

Oct. 10, 1933.

G. SZIGETI

1,929,526

RECTIFYING TUBE WITH GLOW DISCHARGE

Filed Aug. 25, 1930

FIG. 1

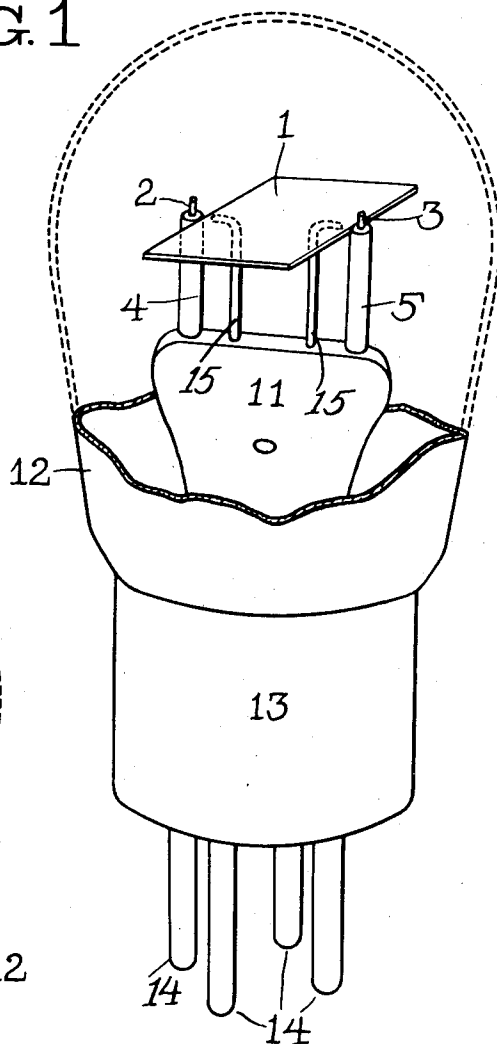
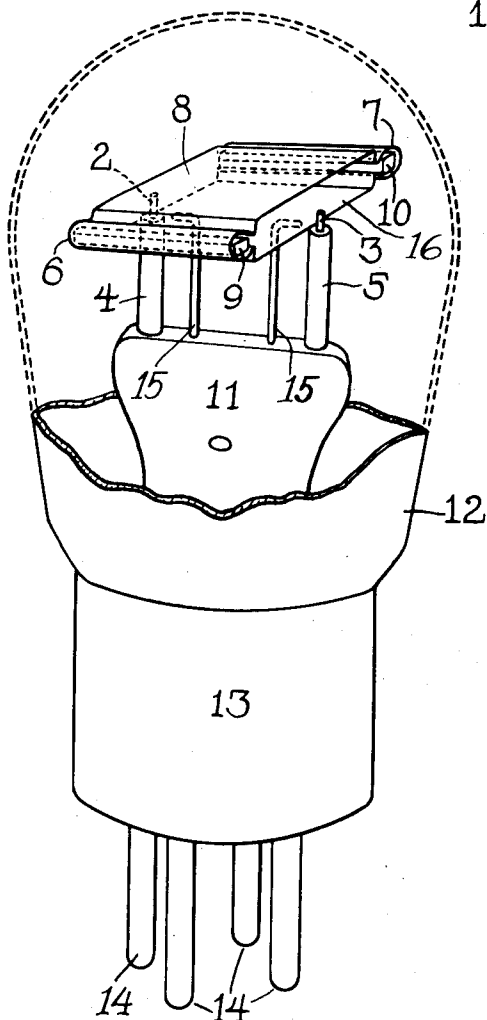


FIG. 2.



GYORGY SZIGETI

INVENTOR

BY *Haseltine, Lake & Co.*
ATTORNEYS

UNITED STATES PATENT OFFICE

1,929,526

RECTIFYING TUBE WITH GLOW
DISCHARGEGyörgy Szigeti, Ujpest, near Budapest, Hungary,
assignor to Egyesült Izzólampa és Villamos-
sági részvénytársaság, Budapest, HungaryApplication August 25, 1930, Serial No. 477,791,
and in Hungary March 18, 1930

5 Claims. (Cl. 250—27.5)

The invention relates to rectifying tubes with glow discharge and having several anodes and plate-shaped cathodes of large surface. In such tubes it is desirable to use as high a gas pressure as possible in order to obtain good efficiency and long life. However, the danger of arcing back increases with increase in the gas pressure. The greater the pressure of the filling gas the easier it is for the glow discharge which is produced in the desired direction to change into a harmful arc discharge between anode and cathode or between the anodes.

In a known arrangement, screens are placed between the anode and cathode or between the anodes to prevent discharges in an undesirable direction, such an arrangement prevents a discharge from taking place. Such screen may also be represented by the cathode itself which is constructed correspondingly, but it may also be independent of the cathode, in which case it can be brought to a corresponding potential.

The discharge between the anodes may also be entirely eliminated by the use of screens. However, in that case, as is also known, another harmful phenomenon arises. The so-called ignition voltage for discharges in rarefied gases is substantially greater than the voltage needed to maintain the discharge. Therefore, when a discharge between two electrodes has taken place in a tube having several electrodes, a discharge can take place between these and the other electrodes located in the same space even at a considerably less voltage than the ignition voltage. In a poly-phase rectifier the voltage between the individual anodes is several times that of the voltage existing between the cathode and anode.

Thus when a discharge takes place between the anodes, a discharge in the working direction between cathode and one anode can take place at a much lower voltage than the ignition voltage proper. However if a discharge between the anodes is prevented by the use of protective screens, the discharge can take place in the working direction only if the voltage between cathode and anode attains the value of the ignition voltage.

