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FAULT INDICATING MEANS FOR SIGNAL SYSTEMS

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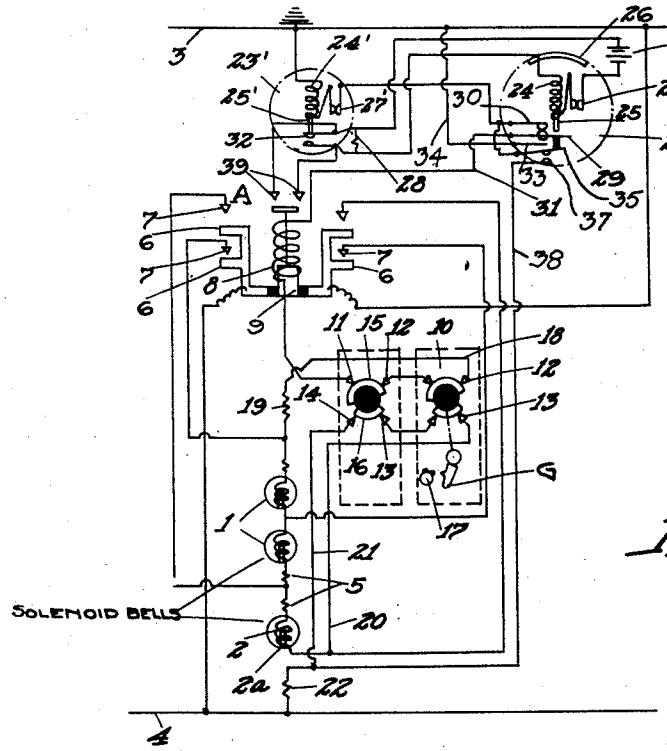


Fig. 1.

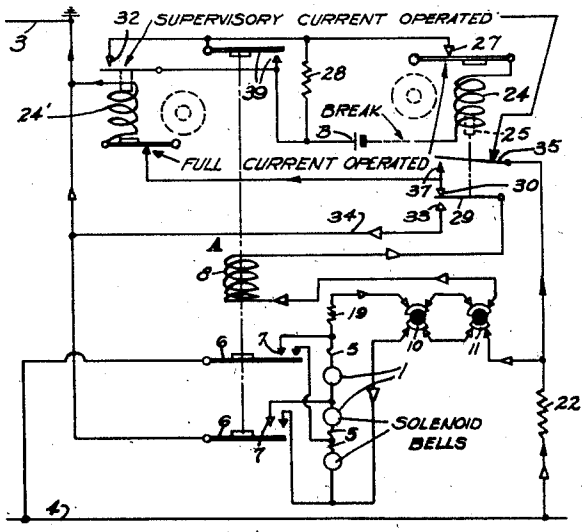


Fig. 2.

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FAULT-INDICATING MEANS FOR SIGNAL SYSTEMS

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Application February 28, 1940, Serial No. 321,323, which is a division of application Serial No. 86,512, filed June 22, 1936, now Patent No. 2,238,144, dated April 15, 1941. Divided and this application April 7, 1941, Serial No. 387,126

4 Claims. (Cl. 177—311)

This application is a division of my copending application, Serial No. 321,323, filed February 28, 1940, which copending application is a division of my original application, Serial No. 86,512, filed June 22, 1936, for an Alarm signal system, since issued as Patent No. 2,238,144, dated April 15, 1941, and relates particularly to improved means for indicating the occurrence of a fault, power failure, or any abnormal circuit condition, which might occur in a system of the character contemplated by the aforesaid original application, or in any other supervised electrical system.

In Wheelock Patent No. 2,170,104, issued August 22, 1939, there is shown and described an arrangement whereby fault-indicating means for supervising an electrical circuit is also supervised, with provision being made for concurrent supervision of the additional fault-indicating means. As a result, any fault occurring in either the supervised circuit, or in the inter-connected circuits of the dual fault-indicating means, is immediately called to attention.

The invention of the present application relates to an improved arrangement of the fault-indicating means and inter-connected circuits disclosed in my aforesaid Patent No. 2,170,104, whereby there is obtained additional supervision of certain parts of the electrical signal system with which the trouble indicating means is associated. Briefly stated, the invention resides in placing one fault-indicating signal directly in the supervisory circuit of the system under supervision, where it will of itself control actuation of a second fault-indicating signal. Furthermore, provision is made for temporarily removing the first signal from the main supervisory circuit, in order to cause it to indicate a fault in the other signal independently of the system, and therefore without giving a false alarm.

The above and other advantageous features of the invention will hereinafter more fully appear, with reference to the accompanying drawing, in which:

Fig. 1 is a wiring diagram, illustrating a system to which there has been applied cross-supervision of the inter-connected fault-indicating signals, in accordance with the present invention.

