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DISCHARGE TUBE

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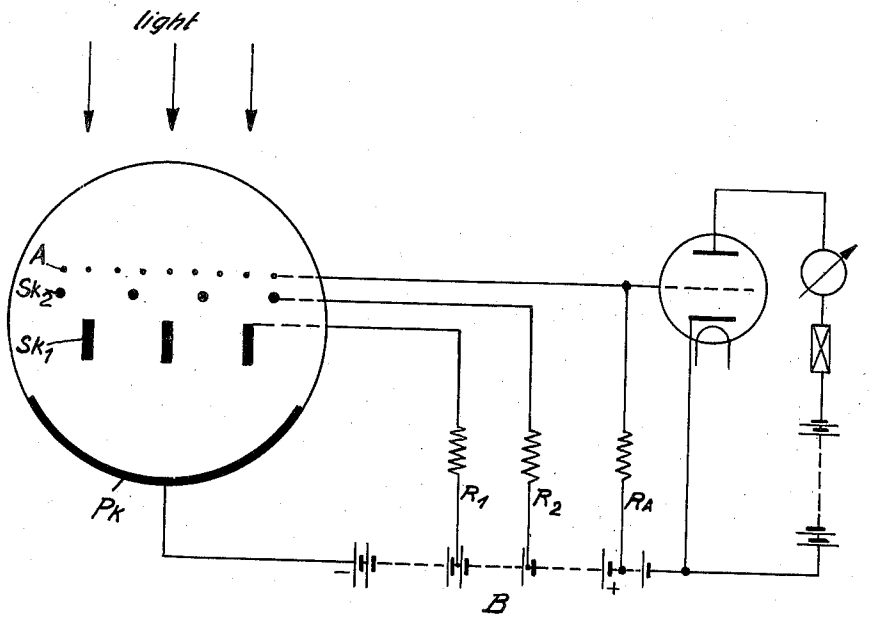

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DISCHARGE TUBE

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3 Claims. (Cl. 250—166)

The invention relates to a discharge tube, in which the electronic current emitted by the cathode is reinforced by secondary electrons within the tube itself.

In the discharge tube according to the invention there are provided two or more electrodes, which are adapted to give off secondary electrons and possess a grid-like form. This embodiment of the electrodes supplying the secondary electrons ensures particularly favourable conditions of reinforcement. A further considerable advantage is disclosed by the said invention if the discharge tube according to the invention is a photo-tube, as in this case it is prevented by the grid-like form that a considerable portion of the incident light current is absorbed by the secondary cathodes.

The discharge tube according to the invention comprises a vessel, which is spherical or cylindrical in the usual fashion and has been evacuated to the best possible degree, and in which there are located in front of the primary cathode a plurality of grids conducted out separately. In the drawing there is shown by way of example a discharge tube according to the invention in which the primary electrons are produced in light-electrical fashion.

In the drawing the single figure shows schematically a cross section of a photo-electric tube according to the invention, including the important connections.

In the drawing the primary cathode is designated Pk and is shown as a light responsive coating provided on the wall of the tube itself.

There are shown for example, three grid-like electrodes Sk_1, Sk_2 and A, which are, preferably, flat or planar. Of these grids, Sk_1 and Sk_2 are supplied with a coating which will emit secondary electrons comparatively readily and which for example, may be a thin layer of an alkali or alkaline earth metal, whilst the grid A is not furnished with a coating of this kind. To the grids there are applied three potentials of different amount; for example, there may be imparted to the electrode Sk_1 a potential of 200 volts, to the electrode Sk_2 a potential of 400 volts and to the electrode A a potential of 450 volts, whilst the cathode Pk is joined up with zero. The potentials are taken from the battery B.

