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SIGNALING SYSTEM

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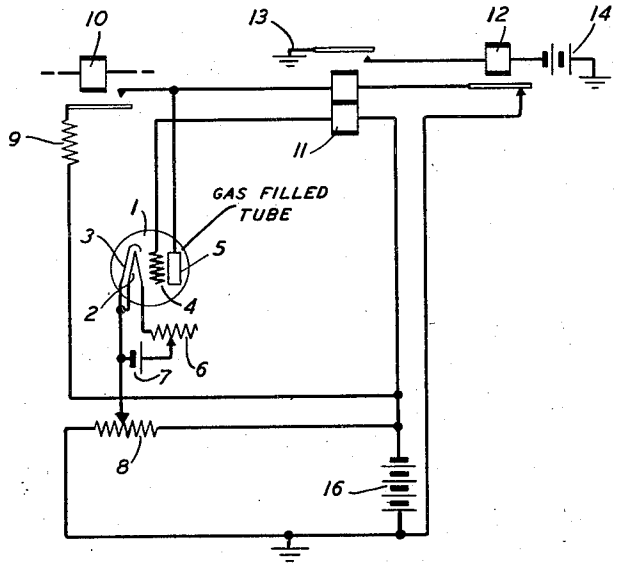

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SIGNALING SYSTEM

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This invention relates to a signaling system and more particularly to the operation and locking of a relay in response to an impulse of short duration. In signaling systems where a circuit closing means controls the operating circuit of a relay, the relay then locking itself operated, difficulty may be experienced in designing the relay so that it will operate quickly enough to close its locking circuit if the closure of its operating circuit is for a very short interval. This is particularly true if the circuit closing means is controlled by another relay which is operated only momentarily. It is therefore the object of the present invention to provide an operating circuit for a relay wherein the relay will operate and remain operated regardless of the length of time that the operating circuit is closed.

In accordance with the invention, this is accomplished by the employment of a gaseous conductor tube in conjunction with the relay and the circuit closing means. The tube employed is filled with a low pressure gaseous content which may, for purposes of illustration, be neon, helium, argon, mercury vapor or combinations of gases of this group. The tube has a certain characteristic that the gaseous content will become ionized and thus conductive on one potential determined by the electrode design, the nature of the gaseous content and its pressure, but once conducting will maintain its condition of conductivity on a much lower potential. As disclosed, the tube is of the hot cathode type having a filament heated by direct or alternating current and a cathode heated conductively from the filament. Obviously, a hot cathode type of tube in which the filament heated by direct current serves as the cathode or a cold cathode type of tube might be employed.

The relay to be operated is provided with two inductively connected windings, the first of which is connected in series with a source of potential in the cathode-anode circuit of the tube, anode potential being supplied to the tube therethrough. The second winding of the relay is connected in a circuit extending from the negative terminal of the source of potential to the control electrode or grid of the tube. The potential thus supplied to the control electrode negatively biases the electrode above the breakdown potential of the tube. An external control circuit for the relay includes the source of potential, the first winding of the relay, a resistance and a circuit closing means. As illustrated, the circuit closing means is a contact of a relay which will be assumed to operate only momentarily.

The circuit functions in the following manner: When the external control circuit is closed, current flows through the first winding of the relay but due to the inclusion of the resistance therein, the relay does not operate but the positive potential on the anode of the tube is decreased. An inductive surge of potential is generated in the second winding of the relay which, because of the relationship of the two windings, will be in such a direction as to increase the negative bias on the control electrode. Under these conditions the tube cannot ionize. When the control circuit is subsequently opened, which it is assumed occurs after a very short interval, the positive potential on the anode is increased and an inductive surge of potential is generated in the second winding of the relay which is now of a polarity to oppose the normal negative bias on the control electrode and thus reduce it to a potential substantially equal to the breakdown potential of the tube. The tube will therefore ionize, operating the relay over its cathode-anode circuit. The relay will remain operated or locked until the tube is deionized by some means such as, for example, the removal of potential from the anode of the tube.

This invention may be used in a variety of arrangements in a signaling or a switching system. It is to be understood that the invention is not limited to the circuit arrangement shown on the drawing as the amount of equipment used may be increased or decreased to perform the desired circuit functions.

The invention may be more fully understood from the following detailed description of the accompanying drawing which shows one specific embodiment of my invention. This drawing shows in diagrammatic form an arrangement of a gas-filled tube 1 and a relay 11 which it is desired to operate in response to another relay 10 which closes its lower front contact only momentarily.

Relay 11 is provided with two windings so connected that a surge of potential in the upper winding will create a surge of potential in the opposite direction in the lower winding. The upper winding of relay 11 is connected in a circuit extending from the positive pole of battery 16 through the back contact of relay 12 and the upper winding of relay 11 to anode 5 of tube 1, thereby supplying positive potential to anode 5. The lower winding of relay 11 is connected in a circuit extending from the negative pole of

battery 16 through the lower winding of relay 11 to the control electrode 4 of tube 1, thereby placing a negative potential on the control electrode 4. The potential thus supplied to the control electrode 4 negatively biases control electrode 4 above the breakdown potential of the tube. The filament 2 and cathode 3 of tube 1 are heated by current from battery 7 which is controlled by rheostat 6. A negative potential is placed on the cathode 3 of tube 1 from the negative pole of battery 16 through potentiometer 8 to cathode 3. The resistance of potentiometer 8 maintains the proper bias on cathode 3 of tube 1 and limits the current through the cathode-anode circuit of tube 1.

