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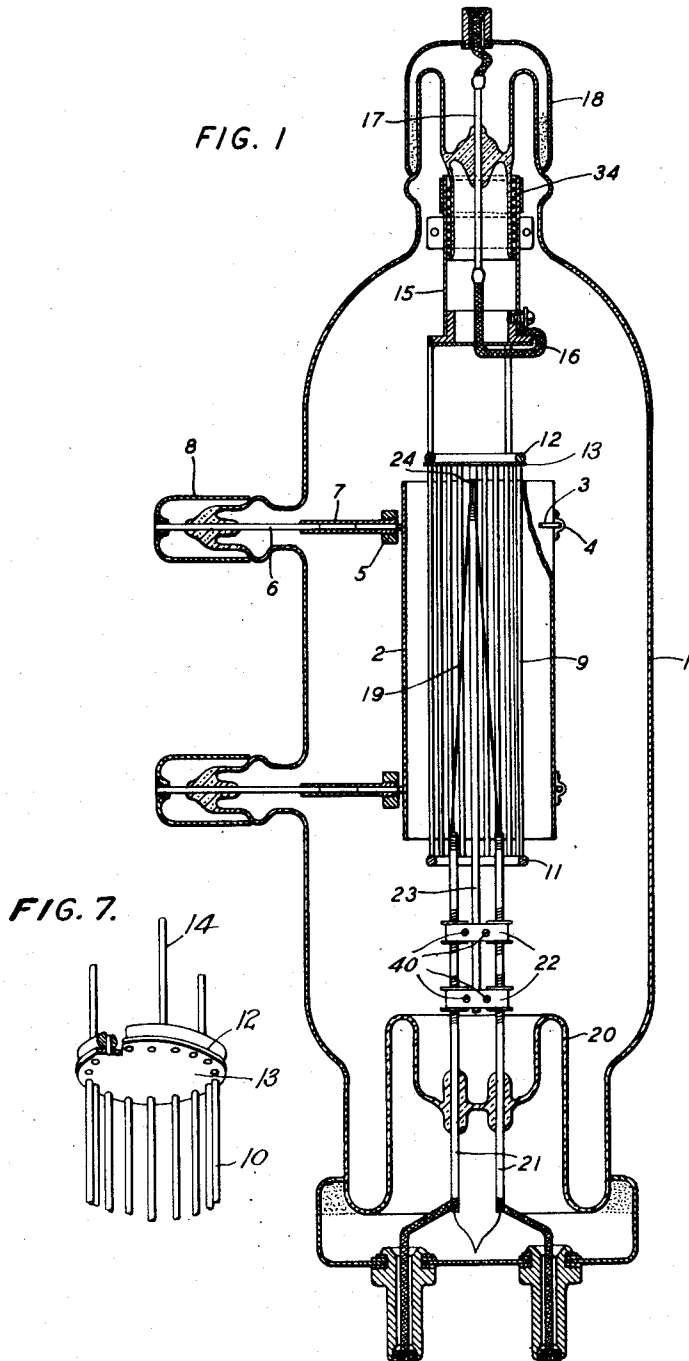
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1,965,338

