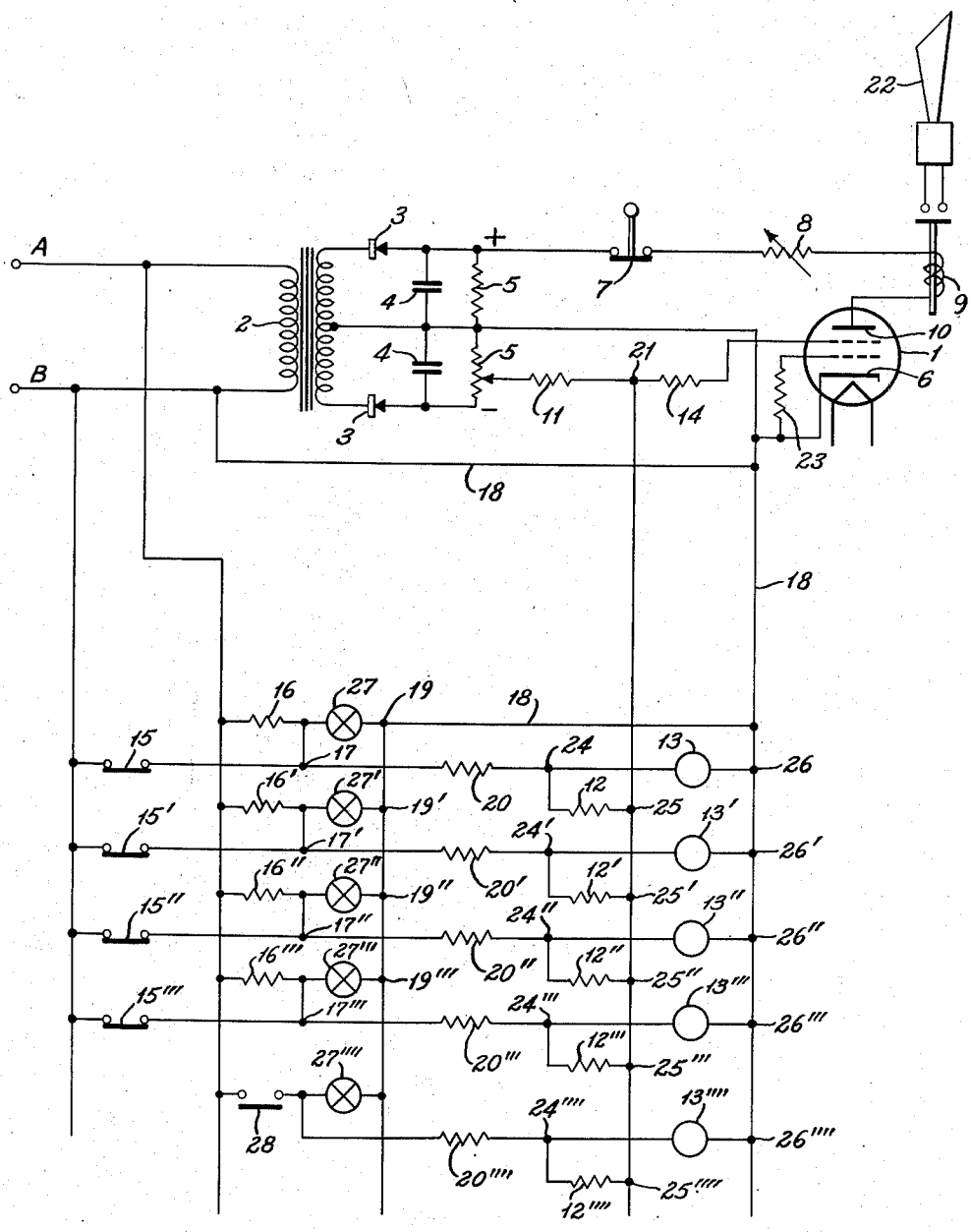
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ELECTRIC SIGNALING DEVICE

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ELECTRIC SIGNALING DEVICE

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The invention relates to an electric signalling system, provided with at least one signalling apparatus for attracting the attention of a machine operator or attendant, and at least one visual, location signalling apparatus. The attention signalling apparatus is connected in such a way that it can be disconnected independently from the one or more visual, location signalling apparatus, and is immediately ready for a new warning.

