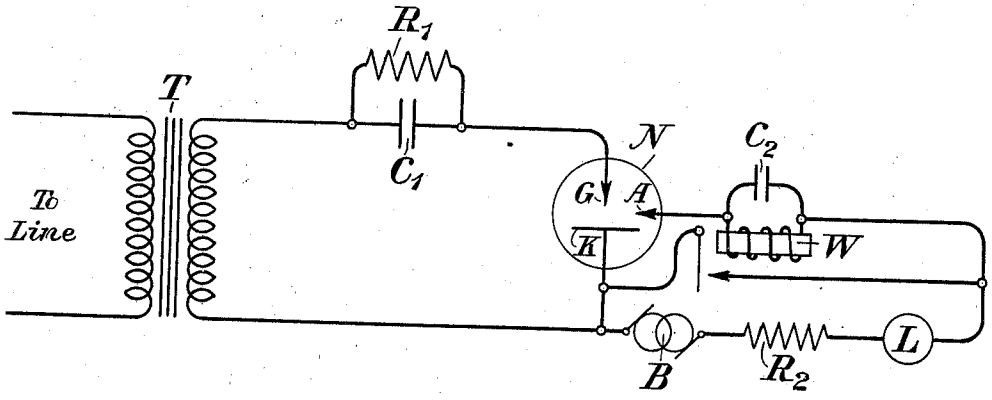
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GAS TUBE CIRCUIT

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GAS TUBE CIRCUIT

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This invention relates to gas-filled tubes and to circuits therefor. More particularly, this invention relates to arrangements for indicating the occurrence of short-lived impulses.

The gas-filled tube of the so-called "cold cathode" type has heretofore been applied to trigger circuits and the like. Such a tube may comprise three electrodes, two of which are connected to an input circuit and the third electrode and one of the other electrodes to an output or work circuit. A source of voltage—generally a direct current voltage—may be connected to the work circuit, but this voltage must be less than the voltage required to ionize the gas between the electrodes to which the work circuit is connected, yet be greater than the voltage required to sustain gaseous ionization between these electrodes after such ionization has been initiated.

The work circuit of such an arrangement may be actuated by applying to the input electrodes a voltage exceeding that required to initiate ionization between these input electrodes. However, if the source of voltage of the output circuit is of the alternating type, and of a peak voltage less than the breakdown voltage between the electrodes of the output circuit, it is essential that gaseous ionization be initiated at, or that ionization be maintained until a time when the peak voltage is applied to the output circuit electrodes.

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

Referring to the drawing the primary winding of the transformer T is connected to a line or circuit which may or may not be used for signaling purposes. The secondary winding of the transformer is connected to the input electrodes G and K of a cold cathode gas-filled tube N, the interconnected circuit including a condenser C_1 shunted by a resistor R_1. The anode A of the tube together with electrode (cathode) K form the output or work circuit electrodes. Besides the latter electrodes the output or work circuit includes an alternating current generator B, a resistor R_2, a lamp L, and the winding of a relay W, all arranged in series relationship. The winding of relay W is shunted by a condenser C_2. The armature and make contact of relay W are connected between the electrodes A and K of tube N through the winding of relay W.

The peak voltage of generator B must be less than the breakdown voltage between the anode A and cathode K. Were the generator of higher peak voltage, gaseous ionization within tube N would be initiated between electrodes A and K independently of the presence or absence of voltage in the input circuit.

Voltages transmitted from the line through transformer T are transmitted through condenser C_1 and resistor R_1 which is of large magnitude, and then to the electrodes G and K of the tube N. If such voltage exceeds the breakdown voltage between these electrodes, gaseous ionization will be initiated. The generator B will then transmit current through resistor R_2, lamp L, the winding of relay W and through the path between electrodes A and K of tube N.

The relay W, which may be part of recording equipment, will indicate that sufficient voltage has been applied to the input electrodes of the tube to ionize the gas therebetween.

The voltage available to operate the relay W (and its associated equipment) will depend upon the voltage difference between the average voltage applied by generator B and the voltage required to sustain glow between the anode A and cathode K. The greater this voltage difference—the upper limit of applied voltage always being less than the breakdown voltage between electrodes A and K—the more energy may be available to operate relay W and its associated apparatus. The energy available is also related to the time that the voltage applied in the work circuit exceeds the sustaining voltage of the tube.

In view of these limitations upon the energy available in the work circuit—the necessary requirement that the breakdown voltage between A and K be very high with respect to the sustaining voltage—difficulty may be met in operation of circuits operated especially from a source of alternating current, unless the features of this invention are employed.

