

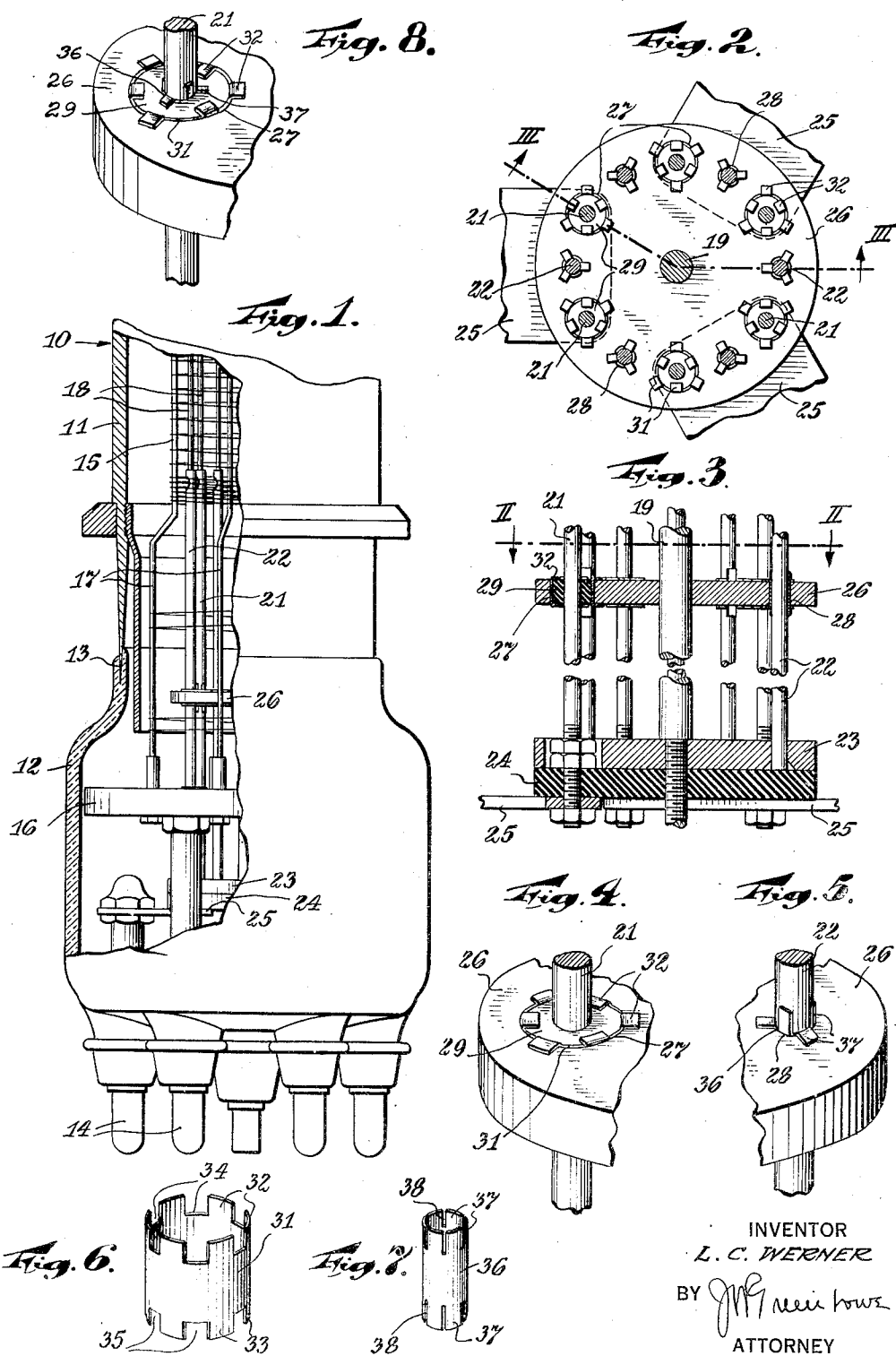
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ELECTRON DISCHARGE DEVICE AND LOCKING MEANS THEREFOR

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ELECTRON DISCHARGE DEVICE AND
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This invention relates to electron-discharge devices and, more particularly, to locking means associated with spacers therein for the cathode or filament support rods or leads, which have of necessity close relation to a grid, if employed, and its supports.

The principal object of my invention, generally considered, is to provide, in an electron-discharge device, means for locking insulating bushings in flat metal discs or spacers, as well as locking support rods and/or insulating bushings to such metal discs or spacers, without tie wires and notching of said rods, whereby such discs may serve as spacers for the filament leads.

Another object of my invention is to provide a metal sleeve slit at both ends to form bendable locking tabs for holding with respect to both internal and external members.

