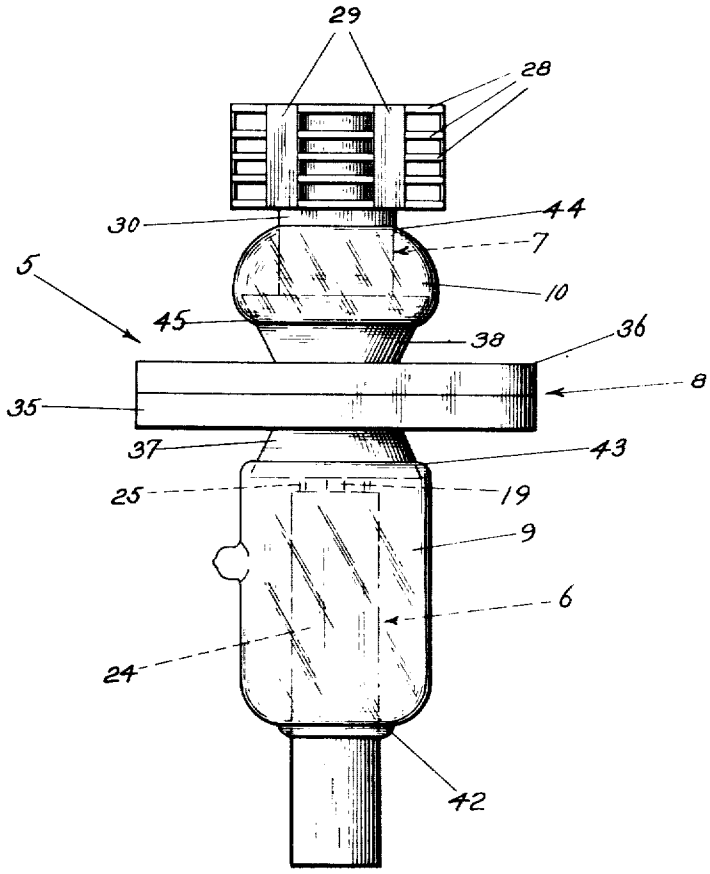
Dec. 14, 1948. P. L. SPENCER 2,455,957

MULTIELEMENT ELECTRON DISCHARGE DEVICE

Filed May 9, 1945 2 Sheets-Sheet 1

FIG. 1.



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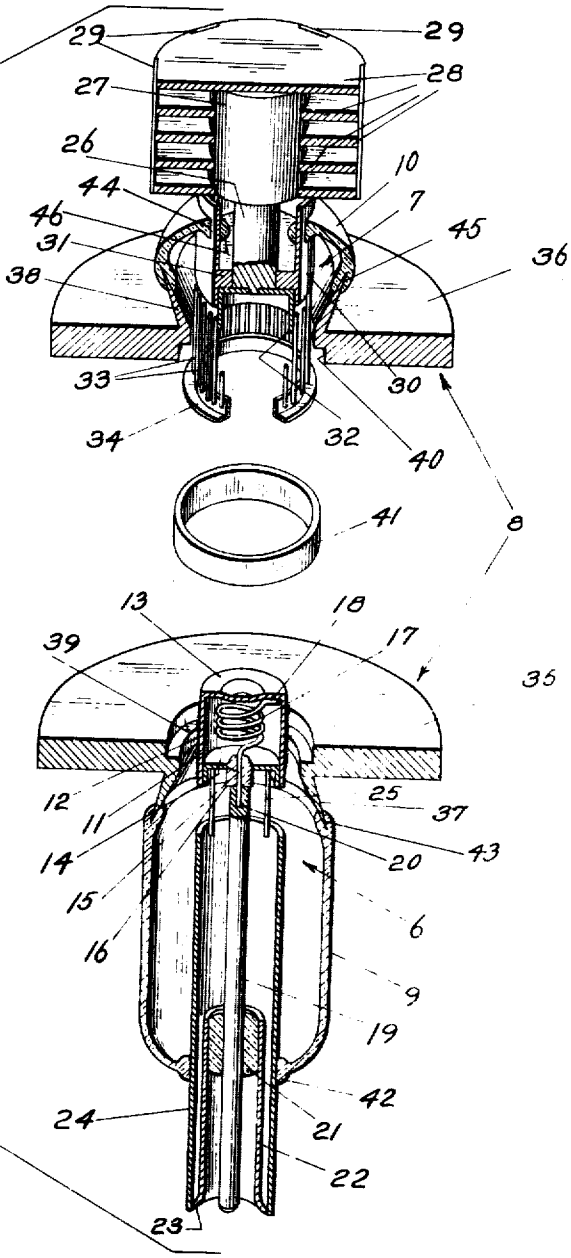


FIG. 2.

