

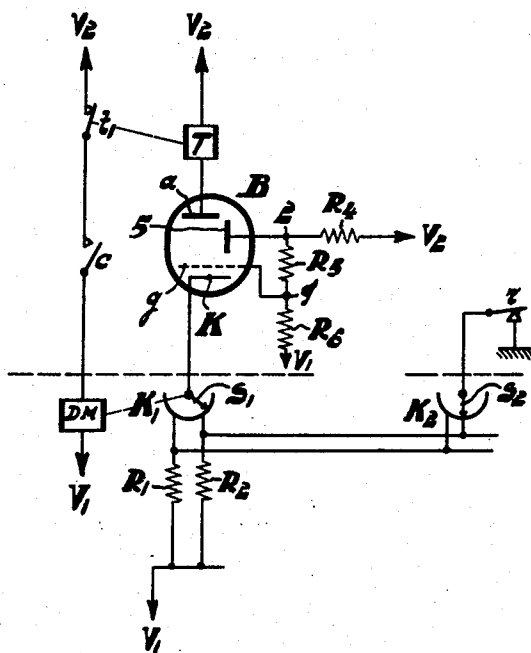
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CIRCUIT-ARRANGEMENT IN AUTOMATIC SIGNALING SYSTEM

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CIRCUIT-ARRANGEMENT IN AUTOMATIC
SIGNALING SYSTEM

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This invention relates to a circuit-arrangement in automatic signalling systems, for example, telephone systems, for testing the potential of a mark point, to which other similar testing circuits have concurrent access, and for engaging the mark point engaged.

Such circuit-arrangements are used inter alia for setting a selector switch to a free outlet corresponding to the desired number, or for setting a line finder to the outlet of a calling line. The testing circuit then forms part of the control-circuit of the switch. In these cases mark contacts of the desired outlets are marked by a potential different from those of unwanted outlets.

During the movement of the switch, the circuit tests the potentials of the mark contacts and stops the switch as soon as a desired outlet is found. The outlet is subsequently marked engaged by varying the potential of the mark contact. Since the mark contacts of the switch are multiplied to corresponding contacts of other switches, the same marking potential may be tested simultaneously by more than one testing circuit. It is desirable that the test should be followed as rapidly as possible by engagement of the outlet to prevent a plurality of switches from being adjusted to one and the same outlet.

A circuit-arrangement of the above-described type may also be used to test whether a definite, common apparatus, for example, a marking circuit in a cross-bar system, or a device for recording calls is free or busy.

It is known to effect the engagement of a mark point by electronic means. In a known circuit-arrangement the anode of a gas-filled discharge tube is connected to the mark point. If the mark point is engaged, the tube remains extinguished, but if the mark point is free, the tube ignites, so that owing to the current flowing through a resistance connected to the mark point, the potential is varied such that the mark point is marked engaged, i. e. that the test tube in another testing circuit cannot become conductive, if it is connected to the mark point. In addition, a relay included in the anode circuit of the gas-filled discharge tubes is energized, and the switch stops. This circuit-arrangement has the disadvantage that a limit is set to the potential variation to be produced. Furthermore, the tubes require a certain time to become conductive, which time is increased by the inductance in the anode circuit.

The copending U. S. patent application S. N. 66,679, filed December 22, 1948, proposes a circuit-arrangement in which the mark contact is connected to the cathode of a first discharge tube

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whose control-electrode is coupled to an output circuit of a second discharge tube, the control-electrode of the second tube being coupled to an output circuit of the first tube. In the non-conductive state of the first tube, its control-electrode has such a potential, that, if the cathode is connected to an engaged mark point, the tube remains cut off, whereas the tube becomes conductive if the cathode is connected to a free mark point. Thus, the second tube is cut off and the potential of the control-electrode of the first tube is increased to such an extent that the tube is traversed by a strong current which produces such a voltage drop across a resistance connected to the mark point that the mark point is engaged. This circuit operates very rapidly and permits voltage variations of any desired value to be obtained.

The invention provides in more simple form a circuit-arrangement which has the same advantages as the last-mentioned circuit. The circuit according to the invention comprises a discharge tube having a cathode, a control-electrode, a first collecting electrode and a further collecting electrode, the surface of which has a secondary-emission factor exceeding unity. Provision is furthermore made of means for connecting the mark point to the cathode of the tube. Through at least one resistance the additional collecting electrode has to it applied a potential which exceeds that of the cathode and which, at least when the tube is not conductive, is lower than the potential of the first collecting electrode. The control-electrode is coupled to the additional collecting electrode and, in the non-conducting state of the tube, it has such a potential that the tube does not become conductive. Upon connecting the cathode to the mark point when this is busy i. e. has a comparatively high potential, the tube becoming conductive, however, if the mark point is free and thus has a comparatively low potential. When the tube becomes conductive, the potential of the additional collecting electrode increases and that of the control-electrode rises too so that the resistance connected to the mark point is traversed by such a current that the mark point is engaged.

The control-electrode and the additional collecting electrode are preferably connected to various taps of a potentiometer connected between two points having fixed potentials.

The circuit-arrangement according to the invention is particularly suitable for use in a resistance-testing circuit as described in U. S. A. patent application Serial Number 163,170, filed May 20, 1950.

In order that the invention may be more clearly understood and readily carried into effect, it will now be described in detail with reference to the accompanying drawing, in which a circuit-arrangement for setting a selector switch e. g. a group selector to a desired free outlet is shown in a simplified and diagrammatical form by way of example.