A further object of my invention is to provide a metal sleeve which is inserted over an insulating bushing, and portions of each end thereof alternately lockingly bent over said bushing and an associated spacer plate, or such a sleeve similarly employed for locking a support rod or lead in an associated spacer plate.

Other objects and advantages of the invention will become apparent as the description proceeds.

Referring to the drawing, like parts being designated by like reference characters:

Figure 1 is an elevational view, with parts in axial section, of an electron-discharge device embodying my invention.

Figure 2 is a plan on a larger scale of the spacer member with the associated filament lead-in wires or posts, with parts in section on the line II—II of Figure 3, viewed in the direction of the arrows.

Figure 3 is an axial sectional view on the lines III—III of Figure 2, in the direction of the arrows.

Figure 4 is a perspective view on an enlarged scale showing one of the filament posts of Fig. 2 extending through an insulator, held in the spacer plate by means embodying my invention.

Figure 5 is a view similar to Figure 4, but showing one of the filament leads or rods of Fig. 2 extending through said spacer plate, and held in place by means embodying my invention.

Figure 6 is a perspective view of one of the insulator locking means embodying my invention.

Figure 7 is a perspective view of one of the filament rod or lead locking means embodying my invention.

Figure 8 is a view similar to Figure 4, but showing in addition the illustrated filament lead

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held in place in its insulator by means such as illustrated in Figure 5.

In the Dailey et al. patent, No. 2,404,042, dated July 16, 1946, there is disclosed an electron-discharge device comprising a vacuum-tight container formed by an outer metal tube which acts as the anode, which container encloses a grid and a cathode. The leads or conductive posts for said cathode pass through a spacer formed as two plates, between which are held ceramic insulating discs or bushings, in order to insulate alternate cathode leads from one another. The present invention involves an improvement over that of said patent, in that the means for locking the insulating discs to the spacer plate, and certain leads or cathode posts to said spacer plate, are improved and the necessity for studs supporting said spacer plate from the underlying metallic supporting plate, is avoided.

Referring now to the drawing in detail, there is disclosed a specific embodiment of the invention in a form of discharge device comprising a vacuum-tight container formed by an outer metal tube 11 which acts as the anode, and which is closed at its upper end, or that shown cut away, in a conventional manner. It is closed at its lower end by means of a glass bowl or base 12, which is sealed to it in a suitable manner, as by feather-edge joint 13. From the bottom of the bowl at the exterior thereof, project the usual contact prongs 14 for making connection with external conductors.

Disposed coaxially within the anode 11 is a grid 15, supported from an interior plate 16 as by means of wires or rods 17 extending therefrom in a conventional manner. Inside the grid 15 is a cathode 18, formed as a plurality of hair-pin sections, each with parallel wires or legs, all of said legs being symmetrically disposed as elements of a cylinder in relatively close proximity to the grid. On the axis of the coaxial cathode and grid is a metal post 19, which forms a center support for the upper end of the cathode. Each filament section has one leg secured at its lower end to a lead, rod, or post 21, and its other leg secured at its lower end to a lead, rod, or post 22, the posts extending downwardly into the bowl 12. The posts 22, constituting one set, pass through in contact with, and are secured in, a metallic supporting plate 23 forming a common electrical connection thereto. The other set of posts 21 pass with clearance through said plate 23 and are secured to an insulative plate 24, which is disposed in engagement with the under side of said plate 23.

The posts 21 are secured to brackets 25 which support the two plates, 23 and 24, thereabove. These brackets are carried by inwardly-projecting parts of a plurality of the aforementioned prongs 14, and thereby have electrical connection with the exterior of the device. Said metallic supporting plate 23 has a connection (not shown) with another one of said prongs 14. Of course, one set of posts will during operation be at a potential different from that of the other set for obtaining current flow in the several filament sections.

Intermediate the ends of the several posts 21 and 22, and also on the central post 19, is a transverse and preferably circular metallic spacer plate 26. The grid-supporting wires or legs 17 pass to the bowl 12 on the outside of the spacer 26, out of contact therewith, but because of limited space, necessarily near to the same and likewise near to the filament parts. There may be during operation a high electrical gradient or radio-frequency electrostatic field between the posts of one set and the grid.

According to the present invention, the metallic spacer 26 is shown provided with a plurality of apertures, preferably disposed on a circle whose center is the axis of the support lead 19. Alternate apertures are larger than those therebetween, so that those numbered 27 are relatively large, while those numbered 28 are relatively small. In the relatively large apertures 27, there are disposed ceramic bushings or insulators 29, or such formed of lava or its equivalent. These insulators, preferably hollow cylindrical, serve to maintain the potential difference between the rods 21, on which they are applied, and the adjacent rods 22 which are electrically connected to the spacer 26.

