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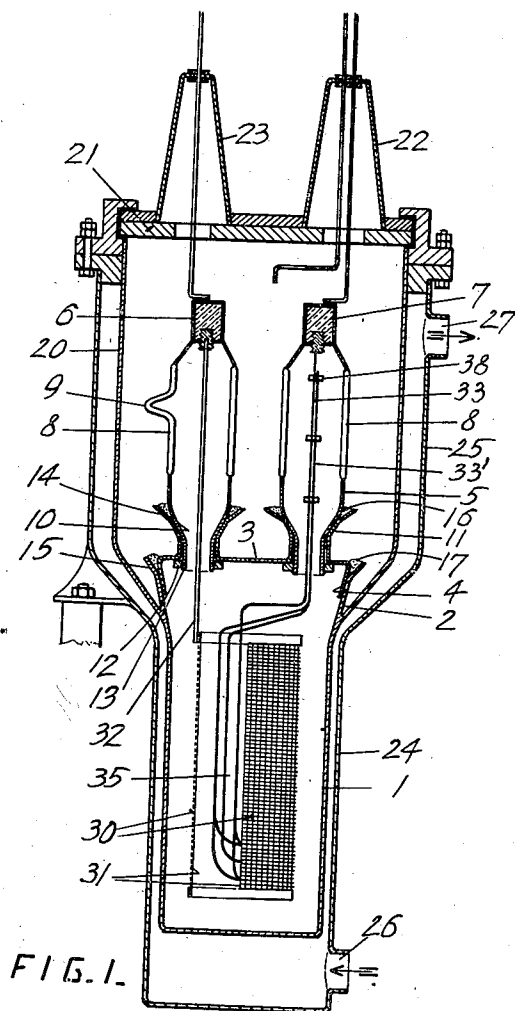
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DISCHARGE DEVICE WITH AN OUTER ANODE

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2 Sheets-Sheet 1



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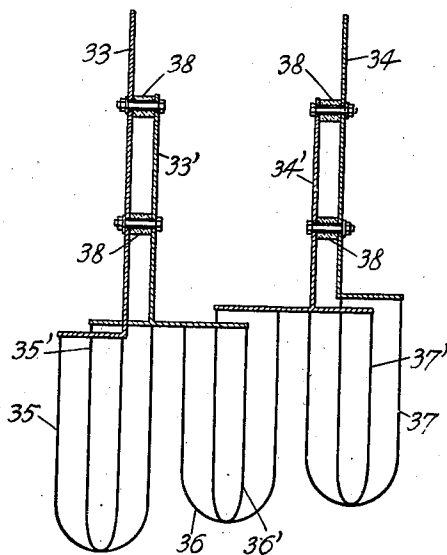
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DISCHARGE DEVICE WITH AN OUTER ANODE

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7 Claims. (Cl. 250—27.5)

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The present invention relates to a discharge device with an outer anode.

The main object of the invention is to provide a new kind of a discharge device which has numerous advantages over discharge devices known up to now, in particular simplicity of manufacture of various parts which may be assembled into a discharge device in an extremely simple way.

The discharge device according to the invention is distinguished substantially by the fact that the cathode and grid leads are suspended in separate extensions mounted on the cover of the anode vessel and consist at least partially of glass tubes, insulating the said leads from the anode, which forms an envelope for the discharge device, said extensions being preferably enclosed within a container arranged above the envelope and filled with liquid insulating material such as oil.

The anode and the oil container, mounted above the anode may preferably be surrounded by a common cooling jacket, and the water used for cooling the anode, serves also to cool the oil in the container enclosing the members connecting the glass and metal parts.

Further features and advantages of the invention will appear from the ensuing description.

Examples of carrying out the discharge device according to the invention are represented in the accompanying drawings, in which

Fig. 1 shows in longitudinal section a discharge device in which water cooling is used, and

Fig. 2 shows the arrangement of the cathode filament.

As shown in Fig. 1 the metal anode has the shape of a cylindrical container 1, comprising the cathode filament and grid 30.

The anode vessel 1 is closed on top by a cover 3. The lower ends of extensions 5 for leads 6 and 7 of the cathode and grid respectively are inserted into corresponding apertures in the cover 3. The drawing shows only one cathode lead it being evident, that two such members have to be used so that altogether three extensions 5 have to be provided. To achieve symmetry and a better suspension, two grid leads or suspension members may be used so that altogether four extensions are then employed.

The connection and sealing of the cover 3 in the anode vessel 1 and of the lower ends of the supply extensions 5 in the apertures in the cover 3 may be carried out by rolling and/or welding of the rims.