On such a signalling device, where a large number of warning signals may take place, the following requirements must be met:

1. Every warning must be indicated visually (for example by means of a signal lamp) independently of the other ones, and must remain visible as long as the warning lasts.

2. At every arbitrary warning, at least one attention signalling apparatus must be put in operation, for example a signal horn.

3. Immediately after observation and location of the warning by means of the signal lamp indicator, it must be possible to switch the attention signalling apparatus off.

4. Immediately after switching-off, the attention signalling apparatus must be ready to signal a new warning.

In order to be able to meet the above requirements, previously each signal transmitter required either two normal relays, each with four contacts, or one special relay, which had to be provided with so-called self-wiping contacts. A relay of the later type is either not reliable, or very expensive.

As is generally known, every relay, however well it may be constructed, is a weak point in the circuit which it is used because of the required opening- and closing-contacts, coils, etc., especially when the circuit must be set up in relatively inaccessible places. Moreover, a reliable relay is an expensive piece of equipment.

The invention has, as an object, the provision of an electric signalling device at reduced costs, and, what is often still more important, a more reliable and simpler device. This object is achieved by providing, in the operating circuit of the attention signalling apparatus, a discharge tube, the grid of which, in the normal operating condition, has such a negative potential that it is non-conductive. In case of a disturbance occurring in a circuit of one of the location signalling devices, the tube becomes conductive due to a control voltage applied to the grid thereof. Resistance with large negative temperature coefficient is provided in the signal circuit, the connecting terminal of which is connected with the cathode of the discharge tube. This device has the advantage of not containing extra moving parts or contacts. If desired, after having been mounted, the component parts, which have very small dimensions and a practically unlimited life, can be embedded in artificial resin, or sprayed with a thick layer of acid-resistant paint, so that they can be set up in the most unfavorable atmosphere.

The resistance with a large negative temperature coefficient (—3 to 4.5% per ° C. at 20° C.) are so-called semiconductors. With increasing temperature, the resistance decreases rapidly and considerably.

According to the invention the signalling system can be provided having a transformer with a secondary winding with a center tap, the terminals of which are, via rectifiers, connected with the terminals of a resistance, the center of which is connected with the center tap of the secondary winding, while the positive terminal of the resistance is, via a contact and a relay winding of the attention signalling apparatus, connected with the anode of a discharge tube.

The cathode of the discharge tube is connected with the center tap and the grid of which is, via a grid resistance, connected with a point of the resistance which is negative with respect to this center tap, and the cathode is connected with this center tap and a supply line.

A preferred embodiment of the signalling system according to the invention is characterized in that one of the terminals of each signalling device is connected with the side of the line which is connected with the cathode of the discharge tube, the other terminal being connected on the one hand via a resistance with the other side of the line, and via a signal lamp with the first side of the line, while moreover, a line goes from this other terminal to the cathode of the discharge tube via a resistance and a resistance with a large negative temperature coefficient, and the grid of this discharge tube is connected, via a resistance, with the connecting terminal of the resistance with a large negative temperature coefficient.

The invention will be further described below with reference to the drawing, in which, by way of example, an embodiment of the signalling system according to the invention is shown.

In the drawing, A and B indicate the conductors of an alternating current supply line, between which a voltage of, for example, 220 v. exists. These conductors are connected with the primary winding of a transformer **2**, the secondary winding of which has a center tap, the terminal voltages between the ends of this secondary winding and this center tap each amounting to, for example, 300 v. A rectifier **3** has been inserted in each of the conductors which are connected with the outer terminals of the secondary winding, smoothing condensers **4** being provided between these conductors and the center tap. Resistances **5**, each of, for example, 50 k. ohm, furnish a load for limiting the voltage in the normal operating position, when no current is consumed.

The center tap of the secondary winding of the transformer is connected with the cathode **6** of a thyratron **1**, and, via a conductor **18**, with one side of the supply line B. The end of the resistance **5** which is positive with respect to this center tapping is connected with the anode **10** of the thyratron **1** via a disconnecting button **7**, an adjustable resistance **8** and a relay coil **9** for controlling the operating circuit of an attention signalling apparatus **22**, for example, a signal horn.

