Feb. 25, 1947. W. HOTINE 2,416,318

ELECTRON DISCHARGE DEVICE

Filed Aug. 15, 1942

Fig:1.

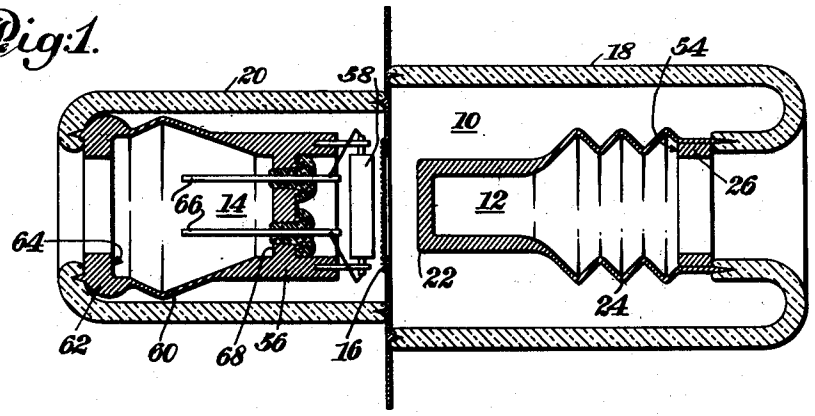


Fig:3.

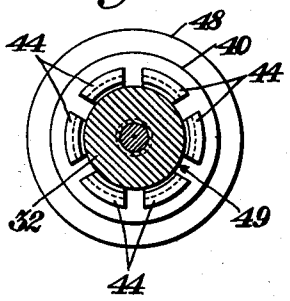


Fig:2.

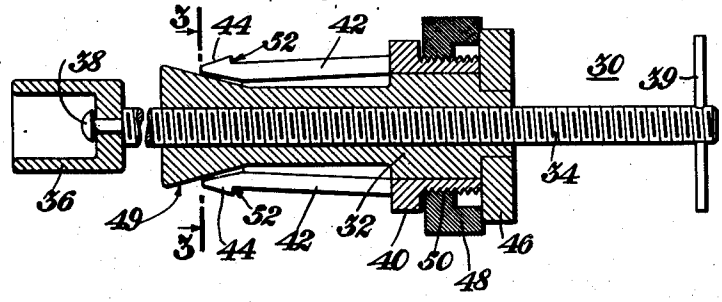
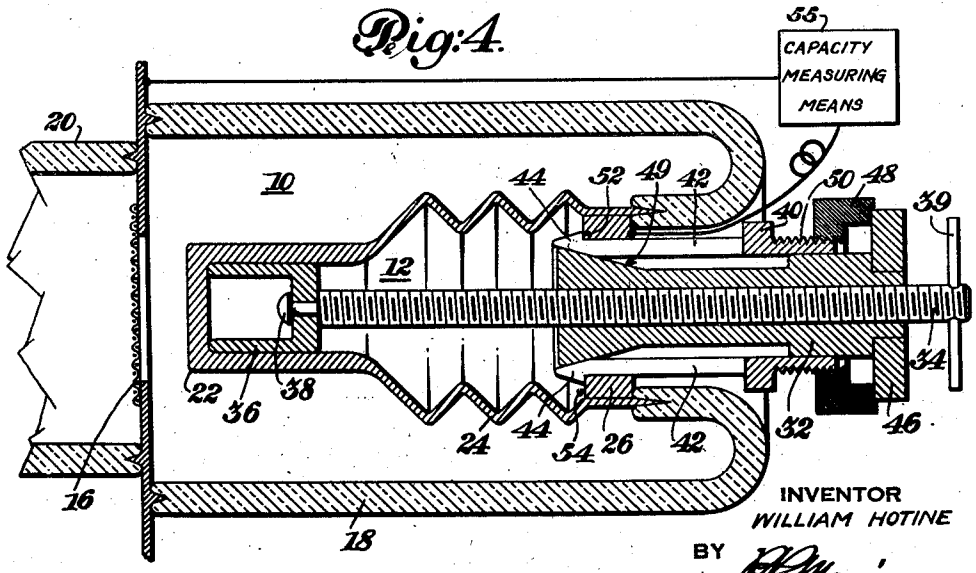


Fig:4.



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ELECTRON DISCHARGE DEVICE

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5 Claims. (Cl. 250—27.5)

1

This invention relates to electron discharge devices and method of adjusting same and more particularly to such a device whose electrodes may be adjusted for proper inter-electrode capacitance after assembly.

An object of this invention is to provide a novel electron discharge device having adjustable electrodes.