Impulses of very short duration applied to the input circuit of the tube may occur at intervals when the voltage in the work circuit is below the sustaining voltage of the tube, but in the present invention, this will not hamper operation of the work circuit. The condenser C_2 shunting the winding of relay W is employed to lengthen out the "hold over" time of this relay. This enables the relay operation to be accomplished when ionization voltage has been applied between the input electrodes at a brief interval theretofore.

The condenser C_1 which shunts resistor R_1

stores a portion of the energy obtained through transformer T during the interval of time that the voltage applied between electrode G and cathode K exceeds the sustaining voltage between these electrodes. This same condenser C_1 discharges from cathode K to electrode G on disappearance of potential from the transformer T.

The presence of condenser C_1 and shunt resistor R_1 insures that all impulses—no matter how short—if of proper magnitude will "lock in" the tube N for a period long enough to operate relay W. The addition of condenser C_2 will also insure that generator B will pass current through the work circuit.

In order to further assure the indication of the occurrence of short-lived impulses, the auxiliary electrode G should be made of very small area. In such an arrangement the impedance path from the auxiliary electrode G to the cathode K will be but a few hundred ohms, whereas the path from cathode K to electrode G will be of several thousand ohms. The discharge time between these electrodes will therefore be vastly in excess of that of the charging time of condenser C_1. Hence glow will persist between these electrodes for an interval of time sufficient to "lock in" the work circuit.

It is also desirable to employ inert gases at such pressures as to promote slow deionization of the gas within the tube N. This will lengthen out the period of deionization between electrodes G and K for a period of time necessary to enable operation of the work circuit.

It is also important that the anode A of tube N be of small area, that is, practically point-like in shape. The difference between the areas of electrodes A and K determines in a large measure the difference between the breakdown voltage and the sustaining voltage. The greater this difference, the greater will be the energy available in the work circuit.

As the anode A becomes of smaller and smaller area and approaches a point, more and more rectification of the alternating current supplied by generator B will take place. The condenser C_2 of the work circuit aids in storing this rectified current so that it may be applied to the apparatus of the work circuit while the voltage of source B passes through zero.

In the arrangement shown in the drawing, operation of relay W will reduce to zero the voltage between electrodes A and K as a consequence of the closure of the circuit of the contact of the relay. This enables relay W to release and the gas within tube N to deionize and be prepared for another voltage surge at its input electrodes.

If desired the tube N may be replaced by a tube having four electrodes, two of which may be connected to the circuit to which electrodes G and K is connected. The remaining two electrodes may be connected to the circuit to which electrodes A and K is connected. Such an arrangement may be caused to operate in the manner already described with respect to the three-electrode tube.

While this invention has been shown and described in a certain particular arrangement merely for the purpose of illustration, it will be understood that the general principles of this invention may be applied to other and widely varied organizations without departing from the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. The combination of an input circuit, a work circuit independent of said input circuit, and a gas tube having an electrode of large area and another electrode between which the input circuit is connected, said tube having a third, point-like electrode which is connected to the electrode of large area through the work circuit, said input circuit including a condenser which, upon discharge, will maintain the gas within the tube ionized for a predetermined time interval, the charging circuit of said condenser including the electrodes of said tube to which the input circuit is connected.

2. The combination of input and output circuits which are independent of each other, a gas-filled tube having three electrodes one of which is point-like, said input circuit including a condenser and being connected to said point-like electrode and one of the other electrodes, said condenser being charged through a path formed by the two electrodes to which said condenser is connected only when voltages applied to the input circuit are sufficient to produce ionization of the gas of the tube, said output circuit being connected to the two electrodes other than said point-like electrode, the discharge of the condenser producing a voltage to maintain gaseous ionization within the tube for a predetermined time interval.

3. The combination of independent input and output circuits, a condenser connected to said input circuit, a gas-filled tube coupling both circuits, said tube having a plurality of electrodes one of which is point-like and connected to said input circuit but is not connected to said output circuit, voltages applied to said input circuit charging said condenser through a path formed by the electrodes to which the input circuit is connected and ionizing the gas of the tube, said condenser discharging upon the removal of said applied voltages and maintaining gaseous ionization within the tube in a reversed direction for a predetermined time interval.

4. The combination of a gas-filled tube having at least three electrodes one of which is point-like, a first circuit connected to the point-like electrode and one of the other electrodes, a second circuit connected to two of said electrodes neither of which is said point-like electrode, said first circuit including a condenser and means whereby a predetermined voltage will charge said condenser through a circuit including the electrodes of said first circuit and then ionize the gas of the tube in one direction and upon disappearance of said predetermined voltage will ionize the gas of the tube in the opposite direction for a predetermined time interval.

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