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UNITED STATES PATENT OFFICE

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MULTIELEMENT ELECTRON-DISCHARGE DEVICE

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7 Claims. (Cl. 250—27.5)

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My present invention relates to electron-discharge devices, and more particularly to electron-discharge devices adapted for use at high frequencies.

As is well known, it is necessary, in order to counteract undesirable inductive and capacitive effects of the electrode leads in such devices, to maintain lead length at a minimum and lead spacing at a maximum.

In order to satisfy these conditions, it has heretofore been proposed to arrange the electrodes concentrically with respect to each other, with the cathode at the center, the grid surrounding the cathode, and the anode surrounding the grid, the cathode and grid leads entering the device from opposite directions, and the anode comprising a unitary, centrally-apertured, annular member of a thickness substantially coextensive with the length of the cathode and grid.

I have found, however, that, in assembling such a device, it is most difficult properly to align the cathode and grid within the central aperture of the anode, and inasmuch as the electrode spacing in such a device is extremely critical, this construction is unsatisfactory.

It is, therefore, the main object of my present invention to provide a construction for an electron-discharge device of the general character indicated which enables the easy and accurate assembling thereof.

It is a further object of my present invention to accomplish the foregoing in a rapid manner, and without the need of as highly skilled labor as has heretofore been necessary.

These and other objects of my present invention, which will become more apparent as the detailed description thereof progresses, are attained, briefly, in the following manner:

As in the above-described prior devices, the electrodes in the electron-discharge device of my present invention are concentrically disposed with respect to each other, and the cathode and grid leads enter the device from opposite directions. The anode of my present invention is not of unitary construction. Instead, it comprises a pair of centrally-apertured, annular members which, through the use of appropriate jigs, may, during the assembling operations, be accurately secured, respectively, to the cathode and grid structures of the device, a pair of glass envelopes, each having one end sealed to one of said annular members and its other end sealed to the cathode or grid structure, as the case may be, providing the means for supporting the anode

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structure with respect to said cathode and said grid.

I have found that by constructing the anode as aforesaid, the cathode and grid structures may be speedily and more accurately secured thereto than has heretofore been possible, thus eliminating the above referred to disadvantages of prior practices.

In the accompanying specification I shall describe, and in the annexed drawings show, an illustrative embodiment of electron-discharge device of my present invention. It is, however, to be clearly understood that I do not wish to be limited to the details herein shown and described for purposes of illustration only, inasmuch as changes therein may be made without the exercise of invention and within the true spirit and scope of the claims hereto appended.

In said drawings:

Fig. 1 is a side elevational view of an electron-discharge device assembled in accordance with the principles of my present invention; and

Fig. 2 is a partially exploded, longitudinal sectional view of the same.

Referring now more in detail to the aforesaid illustrative embodiment of my present invention, and with particular reference to Fig. 1 of the drawings, the numeral 5 generally designates an electron-discharge device comprising, for example, a cathode structure 6, a grid structure 7, an anode structure 8 and a pair of glass envelopes 9 and 10.

As shown more specifically in Fig. 2 of the drawings, the cathode structure 6 may comprise a cylindrical cathode head 11 provided with a highly electron-emissive coating 12, for example, of the alkaline-earth metal oxide type, said head being closed, at its upper end, by a wall 13, and at its lower end, by a dish-shaped member 14 having a central aperture 15.

Extending into the aperture 15 is an insulating bushing 16 through which may pass a heating filament 17, the latter being disposed within the cathode head 11, having one of its ends electrically connected to said head, as at 18, and having its other end electrically connected to a lead-in conductor 19, as at 20. The lead-in conductor 19 extends downwardly through a glass seal 21 which is lodged in a tubular member 22, the latter being brazed at its lower, flared end 23 to a tubular conductor 24 which, together with the lead-in conductor 19, constitutes a coaxial line for conveying heating current to the filament 17. The electrical circuit through the filament 17 is completed by connecting the upper end of

the tubular conductor 24 to the cathode head 11 through a plurality of spaced conducting rods 25.

It will be noted that the rods 25 are of relatively small diameter, so that while they readily permit the passage of current to the filament 17, they serve to isolate the cathode head 11 from the tubular conductor 24 insofar as the heat developed by said filament 17 is concerned.

The grid structure 7 may comprise a cylindrical bar 26 made of highly conductive material, such as copper, and being of substantial cross-section so as readily to convey heat, said bar having, at its upper end, an enlarged portion 27 provided with a plurality of heat-dissipating fins 28, the latter being bridged by a plurality of spaced, flat conductors 29 presenting short R.-F. energy paths. Surrounding the bar 26, with its upper edge abutting the undersurface of the lowermost of the heat-dissipating fins 28, is a conducting sleeve 30 having, near its lower end, an inwardly-directed annulus 31 which is centrally apertured to receive said bar 26; and nesting within the lower portion of said sleeve, and secured to the annulus 31 and the lower end of the bar 26, is a thimble 32.