Another object of this invention is to provide a novel method for accurately adjusting the inter-electrode capacitance of electron discharge devices.

Still another object of this invention is the provision of a novel stretching tool for adjusting the position of the electrodes within an electron discharge device.

A further object of this invention is to provide an electron discharge device in which some of the electrodes may be longitudinally stretched for the purpose of adjusting the inter-electrode capacities.

A more specific aspect of the invention lies in the method of longitudinally adjusting the position of the electrodes in an electron discharge device by the insertion of a stretching tool, and stretching such electrodes by this tool until a desired predetermined inter-electrode capacity is measured.

Embodiments of a tube formed in accordance with the present invention, and my novel method for adjusting the inter-electrode capacities thereof, will be more clearly described below, and preferred embodiments are illustrated in the attached drawings, in which:

Fig. 1 is a longitudinal cross-sectional view of an electron discharge device constructed in accordance with the present invention;

Fig. 2 is a longitudinal cross-sectional view of a tool which may be used to adjust the electrodes of the device illustrated in Fig. 1;

Fig. 3 is a cross-sectional view of the tool illustrated in Fig. 2, taken along the line 3—3; and

Fig. 4 is a partial cross-sectional view of the device illustrated in Fig. 1, showing the tool inserted within an electrode for stretching the same.

The electron discharge device 10 shown in Fig. 1 is of a generally well-known configuration, and may be a triode having an anode 12, a cathode electrode 14, and a grid 16. A suitable envelope 18 surrounds the anode 12, while an envelope 20 surrounds the cathode 14, the grid 16 in this case forming the interconnecting means between the two envelopes.

2

Considering first, by way of example, the anode 12 constructed in accordance with the present invention, it will be noted that this anode is formed with a head portion 22 in juxtaposition with the grid 16, and a supporting base 24 illustrated as being corrugated in the form of a bellows. A collar 26 is preferably attached at the bottom of the base 24 for a purpose to be described hereinafter. The form of electrode just described is such that while the corrugated thin-walled base 24 is sufficiently strong to properly support the anode head 22, at the same time the distance between the head 22 and grid 16 may be adjusted by stretching the anode through expansion of the base 24. Anodes in electron discharge devices of the type described are generally made of copper which will permit a certain amount of stretching when a corrugated section such as base 24 is used, and since copper of the form used has practically no resiliency, the anode 12 will retain its position relatively to the grid 16 after the corrugated section has been stretched the desired amount.

A tool suitable for stretching an electrode such as anode 12 of Fig. 1, is generally indicated at 30 in Figs. 2 and 3. This preferred form of tool may consist of an internal threaded sleeve 32 supporting an externally threaded rod 34 upon one end of which is mounted a preferably cup-shaped plunger 36, attached to the rod 34 as by pivot pin or rivet 38. A handle 39 at the other end of the rod may be used to rotate the latter in the sleeve 32 and move the plunger 36 longitudinally relatively thereto. Slidably mounted on the sleeve 32 is a second sleeve 40 which is split for the greater part of its length to form fingers 42 upon whose outer ends are formed dogs 44. The periphery of the solid portion of the sleeve 40 is threaded and supports a nut 48, one end of which bears against a collar 46 attached in any suitable manner to the proper end of the sleeve 32. Accordingly, rotation of the nut 48 bearing against the collar 46 will longitudinally slide the sleeve 40 relatively to the sleeve 32, suitable means (not shown) being provided to prevent relative rotation between the sleeves. The end of the sleeve 32 adjacent the dogs 44 is formed with a conical surface 49 upon which the dogs 44 are supported. It will therefore be seen that longitudinal movement of the sleeve 40 relatively to the sleeve 32 varies the radial position of the dogs 44, moving them inwardly or outwardly depending upon their position on the conical surface 49.

The manner in which the tool 30 is used to

adjust the electrodes of the electron discharge device of Fig. 1 is clearly illustrated in Fig. 4 which shows such a tool mounted in stretching position within the anode 12. It will be noted that in this case the plunger 36 abuts against the inner end of the anode head 22, this plunger being preferably of such a diameter as to slidably fit within the head 22 so as to provide an equal radial bearing surface. At the other end of the tool the sleeve 40 has been so shifted upon the sleeve 32 that the dogs 44 have been pushed outwardly sufficiently that their abutting surfaces 52 engage the abutting surface 54 of the internal collar 26 previously described in connection with Fig. 1. In the position of the parts shown in Fig. 4 it will be obvious to those skilled in this art that upon rotation of the handle 39 of tool 30, the plunger 36 will be moved longitudinally forwardly, pushing out the anode head 22 and stretching the corrugated base 24. The capacitance between the grid 16 and the anode 12 may, at this time, be measured by any suitable means indicated at 55, and the anode is stretched by the device 30 until the predetermined desired capacity is indicated. At this time the tool will be removed and the anode 12 will remain in the position to which it has been stretched.

