Jan. 15, 1935. M. STEENBECK 1,987,645

CONTROL OF ELECTRIC CIRCUIT BY MEANS OF ELECTRON TUBES

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Fig. 1.

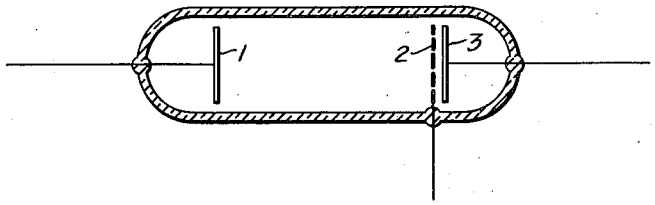
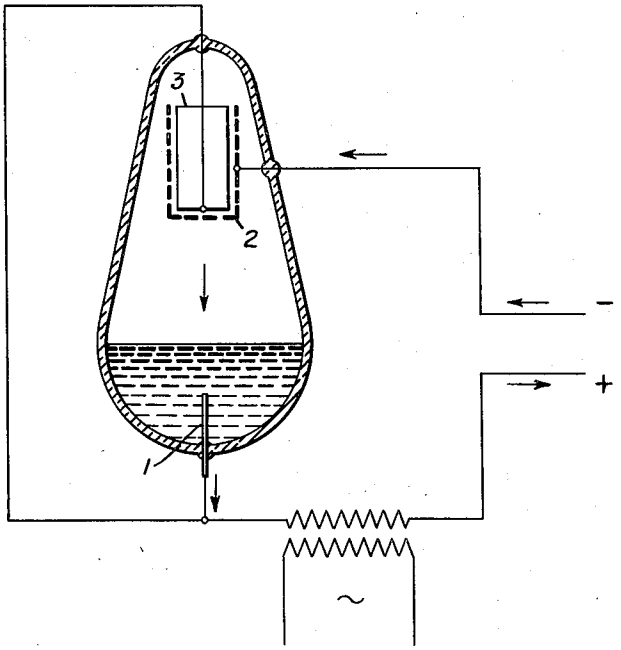


Fig. 2.



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CONTROL OF ELECTRIC CIRCUIT BY MEANS OF ELECTRON TUBES

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2 Claims. (Cl. 250—27.5)

My invention relates to improvements in the control of electric circuits by means of electron tubes.

For controlling electric circuits gas, electron or vacuum tubes with a grid-like cathode may be employed. On one side of this cathode is located an anode and on the other side a control electrode is located at a considerably shorter distance. The distance between the cathode and the control electrode behind it is so short that a discharge between these two electrodes is rendered impossible. As long as the control electrode is not charged an independent glow discharge exists between the anode and the cathode. The discharge process takes place in such a manner that due to the bombardment of the positive ions accelerated by the cathode drop the cathode emits a small number of electrons, which then continually increase in consequence of ionization by collision and thus induce the formation of fresh positive ions. This small electron emission of the cold cathode is absolutely necessary for the maintenance of a glow discharge. If it is prevented the glow discharge is also extinguished although the cathodic electron emission amounts only to about 1 per cent of the total current traversing the tube.

One object of my invention is a process of controlling electric circuits by means of gas-filled electron tubes with a grid-like cathode and a control electrode adjacent to it, in which the control electrode for interrupting the main discharge is charged to a potential positive with respect to the cathode. This potential exceeds the potential serving for the maintenance of the main discharge.

A further object of my invention is to develop the process of controlling electric circuits in such a manner, that for igniting the main discharge the potential of the control electrode is reduced to approximately the cathode potential and simultaneously there is initiated an additional discharge between special ignition electrodes.

A still further object of my invention is to provide a gas-filled electron tube functioning as rectifier, the main electrode of which acting as cathode during the passage of the current is electrically connected to the control electrode, the control electrode as well as the second grid-like electrode being designed as telescoped cups.

For carrying out the process according to my invention I use, for instance, the vacuum tubes illustrated in the drawing affixed hereto and forming part of my specification.

In the drawing:

Fig. 1 is a view, partly in cross-section of a vacuum tube embodying the invention,

Fig. 2 is a view, partly in cross-section of another tube constructed according to the invention, and partly diagrammatic of the connections thereto.

Referring to Fig. 1 of the drawing it will be observed that between the anode or plate 1 and the control electrode 3 and close to the latter there is located the grid-like cathode 2. This arrangement may be employed as a relay, because it is possible to open and close the much stronger current between the main anode 1 and the main cathode 2 by the comparatively weak current between the grid cathode 2 and the control electrode 3. It is thus obvious that a quantitative control is here possible.

In Fig. 2 of the drawing is illustrated a pear-shaped tube or bulb. At the upper end of this tube is sealed in the leading-in wire for the control electrode 3 and at the lower end, the leading-in wire for the main electrode 1. The wires of the two electrodes, the control electrode 3 and the main electrode 1, are directly connected. Additional ignition electrodes may be inserted in the tube for initiating an additional discharge.

Since the effect attainable by my improved process develops at the cathode only and not at the anode, it is possible to connect such a tube as a rectifier, as shown in Fig. 2 of the drawing. In this case the electrode 2 and the control electrode 3 are designed as cups, the electrode 3 being placed into the grid electrode 2. The current then only passes through this valve in the direction in which the electrode 2 is anode and the electrode 1 is cathode.

The process according to my invention thus serves for controlling electric circuits by means of vacuum tubes, the effect of the cathodic electron emission being neutralized by means of a strong field produced behind the cathode, that is between the cathode and the control electrode, by the control electrode being charged to a positive potential with respect to the cathode, which potential exceeds the potential serving for the maintenance of the discharge. This field withdraws from the main discharge a large portion of the cathodically emitted electrons, and these are absorbed by the control electrode without ionizing on their part. The portion of electrons remaining for the main discharge then no longer suffices to maintain the main discharge, this discharge is extinguished, and the stream of electrons taken up by the control electrode also ceases.

If it is desired to reignite the discharge, it is sufficient to bring the control electrode again to its normal potential approximately equal to that of the cathode. An additional ignition discharge between ignition electrodes specially provided for the purpose may also be provided to increase the reliability.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

1. A tube comprising a first main electrode, a second main electrode spaced from said first main electrode, a control electrode on the side of said second main electrode opposite said first main electrode, said second main electrode and said control electrode being spaced close together, whereby no discharge takes place between them and a direct connection between said first main electrode and said control electrode.

2. A tube comprising a first electrode, a second electrode which is perforated and which is spaced from said first electrode, a third electrode on the side of said second electrode opposite said first electrode, said second electrode and said third electrode being spaced close together, whereby no discharge takes place between them and a direct connection between said first electrode and said third electrode.

MAX STEENBECK.