

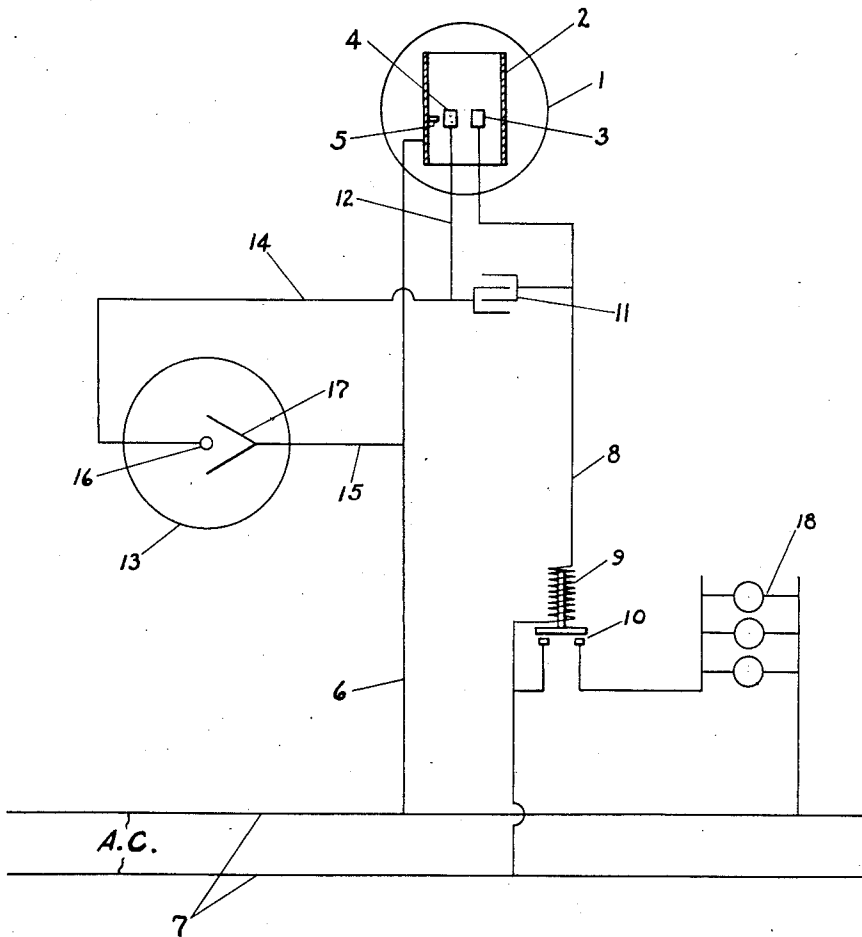
April 2, 1935.

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1,996,556

SYSTEM FOR OPERATING GLOW RELAY TUBES

Filed Nov. 22, 1928



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1,996,556

SYSTEM FOR OPERATING GLOW RELAY TUBES

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Application November 22, 1928, Serial No. 321,188

6 Claims. (Cl. 250—41.5)

This invention relates to a system for operating a glow relay tube of the type described in Patent 1,840,055, issued Jan. 5, 1932, to Harvey C. Rentschler for Glow relay tube, an improvement of which is described in my copending application Serial No. 295,096 filed July 24, 1928 and entitled, "Glow relay tubes".

The glow relay tube described in the above mentioned patent of Dr. Harvey C. Rentschler consists briefly of an envelope containing a gaseous medium having a cathode of relatively large area and a main anode and a starting anode of small areas.

The main anode is positioned with respect to the cathode so that a considerably higher voltage is required to start a discharge between said electrode and the cathode than is ordinarily available from the circuit in which these electrodes are connected, whereas, the starting anode is differently spaced with respect to the cathode and may be constructed of a different material from the main anode so that a discharge may be started between such starting anode and the cathode at a considerably lower voltage than that necessary to initiate the main discharge.

The starting anode is positioned at the critical distance from the cathode, or from an extension of the cathode at which the minimum voltage is required to start the discharge with the particular gas at the pressure employed. The main anode is arranged at a greater distance from the cathode. As a consequence of this construction, if a predetermined voltage is impressed between the main anode and the cathode, somewhat lower than that necessary to initiate a discharge therebetween but sufficiently high to maintain such a discharge after it is once started and if a second source of potential is applied between the starting anode and the cathode of sufficient voltage to initiate a discharge between such electrodes in response to some external condition permitting only a feeble current to flow in the starting anode circuit, the main anode discharge may be started upon the initiation of the discharge from the starting anode.

With such a device the extremely feeble currents obtained for instance, from a photo-electric cell, which may be in the nature of a micro-ampere or a few micro-amperes, produced in the circuit including the starting anode which, for convenience is termed, the in-input circuit, will initiate a discharge in the main anode circuit or output circuit of several hundred milli-amperes, which is sufficient to operate a sensitive relay.

In the above mentioned patent of Dr. Rentsch-

ler, a system is described in which such a starting anode tube is set into operation by an increase in current flowing through a photo-electric cell in response to an increased illumination thereof.

One of the objects of the present invention is to reverse this operation and produce a system in which the starting anode tube is caused to operate when the illumination falls below a definite value and to cease operating when the intensity of the light increases above such value.

Another object is to provide a system of operating a glow relay tube of the starting anode type in which the tube is in a normally operating or broken down condition and in which the operation thereof is caused to be discontinued by feeble electric currents flowing in an external circuit.

In accordance with my invention I supply the in-input circuit of the starting anode tube with current through a fixed or variable condenser, the capacity of which is only slightly higher than that required to pass the amount of current necessary to initiate the discharge from the starting anode so that under normal operating conditions the tube will remain in a broken down condition.