Via a resistance **11** and a leakage resistance **14**, the grid of the thyratron **1** is connected with an adjustable tapping of the lower resistance **5**, which point is negative with respect to the center tapping of the transformer, so that the latter has an adjustable negative pre-voltage with regards to the cathode.

The signalling system is further provided with a number of signal circuits, each of which containing a signal actuator **15**, **15′**, **15″** . . . etc., for example, a contact of a pressure gauge, rheostat, thermometer, magnetic switch of a motor, which signal actuators are on one side connected with one side of the supply line, B. The other connecting terminal of each signal actuator is connected with a terminal of a resistance **16**, **16′**, **16″** . . . etc., as well as with a terminal **17**, **17′**, **17″** . . . etc. of a neon signal lamp **27**, **27′**, **27″** . . . etc. The other terminals of these resistances are connected with the other side of line, A. The second terminal **19**, **19′**, **19″** . . . etc. of each signal lamp is connected with the conductor **18**. The terminals **17**, **17′**, **17″** . . . etc. of the signal lamps **27**, **27′**, **27″** . . . etc. and of the resistances **16**, **16′**, **16″** . . . etc., are each, via a resistance **20**, **20′**, **20″** . . . etc., connected with a connecting terminal **24**, **24′**, **24″** . . . etc. of a resistance **12**, **12′**, **12″** . . . etc., as well as of a resistance **13**, **13′**, **13″** . . . etc. The terminals **25**, **25′**, **25″** . . . etc. of these resistances are connected with the connecting terminal **21** of the leakage resistance **14**, the other terminal **26**, **26′**, **26″** . . . etc. of the resistance **13**, **13′**, **13″** . . . etc. being connected with the circuit **18**. The resistances **13**, **13′**, **13″** . . . etc. are resistances with a large negative temperature coefficient.

As the screen grid of the thyratron is not used, this screen grid is via resistance **23** connected with the cathode **6**.

The device described above operates as follows:

In the normal operating condition of the signalling system, when no current passes through the thyratron 1, the circuits B, 15, 17, 16, A, B, 15', 17', 16', A, etc. are closed, so that in the points 17, 17', 17'' . . . etc. with which one terminal of each of the signal lamps 27, 27', 27'' . . . etc. is connected, the same voltage exists as in B. The side of the supply line B, which is also connected with the cathode of the thyratron, is, via the circuit 18, connected with the other terminal 19, 19', 19'' . . . etc. of each of the signal lamps, so that the points 17, 17', 17'' and the points 19, 19', 19'' have the same potential, so that the signal lamps cannot burn.

When a disturbance occurs, for example because the contact 15, 15', 15'' . . . etc. of one of the signal circuits is opened, this signal circuit is interrupted or gets grounded due to corrosion, the point 17 obtains approximately the same potential as the line A. Consequently, there is a sufficient voltage difference between the connecting terminals 17 and 19 of the signal lamp, so that the signal lamp of that circuit in which the signal was given or the fault occurred, is switched on, and keeps burning as long as the disturbance lasts.

Now the attention signalling apparatus must be put in operation, which takes place in the following way:

As indicated above, the point 17, 17' . . . etc. is, via the resistance 20 and the resistance 12, connected with the connecting terminal of the leakage resistance 14. The voltage of the point 21 is, together with the adjusted negative prevoltage (center tap of the resistance 5), impressed upon the grid of the thyratron. As the voltage of the point 17 is an alternating voltage, the voltage imparted to 21 by the signal circuit A will also be an alternating voltage, which, in the positive part of the cycle, decreases the adjusted negative grid voltage to such an extent that the thyratron breaks down. Consequently current passes from the cathode to the anode of the thyratron, in consequence of which the relay winding 9 is excited, and the relay closes the operating circuit of the attention signalling apparatus, which is then put in operation, so that a warning is given that the normal operating condition is disturbed.

In order to be able to put the attention signalling apparatus out of action again, so that it is immediately ready for the next warning from another signal circuit, it must be possible that after a very short time the negative grid voltage is automatically restored to practically its original magnitude, notwithstanding the fact that the signalled disturbance is still present. The warning of this disturbance must be continued as long as it is not eliminated.

