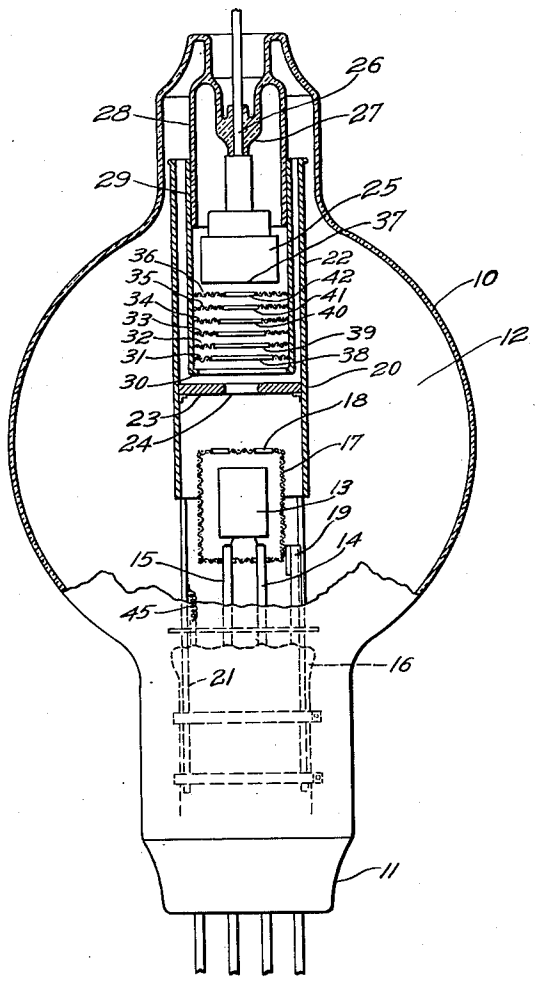
Feb. 1, 1938. H. KNIEPKAMP 2,106,847

ELECTRIC DISCHARGE APPARATUS

Filed Feb. 20, 1936



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Patented Feb. 1, 1938 2,106,847

UNITED STATES PATENT OFFICE

2,106,847

ELECTRIC DISCHARGE APPARATUS

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Application February 20, 1936, Serial No. 64,873
In Germany March 4, 1935

6 Claims. (Cl. 250—27.5)

The invention relates to an electrical discharge apparatus and especially to a discharge apparatus of the grid controlled type having a gaseous medium therein of a noble gas or metallic vapor.

An object of my invention is to provide an electric discharge apparatus wherein a high potential may be applied to the anode and a low potential applied to the control grid without having the control grid lose its blocking property.

Another object of my invention is to prevent discharges occurring between the control grid and the anode in high potential gas filled discharge devices.

Other objects of my invention will become apparent from the following specification and drawing in which the figure illustrates a preferred embodiment of my invention in elevation with certain parts illustrated in cross section.

In the figure, an electric discharge device is illustrated having the glass wall container 10 with the usual socket 11 therewith. In place of this glass wall vessel, a metal or part metal and part glass container may be used. Inside of the container is a filling of gaseous medium designated by the number 12. This gaseous medium may be one or a mixture of the noble gases, such as neon or argon or may be a metallic vapor such as mercury.

A cathode 13 is preferably supported on leads 14 and 15 from the press 16 at one end of the tube. This cathode may be of any particular type and I prefer to use the type having a strontium and barium oxide coating heated into an electron emitting state by current passing through the leads 14 and 15. Surrounding the cathode structure proper is preferably a radiation shield device 17 with one or more openings 18 to direct the passage of electrons towards the anode. This radiation shield device has a connection 19 through the press 16 if desired.

A control grid structure 20 is also preferably supported on the press 16 by means of the standards 21. The control grid structure preferably comprises a hollow conducting metal tube 22 extending from the region of the cathode into the upper portion of the tube. Across this tube is placed a carbon disk or button 23 with a central opening 24 for passage of the discharge therethrough. It is preferred to use a carbon disk because if a particle of the oxide coating of the cathode 13 should be carried thereto, the carbon will act as a poison for the electron emitting property of the material and will prevent this particle from causing emission from the grid to other parts of the tube.

