

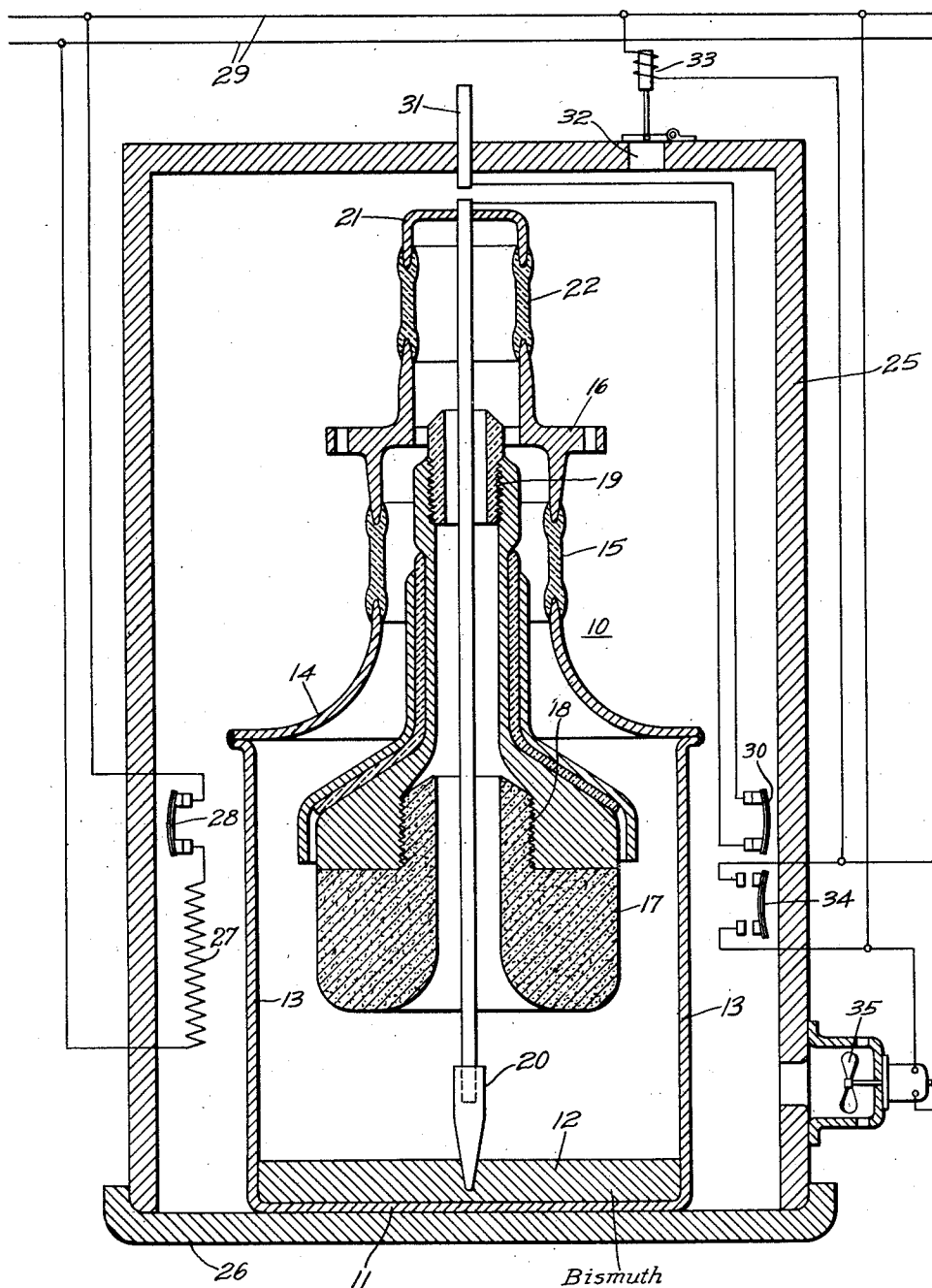
Feb. 6, 1940.

J. SLEPIAN ET AL

2,189,618

VAPOR ELECTRIC TUBE

Filed March 25, 1938



WITNESSES:

C. J. Weller.
R. W. Bailey

INVENTORS

Joseph Slepian and
Leon R. Ludwig.

BY

F. W. Lyle

ATTORNEY

UNITED STATES PATENT OFFICE

2,189,618

VAPOR ELECTRIC TUBE

Joseph Sleplan, Pittsburgh, and Leon R. Ludwig,
Wilksburg, Pa., assignors to Westinghouse
Electric & Manufacturing Company, East Pitts-
burgh, Pa., a corporation of Pennsylvania

Application March 25, 1938, Serial No. 198,070

6 Claims. (Cl. 250—27.5)

The invention relates to electric discharge devices and especially vapor electric discharge devices.

An object of the invention is to provide a discharge device in which a greater amount of power can be converted by a tube of moderate size.

Another object of the invention is to utilize as cathode materials substances which are solids at ordinary room temperatures.

Other objects and advantages of the invention will be apparent from the following description and drawing in which the single figure is a view partly in cross section and partly diagrammatic of a preferred embodiment of the invention.

A limitation of mercury arc glass tubes as at present constructed is that the mercury must be kept at a low temperature under 100° C. for satisfactory operation. Because of the poor thermal conductivity of the glass, the amount of power which can be converted by a tube of moderate size is very much limited.

The invention contemplates the utilization of other metals than mercury for the cathode material. These substances have a low vapor pressure at high temperatures. In particular, the invention contemplates using bismuth, lead, cadmium, lithium and sodium which have a very much higher melting point than room temperatures. To this list might be also added caesium, rubidium and gallium which have a melting point intermediate that of room temperature and the melting point of the group above mentioned. The invention contemplates operating electric discharge devices utilizing the metals above mentioned or their alloys in definite temperature intervals above the ordinary ambient temperatures and accordingly special temperature controlling means is included in the invention.