The insulators 29 are, in the present embodiment, held in place in the spacer 26 by improved locking devices 31 embodying my invention. These locking devices are each nothing more than a simple metal sleeve or thin-walled hollow cylinder, as shown in detail in Figure 6, that is, one provided with oppositely extending tabs 32 and 33, defined by slots or slits 34 and 35, respectively, in their opposite edges. The sleeve may be continuous, or formed by bending a properly slit or slotted flat metal plate to cylindrical or partly cylindrical form. Each locking device may, for example, be formed by combining two or more of such plates and assembling them around the circumference of the part to be locked in place. Although when assembled, each locking tab desirably extends in a direction different from that of its neighbors, it may, for example, extend in the same direction as one of its neighbors. This means that the locking does not have to be by uniform alternate bending one way and then the other. These devices 31 may be formed of nickel, tantalum, copper, or other metal such as is used for structural elements in discharge devices, desirably about .01" thick. The depth of the slots or slits depends on the thickness of the particular disc or spacing plate 26 in use, and the diameter of the insulator 29 with which associated.

The spacer 26 is formed with apertures of such size that a space equal to the thickness of the wall of each sleeve 31 or bent section will be allowed between the associated bushing 29 and the spacer 26, with approximately .001" or .002" additional clearance for assembly. A sleeve 31 may be inserted over to grip each bushing 29 and some of its tabs bent over it therebetween. Desirably, but not necessarily, every other one of

the tabs, 33 as well as 32, are crimped or permanently bent over, as shown in detail in Figures 4 and 8. Although only one end is shown in Figures 4 and 8, it will thus be understood that permanent bending over is effected at the lower end, or that not shown, in a similar manner. This holds each sleeve 31 to its insulator or bushing 29.

The bushings 29 are each then placed in a large aperture 27 and the remaining projecting tabs, 33 as well as 32, crimped over to grip the spacer 26 therebetween as shown in Figures 4 and 8, it being thus understood that a similar crimping or bending is effected at the lower side, or that not illustrated. This gives a double interlocking support, that is, each sleeve or locking device 31 is connected, not only to the insulating bushing, but also to the spacer 26.

Each rod 21 which passes through an insulating bushing 29 may be connected to said bushing in the manner illustrated in Figures 5 and 8, as by means of a locking device 36, formed generally like the device 31, that is with tabs 37 formed by slits and extending from both ends, as illustrated in Figure 7. However, it is considered ordinarily sufficient that a locking device 36 be employed only with each of the alternately-disposed rods 22 as shown in Figure 5. In accordance with this figure, it will be seen that a locking device 36 is placed in each aperture 28, and every other leg 37, formed by slits 38, bent down over the spacer 26 as illustrated in Figure 5, it being understood that a corresponding connection is provided at the bottom of the plate 26. The rods 22 which pass through these locking devices 36, are held in place with respect thereto by the unbent tabs 37 being secured thereto in any desired manner, as by spot welding, brazing, or soldering.

Most of the bushings and spacers now in use have a step machined in both, so that if the bushing cracks, it will be locked in the spacer and not fall into the bulb. In accordance with my present invention, my new locking device serves the purpose without the costly machining necessary to make a two-step opening in the spacer and a shoulder on the bushing.

Although I have shown a certain design of locking sleeve, yet other designs may be made within the spirit and scope of the invention. It will be understood that my invention is particularly adapted for use with support rods or leads not smaller than $\frac{1}{8}$ inch in diameter. On very small diameter bushings, a space may be cut out, instead of the slitting as shown in Figure 7, to make the circumferential width of each tab relatively small and thereby avoid a sharp radius thereon which might make it difficult to effect a neat crimping operation.

Although a preferred embodiment of my invention has been disclosed, it will be understood that modifications may be made within the spirit and scope of the appended claims.

I claim:

1. An electron discharge device comprising a cathode, support rods for said cathode, a metallic spacer plate formed with apertures, cathode support members disposed in said apertures and comprising rods and insulators on alternate cathode support rods, locking sleeves enclosed in said spacer plate, said sleeves having intermediate hollow cylindrical portions, and tabs at both ends, some of which are bent over on said spacer plate and others of which are secured to members disposed in said plate apertures, and other locking sleeves enclosed in said insulators, said other sleeves having tabs at both

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ends some of which are bent over on said insulators and others of which are secured to the support rods passing through said insulators.

2. An electron discharge device comprising a cathode, support rods for said cathode, a metallic spacer plate through which said cathode support rods extend, insulators on alternate cathode support rods and enclosed in corresponding apertures in said spacer plate, locking sleeves on said other support rods and enclosed in said spacer, said sleeves having tabs, some of which are bent over on said spacer plate and others of which extend along said support rods and are secured thereto, and other locking sleeves enclosed in said insulators, said other sleeves having tabs at both ends some of which are bent over on said insulators and others of which are secured to the support rods passing through said insulators.