The electrons emitted by the cathode (by reason of the light radiation in the form of embodiment shown in the drawing) are accelerated by the potential linked up with Sk_1. Upon striking against the electrode Sk_1 they release secondary electrons, which are sucked up by the cathode Sk_2. By reason of the field situated between Sk_1 and Sk_2 the secondary electrons emitted by Sk_1 are accelerated to such extent that at the electrode Sk_2 they again produce secondary electrons which are picked up by the anode A, which in the form of embodiment given by way of example has a grid-like form. Since the potentials may be so selected that upon each impact of a primary electron a plurality of secondary electrons are liberated, there is obtained in every case an amplification by a certain factor. The described system of the secondary emission cathodes accordingly represents in a manner of speaking a cascade connection of amplifying stages. It is naturally also possible in place of the two-stage amplification as described to obtain an amplification with a greater number of stages by the provision of additional secondary-emission cathodes linked up with suitable potentials. The electronic current flowing off by way of the anode produces at the anode resistance R_A in the drawing a drop in potential which, if necessary, may be additionally amplified in the known fashion and conducted to consuming apparatus.

It is desirable to construct one or more of the secondary-emission cathodes in the form of a series of surfaces disposed edgewise against the light, as in this way there is increased the emissive surface without increase of the light-absorbing cross-section. It is also possible with suitable adjustment of the potentials applied to the electrodes to make a different selection of the sequence of the grids acting as anode or secondary-emission cathodes, or to allow the single grids to encircle one another.

It is particularly convenient to furnish both the primary cathode as well as all of the grids acting as secondary cathodes with the same coating readily supplying electrons, the basic metal of these electrodes consisting, for example, of silver, which at the same time is subjected to a sensitizing process. The sensitization may be performed in the manner known per se, for example by oxidation of the base, the introduction of caesium into the interior of the tube and subsequent thermal treatment. It is, however, also possible to employ any of the other known sensitizing methods.

I claim:

1. A photo-electric tube comprising a light responsive cathode upon which light may be projected along a predetermined path, a substantially planar output electrode in the form of an open mesh positioned opposite the cathode and spaced therefrom across the light path, a plurality of substantially planar light pervious grid structures positioned substantially parallel to the plane of the output electrode and in spaced planes in-

termediate the output electrode and the cathode, said grid structures being provided with a coating adapted to produce secondary electrons when bombarded by primary electrons in excess of the number of arriving primary electrons, and conductors whereby the grid structures and the output electrode may be maintained at progressively higher positive potentials with respect to the cathode in accordance with their spacing from the cathode, whereby when light is projected onto the light responsive cathode through the output electrode and the light pervious grid structures to liberate electrons at the cathode, secondary electron multiplication at the grids will result and an increase in the number of electrons collected at the output electrode will be produced.

2. A photo-electric tube comprising a light responsive cathode upon which light may be projected along a predetermined path, a substantially planar output electrode in the form of an open mesh positioned opposite the cathode and spaced therefrom across the light path, a plurality of substantially planar light pervious grid structures positioned substantially parallel to the plane of the output electrode and in spaced planes intermediate the output electrode and the cathode, said grid structures being provided with a coating adapted to produce secondary electrons when bombarded by primary electrons in excess of the number of arriving primary electrons, one of said grid structures having elements elongated in the direction of said light path to provide an increased secondary emissive area without reducing the effective light area of the cathode, and conductors whereby the grid structures and the output electrode may be maintained at progressively higher positive potentials with respect to the cathode in accordance with their spacing from the cathode, whereby when light is projected onto the light responsive cathode through the output electrode and the light pervious grid structures to liberate electrons at the cathode, secondary electron multiplication at the grids will result and an increase in the number of electrons collected at the output electrode will be produced.

3. A photo-electric tube comprising a light responsive cathode upon which light may be projected along a predetermined path, a substantially planar output electrode in the form of an open mesh positioned opposite the cathode and spaced therefrom across the light path, a plurality of substantially planar light pervious grid structures positioned substantially parallel to the plane of the output electrode and in spaced planes intermediate the output electrode and the cathode, said grid structures being provided with a coating adapted to produce secondary electrons when bombarded by primary electrons in excess of the number of arriving primary electrons, one of said grid structures having elements elongated in the direction of said light path to provide an increased secondary emissive area without reducing the effective light area of the cathode, the elements of another of said grid structures being positioned opposite the spaces between the elements of said one grid structure, and conductors whereby the grid structures and the output electrode may be maintained at progressively higher positive potentials with respect to the cathode in accordance with their spacing from the cathode, whereby when light is projected onto the light responsive cathode through the output electrode and the light pervious grid structures to liberate electrons at the cathode, secondary electron multiplication at the grids will result and an increase in the number of electrons collected at the output electrode will be produced.

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