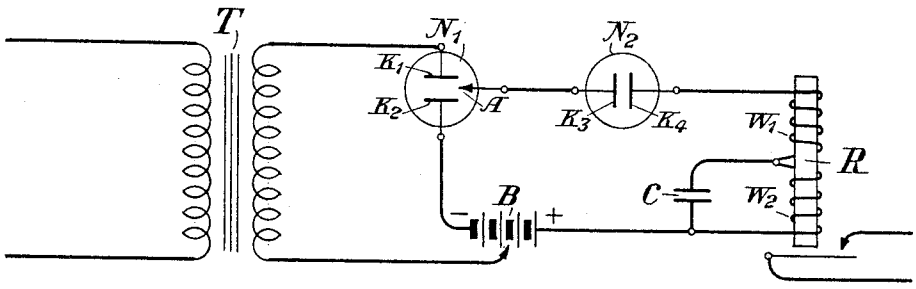
Oct. 26, 1937. L. K. SWART 2,096,865

RESETTING CIRCUITS FOR GAS-FILLED TUBES

Filed April 16, 1936



INVENTOR
L. K. Swart

BY

ATTORNEY

Patented Oct. 26, 1937

2,096,865

UNITED STATES PATENT OFFICE

2,096,865

RESETTING CIRCUITS FOR GAS-FILLED TUBES

Leland Kasson Swart, Mountain Lakes, N. J., assignor to American Telephone and Telegraph Company, a corporation of New York

Application April 16, 1936, Serial No. 74,793

8 Claims. (Cl. 175—320)

This invention relates to electrical circuits and to gas-filled tubes and to circuits for gas-filled tubes. More particularly, this invention relates to methods and apparatus for restoring gas-filled tubes after operation to their initial condition prior to operation. Stated in other words, this invention relates to methods and apparatus for unlocking or resetting operated gas-filled tubes.

It has heretofore been the practice in the voltage recording art, for example, to employ a vibrating relay to extinguish or deionize the gas contained within gas-filled tubes. In such arrangements, the armature and contact of the vibrating relay are generally connected in series with the anode of the tube or to shunt it to the cathode at each vibration of the relay armature.

There has been criticism of the use of the vibrating relay for resetting gas-filled tubes because of the more or less continuous wear of the contacts of the relay and of the cost of maintenance of the relay, even though relatively small. It is therefore preferable to employ a resetting circuit which avoids vibrating or other make-and-break devices.

Accordingly, it is one of the objects of this invention to reset the circuit of a gas-filled tube where D. C. potentials are used without moving or mechanical means.

Another of the objects of this invention is to reset the circuit of a gas-filled tube and to deionize the gas within the tube with a circuit arrangement embodying a second gas-filled tube.

These and further objects of this invention will be better understood from the detailed description hereinafter following when read in connection with the accompanying drawing showing one embodiment of the invention merely for the purpose of illustration.

The transformer T interconnects a source of voltage (not shown) with the cathodes K_1 and K_2 of a three-element cold cathode gas-filled tube N_1 of well known construction, the interconnecting circuit including part of the battery or other fixed source of voltage B for the purpose of reducing the value of voltage required to ionize the gas between the cathodes K_1 and K_2. The anode A of the tube N_1 is connected in a circuit which includes the electrodes K_3 and K_4 of another gas-filled tube N_2, which may be an ordinary neon tube, the windings W_1 and W_2 of a relay R and the battery B. A condenser C is connected across the winding W_2 of relay R.

The battery B must have a terminal voltage exceeding the sum of the voltage required to sustain gaseous ionization between the anode A and cathode K_2 after initiation of ionization, plus the breakdown voltage between the electrodes K_3 and K_4 of tube N_2, plus a sufficient potential drop to perform the necessary operation of relay R. This battery voltage, however, must be less than the additive sum of the breakdown voltage between the anode A and cathode K_2 of tube N_1 and the breakdown voltage between electrodes K_3 and K_4 of tube N_2.

When no voltage is applied to the primary winding of the transformer T, the gas within both tubes N_1 and N_2 will be in a deionized condition, no current will flow from battery B through the windings of relay R and the condenser C will be discharged. Upon the application of a sufficient voltage to the primary winding of transformer T, the voltage across the secondary winding will be transmitted along with that between the tap and negative terminal of battery B to the cathodes K_1 and K_2 of tube N_1. This will ionize the gas between electrodes K_1 and K_2 and hence reduce the impedance between electrodes A and K_2 from a very large value to a small and practically negligible value. In certain cold cathode tubes of well known type, the voltage required to break down the space between electrodes A and K_2 will be reduced from about 180 volts before gaseous ionization to about 70 volts after gaseous ionization, 70 volts being the sustaining voltage between the electrodes A and K_2 of tube N. The reduction in the value of voltage required to cause the passage of current between electrodes A and K_2 may allow as much as about 110 additional volts to be applied between electrodes K_3 and K_4 of tube N_2, thereby initiating gaseous ionization within tube N_2. When this occurs, current from battery B will traverse the windings W_1 and W_2 of relay R. As current traverses winding W_2, the condenser C will become charged. During the charge of condenser C, the winding W_1 of relay R will receive sufficient current to cause the relay armature to close its associated contact.