According to another embodiment, shown in

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the drawing, the cover 3 may be placed with its tapered rim into the conically diverging upper part of the anode vessel 1. The apertures in the cover 3 are provided with conically diverging seats 11, in which the tapered lower ends of the supply extensions 5 are inserted, the latter being extended downwards by cylindrical portions 13, provided with a screw thread. Nuts 12 screwed on to such thread warrant a tight seal between the conical ends 10 and seats 11. A perfect sealing of such mounting and of mounting of the cover 3 in the conical rim 2 of the anode vessel 1 may be achieved by additional sealing with tin, solder, or with any other low melting alloy 16 applied into grooves 14 and 15, provided on the upper rims of the conical seats 12 and 2.

In order to protect the said alloy during the evacuation of the discharge device, said metal or alloy may be covered with a suitable salt or slag. In operation the parts are protected by oil surrounding the extensions 5.

The metallic lower parts of the extensions 5 are in any suitable way gas-tightly attached to glass tubes 8, which are closed at their tops by metal caps provided with leads 6 and 7 for the grid and cathode filaments respectively. 9 is the remainder of the evacuating tube. This tube is preferably arranged on the glass portion of one of the extensions 5; this dispenses with the necessity of providing separate sealing means for the evacuating tube which would pass, for instance, through the metal cover 3.

The upper ends of the grid and filament suspensions are preferably provided with a thread, screwed into corresponding female threads, arranged in the bottom of the metal leads 6 and 7. This arrangement facilitates considerably the assembly, as the cover 3 may be placed from above on the suspension members, carrying already the said grid and filament, whereupon the extensions 5 are inserted and screwed on to the upper end of the suspension members. By tightening the nuts 12 the extensions 5 are then secured in their position whereupon the whole unit is positioned on the vessel 1 and suitably sealed.

All extensions 5 are enclosed in a metal container 20, provided above the anode 1 and attached to the same at its lower end. The said container 20 is filled with a suitable insulating liquid such as oil and closed on top by a cover 21, provided with lugs 21 and 23, through which extend the grid and cathode leads respectively. The whole discharge device i. e. the anode vessel 1 and the oil container 20 are surrounded by a cooling jacket 24—25, through which a flow of

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cooling water is maintained. Water is admitted through an aperture 26 in the lower part underneath the bottom of the anode 21 and flows upwards around the anode and further around the container 20 to the outlet 27 in the upper part. The water which cools the anode serves, therefore, also for cooling oil in the container 20.

By the described arrangement the most sensitive and delicate parts of the discharge device, i. e. the glass insulating members 8 of the extensions 5 are safely protected. The said extensions are further efficiently cooled by oil, so that they are not subject to any thermic stress.

The grid 30 is wound round the grid carriers 31, secured to the grid lead 6. The cathode filament 35 is, in contradistinction to the usual practice, arranged in a manner shown diagrammatically in Fig. 2. It consists of several, for instance, two filaments, connected in parallel, and suspended in U-shape within the grid on leads 33 and 34.

In order to reduce as far as possible the thermic stress of the cathode leads, it would be advantageous to have the heated filament as long as possible. In such a case it is then possible to achieve the required heating effect even at a lower intensity of current by increase of the heating voltage. In the arrangements known up to now the provision of such long filaments could not be carried out, as it was impossible to support the hot filament. The insulators used for this purpose, when brought to a high temperature, release gases which destroy the vacuum in the discharge device.

According to the invention this drawback is removed by dividing the filament into several parts 35, 36, 37 (Fig. 2) connected in series, each part of the filament being suspended in U-form from above into the anode vessel 1 and the individual branches of these parts being arranged on the circumference of the cylinder. The portions of the filament are suspended on the one hand on the leads 33 and 34 and on the other hand on interposed suspension members 33' and 34' which are made of e. g. molybdenum rods similarly to members 33 and 34 (see diagrammatic representation in Fig. 2). The upper ends of the suspension members 33' and 34' are secured by means of suitable insulators 38 to the upper parts of the supply members 33 and 34 i. e. in portions where the temperatures are already sufficiently low so that the above mentioned objectionable destroying of vacuum is prevented. In order to eliminate short circuiting of the filaments in the lower part of the anode vessel 1, where they cross each other, the lower bent portions of the various partial filament, connected in series, are arranged in different heights, as shown in the drawing.

In the example shown, two such filaments, consisting of three parts connected in series are used. The suspension members 33' and 34' are, of course common for both filaments and, in addition, the lower parts of the individual filament portions 35 and 35', 36 and 36', 37 and 37', which are on the same potential, are connected together. In a practical embodiment of the invention this may be carried out by crosswise arrangement of these portions of filaments in the same height in the lower part of the anode vessel 1.

