 25 therein against displacement in a direction toward the smaller end of the opening. Displacement of the said insulating washers in a direction toward the larger ends of the openings is shown accomplished by a washer-like securing ring 26

situated flatwise and coaxially upon the spacer and spot welded or otherwise secured thereto. The insulators each have a hole therethrough to admit passage of rods 27 therethrough. Corresponding, but larger holes 28, are provided in said securing ring 26 for passage of said rods 27 without contact between said rods and ring.

The lower ends of said rods are screw threaded, and each has nuts 29, 30 thereon between which is gripped one end of a flexible U-shaped lead connection 31, the other end of which is gripped between a like pair of nuts on one of the aforementioned lead-in posts 23. There are preferably as many rods as there are posts, so that each rod is electrically a continuation of its respective post. The rods extend a considerable distance above the spacer and the upper end of each has the foot end of a strand of filament 13 secured thereto. The upper ends of the filament strands are spaced by a common metallic or other plate 32 carried by the central support 19, with the end portions of the filament strands disposed radially across the plate and longitudinally of the said support to which they are appropriately welded or otherwise secured. Positive and negative sides of power supply are connected to alternate filament strands through the lead-in posts 23, connections 31 and rods 27.

Rods 27 are, as indicated above, quite long, so as to situate their lower ends remote from the filament and subject to as little of the heat from the filament as possible. Intermediate the ends of said rods, preferably at approximately half the lengths of said rods, is provided another and similar spacer 24*a* having frusto-conical or equivalent insulating washers 25*a* therein and through which the said rods pass. These insulating washers, as before, are retained in the sockets of the spacer by means of a washer-like ring 26*a* welded to the spacer and having enlarged holes 28*a* for passage of the rods without making contact therewith. This intermediate spacer 24*a* is preferably secured at the upper end of a sleeve 33 carried on support 19, the lower end of the sleeve being secured to the lower spacer 24.

By virtue of the fixed mounting of the upper ends of the filament strands from fixed support 19, the said strands may be kept taut by applying resilient tension at the foot ends of the strands. For accomplishment of this purpose, said rods 27 to which the said strands are attached are slidable in the insulating washers of the spacers 24 and 24*a*. Furthermore, between the lower spacer 24 and nut 29 therebelow on each said rod 27 is provided a spiral spring 34 under compression. That these springs may better withstand operating temperatures it is preferable that they be made from tungsten wire. Each filament strand is accordingly individually tensioned and will be kept taut irrespective of length variation due to heat expansion or other causes. Preferably, each end of each spring 34 is confined by a metallic or other cup 35, each of which is individual to the end of each spring on which applied. These cups are, to an extent, also useful as heat shields for the springs. Furthermore, situation of the springs beneath the spacer 24 shields the springs very effectively from heat from the filament. Even the intermediate

spacer 24*a* has some shielding effect in deflecting the heat outward toward the anode or other outer part of the envelope. The springs are thus protected by their remote situation from the filament and by intervening shielding means, so that each spring will retain its resiliency indefinitely and each filament strand will be kept taut at all times and under all conditions.

I claim:

1. An electron discharge device having a basal end and a hollow anode remote from and opening toward said basal end, a stranded filament within said anode, rods interposed between the foot ends of said filament strands and said basal end and each connected to a strand of the filament, a nut on the end portion of each said rod nearest said basal end of the device, a fixed spacer next said basal end through which said rods project, a spring on each said rod and under compression between said nut and said spacer for tensioning the respective filament strands connected to said rod, opposed cups on said rods mounting the ends of said springs therein, lead-in posts at the basal end of said device, and flexible connections looped laterally from and connecting said lead-in posts and rods.

2. An electron discharge device having a rod-like element therein, a spacer through which said rod-like element passes, said spacer having a socket therein around said element and of greater diameter than said element and said spacer having top and bottom faces normal to said socket defining top and bottom planes at said faces, said socket having one end larger than the other, and an insulating washer in said socket and around said element and included entirely between said planes, said insulating washer having different end diameters in agreement with the diameters of the said socket, and both the spacer and the socket being tapered between said top and bottom planes for providing full peripheral surface supporting contact therebetween.

3. An electron discharge device having a rod-like element therein, a spacer through which said rod-like element passes, said spacer comprising two plates substantially concentrically positioned with respect to each other and at juxtaposed solid parts thereof in substantially flatwise engagement, said plates being held against separation, one of said plates having a tapered hole therein, the larger end of which is toward the other plate, and an insulator in said hole between parts of each of said plates and held thereby from displacement, said insulator receiving said rod therethrough and holding the rod out of contact from both said plates.

LEO C. WERNER.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,105,472	Clark et al.	Jan. 18, 1938
2,167,844	Kaegi	Aug. 1, 1939
1,887,069	Seitz	Nov. 8, 1932
2,229,957	Crawford	Jan. 28, 1941