

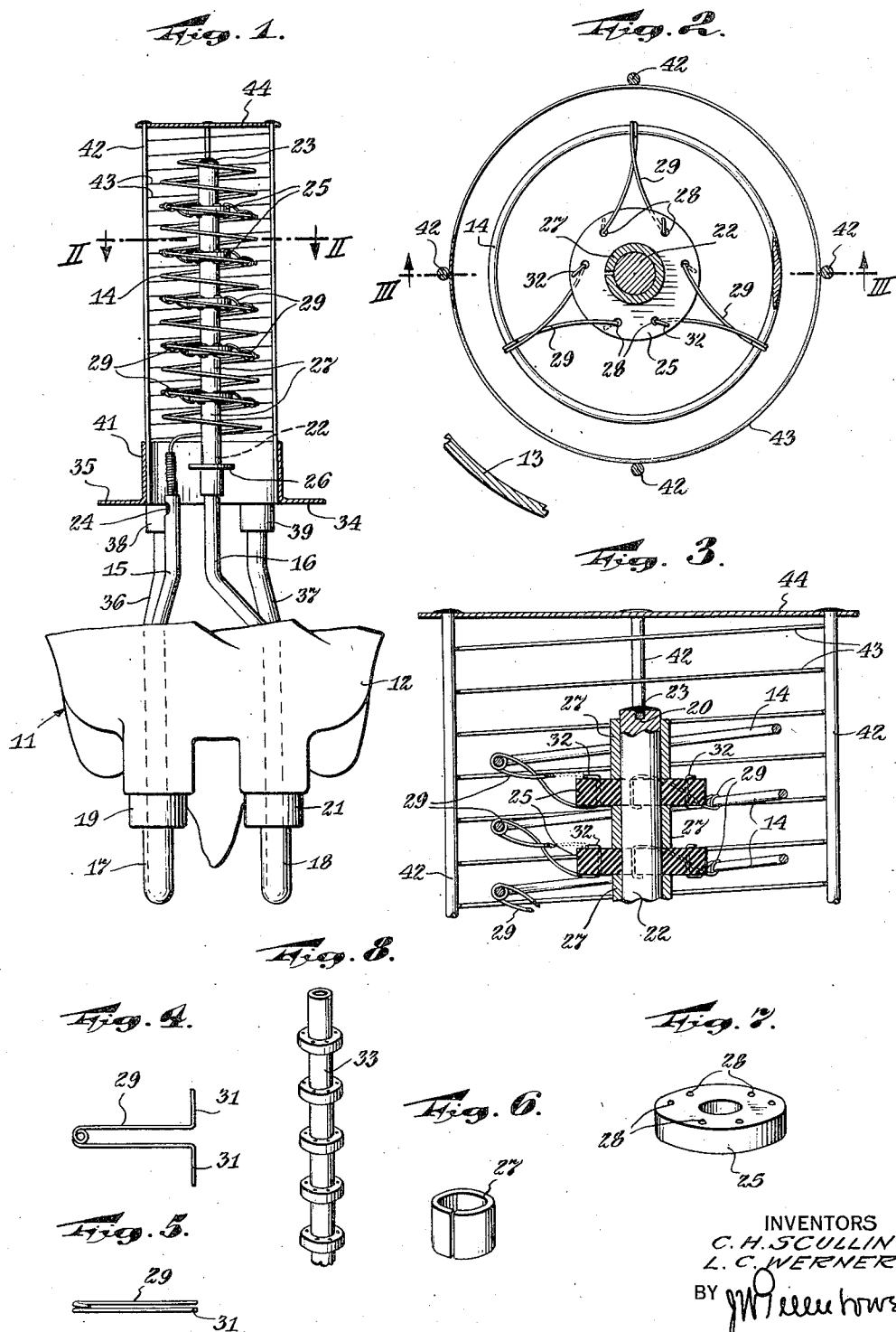
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ELECTRONIC DEVICE

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ELECTRONIC DEVICE

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This invention relates to electronic devices and, more particularly, to such with helical filaments braced against undesired distortion.

The principal object of our invention, generally considered, is to provide an electron device having a relatively large filamentary cathode, with means restrainingly engaging said cathode to prevent undesired distortion thereof when in service.

Another object of our invention is to provide an electron device which has a helical electron-emissive filament, with means for restricting the distortion thereof comprising an insulating member mounted on a supporting stem, and means extending from said member and restrainingly engaging said filament intermediate its ends.