An external control circuit for operating relay 11 comprises a relay 10, which acts as a circuit closing means, and a resistance 9, which acts to prevent relay 11 from operating when the control circuit is closed and as a protection for relay 11. This circuit extends from the negative pole of battery 16 through resistance 9, the front contact of relay 10, the upper winding of relay 11, the back contact of relay 12 to the positive pole of battery 16. Relay 10, acting as the circuit closing means in the operating control circuit is assumed to operate and release very quickly thereby maintaining only a momentary closure of its front contact. The ohmic resistance of resistance 9 is very high in comparison with the ohmic resistance of the upper winding of relay 11.

An external control circuit for causing deionization of tube 1 and releasing relay 11 comprises a relay 12 and extends from ground 13, through the front contact of relay 11, through relay 12 to battery 14.

When the external control circuit through the front contact of relay 10 is closed by the operation of relay 10, current flows through the upper winding of relay 11 from the positive pole of battery 16, through the back contact of relay 12, the upper winding of relay 11, the front contact of relay 10, resistance 9, to the negative terminal of battery 16. Due to the short period of closure of the front contact of relay 10, relay 11 will not operate its armature, but the positive potential on anode 5 of tube 1 will be decreased. This produces an inductive surge of potential in the lower winding of relay 11 which, because of the relationship of the upper and the lower windings of relay 11, will be in such a direction as to increase the negative bias on the control electrode 4. Under these conditions the tube cannot ionize.

When the control circuit through the front contact of delay 10 is opened by the release of relay 10, the positive potential on the anode 5 of tube 1 is increased and an inductive surge of potential is generated in the opposite direction in the lower winding of relay 11. This potential is of a polarity to oppose the normal negative bias on the control electrode 4 of tube 1 and thus reduce the potential thereon until it is substantially equal to the breakdown potential of the tube 1. The tube 1 will therefore ionize and current will flow in the circuit from the positive pole of battery 16 through the back contact of relay 12, the upper winding of relay 11, the anode 5 and the cathode 3 of tube 1, potentiometer 8 to the negative pole of battery 16. Relay 11 will become energized by the current in this circuit and the front contact of relay 11 will be closed.

Relay 11 will remain energized until the tube 1 is deionized. This deionization of tube 1 may be caused by opening the anode circuit. In this specific embodiment of my invention, the closure of the front contact of relay 11, closes a circuit from ground 13, the front contact of relay 11, relay 12 to battery 14. Relay 12 will become energized and cause its back contact to be opened thereby opening the cathode-anode circuit through relay 11 and causing tube 1 to become deionized. This permits relay 11 to become deenergized. When relay 11 becomes deenergized, its contact will be opened thereby opening the operating circuit for relay 12 which will become deenergized and close its back contact. Closure of the back contact of relay 12 will close the cathode-anode circuit through tube 1 and relay 11. Tube 1 will not ionize, however, because the potential on the control electrode 4 of tube 1 is again such as to bias control electrode 4 of tube 1 above the breakdown potential of tube 1. When the front contact of relay 11 closes on the next pulse, the circuit will function again in the manner outlined above.

What is claimed is:

1. In a signaling system, a gaseous conductor tube having a control electrode, a cathode and an anode, a source of potential, a two-winding relay having one winding associated with said source of potential and the cathode-anode circuit of said tube, and the other winding associated with said source of potential and the control electrode circuit of said tube, and a circuit closing means operative upon its closure and subsequent restoration to cause said tube to ionize and operate said relay.

2. In a signaling system, a gaseous conductor tube having a control electrode, a cathode and an anode, a source of potential, a two-winding relay having a first winding connected in series with said source of potential in the cathode-anode circuit of said tube, and its second winding connected between the negative terminal of said source and the control electrode, and circuit closing means for establishing upon its closure a non-operate circuit from said source through said first winding whereby said anode is rendered less positive and said control electrode is rendered more negative thereby blocking said tube, said circuit closing means upon restoring rendering said anode more positive and said control electrode less negative whereupon said tube ionizes and causes the operation of said relay.

3. In a signaling system, a gaseous conductor tube having a control electrode, a cathode and an anode, a source of potential, a two-winding relay having a first winding connected in series with said source of potential in the cathode-anode circuit of said tube, and its second winding connected between the negative terminal of said source and the control electrode, and circuit closing means for establishing upon its closure a non-operate circuit from said source through said first winding whereby said anode is rendered less positive and an inductive surge is established in said second winding of such polarity as to render said control electrode more negative thereby blocking said tube, said circuit closing means upon restoring rendering said anode more positive and producing an inductive surge in said second winding of such polarity as to render said control electrode less negative whereupon said tube ionizes and causes the operation of said relay.

4. In a signaling system, a gaseous conductor tube having a control electrode, a cathode and an anode, a source of potential, a two-winding relay having one winding associated with said source of potential and the cathode-anode circuit of

said tube, and the other winding associated with said source of potential and the control electrode circuit of said tube, a circuit closing means operative upon its closure and subsequent restoration to cause said tube to ionize and operate said relay, and means controlled by said relay for causing the deionization of said tube and the release of said relay.

5. In a signaling system, a gaseous conductor tube having a control electrode, a cathode and an anode, a source of potential, a two-winding relay having a first winding connected in series with said source of potential in the cathode-anode circuit of said tube, and its second winding connected between the negative terminal of said source and the control electrode, circuit closing means for establishing upon its closure a non-operate circuit from said source through said first winding whereby said anode is rendered less positive and said control electrode is rendered more negative thereby blocking said tube, said circuit closing means upon restoring rendering said anode more positive and said control electrode less negative whereupon said tube ionizes and causes the operation of said relay, and a second relay operative upon the operation of said first relay for opening the cathode-anode circuit of said tube thereby causing the deionization of said tube and the release of said relays.

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