In the case of an intermittently operated discharge device, the jacket for cooling water may be dispensed with and the anode provided with cooling ribs 40, extending substantially at right angles to the axis of the tube. The cooling ribs

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are surrounded by a jacket 41, supplied by cooling air from a conduit 42 the air flowing around the cooling ribs to the outlet 43. The anode vessel 1 may be overheated during the operational periods of the discharge device, but is sufficiently cooled by the flow of air during inoperative intervals, so as to be able to receive heat generated in the further operative period. The anode vessel 1 operates in this case as a heat accumulator receiving the heat intermittently generated which is then continuously carried off by the flow of cooling air.

The term "insulating vessel" as used in the following claims is intended to define a vessel which serves for insulating purposes by being filled with an insulating liquid but is not intended to indicate that the vessel itself is made out of insulating material.

I claim:

1. An electron discharge device comprising in combination a closed anode vessel having a top wall; inlet openings in said top wall of said anode vessel; tubular leading-in members extending upwardly from said upper wall of said anode vessel, each firmly secured to the same surrounding one of said inlet openings; cathode and grid leads passing through said tubular leading-in members and through said inlet openings into said anode vessel; electric contact terminals at the upper ends of said tubular leading-in members connected to said cathode and grid leads; an insulating vessel surrounding said tubular leading-in members and extending upwardly from said anode vessel sealed at its bottom edge to the same; an insulating and heat conducting liquid at least partly filling said insulating vessel; a cooling vessel surrounding at least said insulating vessel; and an inlet and an outlet opening in said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the wall of said insulating vessel.

2. An electron discharge device comprising in combination a closed anode vessel having a top wall; inlet openings in said top wall of said anode vessel; tubular leading-in members extending upwardly from said upper wall of said anode vessel, each firmly secured to the same surrounding one of said inlet openings; cathode and grid leads passing through said tubular leading-in members and through said inlet openings into said anode vessel; electric contact terminals at the upper ends of said tubular leading-in members connected to said cathode and grid leads; an insulating vessel surrounding said tubular leading-in members and extending upwardly from said anode vessel sealed at its bottom edge to the same; an insulating and heat conducting liquid at least partly filling said insulating vessel; a cooling vessel surrounding said anode vessel and said insulating vessel; and an inlet and an outlet opening in said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the walls of said anode vessel and said insulating vessel.

3. An electron discharge device comprising in combination a closed discharge vessel having a top wall; cathode and grid leads extending upwardly from said top wall of said discharge vessel; an insulating vessel surrounding said cathode and grid leads and extending upwardly from said discharge vessel sealed at its bottom edge to the same; an insulating and heat conducting liquid at least partly filling said insulating vessel; a cooling vessel surrounding at least said insulating vessel; and an inlet and an outlet opening in

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said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the wall of said insulating vessel.

4. An electron discharge device comprising in combination a close discharge vessel having a top wall; cathode and grid leads extending upwardly from said top wall of said discharge vessel; an insulating vessel surrounding said cathode and grid leads and extending upwardly from said discharge vessel sealed at its bottom edge to the same; an insulating and heat conducting liquid filling at least partly said insulating vessel; a cooling vessel surrounding said discharge vessel and said insulating vessel; and an inlet and an outlet opening in said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the walls of said discharge vessel and said insulating vessel.

5. An electron discharge device comprising in combination a closed discharge vessel having a top wall; inlet openings in said top wall of said discharge vessel; tubular leading-in members extending upwardly from said upper wall of said discharge vessel each firmly secured to the same surrounding one of said inlet openings; an insulating vessel surrounding said tubular leading-in members and extending upwardly from said discharge vessel sealed at its bottom edge to the same; an insulating and heat conducting liquid at least partly filling said insulating vessel; a cooling vessel surrounding at least said insulating vessel; and an inlet and an outlet opening in said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the wall of said insulating vessel.

6. An electron discharge device comprising in combination a closed discharge vessel having a top wall; inlet openings in said top wall of said discharge vessel; tubular leading-in members extending upwardly from said upper wall of said discharge vessel each firmly secured to the same surrounding one of said inlet openings; an insulating vessel surrounding said tubular leading-in members and extending upwardly from said discharge vessel sealed at its bottom edge to the

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same; an insulating and heat conducting liquid at least partly filling said insulating vessel; a cooling vessel surrounding said discharge vessel and said insulating vessel; and an inlet and an outlet opening in said cooling vessel arranged so as to enable circulation of a cooling liquid through the same past the walls of said discharge vessel and said insulating vessel.

7. An electron discharge device as claimed in claim 3, wherein the cathode filament is divided into a plurality of parts connected in series, the ends of the outer parts on one side being suspended on one set of leads and the ends of the outer parts on the other side and the ends of the intermediate parts being suspended on intermediate suspension members, secured by means of insulators to the upper portions of the leads which in operation are relatively cool, the individual filaments themselves hanging down in U-shape into the discharge vessel being arranged in different heights, in order to prevent contact with each other.

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