The tool 30 may also be used to adjust the capacity between the cathode 14 and the grid 16. In Fig. 1, I have shown, by way of example, a cathode structure in which the cathode proper 58 is supported in any suitable manner upon a head 56 which, in turn, is connected to the envelope 20 through a bowed-out base 60. In this form of construction the bottom of the base 60 is formed with an integral collar 62 having a suitable abutting surface 64, which will function similarly to the attached collar 26 illustrated in connection with the anode 12. Suitable heater leads 66 can be provided, passing through the transverse portion 68 of the head 56. It will be clear to those skilled in this art that adjusting of the cathode structure 58 by the tool 30 will take place similarly to the aforedescribed adjusting of the anode structure 12. In this case the dogs 44 will abut the surface 64 of the collar 62, while the plunger 36 will bear against the transverse portion 68 of the head 56. Actual stretching of the electrode structure takes place in the thin bowed-out base 60, this base being stretched by the tool 30 until the desired capacity between the cathode element 58 and the grid 16 is indicated upon the measuring device.

While a corrugated base with an attached collar has been illustrated in connection with the anode structure 12, and a bowed-out base with integral collar has been illustrated in connection with the cathode structure 14, it is to be understood that these structural details are interchangeable. For example, the integral collar can be used in connection with the corrugated base or the inserted collar with the bowed-out base. The cathode and anode structures may be formed alike or differently.

It will also be clear to those skilled in this art that the principles of the present invention are not confined to the exact type of electron discharge device illustrated but, on the other hand, are readily applicable to all types of electron discharge devices in which it is desired to obtain an accurate capacitative relationship between longitudinally related electrodes.

While certain preferred forms of construction have been illustrated and described, it is to be understood that changes may be made as will be apparent to those skilled in this art.

What I claim is:

1. An electron discharge device including an envelope, a first electrode structure and a second electrode structure mounted in said envelope, said second electrode structure having a head portion positioned adjacent said first electrode structure and in capacitative relationship therewith and a longitudinally extensible base attached to said envelope, and removable adjustable means engaging within said second electrode structure for stretching said extensible base and moving said head toward said first electrode structure until a predetermined capacity between the same has been attained.

2. The combination according to claim 1, in which said extensible base is formed as a hollow bowed-out cylinder.

3. An electron discharge device including a generally cylindrical hollow envelope, an electrode extending across said envelope and positioned substantially centrally between its ends, and a pair of additional electrodes, one mounted in each end of said envelope, each of said additional electrodes having a head portion positioned within said envelope and in capacitative relation with the central electrode, and each of said additional electrodes having a longitudinally extensible base attached to an end of the envelope, whereby the distance between the head of each of said additional electrodes and the central electrode may be adjusted by the longitudinal expansion of its respective base to vary the capacity between the corresponding electrodes.

4. An electron discharge device including an envelope, a first electrode structure and a second electrode structure mounted in said envelope, said second electrode structure having a head portion formed as a hollow cylinder, positioned adjacent said first electrode structure and in capacitative relationship therewith, and a longitudinally extensible base formed with an internal shoulder at its lower end and attached to said envelope, and removable means inserted within said second electrode structure for stretching said extensible base and moving said head toward said first electrode structure until a predetermined capacity between the same has been attained, said means including a plurality of radially extensible fingers having dogs abutting longitudinally against said shoulder, and a longitudinally movable plunger engaging the inside of said head for moving the latter relatively to said internal shoulder.

5. An electron discharge device including an envelope, a first electrode structure and a second electrode structure mounted in said envelope, said second electrode structure having a head portion formed as a hollow cylinder, positioned adjacent said first electrode structure and in capacitative relationship therewith, and a longitudinally extensible base formed with an internal shoulder at its lower end, attached to said envelope, and removable means inserted within said second electrode structure for stretching said extensible base and moving said head toward said first electrode structure until a predetermined capacity between the same has been attained, said means including a plurality of circumferentially spaced fingers each having a dog, means for moving said fingers radially outwardly in juxtaposition to said shoulder, an expansion plunger, and further means operable from without the envelope for moving said plunger against the inside of the head portion against the reaction of said dogs on said

shoulder for stretching the head portion of the electrode relatively to said shoulder.

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