Fixed, as by being welded, to the outer surface of the thimble 32 is a multiplicity of grid wires 33, the lower ends of said grid wires being secured to the outer surface of a flanged ring 34.

The anode structure 8 may comprise a pair of centrally-apertured, annular members 35 and 36 made of highly conductive material, such as copper, said annular members being provided, at their central apertures, with diverging, feathered edges 37 and 38, and recesses 39 and 40. The latter are adapted to receive a ring 41 so as properly to align the annular members 35 and 36 during assembly, thereby assuring accurate positioning of the cathode and grid structures with respect to each other.

The envelope 9 is sealed at one end thereof to the tubular conductor 24 of the cathode structure 6, as at 42, and it is sealed at the other end thereof to the feathered edge 37 of the annular member 35, as at 43.

The envelope 10 is sealed at one end thereof to the sleeve 30 of the grid structure 7, as at 44, and it is sealed at the other end thereof to the feathered edge 38 of the annular member 36, as at 45, the inner surface of the sleeve 30, preferably, being backed, in the region of the seal 44, with a ring 46 of glass, whereby the materials of which the sleeve and envelope are made are caused to expand and contract substantially to a like degree and thus prevent separation.

In the final assembly of the device, the annular members 35 and 36 are brought together with the ring 41 sitting in the recesses 39 and 40 thereof, and they are made secure, for example, by silver-soldering, the contacting surfaces of said members being of appreciable area and lying in a plane parallel to the direction of the electron-path between the cathode head 11 and the wall defining the central aperture of the anode structure.

This completes the description of the aforesaid illustrative embodiment of my present invention. It will be noted from all of the foregoing that I have provided a construction for an electron-discharge device wherein, because it is especially adapted for use at high frequencies, the electrode leads enter the device from opposite directions, whereby the cathode and grid structures of said device may be speedily and accurately assembled with respect to each other. It will further be noted that by reason of the construction employed in my present invention, the necessity for highly skilled labor in assembling the same is, to a great extent, eliminated.

Other advantages of my present invention will readily occur to those skilled in the art to which the same relates.

What is claimed is:

1. An electron-discharge device comprising: a plurality of electrodes, one of which consists of a pair of annular members surrounding the remaining electrodes; said annular members having contacting surfaces of appreciable area lying in a plane normal to the direction of the axes thereof; and a pair of envelopes each of which is sealed to one of said annular members and to one of the remaining electrodes.

2. An electron-discharge device comprising: a plurality of electrodes, one of which consists of a pair of annular members surrounding the remaining electrodes; said annular members having contacting surfaces of appreciable area lying in a plane normal to the direction of the axes thereof; and a pair of envelopes, extending in opposite directions from said annular members, each of which is sealed to one of said annular members and to one of the remaining electrodes.

3. An electron-discharge device comprising: a cathode structure; a grid structure; an anode structure consisting of a pair of annular members surrounding said cathode and grid structures; and annular members having contacting surfaces lying in a plane substantially parallel to the direction of the electron-path between said cathode and anode structures; and a pair of envelopes, one of which is sealed to one of said annular members and said cathode structure, and the other of which is sealed to the remaining annular member and said grid structure.

4. An electron-discharge device comprising: a plurality of electrodes, one of which surrounds the others and includes a pair of annular members having contacting surfaces of appreciable area lying in a plane normal to the direction of the axes thereof; said annular members being provided with registering recesses receptive of a common guide member; and a pair of envelopes each of which is sealed to one of said annular members and to one of the remaining electrodes.

5. An electron-discharge device comprising: a plurality of electrodes, one of which surrounds the others and includes a pair of annular members having contacting surfaces of appreciable area lying in a plane normal to the direction of the axes thereof; said annular members being provided with registering recesses receptive of a common guide member; and a pair of envelopes, extending in opposite directions from said anode structure, each of which is sealed to one of said annular members and to one of the remaining electrodes.

6. An electron-discharge device comprising: a cathode structure; a grid structure; an anode structure surrounding said cathode and grid structures, and including a pair of annular members having contacting surfaces lying in a plane substantially parallel to the direction of the electron-path between said cathode and anode structures; said annular members being provided with registering recesses receptive of a common guide member; and a pair of envelopes, one of which is sealed to one of said annular members and said cathode structure, and the other of which is sealed to the remaining annular member and said grid structure.

7. An electron-discharge device comprising: a plurality of electrodes, one of which consists of a pair of coaxial members surrounding the remaining electrodes; said coaxial members having contacting surfaces of appreciable area lying in a plane normal to the direction of the axes thereof; and a pair of envelopes each of which is sealed to one of said coaxial members and to one of the remaining electrodes.

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