In order to discontinue the operation of the relay tube I connect a shunt path between the starting anode and the cathode which is normally of sufficiently high resistance to prevent an appreciable current flow therethrough, but the resistance of which may be decreased in response to an external condition to allow the current supplied to the starting anode, by the condenser, to leak off through the shunt circuit. One form of variable resistance device which may be employed in the shunt path is a photo-electric cell which, when subject to a predetermined illumination, permits enough current to flow through the shunt path to prevent a discharge occurring between the starting anode and the cathode of the relay tube.

In order that the invention may be more fully understood reference will be had to the accompanying drawing in which the single figure illustrates an electrical system embodying my invention.

In the drawing I have illustrated diagrammatically a starting anode tube 1 having a cylindrical cathode 2, a main anode 3 and a starting anode 4. A starting tip or projection 5 extends from the cathode into close proximity to the anode 4 so that the discharge between the starting anode and the cathode will be initiated at a lower voltage than that required to initiate a discharge from the anode 3 when the tube is in a non-operating condition. The cathode is connected

through a conductor 6 to a source of current such as a 110 volt A. C. line 7. The main anode 3 is also connected to the line 7 through a conductor 8 and a winding 9 of an electric switch 10. The break down voltage of the tube between the main anode 3 and the cathode 2 is adjusted so that it will be slightly higher than the voltage of the line 7, whereby normally no current will flow through the tube except when the break down resistance of the tube is decreased by the occurrence of a discharge between the starting anode and the cathode.

The starting anode is supplied with current from the line 7 through the conductor 9, condenser 11 and conductor 12. The capacity of the condenser 11 is such that it will supply current slightly in excess of that necessary to create and maintain a discharge between the starting anode 4 and the cathode 2.

With the circuit arrangement so far described a voltage will build up on the plates of the condenser 11 sufficiently high to exceed the break down potential of the starting anode and a discharge under normal conditions will occur between the starting anode and the cathode, which will permit a larger current discharge to flow between the main anode 3 and the cathode, thereby energizing the winding 9 and operating the switch 10.

In order to discontinue the operation of the glow relay tube in accordance with an increase in the intensity of a light source, I connect a photo-electric cell 13 in shunt to the starting anode 4 and the cathode 2 by the conductors 14 and 15 respectively, the former of which is joined to the anode 16 of the photo-electric cell and the latter of which is joined to the cathode 17. With such an arrangement, when light below a predetermined value falls upon the photo-electric cell the resistance of the cell to current flow is high enough to prevent any appreciable leakage from the condenser 11 and the current and voltage supplied by the condenser is sufficient to maintain the starting anode discharge. However, when the light falling upon the photo-electric cell increases to a predetermined value the resistance of the photo-electric cell to the flow of current, decreases and the charge on the condenser is by-passed through the photo-electric cell, thus reducing the potential applied to the starting tip below the break down voltage of the starting gap.

This causes a discontinuance of the discharge from the starting anode and consequently causes the main discharge from the anode 3 to cease and the winding 9 of the switch 10 to be de-energized. The switch 10 may be utilized to operate a bank of lamps 18 or other suitable apparatus.

It will be noted that I have provided an arrangement by which the operation of the glow relay tube is caused to be discontinued when the light falling upon the photo-electric cell increases to a definite value and it is caused to operate when the light falls below such predetermined value.

Many changes may be made in the circuit arrangement and in the nature of the current limiting device 11 and the variable resistance device 13, and I do not desire to be limited to the specific arrangement shown and described.

What is claimed is:

1. An electric control system comprising an in-

put circuit and an output circuit, a glow relay tube included in both said input circuit and said output circuit, a capacity coupling for permitting a small flow of current in said input circuit and also being part of said input circuit and photo-electric means responsive to predetermined light intensities for shunting said current across said tube externally thereof.

2. An electric control system including a glow relay tube having a cathode, a main anode and a starting anode comprising an input circuit and an output circuit, said input circuit including the starting anode and cathode of said tube and a condenser having a capacity only slightly greater than that required to supply sufficient current to operate the relay tube, and photo-electric means responsive to external conditions for shunting a portion of the current in the input circuit across said starting anode and cathode externally of said tube.

3. An electric control system including a glow relay tube having a cathode, a main anode and a starting anode comprising an input circuit and an output circuit, said input circuit including the starting anode and the cathode of said tube, said output circuit including the main anode and the cathode of said tube whereby a discharge between the main anode and the cathode occurs only in response to a discharge between the cathode and starting anode, capacity coupling means also included in said input circuit for enabling a low current discharge only between said starting anode and cathode and a photo-electric cell in shunt relation to the starting anode and the cathode.

4. An electric system, including a relay tube having a main anode, a cathode and a starting anode, comprising a circuit including said starting anode, said cathode, a source of potential and means for restricting the amount of current flow between said starting anode and cathode, another circuit including a source of potential, said main anode and cathode, and a radiation responsive means in electrical parallel relationship to said starting anode and said cathode.

5. An electric system, including a tube having a main anode, a cathode and a starting anode comprising a circuit including said starting anode, said cathode, a condenser and a source of potential in electrical series relationship, another circuit including said main anode, said cathode and a source of potential in electrical series relationship, and radiation responsive means in electrical parallel relationship to said starting anode and said cathode.

6. In combination with a load circuit including a switch, of a control system including a glow discharge tube of the starting anode type having a main anode, a cathode and a starting anode, said control system having a plurality of circuits, one circuit including a source of potential, said starting anode, said cathode and a condenser in electrical series relationship, a second circuit including said source of potential, said cathode, said main anode and an energy translating means in electrical series relationship and a third circuit including said condenser, a radiation responsive means and said source of potential in series, said switch being operable upon said energization of said energy translating means.

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