Reference numeral K_1 designates a selector switch, of which only the test wiper S_1 , its associated mark contacts and the rotary magnet DM are shown. The mark contacts are connected through resistances R_1 , R_2 to a voltage source V_1 having a potential of, say, -60 v. relative to earth. The mark contacts are multiplied to corresponding mark contacts of other switches, for example K_2 .

The control-device of switch K_1 comprises a discharge tube B having a cathode K, a control-grid g , an anode a and an auxiliary collecting electrode S, the surface of which has a secondary-emission factor exceeding unity.

The control-grid g and the auxiliary collecting electrode S are connected to taps 1 and 2 of the potentiometer $R_4R_5R_6$ connected between the voltage sources V_1 and V_2 . The anode circuit of tube B comprises a relay T, of which the break contact t_1 is included in the energizing circuit of the rotary magnet DM.

It will be assumed that the outlets of K_1 having the same reference numeral are arranged in succession in the contact bank of K_1 .

After the selector switch has been adjusted to the beginning of a group, in a manner not further described, the switch K_1 selects a free outlet within the group under the control of the control-circuit.

For this purpose the cathode of B is connected, if desired, by way of switches in preceding selector stages, to the test wiper S_1 of switch K_1 , and contact c is closed. Tube B is cut off at this instant and contact t_1 is closed, so that the rotary magnet DM is energized and the switch K_1 is actuated.

The mark contacts of free outlets have a potential of -60 v., whereas the mark contact of a busy outlet is connected to earth through the test wiper S_2 of a switch K_2 , by way of which the speech channel passes and a relay contact r .

The tap 1 of potentiometer $R_4R_5R_6$ is chosen such that in the non-conductive state of tube B the control grid has a potential of, say, -30 v. As long as the test arm S_1 is in contact with mark contacts of busy outlets, tube B remains cut off, since the control grid has a potential exceeding by 30 v. that of the cathode.

However, if the test wiper strikes a mark contact of a free outlet, the tube becomes conductive. Assuming that the control-grid of B has a potential of -30 v., the voltage drop across the resistance connected to the mark contact would result in an increase in potential of the cathode to a few volts in excess of -30 v., for example to -27 v. The outlet would then not be marked engaged, since the tube of the control device of a further switch reaching the same outlet at this instant would also become conductive.

Since the secondary-emission factor of the surface of collecting electrode S exceeds unity the electron current flowing, if tube B is conductive, from the electrodes to the anode a is stronger than that flowing from the cathode to the electrode S.

This results in an increased potential on the

electrode S owing to the galvanic coupling between the control grid g and the electrode S; the potential of the control electrode g also increases to, say approximately earth potential.

The tube B thus becomes more conductive and the potential of the cathode follows substantially that of the control grid. Consequently the cathode assumes a potential such that the outlet concerned is marked engaged.

At the same time relay T is energized and the break contact t_1 interrupts the energizing circuit of the rotary magnet DM, so that switch K_1 stops.

The whole process wherein the tube becomes conductive and the potential of the mark contact is increased takes very little time, so that a further switch cannot engage the same outlet.

Many changes may be made in the circuit-arrangement. Thus, for example, the control-grid g may be coupled to the collecting electrode S, through a battery instead of through the potentiometer $R_4R_5R_6$ connected between the S and V_1 .

The inductance constituted by relay T in the anode circuit of the tube may give rise to undesirable effects. When the tube becomes conductive, such a voltage pulse might, for example, be produced across the inductance that the anode potential drops below the potential of the secondary-emission electrode S. In this event, the secondary-emission electrons cannot be carried off and the process is delayed. This may be avoided by providing the tube with a separate screen grid, the potential of which exceeds that of the electrode S.

Furthermore the rotary magnet DM may be included in an output circuit of a separate discharge tube, a control-electrode of which is coupled to a point on the anode circuit of tube B. In this event, the relay T can be dispensed with and the anode circuit of tube B may include a resistance for example in a manner described in the above identified copending application S. N. 66,679.

It will be obvious that the range of application of the circuit-arrangement according to the invention is not limited to the control of the switches. As stated above, the trigger circuit may be used with advantage in a circuit arrangement as proposed in U. S. A. patent application Serial Number 163,170, filed May 20, 1950.

What I claim is:

1. In an automatic signalling system, a circuit for testing the potential of a mark point, the mark point when free presenting a potential which is low relative to its potential when busy, said circuit comprising an electron discharge tube having a cathode, a grid, an anode and an emissive collecting electrode having a secondary-emission factor exceeding unity, means connecting said mark point to said cathode, means to apply a potential to said anode having a value which is high relative to the mark point potential on said cathode, means to apply a potential to said grid having a value relative to the potential on said cathode at which said tube is maintained non-conductive at a busy mark point potential and is rendered conductive at a free mark point potential, a resistance, means to apply a potential to said additional electrode through said resistance having a value exceeding that on said cathode and in the non-conductive state of said tube lower than that on said anode, and means coupling the additional electrode to said grid, whereby in the conductive state of said tube the

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potential on said additional electrode increases and correspondingly the potential on said grid, the cathode potential substantially following the grid potential to mark the point connected thereto engaged.

2. An arrangement, as set forth in claim 1, wherein the grid and additional electrode are connected to different taps on a potentiometer connected between two points of fixed potential.

3. An arrangement, as set forth in claim 1, further including a selector switch for connecting said mark point to said cathode and an electromagnet for actuating said switch, a switch for passing energizing current through said electro-

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magnet, and a relay operatively coupled to said switch and connected in the anode circuit of said tube whereby when said tube is rendered non-conductive said switch is opened to de-energize said electromagnet.

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