A further object of our invention is to provide an improved method for mounting an electron-emissive filament to protect it against undesired distortion when in service.

Other objects and advantages of the invention, relating to the particular arrangement and construction of the various parts, will become apparent as the description proceeds.

Referring to the drawing:

Figure 1 is an elevational view, with parts broken away, of an electron device embodying our invention.

Figure 2 is a transverse sectional view on an enlarged scale on the line II—II of Figure 1, in the direction of the arrows.

Figure 3 is a fragmentary vertical sectional view on the line III—III of Figure 2, in the direction of the arrows.

Figure 4 is a detailed elevational view of one of the spring-tungsten wire supports used for restraining distortion of the filament.

Figure 5 is an edge view of the support illustrated in Figure 4.

Figure 6 is a perspective view of one of the sleeves or devices which space the insulating supporting washers.

Figure 7 is a perspective view of one of the insulating supporting washers used in the practice of our invention.

Figure 8 is a one-piece ceramic structure designed as an alternative to using spacers and washers, such as illustrated in Figures 6 and 7.

Many filament structures end in failure or changed tube characteristics due to sagging or other distortion of the filaments from their original positions. This is particularly true in connection with helical filaments, and gets progressively worse as the diameter of the filament is increased with a resultant increase in weight. It

has been the practice to support helical filaments at their ends only. This makes it very difficult to prevent distortion of the central portion of the helix, if it is substantial in length. These facts limit the size of practical helical filaments.

However, there are several advantages that helical filaments have over those of the multi-stranded type which makes it desirable to use such helical filaments. Some of their advantages are:

(1) For the same wattage input and electron emission, a helical filament usually draws a smaller heating current at a higher voltage than do multi-stranded types. This makes it possible to use smaller filament lead wires and cheaper filament transformers.

(2) Since the filament wires run approximately perpendicular to the axes of the grid support wires, there is much less electron beaming effect which causes undesirable local anode heating and reduced allowable anode dissipations.

(3) Multi-stranded filaments require an elaborate mechanical construction to get uniform tension on the several strands and to properly support said strands. A helical filament, on the contrary, can be simply mounted on two supports which also serve as current-carrying leads thus involving a much simpler and cheaper structure.

Because of these and other advantages it is desirable to use helical rather than multi-strand filaments. However, with filaments of helical form there is a tendency to sag and distort, which tendency is substantially eliminated by the present invention.

Referring to the drawing in detail, and first considering the embodiment of our invention illustrated in Figs. 1 to 7, inclusive, there is shown an electronic device 11 comprising an enclosing envelope 12, including a metal or copper portion 13 of which may constitute the anode-acting electrode of said device. The metal portion 13 may be secured to the base or cup portion carrying contact prongs 17 and 18 in a conventional manner, as will be understood by those skilled in the art. The cathode, in the present embodiment, comprises a tungsten filament 14 receiving power from supporting leads 15 and 16, which in turn connect with contact prongs 17 and 18, respectively, having skirts 19 and 21 sealed to the base portion of the envelope 12. The lead 16 terminates interiorly in a normally-vertical metal support rod 22, desirably formed of molybdenum, and to which in the slotted free end portion 20, the upper end of the filament 14 is secured as

by welding, indicated at 23. The other end of the filament is secured, as by brazing or welding indicated at 24, to the lead 15.

In order to support intermediate portions of the filament 14 and prevent undesired distortion, we provide a plurality of insulating discs or washers 25, desirably spaced from one another, and supported above a molybdenum collar portion 26 mounted on the lead 16, by molybdenum sleeves 27 closely fitting the support rod 22, as shown more clearly in Figures 2 and 3, and spacing the respective washers 25 above the collar portion 26 and at proper distances from one another.

The washers 25 are desirably spaced a distance corresponding with the turn-spacing of the filament 14, and each has a plurality, in this instance, six, holes 28 disposed around its center aperture adjacent its periphery. Each pair of holes 28 receives the corresponding ends of a supporting and restraining loop 29, preferably formed of spring-tungsten wire, each loop being initially formed, as illustrated in Figures 4 and 5, so that it contacts the supported portion of the filament 14 around a complete circumference only, and the portions beyond said loop are bent across one another, as illustrated in Figure 3, and have the angular ends 31 fitting a pair of apertures 28 from opposite faces thereof, with their projecting ends bent over as indicated at 32 to prevent undesired removal.

