July 27, 1937. L. L. E. CHAUVEAU 2,088,548

GAS DISCHARGE RELAY

Filed Sept. 26, 1935

Fig. 1

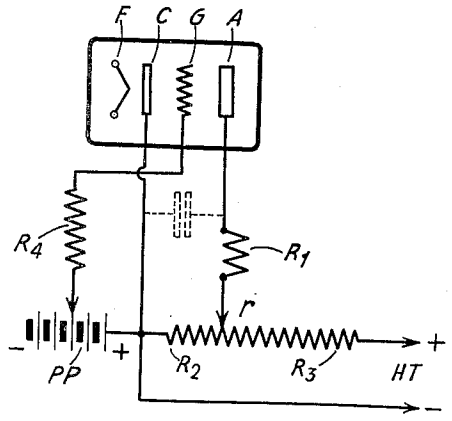


Fig. 2

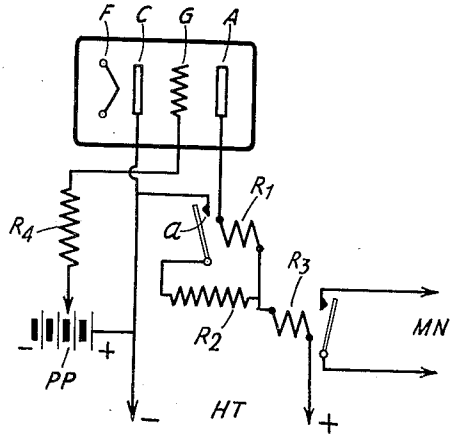
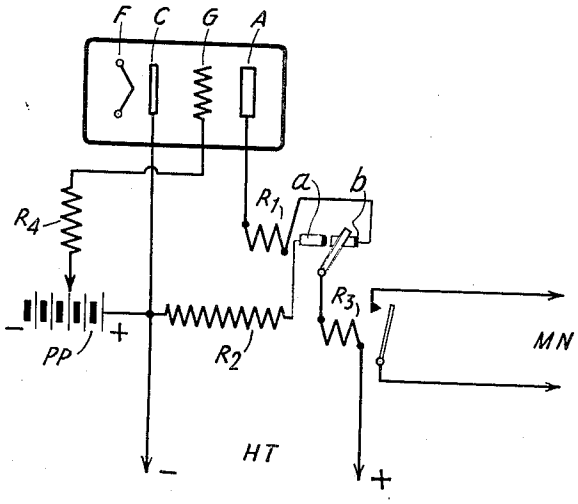


Fig. 3



INVENTOR.
LOUIS LUCIEN EUGENE CHAUVEAU

BY Charles McClay.
ATTORNEY.

Patented July 27, 1937 2,088,548

UNITED STATES PATENT OFFICE

2,088,548

GAS DISCHARGE RELAY

Louis Lucien Eugène Chauveau, Paris, France, assignor to Compagnie Generale de Telegraphie Sans Fil, a corporation of France

Application September 26, 1935, Serial No. 42,228
In France October 2, 1934

4 Claims. (Cl. 179—16)

The present invention is concerned with gas discharge relays, particularly those using a control grid, for example, mercury vapor relays or "thyratrons".

It is known in the prior art that in this kind of relay the discharge is initiated by the grid. A negative voltage applied to the grid prevents the discharge from becoming produced, the value of this negative voltage being a function of the potential applied to the anode or plate and the characteristics of the relay. A slight positive variation of this grid voltage causes discharge and operation of relays and other means that may be included in the plate circuit.

However, after the discharge has been initiated, the grid as a general rule no longer exercises any control action, and the plate current if continuous can not be stopped except by breaking the plate circuit.

Now, the present invention discloses means to insure complete control of the relay by the grid so that the grid not only causes the initiation of the discharge, but also stops the discharge as soon as its voltage resumes its previous negative value.

Arrangements of this kind may have many different applications and uses; for instance, they permit the controlling of relays by telegraphic signals, or series or trains of impulses of the kind used in automatic telephony work. An ionizing relay of the kind in question may also be used as a generator of a vibratory or intermittent current from a D. C. Their action will be better understood from the following description given by way of example by reference to the attached drawing comprising three figures, of which

Figure 1 shows one of the embodiments of the basic idea of the invention;

Figure 2 is a modification of the preceding figure, and

Figure 3 is another modification of the invention.

The ionizing relay of Figure 1 may consist of a mercury-vapor tube of the indirectly heated type with a control grid, this tube comprising a filament F, cathode C, grid G and plate A.

The plate voltage HT instead of being applied directly between anode A and cathode C is connected thru a potentiometer consisting of resistances R2, R3, the plate being connected to point r of the potentiometer thru resistance R1.

The grid G by the agency of the resistance R4 (which is not indispensable, but which will facilitate the following explanations) is connected with the polarizing cell PP.