THERMIONIC DISCHARGE DEVICE

Filed Oct. 23, 1930

2 Sheets-Sheet 1



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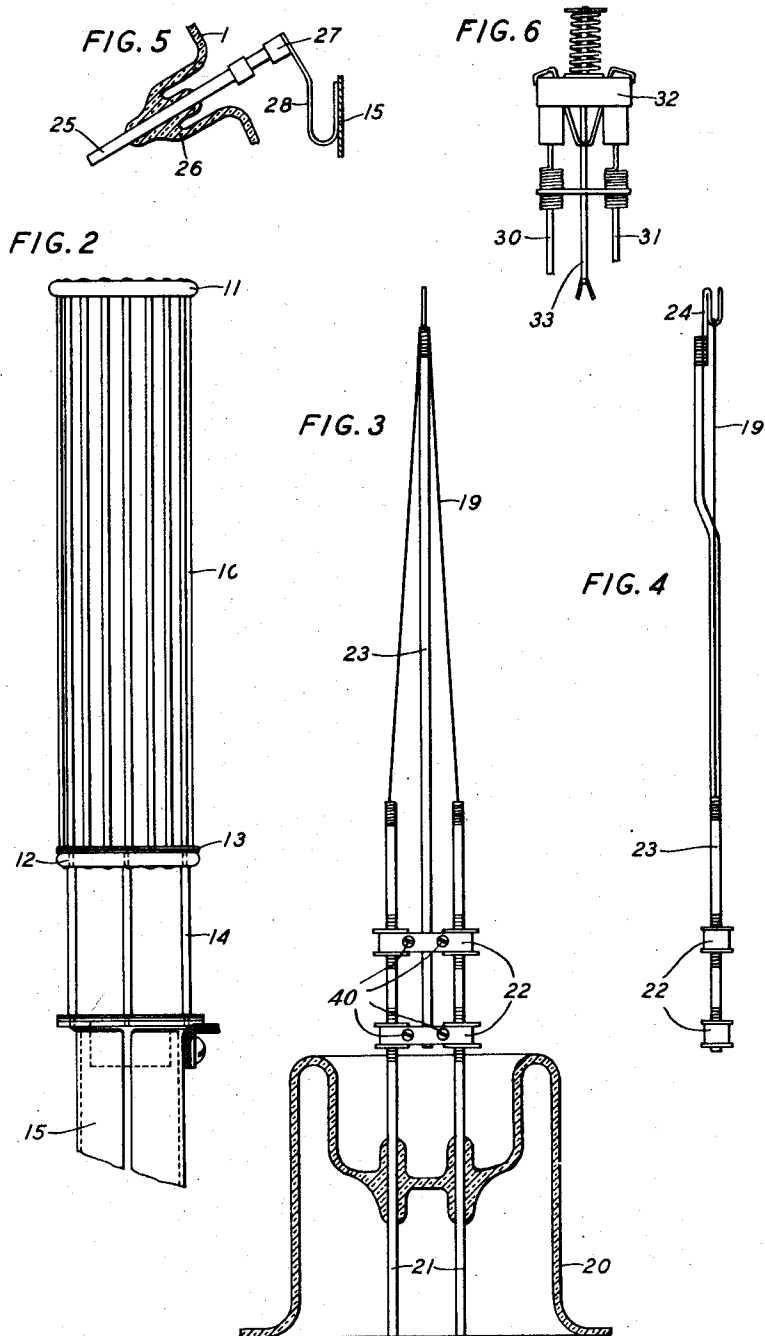
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UNITED STATES PATENT OFFICE

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THERMIONIC DISCHARGE DEVICE

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This invention relates to thermionic discharge devices, and more particularly to large thermionic power devices, and has for its chief object improvements in the construction and the means for mounting the elements of such devices in position.

According to this invention a thermionic discharge device is provided in which a cathode, a control electrode and an anode are accommodated within an envelope, the cathode being entirely supported on one end of the envelope, the control electrode being entirely supported on the opposite end of the envelope, and the anode being supported from one side of the envelope at places between the cathode and control electrode support.

According to another feature of the invention, a thermionic device is provided in which the grid element consists of a substantially cylindrical cage built up of a pair of discs or rings interconnected by a series of parallel wires. The wires may be composed of tungsten or other suitable material, preferably of such dimension that the grid is in the form of a self-supporting cylinder, and preferably the wires are so welded to the discs or rings as to form a rigid structure.

According to another feature of the invention, the anode element comprises a cylindrical structure which is supported in position by rods disposed at right angles to the cylinder. If desired a ring of molybdenum wire or other suitable material may be disposed around each end of the anode structure, and the rod suitably connected at their inner ends to these rings.

Further features of the invention will be disclosed in the following description, wherein reference will be made to the accompanying drawings:

Fig. 1 illustrates a three-electrode discharge device made in accordance with this invention with the enclosing vessel shown in cross-section and portions of the electrode structure in cross-section to clearly show the details of construction;

Fig. 2 is an enlarged detailed view of the grid shown in Fig. 1 disclosing the detailed structure of this electrode in inverse position to that shown in Fig. 1;

Fig. 3 illustrates the supporting structure for the filament or cathode and its support from the glass stem of the vessel;

Fig. 4 is a side view of the filament structure shown in Fig. 3;

Fig. 5 shows in detail an alternative arrangement for providing a flexible connection for the electrodes;

Fig. 6 shows an alternative method of supporting and tensioning the cathode, and

Fig. 7 is a perspective view of the upper portion of the grid structure shown in Fig. 1 to illustrate the shield.

Referring now to Fig. 1 it will be seen that an envelope 1 is provided which may be of the glass known as "Sibor" or of a boro-silicate glass, or of any similar heat resisting material. The envelope is provided with a reentrant stem at each end, and with two stems on one side. The filament assembly is supported from one end, the grid from the other end, and the anode from the side stems.