This is effected in the following way:

Because of the fact that, during a disturbance, current passes from the line A, via the resistance 16, 20 and 13, to the line B, the resistance 13 with the negative temperature coefficient is heated. This current is exactly so large that the effect of the negative temperature coefficient is used to such an extent (about 75%) that this resistance, which in cold condition amounts to, for example, 250 k. ohm, after this current has passed through it for about ½ second still amounts to ±3000 Ω. This current is still so small that the life of the resistance 13 is hardly influenced by it. Because the resistance 13 suddenly becomes very small, the effect of the disturbance signal on the grid is reduced to such an extent that it has no influence any more. When button 7 is pressed, the circuit of relay 9 is interrupted and this relay is released. Consequently, the current through the thyratron is also interrupted. So the attention signalling apparatus is again ready for warning of a disturbance in another signal circuit, while the signal lamp in the signal circuit in which a disturbance is present keeps burning, until the disturbance is eliminated.

It is clear that the invention is not restricted to the above described embodiment of the signal circuit according to the invention, but that it can be modified in numerous ways without leaving the field of the invention. For example, more than one attention signalling apparatus can be provided in the relay circuit, and these apparatus can be present in various places. Instead of a thyratron, another tube with control grid can also be used and even a so-called cold cathode tube. It is also possible to construct each signalling device, independently of the other ones, as an opening- or closing-contact, on the understanding that if a closing contact is desired, the resistance 16 is omitted, and in its place the closing contact 28 is provided, the connection between line B and terminal 17, which is now effected by the signalling device with opening contact 15, being entirely omitted.

It is to be understood that certain changes, alterations, modifications and substitutions can be made without departing from the spirit and scope of the appended claims.

What is claimed is:

1. An electric signalling system comprising at least one attention signalling apparatus and at least one locating signalling apparatus, the attention signalling apparatus being connected in a circuit including means whereby it can be disconnected independently of said locating signalling apparatus, and is immediately ready for a new warning, said system having in the operating circuit of the attention signalling apparatus, a discharge tube, the grid of which, in the normal operating condition, has such a negative pre-voltage that it is non-conductive, and circuit means connected to said grid for applying a control voltage in case of a disturbance occurring in a circuit of one of the locating signalling apparatus, said tube thereby becoming conductive, due to said control voltage applied to the grid of the tube, and a resistance means having a large negative temperature coefficient provided in said signal circuit, the connecting terminal of which is connected with the cathode of the discharge tube.

2. Signalling device as claimed in claim 1, characterized in that it is provided with a transformer with a secondary winding with center tapping, the terminals of which are, via rectifiers, connected with the terminals of a resistance, the center of which is connected with the center tapping of the secondary winding, while the positive terminal of the resistance is, via a contact and a relay winding of the attention signalling apparatus, connected with the anode of a discharge tube, the cathode of which is connected with the center tapping and the grid of which is, via the grid resistance, connected with a point of this resistance which is negative with respect to this center tapping and the cathode is connected with this center tapping and the supply line.

3. A signalling device as claimed in claim 2, characterized in that one of the terminals of each signaller is connected with the side of the line which is connected with the cathode of the discharge tube, the other terminal being connected, via a resistance, with the other side of the line and via a signal lamp with the first mentioned side of the line, while, a line connects the second mentioned terminal to the cathode of the discharge tube via a resistance and said resistance with a large negative temperature coefficient, and the grid of this discharge tube is connected, via a resistance, with the connecting terminal of said resistance with a large negative temperature coefficient.

4. A signalling device as claimed in claim 1, characterized in that one of the terminals of each signaller is connected with the side of the line which is connected with the cathode of the discharge tube, the other terminal being connected via a resistance with the other side of the line and via a signal lamp with the first mentioned side of the line, while, a line connects the second mentioned terminal to the cathode of the discharge tube via a resistance and said resistance with said large negative temperature coefficient, and the grid of this discharge tube is connected, via a resistance, with the connecting terminal of said resistance with a large negative temperature coefficient.