The assembly being thus constituted, point r of the potentiometer R2, R3 is so selected that the voltage between plate A and the cathode C will be sufficient to initiate the discharge upon a slight positive variation of the grid voltage. However, the said point r is so chosen that when a discharge takes place the discharge current traversing R2, A and C occasions across R3 a fall of potential such that the voltage between A and C remains sufficient to maintain the discharge. When there is no discharge the voltage across A and C will be high enough to occasion striking of a discharge upon a small positive variation of the grid voltage; but as soon as the discharge starts the potential between A and C falls to a value below the striking or initiating voltage. The result is that the tube goes out, but if the grid remains at its less negative or positive potential the tube is immediately restarted. If, on the contrary, at the instant of extinction, the grid is restored to its original negative value of potential, the tube remains extinguished.

It will be seen that it is thus feasible to completely and perfectly control the action of a gas discharge device by the grid in the tube. It is sufficient for the purpose of control to vary, for instance, the potential across the terminals of the resistance R4 by an E. M. F. opposed to PP, such as is customary in radio receiver apparatus. In the course of a signal the striking and extinctions of the tube are infinitely rapid, and if the impedance R1 consists, for example, of a standard telephone relay, the same will remain operative as long as the grid is slightly positive, and will be restored to the state of inoperation only when the grid resumes its original negative voltage.

It will be easily conceived that if R1 comprises the primary of a transformer, it would be feasible to obtain at the secondary end thereof a modulated current the frequency of which would be a function of the characteristics of the tube.

The resistances R2, R3 could consist of fixed resistances whose values are priorly determined as a function of the plate voltage, the grid voltage and the type of tube that is employed.

Figure 2 shows a modification wherein the potentiometer impedances R2 and R3 are connected across the source HT thru the contacts a. R1 and R3 may be the windings of relays, for instance, of the type used in telephone work. When the tube has not been lighted or caused to discharge, the voltage between plate A and the cathode C is the same as that of the source HT. However, as soon as the discharging has been

initiated, the relays R1 and R3 are rendered operative, R1 closes the contact *a* and as a result the voltage between A and C becomes lower than the initiating or striking potential, the tube goes out, R3 is not restored to inoperation since its circuit is completed thru R2 and *a*. The consequence is that as long as the grid is slightly positive R1 vibrates and short-circuits partially and periodically the anode-cathode path, and R3 remains excited until the grid is restored to its original negative voltage when no re-striking happens and R1 and R3 remain inoperative. The result is that during a signal occasioning a slight positive variation of the grid voltage R1 vibrates, R3 remains in operation. The latter relay may therefore follow code keying impulses impressed on the grid.

In the arrangement of Figure 2 the resistance R2 may have a very small value or may, if necessary, constitute a dead short-circuit. This arrangement moreover offers the merit that, for a suitable choice of the various elements of the circuit RT, no sparking will be noticed on contact *a*, and no reaction will be produced upon such radio circuits as may be associated with the relay.

The circuit organization of Figure 3 is similar to that of Figure 2, except that the relay R1 comprises a reversing contact or two-way contact which closes at *a* the potentiometer circuit R2—R3, while opening at *b* the plate circuit, the disposition of the reversing means indicated at *a* and *b* being such that the contact *a* will be closed before contact *b* is opened. The operation of this circuit is similar to that shown in Figure 2.

In the various circuit organizations hereinbefore disclosed, capacities and resistances properly chosen may be connected if desired, across the terminals of the relays and contacts, or any other point of the circuits to facilitate operation. More particularly speaking, a suitable capacity could be arranged between the plate and the cathode of the tube; experience has shown that such a capacity facilitates regulation and smooths the operation of the arrangements hereinbefore disclosed.

The specification hereinbefore given is merely by way of example, the invention being concerned with the use of circuits described for the various applications of ionizing relays controlled by a control grid.

What is claimed is:

1. A circuit arrangement comprising a gaseous discharge device having a cathode, plate and control grid, a voltage source with one terminal connected to said cathode, a potentiometer with two series branches connected across the terminals of said source and connected at the junction of the branches to said plate, the source impressing between the anode and a cathode a potential sufficient to start a discharge in the tube in response to a signal on the control grid so that a fall of potential in one of the branches of the potentiometer, in response to said discharge, renders the voltage between the plate and the cathode insufficient to maintain the discharge, and an electromagnetic relay connected in the plate circuit whereby the relay will respond to the control signals.

2. In a circuit organization of the type defined in claim 1 with this characteristic feature, that the potentiometer circuit is connected in series with contacts of a relay, the winding of said relay being connected in series with the plate circuit, the said circuit being characterized by this feature that the other of said branches of the potentiometer is completed thru an electromagnet representing the controlled device.

3. In combination, a gaseous discharge device with an anode and a cathode, a relay comprising two contacts and an armature to engage selectively either contact, the said contacts being so disposed that closure of one occurs prior to the breaking of the other, and a winding for controlling said armature, a source of potential with its negative terminal connected to said cathode and its positive terminal connected to said anode thru said winding, one of said contacts and said armature in series, the other contact being connected thru a resistor to the said cathode.

4. In a relay, a gaseous discharge device with a cathode, an anode, and a control grid, a potential source, an impedance device connected across said source at one end of said cathode, a second impedance connected between said plate and a point on the first mentioned impedance intermediate its ends, and means coupled between said grid and said cathode to vary the potential of said grid.

LOUIS LUCIEN EUGÈNE CHAUVEAU.