The anode 2 is composed of a sheet of suitable metal, such as molybdenum, the sheet being formed into a cylindrical shape with a riveted overlapping edge. Around the cylinder and near each end, are placed molybdenum wire rings 3, held in position by saddles 4. On one side of each ring, and in line with the longitudinal axis of the cylinder a nickel block 5 is fixed, into which the support rods 6 are fixed by suitable means, such as by means of tube 7 screwed into the block, the rods 6 being welded or silver-soldered into the tubes. The rods 6 are sealed into the side stem of the glass envelope, and are silver-soldered to the caps 8 which form contact members for connecting external circuits to the anode.

The grid electrode 9, shown in Fig. 2, is composed of a number of rigid rods or wires 10, spot-welded or otherwise suitably fixed to metallic rings 11 and 12 at opposite ends. A metallic disc 13, adapted to function as a shield, is positioned adjacent the ring 12 and is provided with apertures through which the rods 10 pass. Support rods 14 and a slit tube 15 are provided on the grid structure to allow of its being supported from one of the reentrant stems of the envelope.

The grid is mounted as shown in Fig. 1 with the slit tube 15 being held on the reentrant stem by means of a metallic collar 34. A piece of copper braid 16, or similar flexible material, is welded to the rod 17, which is itself connected to the cap 18 by a second piece of flexible material silver-soldered to the cap.

Figs. 3 and 4 show the method of mounting the tungsten filament 19. It will be seen that a reentrant glass stem 20 is provided, which carries the tungsten rods 21 to which the ends of the hairpin filament 19 are fixed. Two saddles 22 are adapted to be slidably mounted on the rods 21, and these carry a central support rod 23 which is bent at the end and provided with a hook 24, over which the loop of the filament is placed.

The reentrant stem 20 is sealed into the glass envelope 1 of Fig. 1.

There are many advantages in this form of construction for thermionic discharge devices. The electrodes being self-supporting may be carried on different portions of the envelope, with the advantage that the various leading-in wires from the electrodes are well separated from each other.

A further advantage is that the electrodes may be adjusted as to their relative positions more easily when the above described slidable mounting is adapted than when the supports are sealed directly into the envelope. For instance, the grid may be moved longitudinally by virtue of the split tube 15, and the copper braid 16, so as to adjust its position relative to the cathode and the anode.

In a similar manner, the anode may be moved across the longitudinal axis of the device bodily, or either end may be so moved, thus allowing it to be accurately aligned before it is finally fixed.

The filament may have any degree of initial tension placed upon it by releasing the fixing screws 40 of the blocks or saddles 22. The support rod 23 may then be adjusted and the saddles 22 rigidly fastened in position on the rods 21.

A further advantage of the above described manner of mounting the electrodes is that they may be easily dismantled for the purpose of effecting repairs. For instance, the filament may be dismantled completely by breaking the seal between the stem 20 and the envelope 1. A new filament may then be fixed in place, and in the event of it being of a different length from the original filament, the saddles 22 may be adjusted as above described, and the stem resealed to the envelope.

An alternative arrangement for flexibly connecting the grid or other electrode to its conducting leading-in wire is shown in Fig. 5. In this arrangement, the envelope 1 has a small stem 26 formed upon it, close to the electrode support, and a tungsten or other rod 25 is sealed into this stem. A block of nickel 27 is fixed to the inner end of rod 25, which is in turn fixed to a molybdenum or similar spring 28. This spring is silver-soldered or welded to the split collar 15 of the grid structure. A similar arrangement may be employed in connection with either of the electrodes to allow the electrode concerned to freely expand or otherwise move when heated.

The filament support may also be modified in many ways to insure that the filament proper remains taut when it is heated. The hook shown in Figs. 3 and 4 may be made sufficiently springy to take up any expansion of the filament. Alternatively, for example, the central rod 23 may be replaced by two rods 30 and 31 carrying a block 32 through which passes a spring loaded hook 33 to which the bight of the filament is attached as shown in Fig. 6.

What is claimed is:

1. A thermionic discharge device comprising an enclosing vessel having a stem at each end, a cathode supported from one of said stems, a grid supported from the other of said stems, an anode supported from the side wall of said vessel, and individually adjustable means associated with said cathode, grid and anode to position either with respect to the others during the assembly thereof.

2. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a cathode supported from the stem at one end, an anode surrounding said cathode and

supported from the side wall of said vessel, a grid positioned between said cathode and anode and supported solely from the stem opposite the stem supporting said cathode, said grid being formed of closely spaced parallel wires arranged in a circular boundary, and an annular ring member affixed to the opposite ends only of said wires.

3. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a cathode supported from a stem at one end, an anode surrounding said cathode and supported from the side wall of said vessel, a grid positioned between said cathode and anode and supported from the stem opposite the stem supporting the cathode, said grid being formed of closely spaced parallel wires arranged in a circular boundary, an annular ring member adjacent the opposite ends only of said wires, and a shield extending across one of said ring members adjacent the free end of said cathode.

4. A thermionic discharge device comprising an enclosing vessel having a stem at each end and a plurality of stems on a side wall, a cathode supported from said stem at one end, a grid supported from said other stem at the opposite end, an anode surrounding said grid and cathode, parallel external connections sealed through said stems in said side wall, encircling rings surrounding the outer surface of said anode, saddles on said anode positioning said rings, and adjustable members joining said rings to said external connections.

5. A thermionic discharge device comprising an enclosing vessel having a stem at each end and a plurality of stems on a side wall, a cathode supported from one of said end stems, a grid surrounding the cathode and supported from said other stem at the opposite end, a cylindrical anode surrounding said grid and cathode, parallel external connections sealed in said stems in the side wall of said vessel, encircling rings about the outer surface of said anode, saddles on said anode positioning said rings, threaded blocks carried by said rings, projections extending from said blocks, and sleeve members joining said projections to said external connections.

6. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a grid supported from said stem at one end, a cylindrical anode surrounding said grid and supported from the side wall of the vessel, a plurality of rigid leading-in wires sealed in said stem opposite the stem supporting said grid, a central standard between said leading-in wires, a filamentary cathode extending between said leading-in wires and the extreme end of said standard, and adjustable spaced members associated with said leading-in wires and said standard having means for rigidly clamping them to said leading-in wires and said standard after the desired tension has been obtained in said cathode.

7. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a cylindrical anode supported from the side wall of said vessel, a grid within said anode supported from one of said stems, and a cathode support extending from the opposite stem, said cathode support comprising a plurality of rigid leading-in wires sealed in said opposite stem and a standard, a filamentary cathode supported at one end by said leading-in wires and at the other end by said standard, a transverse saddle coupled to said standard and said leading-in wires

having means slidably engaging said leading-in wires, and fixing means rigidly positioning said standard and saddle with respect to said leading-in wires when the proper tension is secured in said filamentary cathode.

8. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a cylindrical anode supported from the side wall of said vessel, a wire grid within said anode supported from one of the stems of said vessel, and a cathode assembly extending within said grid and anode and supported from the opposite stem of said vessel, said cathode support comprising a plurality of rigid leading-in wires sealed in said opposite stem, a central standard between said leading-in wires, a filamentary cathode extending between said leading-in wires and the extreme end of said standard, a plurality of spaced saddles attached to said standard, and means for clamping said saddles to said leading-in wires to rigidly support said standard therefrom.

9. A thermionic discharge device comprising an enclosing vessel having a stem at each end thereof, a cylindrical anode supported from the side wall of said vessel, a cylindrical wire grid within said anode supported from the stem at one end of said vessel, and a filamentary cathode support extending within said grid and anode from the opposite stem, said cathode support comprising a plurality of rigid leading-in wires sealed in said opposite stem, a pair of slidably adjustable saddles affixed to said leading-in wires, parallel

standards supported by said saddles, a platform supported by said standards at the free ends thereof, a filamentary cathode having its ends attached to said leading-in wires and its bight positioned between said standards, and a resiliently mounted hook extending from said platform and engaging the bight of said filamentary cathode.

10. A thermionic discharge device comprising an enclosing vessel having a stem at each end and a plurality of stems on a side wall thereof, leading-in wires in said stem at one end of said vessel, clamping saddles on said leading-in wires, a central standard supported from said saddles, an inverted V-shaped filamentary cathode attached to said leading-in wires and supported by said standard, a cylindrical grid composed of longitudinal rods and ring terminations surrounding said cathode, a metallic sleeve support attached to said grid and adjustably connected to said stem at the opposite end of said vessel, a leading-in wire extending through said opposite stem, a flexible connection attached to said leading-in wire and connected to said grid sleeve, a cylindrical anode surrounding said grid and cathode, a plurality of metallic rings encircling said anode, metallic blocks attached to said rings and positioned in alignment with the stems on the side wall of said vessel, leading-in wires sealed in said side wall stems, and sleeve connections between said leading-in wires and said blocks.

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