5. An electric signalling system including an attention signalling apparatus and a plurality of locating signalling apparatus, said attention signalling apparatus so connected as to be actuated by the operation of said location signalling apparatus, said system including current flow-control means whereby said attention signalling apparatus responds to the actuation of each locating signalling apparatus as each is energized; said system comprising an attention signalling circuit including an attention signalling device and a triode connected to a source of power, the grid of said triode having impressed thereon a negative potential such as to preclude the flow of current in said attention signalling cricuit, said system further comprising a plurality of similar, parallel-connected locating signalling circuits including a location signalling device having one terminal thereof connected to one line of a power source and to the cathode of said triode, switch means connected to the other terminal of said location signalling device so connected to said terminal and the other line of said power source so that under

normal conditions both terminals of said location signalling device will be at the same potential, the second-mentioned terminal of said location signalling device being connected to the circuit of the grid of said triode whereby an alternating current is impressed on said grid when said switch means is actuated and said location signalling device is energized, which will cause current to flow in the attention signalling circuit during the positive part of the cycle, and a negative temperature coefficient resistance connected between said grid signal circuit and said cathode which, at a predetermined time after the actuation of said attention signalling circuit, becomes conductive so as to render ineffective said grid signal to pass current through said triode to operate said attention signalling circuit, said location signalling device being energized so long as said switch means is actuated to connect said location signalling device to said power source.

6. Signalling device as claimed in claim 5, characterized in that it is provided with a transformer with a secondary winding with center tapping, the terminals of which are, via rectifiers, connected with the terminals of a resistance, the center of which is connected with the center tapping of the secondary winding, while the positive terminal of the resistance is, via a contact and a relay winding of the attention signalling apparatus, connected with the anode of a discharge tube, the cathode of which is connected with the center tapping and the grid of which is, via the grid resistance, connected with a point of this resistance which is negative with respect to this center tapping and the cathode is connected with this center tapping and the supply line.

7. A signalling device as claimed in claim 6, characterized in that one of the terminals of each signaller is connected with the side of the line which is connected with the cathode of the discharge tube, the other terminal being connected on the one hand via a resistance with the other side of the line and via a signal lamp with the first mentioned side of the line, while, a line connects the second mentioned terminal to the cathode of the discharge tube via a resistance and said resistance with a large negative temperature coefficient, and the grid of this discharge tube is connected, via a resistance, with the connecting terminal of the resistance with said large negative temperature coefficient.

8. An electric signalling system including an attention signalling apparatus and a plurality of locating signalling apparatus, said attention signalling apparatus so connected as to be actuated by the operation of said locating signalling apparatus, said system including current flow control means whereby said attention signalling apparatus responds to the actuation of each locating signalling apparatus as each is energized, said system comprising an attention signalling circuit including an attention signalling device, and a triode connected to a source of power, the grid of said triode having impressed thereon a negative potential such as to preclude the flow of current in said attention signalling circuit, said system further comprising a plurality of similar, parallel-connected locating signalling circuits including a location signalling device having one terminal thereof connected to one line of a power source and to the cathode of said triode, the second terminal thereof being connected by means of a normally closed switch to the same line of the source of power, thus maintaining the same potential at said location signalling device, said second terminal also being connected to the other line of said power source through a current limiting resistor and further connected to the grid of said triode, whereby upon opening of said normally closed switch, an alternating current signal will be impressed on said grid causing current to flow in said attention signalling circuit during the positive part of the cycle, and a negative temperature coefficient resistance connected between said grid signal circuit and said cathode which, after a predetermined period of time become of such value of resistance as to render said grid signal ineffective to pass current through said triode to operate said attention signalling circuit, said location signalling device being energized so long as said normally closed switch remains open.

9. Signalling device as claimed in claim 8, characterized in that it is provided with a transformer with a secondary winding with center tapping, the terminals of which are, via rectifiers, connected with the terminals of a resistance, the center of which is connected with the center tapping of the secondary winding, while the positive terminal of the resistance is, via a contact and a relay winding of the attention signalling apparatus, connected with the anode of a discharge tube, the cathode of which is connected with the center tapping and the grid of which is, via the grid resistance, connected with a point of this resistance which is negative with respect to this center tapping and the cathode is connected with this center tapping and the supply line.

10. A signalling device as claimed in claim 9, characterized in that one of the terminals of each signaller is connected with the side of the line which is connected with the cathode of the discharge tube, the other terminal being connected on the one hand via a resistance with the other side of the line and via a signal lamp with the first mentioned side of the line, while, a line connects the second mentioned terminal to the cathode of the discharge tube via a resistance and said resistance with a large negative temperature coefficient, and the grid of this discharge tube is connected, via a resistance, with the connecting terminal of the resistance with said large negative temperature coefficient.

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