When the condenser C has become fully charged, the flow of current from battery B through the winding W_1 of relay R and between electrodes K_3 and K_4 of tube N_2 and between electrodes A and K_2 of tube N_1 will cease. Then the gases within tubes N_1 and N_2 will become deionized (extinguished). The winding W_1 of relay R will no longer exert its attractive pull upon its associated armature.

Once the gases within tubes N_1 and N_2 become deionized, however, condenser C will begin to discharge through the winding W_2 of relay R. As

winding W_2 is poled in proper relationship with respect to winding W_1, it will replace winding W_1 in applying an attractive force upon the relay armature and hold the armature against its contact. If in the meantime sufficient voltage is no longer applied through transformer T to the electrodes K_1 and K_2 of the tube N_1, the condenser C will become fully discharged and the winding W_2 of relay R will fail thereafter to continue to apply any magneto-motive force on its armature and the armature will leave its contact and restore to normal.

However, if sufficient voltage remains applied to electrodes K_1 and K_2 of tube N_1 and persists, condenser C will thereafter charge to a maximum voltage and discharge to a point where the voltage of battery B minus the combined voltages between electrodes A and K_2 of tube N_1 and across condenser C results in a voltage equal to the breakdown voltage between electrodes K_3 and K_4 of tube N_2. While the gas within tube N_1 remains ionized the voltage acting on winding W_2 due to charge and discharge of condenser C, therefore, will vary in relation to the difference between the breakdown and sustaining voltage values of tube N_2.

The condenser C must be of a predetermined size. The time intervals required for its charge and discharge through winding W_2 should be such that the relay R will not fall off or restore to normal during the interval between successive half cycles of voltage applied between electrodes K_1 and K_2 of tube N_1. Moreover, the relay R should be of low operating current and of high resistance.

It will be apparent that as long as sufficient voltage remains applied between electrodes K_1 and K_2 of tube N_1 to maintain gaseous ionization within the tube, the relay R will remain operated. The relay R will release a short time after gaseous ionization within tube N_1 ceases.

The voltage values mentioned hereinabove are given merely to assist in understanding the operation of the circuit and are under no circumstances to be considered as limiting the invention in any respect.

While the resetting circuit has been shown and described as applied to a gas-filled tube of the cold cathode type, it is of course equally applicable to a gas-filled tube of the hot cathode type.

While the resetting circuit is illustrated as including a two-electrode gas-filled tube, it will be understood that this device may be replaced by any device which requires a lower applied voltage to remain operated than is required to initiate its operation.

Although this invention has been shown and described in a particular arrangement merely for the purpose of illustration, the invention obviously may be embodied in other and widely varied forms without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A resetting system for a first gas-filled tube having three electrodes comprising a circuit having no moving parts and including a second gas-filled tube having electrodes connected in series with two of the electrodes of the first tube.

2. A resetting system for a gas-filled tube having three electrodes comprising a circuit including a two-electrode gas-filled tube, a condenser in series with the latter tube and in series with two of the electrodes of the first tube, and means for periodically charging and discharging the condenser.

3. The combination of a three-electrode gas-filled tube between two of the electrodes of which incoming voltages may be applied, a two electrode gas-filled tube, a relay, a source of potential connected in series with the relay winding, the two electrode tube and the third electrode and one of the other electrodes of the three-electrode tube, and a condenser connected in shunt with part of the relay winding.

4. Apparatus for extinguishing a three-element gas tube having input and output circuits after the gas within the tube has become ionized comprising a neon tube coupled to the gas tube, and means for periodically deionizing the gas within the neon tube.

5. An arrangement for deionizing a three-electrode gas tube comprising a second gas tube having electrodes connected to two of the electrodes of the first tube and means for periodically deionizing the gas within the second tube.

6. A deionization circuit for a gas-filled tube having three electrodes comprising a neon tube of two spaced electrodes connected to two of the electrodes of the gas-filled tube and means for intermittently applying across said electrodes of the neon tube a voltage exceeding the breakdown voltage of the tube.

7. A deionization circuit for a gas-filled tube having three electrodes including an anode, comprising a gapped device connected to said anode and another of the electrodes of said tube, a source of voltage connected to said gapped device, said source having a magnitude exceeding the breakdown value of the gapped device, and means for regularly and periodically removing from the gapped device the effect of said source.

8. An arrangement interconnecting an input circuit and an output circuit, comprising a three-electrode gas tube to two of the electrodes of which the input circuit is connected, a two electrode gas tube, a relay having a winding and contacts for controlling the output circuit, the relay winding being connected to the third electrode of the three-electrode tube through the two-electrode gas tube, and a condenser shunting part of the relay winding.

LELAND KASSON SWART.