Oct. 19, 1937. N. R. SMITH 2,096,205

FILAMENT SPRING

Filed June 27, 1936

Fig. 1

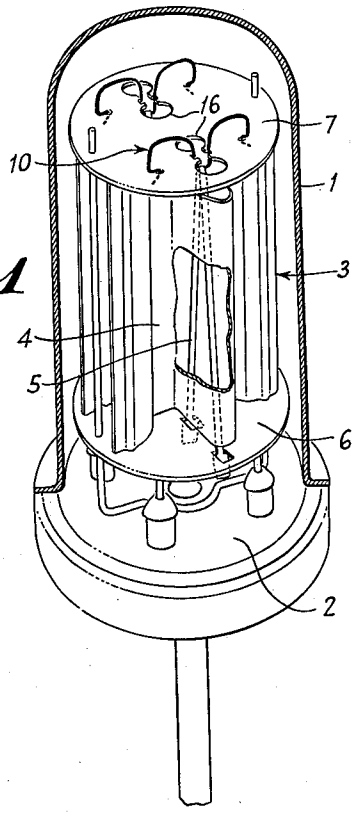


Fig. 2

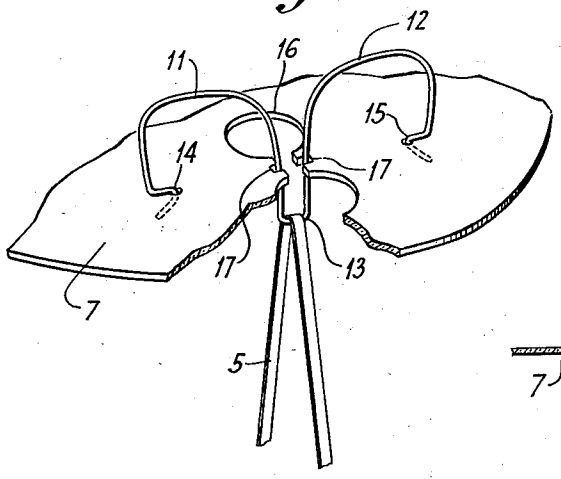
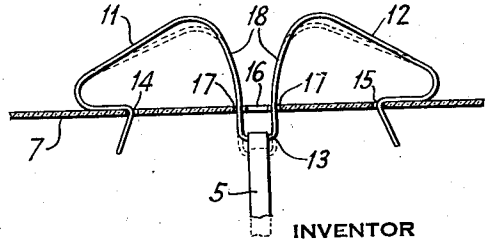


Fig. 3



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FILAMENT SPRING

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Application June 27, 1936, Serial No. 87,603

4 Claims. (Cl. 250—27.5)

This invention relates to electron discharge devices, particularly to filament tensioning means for said devices.

It is desirable that filamentary cathodes be supported so that the filaments are always centered in the electrode assembly, and are kept taut to minimize vibration of the filament. Because of the linear expansion and contraction of the usual filament during heating and cooling, spring tensioning means at one end of the filament are commonly used. The usual spring tensioning means for inverted V-type filaments comprises a resilient arm with a hook at one end to engage the bight or vertex at the upper end of the filament and are attached at its other end, laterally of the plane of the filament, to the upper insulating spacer of the electrode assembly. With such a filament support the hook and the bight of a filament moves in an arc about the outer end of the arm as a center and displaces the filament with respect to the other electrodes. Constructions employing guides in which a filament hook reciprocates in a straight line have been proposed, but are expensive and are difficult to assemble.

It is an object of my invention to provide a resilient spring support for filamentary cathodes which guides the upper end of the filamentary cathode in a straight line parallel to the axis of the electrodes, and which is easy and inexpensive to manufacture and assemble.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims, but the invention itself will be best understood by reference to the following specification taken in connection with the accompanying drawing in which:

Figure 1 is a view in perspective and partly broken away of an electron discharge device embodying my invention;

Figure 2 is a detailed perspective view of a filament support constructed in accordance with my invention.

