March 2, 1937. G. JOBST ET AL 2,072,370

GAS DISCHARGE TUBE WITH CONTROL CATHODE

Filed Feb. 20, 1933

Fig. 1

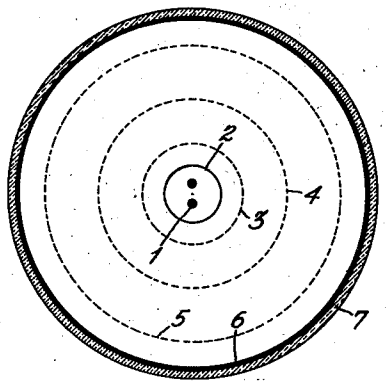
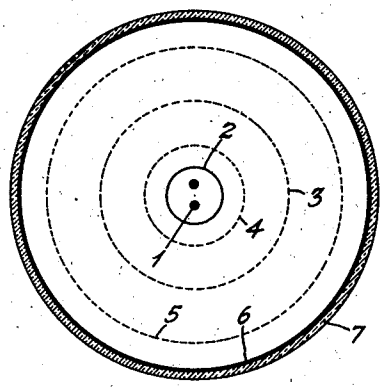


Fig. 2



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Patented Mar. 2, 1937

2,072,370

UNITED STATES PATENT OFFICE

2,072,370

GAS DISCHARGE TUBE WITH CONTROL CATHODE

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Application February 20, 1933, Serial No. 657,651
In Germany March 4, 1932

2 Claims. (Cl. 250—27.5)

The present invention relates to electron tubes with at least three electrodes for the production, amplification, and rectification of electric oscillations.

It is already known to provide such tubes with gas and to choose the potentials and the dimensions for the electrodes in such manner so as to prevent any appreciable ionization in the space between grid and anode. In such tubes the electrons have hitherto been supplied by an auxiliary gas discharge. This arrangement has the disadvantage in that the emission is very irregular and that furthermore the specific emission can hardly be increased beyond 100 milliamperes per watt.

On the other hand it is well known to use incandescent cathodes in gas rectifiers and thyratrons which are thoroughly protected against heat radiation by means of screening arrangements (so-called hollow cathodes) and in which the electrons can only leave the hollow space of the cathode by ionization of the gas which removes the electronic space charges.

In accordance with the present invention these two features known as such, are combined in the following manner:

An electron tube contains gas and a heat protected hollow cathode, whereby the gas only serves to remove the space charges in the hollow cathode by ionization; the tube also contains at least one grid and one anode, whereby the dimensions and the distances of these electrodes and their potentials are chosen in such manner that a notable ionization does not occur thereon. Thus it is the glow cathode that simply serves as an electron source and not a gas discharge. This arrangement has the advantage of constant emission and a utilization of electrons that can be increased to 1 ampere per watt.

According to the present invention the screen or casing serving as a heat protection, or in the case where several are used, one of them may be gradually charged to a potential thereby causing ionization of the cathode space. The potential of the grid and anode can be lower than the ionization potential so that a formation of ions outside the cathode space can no longer occur. However, the anode potential may in a known manner also be increased beyond the ionization potential, whereby the distance of the anode from the grid and from the wall of the bulb may be chosen so small that the formation of ions in the vicinity of the cathode is avoided.

In accordance with a further feature of the invention the potential of the screen is made controllable so that the number and the velocity of the emitted electrons can be varied. Furthermore, additional electrodes can be provided in such manner that the arrangement assumes the properties of a control cathode. This necessitates a further grid, controlling as such, by its voltage, the density or the velocity of the electrons emitted from the filament. This "current grid" may be placed within the cathode space i. e. between the filament and casing so that the casing itself acts as a velocity controlling grid. Moreover, the casing can also be utilized for the regulation of the density of the electrons and a further grid serving for the regulation of the velocity may be arranged around the casing.

An embodiment in accordance with the last mentioned arrangement is shown in Fig. 1 of the drawing by way of example in which the glow cathode is shown at **2** and is heated by a filament **1**, **3** is the screen or casing serving simultaneously as heat protection for the ionization of the gas, and as a means for the regulation of the density of the electrons, **4** represents the auxiliary grid determining the velocity of the emitted electrons, **5** is the actual control grid, **6** designates the anode and **7** is the glass bulb being directly in contact with the anode. The voltage of the grid **4** regulating the velocity is lower than the ionization potential of the gas, and the distance between grid and anode is smaller than the free path of the electrons for the applied gas pressure.

Fig. 2 is a modification of the invention shown in Fig. 1 wherein the heat protective casing **3** is arranged to function as the velocity controlling grid, and within said casing there is arrange- the auxiliary grid **4** which controls the electron density within the cathode space.

What we claim is:

1. An electron discharge tube comprising an envelope, a glow cathode, a heat protecting net surrounding the cathode, a signal control grid and a plate electrode surrounding the net, the plate electrode contacting with the inner surface of the envelope, a gas filling within the tube for neutralizing the space charge around the cathode, a grid electrode interposed between the cathode and the control grid, said grid electrode and said heat protecting net adapted to have suitable potentials impressed thereon for controlling both the density and the velocity of the emitted electrons and the space between the signal grid

and the plate electrode being less tan the mean free path of the electrons.

2. An electron discharge device comprising an envelope, an indirectly heated cathode, a gas filling within the envelope for neutralizing the space charge about the cathode, a screen electrode arranged about the cathode for controlling the electron density, a second screen electrode arranged about the first screen for controlling the electron velocity, and a signal control grid and a plate electrode spaced apart a distance less than the mean free path of the electrons surrounding the screen electrodes, the plate electrode contacting with the inner surface of the envelope, the velocity screen adapted to have a potential impressed thereon which is lower than the ionization potential of the gas filling.

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