In the drawing, I have disclosed a discharge device 10 preferably of a specific form having a metallic cup shaped portion 11 containing the cathode material 12. The cup shaped portion has cylindrical sides 13 upon which the vaporized cathode material may condense and run down to the bottom portion of the cup 11. The device also preferably has the sloping or curved top portion 14 connected to the sides 13. Material condensed on the portion 14 will either drop or run down to the bottom portion of the cup 11. Insulation 15 such as boro silicate glass is sealed to the top portion 14 and an anode lead-in portion 16. Anode 17 is connected to the metallic lead-in portion 16 preferably by screw

threaded connections 18 and 19. These portions are preferably hollow for the passage of the familiar make-alive 20 extending therethrough from a metallic portion 21 of the container wall sealed to insulation 22 such as boro silicate glass which is in turn sealed to the anode lead-in portion 16 of the container.

Surrounding the discharge device is a casing 25 preferably of heat insulating material although the bottom portion 26 may be of conducting material if desired to make contact to the cup shaped portion 11 or a separate lead may extend through the casing to the cathode container. Inside of the casing is an electric heater 27 preferably connected through a thermostatic contact 28 to lines 29 for supplying electrical energy to the heating means. Another thermostat connection 30 is preferably connected in the lead 31 of the control electrode of the device which in the specific embodiment illustrated, is the make-alive 20. The casing also preferably has openings 32 which may be closed or opened by a relay 33 under the control of another thermostatic contact 34. This thermostatic contact 34 may also control the application of cooling means to the interior of the device such as the fan 35. The fan 35 may, of course, be under separate thermostatic control if desired.

It is desired that the temperature of the tube should be above the melting point of the cathode metal utilized. If bismuth, for example, is used, the temperature should be above 269° C. As disclosed in the drawing, the thermostatic contact 28 is closed to bring the device above this temperature and the thermostatic contact 30 to the control electrode has also closed, say at about 300° C., so that the device will start operating at this temperature. At 325° C. the thermostat 28 will open in order to interrupt the heating current through the coil 27 but this thermostat will reclose if the temperature drops to 300° C. If the temperature, however, increases, then at 350° the thermostat 34 will close and the current therethrough will open the ventilating ports 32 and turn on the cooling fan 35. These ventilating openings may reclose at 325° C. and the fan shut off.

The provision for opening the ventilating openings is to prevent especially too great a vapor pressure inside of the discharge device which may cause backfires.

The heater 27 has been diagrammatically disclosed but is preferably so applied that the portions of the metal container wall on which the

vapor substance from the cathode material 12 will condense, are above the melting point of the cathode.

If other materials than bismuth are utilized, the range of temperatures mentioned may be varied in accordance with the change in the melting point of the material. With tin, for example, the temperatures at which the thermostats are set may be lower than that for bismuth. The example given is to be considered as illustrative only and not as specifically limiting the invention to the material and temperature ranges mentioned. By using the device the tube is operated at a very much higher temperature than that possible with mercury vapor and accordingly much more power can be converted by a tube of moderate size. In place of the elements mentioned, alloys of these materials may be utilized.

Many modifications may, of course, be made in the preferred embodiment without departing from the spirit of the invention. Accordingly, only such limitations are to be placed on the following claims as are necessitated by the prior art.

We claim as our invention:

1. A discharge device comprising a container, having the major portion of its wall-area of non-translucent material, an anode and a cathode therein, said cathode being selected from the group of metals consisting of bismuth, lead, cadmium and tin, and means maintaining the portion of said container having said cathode at a temperature between the melting point of said cathode and the temperature at which the vapor pressure of said cathode would cause backfires.
2. A discharge device comprising a container, having the major portion of its wall-area of non-translucent material, an anode and a cathode therein, said cathode being selected from the group of metals consisting of bismuth, lead, cadmium and tin, and means maintaining the portion of said container having said cathode at a temperature between the melting point of said cathode and the temperature at which excessive vapor pressure is generated in said container.
3. A discharge device comprising a container, an anode and a vaporizable cathode therein, said

cathode being a solid at room temperatures, said container having interior surfaces for the condensing of cathode vapor thereon and means maintaining said interior surfaces between the melting point of said cathode and the temperature at which the vapor pressure of said cathode would cause backfires.

4. A discharge device comprising a container, an anode and a vaporizable cathode therein, said cathode being a solid under 30° C., said container having interior surfaces for the condensing of cathode vapor thereon and means maintaining said interior surfaces between the melting point of said cathode and the temperature at which the vapor pressure of said cathode would cause backfires.

5. In combination, a discharge device comprising a container, an anode, a control electrode and a vaporizable cathode therein, said cathode being of a material which is solid at room temperature, said container having interior surfaces for condensing the cathode vapor, and means maintaining said interior surfaces at temperatures between the melting point of said cathode and the temperature at which excessive vapor pressure is generated in said container, a circuit for said control electrode provided with means for preventing current flow in said device when said interior surfaces are at temperatures below the melting point of said cathode.

6. A discharge device comprising a container, an anode, a vaporizable cathode and an igniter-electrode contacting said cathode, said cathode being a solid at room temperature, said container having interior surfaces for condensing the vapor of said cathode, means for maintaining said interior surfaces at temperatures between the melting point of said cathode and the temperature at which excessive vapor pressure is generated in said container, and means for preventing the flow of current through said igniter-electrode when said interior surfaces are at temperatures below the melting point of said cathode.

JOSEPH SLEPIAN.
LEON R. LUDWIG.