The anode 25 is located in the upper portion of the tube and is surrounded by the upper portion of the control grid tube 22. This anode is likewise preferably of carbon. An anode stem 26 is sealed through the glass casing at the press 27 in the upper portion of the tube. This anode press 27 is preferably made with a reentrant flange 28 extending down into the tube. Preferably supported on this flange 28 is another tube 29 preferably of metal concentric with the tube 22 and extending therewithin down to a distance preferably of the order of the mean free path of an electron of the gaseous medium 12 from the carbon disk 23. The distance between the outer circumference of this tube 29 and the adjacent inner wall of the tube 22 is also preferably of the order of the mean free path of an electron of the gas. The lower end of the tube 29 is preferably slightly flanged, as illustrated at 30, leaving a fair size opening for the passage of the electrons therethrough. This opening, however, is preferably larger than the opening 24 in the control disk 23.

A plurality of screens or grids 31, 32, 33, 34, 35, and 36 are supported on the tube 29 and extend across the tube normal to the discharge path. These screens preferably divide the space from the outer flange 30 to the lower anode face 37 into equal distances of the order of the mean free path of an electron of the gaseous medium 12. These screens also preferably have central openings for the discharge path and these central openings 38, 39, 40, 41, and 42 gradually decrease in area towards the anode face 37. These screens outside of their central openings may be of solid or reticulated material and may be electrically connected to or insulatingly supported upon the tube 29 as desired. The tube structure 29 and associated screens preferably act as a floating grid although it may have an outside connection if desired similar to the connection 45 of the control grid structure 20.

It will be noted that by the arrangement of these screens 31 through 36 on the tube 29, that the space from the control grid 23 to the anode face 37 is divided into distances of the order of the mean free path of an electron of the gaseous medium 12 and that consequently there will not be sufficient ionization within this space to cause a discharge from one portion to the adjacent portion of this grid and anode structure. Consequently a high potential may be placed upon the anode 25 and a low potential may be placed on the control grid 23 without danger of losing the blocking power of the grid 23 by an undesirable

discharge from the grid to the anode because of this difference of potential. By use of the spacing between the parts of the control grid structure and the anode, a very closely compact structure is used which results in a large saving of space which has heretofore been necessary in these higher powered tubes.

The discharge device illustrated is especially adapted for metallic vapor and noble gas rectifiers for use in movable plants, portable transmitters, railway vehicles, etc.

It is apparent that many modifications may be made in the various parts of the preferred embodiment such as the size, shape, number and arrangement of the various elements, and, accordingly, the invention is not to be limited by the particular illustration of this preferred embodiment, except as is necessitated by the prior art.

I claim as my invention:

1. An electric discharge device comprising a container, a gaseous medium therein, a press at one portion of said container, a press at another portion of said container, an anode structure sealed through said first press, a cathode structure sealed through said second press, and separate grid structures supported on each press including nested cylindrical members supported on different presses spaced apart the order of the mean free path of an electron of the gaseous medium.

2. An electric discharge device comprising a container, a gaseous medium therein, an anode, a cathode, a grid structure intermediate said anode and cathode and a plurality of screens dividing the distance from said grid structure to said anode into spaces the order of the mean free path of an electron of said gaseous medium.

3. An electric discharge device comprising a container, a gaseous medium therein, an anode, a cathode, a grid structure intermediate said anode and cathode and a plurality of shields substantially normal to the discharge path dividing the distance from said grid structure to said anode, said shields having discharge openings therethrough, the discharge openings decreasing in size in the shields nearer the anode.

4. An electric discharge device comprising a container, a gaseous medium therein, an anode, a cathode, a grid structure intermediate said anode and cathode and a plurality of shields substantially normal to the discharge path dividing the distance from said grid structure to said anode, said shields having discharge openings therethrough, the discharge openings gradually decreasing in size in the shields nearer the anode.

5. An electric discharge device comprising a container, a gaseous medium therein, a cathode and an anode structure therein, said anode structure having an anode lead extending through said container and an anode on the end of said lead, a unitary tubular structure surrounding said anode and anode lead and having a plurality of shields normal to the discharge path and gradually limiting the discharge path towards said anode.

6. An electric discharge device comprising a container, a gaseous medium therein, a cathode and an anode structure therein, said anode structure having an anode lead extending through said container, an anode on the end of said lead, a unitary tubular structure surrounding said anode and anode lead and having a plurality of shields normal to the discharge path and gradually limiting the discharge path towards said anode, the distance between said shields being of the order of the mean free path of an electron of said gaseous medium.

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