3. An electron discharge device comprising a cathode, support rods for said cathode, a metallic spacer plate through which said cathode support rods extend, insulators on alternate cathode support rods and enclosed in corresponding apertures in said spacer plate, locking sleeves on said insulators and enclosed in said spacer plate, said sleeves having tabs some of which are bent over on said spacer and others of which are bent over said insulators, and other locking sleeves on said support rods and enclosed in said insulators, said other sleeves having tabs, some of which are bent over said insulators and others of which are secured to said other support rods.

4. An electron discharge device comprising a grid, a cathode, support rods for said grid and cathode, a metallic spacer plate enclosed by said grid support rods and through which said cathode support rods extend, insulators on alternate cathode support rods and enclosed in corresponding apertures in said spacer plate, and locking sleeves on said insulators and enclosed in said spacer plate, said sleeves having tabs at both ends, some of which are bent over to grip said spacer plate therebetween and others of which are bent over to grip said insulators therebetween.

5. An electron discharge device comprising a grid, a cathode, support rods for said grid and cathode, a metallic spacer plate enclosed by said grid support rods and through which said cathode support rods extend, insulators on alternate cathode support rods and enclosed in corresponding apertures in said spacer plate, locking sleeves on said other support rods and enclosed in said spacer, said sleeves having intermediate hollow cylindrical portions, and tabs at both ends, some of which are bent over on said spacer plate and others of which extend along said support rods and are secured thereto, and similar means for locking said insulators in place.

6. An electron discharge device comprising a grid, a cathode, support rods for said grid and cathode, a metallic spacer plate enclosed by said support rods and through which said cathode support rods extend, insulators on alternate cathode support rods and enclosed in corresponding apertures in said spacer plate, locking sleeves on said insulators and enclosed in said spacer plate, said sleeves having tabs some of which are bent over on said spacer and others of which are bent over on said insulators, and other locking sleeves on said other support rods and enclosed in said spacer plate, said other sleeves having tabs, some of which are bent over on said spacer plate and others of which are secured to said other support rods.

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7. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of members associated with an electrode in said device, alternate apertures being larger for the reception of members including insulators on leads to said electrode, locking sleeves passing through certain of said apertures, said sleeves having tabs, some of which are bent over on said spacers and others of which are secured to members disposed in said apertures, and other locking sleeves enclosed in said insulators, said other sleeves having tabs some of which are bent over on said insulators and others of which are secured to the leads passing through said insulators.

8. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of support rods, alternate apertures being larger for the reception of insulators between said plate and the received rods, insulators in said larger apertures, locking sleeves on said insulators and enclosed in said spacer, said sleeves having tabs, some of which are bent over on said spacer, and others of which are bent over on said insulators, and similar means for locking said support rods in place.

9. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of cathode support rods, alternate apertures being larger for the reception of insulators between said plate and the received rods, locking sleeves on the rods which pass through the smaller apertures, said sleeves having intermediate hollow cylindrical portions, and tabs at both ends, some of which are bent over on said spacer, and others of which extend along the received rods and are secured thereto, and similar means for locking said insulators in place.

10. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of cathode support rods, alternate apertures being larger for the reception of insulators between said plate and the received rods, insulators in said larger apertures, locking sleeves on said insulators and enclosed in said spacer, said sleeves having tabs some of which are bent over on said spacer and others of which are bent over on said insulators, and other sleeves on said support rods and enclosed in said insulators, said other sleeves having tabs, some of which are bent over on said insulators, and others of which are secured to said support rods.

11. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of support rods, alternate apertures being larger for the reception of insulators between said plate and the received rods, insulators in said larger apertures, locking sleeves on said insulators and enclosed in said spacer, said sleeves having tabs, some of which are bent over on said spacer and others of which are bent over on said insulators, and other sleeves on the other support rods and enclosed in said spacer, said other sleeves having tabs, some of which are bent over on said spacer, and others of which are secured to said other support rods.

12. An electron discharge device comprising a metal plate spacer, apertures in said plate for the reception of support rods, insulators in said apertures, locking sleeves on said insulators and enclosed in said spacers, said sleeve having tabs some of which are bent over on said spacer and others of which are bent over on said insulators, and other sleeves on said support rods and enclosed in said insulators, said other sleeves hav-

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ing tabs, some of which are bent over on said insulators, and others of which are secured to said support rods.

13. An electron discharge device comprising a metal spacer, apertures in said plate for the reception of support rods, insulators on some of said support rods, locking sleeves on said insulators and enclosed in said spacer, said sleeves having tabs, some of which are bent over on said spacer, and others of which are bent over on said insulators, and other sleeves on said support rods and enclosed in said spacer, said other sleeves having tabs, some of which

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are bent over on said spacer, and others of which are secured to said other support rods.

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

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