Although we have shown the washers 25 formed of ceramic such as beryllia, they may be made of other suitable material such as alumina or magnesia, and instead of being spaced by molybdenum, or other refractory metal sleeves such as illustrated in Figure 6, they may be spaced by ceramic refractory sleeves of the character mentioned for the washers, or all may be combined in a one-piece ceramic device 33, such as illustrated in Figure 8.

By attaching the tungsten wires 29 to their respective insulating washers, or washer-like portions of the one-piece ceramic device, the assembly can be "threaded" on to the helical filament 14 before the latter is welded to the top of the center support, in a manner similar to threading a nut onto a bolt. This makes a structure which is very easy to assemble.

The cathode assembly just discussed is in turn surrounded by the grid structure illustrated, which comprises a metal, preferably "Kovar" annulus 34, desirably angular in section as illustrated in Figure 1, and through the outstanding flange 35 of which projects the upper ends of the supporting leads 36 and 37, the lower ends of which desirably connect with contact devices corresponding with those designated 17 and 18, but not illustrated. Collars 38 and 39 provide abutments for the flange 35, which is apertured to receive the upper ends of the leads 36 and 37. The latter are secured to said device 34 as by nuts (not shown) fitting threaded end portions of said leads.

The grid structure is connected to the hollow cylindrical portion 41 of the member 34, and consists of preferably four upstanding platinized molybdenum support wires 42, carrying the fine-wire platinized molybdenum helical grid 43 welded or otherwise secured thereto. The upper ends of the wires 42 desirably carry a circular disc 44 of molybdenum or other suitable refractory metal, which may be spot-welded thereto. By using two leads for the grid structure, not only is the support thereof rigidified, but a getter (not shown) may be carried therebetween and

activated by passing current from one lead to the other.

Although preferred embodiments of our invention have been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims. The metal "Kovar" referred to is a special nickel-cobalt-iron alloy, as described in the Lempert et al. Patent No. 2,279,831, dated April 14, 1942.

We claim:

1. In an electron device, a helical electron-emissive filament, a cooperating electrode, a supporting stem for said filament, and means for restricting distortion of said filament comprising an insulating member mounted on said stem, said member having a plurality of apertures disposed toward its periphery, and means extending into said apertures and restrainingly engaging said filament intermediate its ends.

2. In an electron device, a helical electron-emissive filament, a cooperating electrode, a supporting stem for said filament, and means for restricting distortion of said filament comprising an insulating member mounted on said stem and a plurality of wires radiating from said member and restrainingly engaging said filament by being looped therearound.

3. In an electron device, a helical electron-emissive filament, a cooperating electrode, a supporting stem for said filament, a plurality of insulating discs mounted on said stem, means of lesser diameter disposed between said discs for spacing them along said stem, and means extending from portions of each of said discs beyond said spacing means to said filament for restraining movement thereof.

4. In an electron device, a helical electron-emissive filament, a cooperating electrode, a supporting stem for said filament, and means for restricting distortion of said filament comprising an insulating member mounted on said stem, said member having a plurality of apertures near its periphery, and a refractory metal wire with its intermediate portion encircling an intermediate portion of said filament, and its end portions passing into a pair of said apertures from opposite faces of said member.

5. In an electron device, a helical filament of tungsten, a cooperating electrode surrounding said filament, a metallic supporting stem surrounded by said filament and electrode, a plurality of disk-like insulating portions disposed along said stem and spaced from one another by sleeve portions, each of said disk-like portions having a plurality of apertures spaced around its periphery, and tungsten wires encircling portions of said filament and with their end portions fitting said disk apertures from opposite faces thereof.

6. The method of making a filament assembly for an electron device comprising mounting an insulating member upon a supporting stem, forming loops from tungsten wires intermediate their ends and fastening the ends of said loop wires to said insulating member, forming said filament as a helix and threading said filamentary helix through the loops of said supporting wires one by one and finally securing the ends of said helix to means for conducting power thereto.

7. The method of making a filament assembly for an electron device comprising mounting an insulating member upon a supporting stem, forming loops from wires and fastening the ends of each loop to said insulating member, forming

said filament as a helix, and threading it through the loops of said supporting wires.

8. In an electron device, an electron-emissive filament, a supporting stem therefor, and means for restricting distortion of said filament comprising an insulating member mounted on said stem and having a plurality of apertures disposed toward its periphery and a wire encircling an intermediate portion of said filament and passing through said apertures.

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9. In an electron device, a filament, supporting means comprising a plurality of disc-like insulating portions spaced from one another and having a plurality of apertures disposed toward their peripheries, and wires encircling portions of said filament and with their end portions received in said apertures.

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