Therefore, the use of the screens lowers in that respect the economy of the tube. In another method for the prevention of arcing back, the gas pressure is made so small that the discharge in the wrong direction which occurs, cannot pass into an arc discharge.

However, when the gas pressure is small a continual disappearance of the filling gas takes place, partly in consequence of the rapid evapo-

ration of the active substance covering the surface of the cathode. In order to remedy this condition, it has been proposed to construct the cathode so that the discharge can take place only in the interior of the cathode, i. e., in a closed space as far as the discharge is concerned. In that case the cathode surrounds the working surface of the anodes, and the parts of the anodes which are located outside the cathodes must be carefully insulated. Such an arrangement requires a very careful mounting, and yet a perfect functioning of the tube is not absolutely guaranteed by it.

The present invention concerns a discharge tube which makes an economic and safe operation, without arcing back of the tube, possible even with comparatively high gas pressures.

Reference is made hereby to the accompanying drawing wherein similar reference numerals designate similar elements and wherein:

Fig. 1 illustrates in perspective a discharge tube made according to the invention.

Fig. 2 illustrates also in perspective a modification of the tube made according to the invention.

According to Fig. 1 the plate-shaped cathode 1 is placed between the anodes 2 and 3 within the tube or bulb 12 having a base 13 provided with the usual contact prongs 14, 14, the bulb being however partly broken away to reveal the construction. The cathode supports 15, 15 which in Fig. 1 are directly attached to the cathode 1, and in Fig. 2 are attached to the lower portion 16 of cathode 8, at least one of the supports 15 serving as a conductor for the cathode in known manner. Both the cathode supports 15, 15 and the anodes 2 and 3 are supported by and project upwardly from the interior electrode support 11. The plane of the cathode in each case is perpendicular or nearly perpendicular to the longitudinal axes of the anodes or the supporting tube. Insulating tubes 4 and 5 are placed over the anodes and leave free only the small parts of the anodes adjoining the plane of the cathode. In this arrangement the distribution of the electrical field is such that a glow discharge may take place between the anodes, but this glow discharge does not pass into an arc discharge even at very high voltages, even with a helium filling of 20–40 mm Hg. pressure.

The effect produced by the arrangement according to Figure 1 may be still further improved by the arrangement according to Figure 2. In this case the cathode 8 is constructed like a box. The anodes 2 and 3 are surrounded by insulating tubes 4 and 5. For the purpose of diminishing

the voltage drop at cathode the surface of the cathode may be coated with an alkaline earth metal or an alkaline earth metal compound. The coating is suitably effected by arranging, for instance, at both sides of the cathode 8 the channels 6 and 7 in which are placed small rods or pastilles 9 and 10 made out of an alkaline earth metal and protected from harmful atmospheric influences by a paraffin oil coating. After evacuating the tube the cathode 8 is heated in a suitable manner, for example, by means of an electromagnetic field of high frequency, whereby the alkaline earth metal is evaporated forming a uniform coating on the cathode 8.

Further advantages may be attained if the cathode before it is sealed in the tube is provided in the manner known with a coating of tungsten bronze or molybdenum bronze. If after evacuation the cathode coated with tungsten bronze or molybdenum bronze is exposed to the vapor of an alkaline earth metal, there appears on the surface of the cathode a very thin layer of material of very low work function which excellently resists the disintegration of the cathode material.

The tubes produced in that manner are suitably filled with helium of 20-40 mm Hg. pressure, but other rare gases of corresponding pressure may also be used.

The evaporation of the alkaline earth metal may also take place after the tube has been filled with gas, in that case the evaporating alkaline earth metal has a strong purifying effect on the gas so that a previous thorough purification of the filling gas becomes superfluous.

Having now particularly described my invention what I desire to protect by Letters Patent of the United States and what I claim is:

1. A rectifying glow discharge tube including a cathode having a plurality of plate-shaped members, end pieces between said members providing side openings in said cathode, said end pieces being provided with receptacles to receive cathode sensitizing material, a plurality of anodes disposed approximately perpendicular to said plate-shaped members and insulating members partially covering said anodes and leaving exposed portions thereof adjacent said side openings in said cathode.

2. A rectifying glow discharge tube including a cathode having a plurality of plate-shaped members, end pieces between said members providing side openings in said cathode, there being channels in said end pieces for receiving cathode sensitizing materials, which channels are disposed parallel to the plate-shaped members of the cathode, a plurality of anodes disposed approximately perpendicular to said plate-shaped members and insulating members partially covering said anodes and leaving exposed portions thereof adjacent said side openings in said cathode.

3. A rectifying glow discharge tube containing a cathode provided with a coating of alkaline earth metal and including a plurality of substantially plate-shaped members, converging end pieces disposed upon said members providing side openings in said cathode, which end pieces are provided with receptacles adapted to receive cathode sensitizing material, a plurality of anodes disposed approximately perpendicular to said plate-shaped cathode members, insulators partially covering said anodes and exposing portions thereof adjacent to the side openings in the cathode, and a rare gas in said tube at a pressure of about 20 to 40 millimetres of mercury.

4. A rectifying glow discharge tube, including a cathode coated with electronically active material and including a plurality of plane portions disposed opposite to each other, a plurality of partly insulated anodes having exposed portions, which cathode is provided with end pieces adapted to receive cathode sensitizing material, and is disposed relatively perpendicular to said anodes and located substantially between the exposed portions of said anodes, and helium gas in said tube having a pressure of about 20 to 40 millimetres of mercury.

5. A method of producing a rectifying glow discharge cathode, which consists in coating the cathode base with tungsten bronze before the sealing in of the support, sealing the support bearing the base thus coated in the tube, and exposing said base in said tube to alkaline earth metal vapor after sealing in of the support.

GYÖRGY SZIGETI.