The electron discharge device shown in Figure 1 has a metal envelope 1 closed at its lower end by a header 2 upon which is supported an electrode assembly 3 of the unit mount construction. The electrode assembly comprises an anode 4 and filament 5 positioned between transverse insulating spacing members 6 and 7. A filamentary cathode 5 is shown by way of example as an inverted V with the lower end of its legs attached to the lower spacer 6.

In accordance with my invention the bight or vertex of the filament is passed over the center of a novel filament tensioning means 10, comprising a short length of resilient spring metal either in the form of a wire or a flat ribbon formed with two curved legs or loops 11 and 12, best shown in Figure 2, joined by a transverse section 13, over which lies the bight of the filament. The outer ends of the leg portions are provided with hooks 14 and 15, which may, upon a slight compression of the spring, be inserted in openings provided in the insulating spacer 7.

It has been found convenient to snap my filament tensioning spring into place by engaging its end hooks in the insulating spacer, to thread the legs of the V-type filament through the openings of the spacer shown at 16 and lower the filament until its bight rests upon spring portion 13, to depress the center section 13 a predetermined distance below the spacer, and to then secure the lower ends of the filament. By so assembling the spring and filament, an accurately predetermined tension may be placed upon the filament spring so that in the course of manufacture all filaments of a group of tubes are tautened to the same degree.

During heating and stretching of the filament the bight of the filament supported by my improved spring means moves vertically in a straight line, inasmuch as the compression of the two legs of the spring tensioning means is always equal and opposite for any depression of the center portion of the spring.

The filament spring may, if desired, be made of flat or ribbon-like spring metal so that its end hooks 14 and 15 bear throughout their width upon the face of the insulating spacer and thus stabilize the filament spring on the flat insulator. Since the center portion 13 of the spring which carries the load of the filament passes through the insulating spacer and to a point below the outer ends of the spring, the tension placed upon the spring by the filament positively holds the spring in an upright position as shown. The downwardly extending portions of the center section 13 may conveniently be guided in notches or slots 17 in the insulating spacer as shown.

In Figure 3 is shown a filament tensioning spring embodying the characteristic features of my invention in which the legs of the spring member are relatively flat and straight as compared to the curved legs of the filament spring of Figure 1. The straight portions of the legs of the spring are joined to the lower transverse section 13 by curved portions 18, formed on the arc of a circle with the pivotal points at the hooks 14 and 15 as the centers of curvature. When section 13 moves vertically because of expansion or

contraction of the filament, curved portions 18 slide through notches 17 without binding or disengaging.

Good results have been obtained with filament springs made of nonsag tungsten wire about 7 mils in diameter, about 30 centimeters long and formed into the shape shown in any standard punch press with suitable dies.

Since many modifications may be made in my invention without departing from the scope thereof, it is desired that the appended claims be limited only by the prior art.

I claim:

1. An electron discharge device comprising an envelope, an electrode assembly of the unit mount construction in said envelope with a filament fixedly secured at the lower end of the assembly, resilient tensioning means for supporting the other end of the filament comprising an insulating spacer and a spring member with two leg portions with their outer ends attached to one side of said insulating spacer, said two portions being joined by a central section extending below said spacer and attached to said other end of the filament.

2. In combination, a filament, resilient tensioning means for said filament comprising a spring with its center section attached to the filament, the spring having curved portions rising in outwardly extending conjugate curved loops, the outer ends of the curved portions having hook fastening means to engage a support, the fastening means and the center section being in a common plane.

3. An electron discharge device, an insulating spacer in said device, resilient filament tensioning means comprising a spring attached at each end to said spacer, the spring being curved inwardly from its ends in two loops, the inner ends of the loops being joined by an integral section below said spacer.

4. Resilient filament tensioning means comprising a metal spring, a flat sheet of insulation with an opening, the ends of said spring being attached to one side of said spacer and having relatively straight portions extending inwardly toward each other from said ends, the spring having a center section on the other side of said spacer integrally joined to said straight portions by curved portions of the spring extending through said opening, said curved portions being formed on arcs with said ends as centers so that movement of said center section laterally of said spacer causes said curved portions to travel through the opening in said spacer without binding.

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