Fig. 2 is a schematic diagram based on Fig. 1, illustrating functioning of one fault-indicating signal, upon the occurrence of a fault in the circuit of the other signal.

Like reference characters refer to like parts in the different figures.

The invention is shown in Fig. 1, for purposes of illustration, as being embodied in an alarm signal system, in which signals 1 are adapted to be sounded, or otherwise electrically operated, for giving an alarm. The signals 1 are shown as being of the single-stroke solenoid type with each providing an operating winding 2 within which moves a magnetic striker 2a. The windings 2 of the signals 1 are adapted to be connected in sections across the supply mains 3 and 4, with balancing resistors 5 between the sections, by means of a number of sets of relatively movable contacts 6 and 7 forming part of a master controller, generally designated by the reference character A. The controller A comprises a winding 8 and a magnetic armature 9 carrying the contacts 6, with the contacts 6 and 7 being normally out of engagement, as shown.

The winding 8 of the master controller A is shown as having one terminal thereof connected to the supply main 3 through a trouble signal circuit, hereinafter described, while the other terminal thereof is connected in series with a number of alarm sending stations 10, disposed in various locations throughout the system. Each sending station provides a suitable contacting mechanism, here shown as comprising independent pairs of spaced stationary contacts 11, 12 and 13, 14, and in the normal, non-operating condition of the station, a circuit is maintained between contacts 11 and 12 by a bridging member 15, while a second bridging member 16 maintains a circuit between contacts 13 and 14. The bridging members 15 and 16 are insulated from each other and in the operation of a station 10, are turnable in unison, so as to establish a circuit between the station contacts 11 and 14, all as fully described in my aforesaid Patent No. 2,238,144.

In the normal non-operating condition of the system shown in Fig. 1, all of the contacts 11 and 12 of the several stations are connected in series with the controller winding 8 through the bridging members 15, and the contact 12 of the station farthest removed from the winding 8 in the circuit, is connected by a station conductor 18 to a controlling resistor 19. The resistor 19 is in turn connected in series with the signal windings 2 and balancing resistors 5, and the last signal winding 2 is connected to the farthest station contact 13 through a station conductor 20. The circuit extends through the bridged contacts 13 and 14 of the several stations, and a conductor 21 connects the nearest station contact 14 to the main 4 through a current-limiting resistor 22. Normally, a small supervisory current traverses the parts of the system described thus far, as follows:

Beginning at the supply main 4, the supervisory current flows through the resistor 22, bridged station contacts 14 and 13, and through the station conductor 20 to the windings 2 and resistors 5 of the several sections of signals. The current then passes through the controlling resistor 19 and station conductor 18 to the other series of bridged station contacts 12 and 11, and from thence through the winding 8 of the master controller A and the trouble signal circuit to the grounded supply main 3. The value of this supervisory current is not sufficient to energize the winding 8, so that while the armature 9 remains down, the system remains in supervised condition; in readiness either for the operation of the alarm signals, upon actuation of a sending station and bridging of contacts 11 and 14, or indication of a fault or any abnormal circuit condition by a trouble signal, without operation of the alarm signals, as will next be described.

The fault-indicating means of the present application contemplates a trouble signal 23 having a solenoid 24, within which operates a magnetic plunger 25, adapted to strike a resonant member 26 in response to full energization of the solenoid 24. One terminal of the solenoid 24 is connected to one side of a power source, such as a battery B, through normally closed interrupter contacts 27, operable when the plunger 25 moves to its striking position. The other terminal of the solenoid 24 is connected through a resistor 28 to the other side of sources B, with resistor 28 limiting the current flow through the solenoid 24 to such a value as to maintain the plunger 25 slightly raised from its lowermost position, just out of engagement with a flexible contact 29.

An auxiliary trouble signal 23' constructed in the same manner as the signal 23, has one terminal of its solenoid 24' connected to the grounded supply main 3, while its other terminal is connected through closed interrupter contacts 27' to a stationary contact 30, normally engaged with contact 29 of the primary trouble signal 23. The contact 29 is connected by a conductor 31 to the controller winding 8, so that the solenoid 24' is normally included in the main supervisory circuit of the system, including the stations 10 and signals 1, all as previously described.

With supervisory current flowing through the solenoid 24' in series with other parts of the system, its plunger 25' is maintained slightly raised from its lowermost position, just out of engagement with a pair of normally open contacts 32 connected across the terminals of the resistor 28 that is in circuit with the solenoid 24 of the primary trouble signal 23. Therefore, upon the occurrence of a break or ground in the system, or in the solenoid circuit of the signal 23', the resulting interruption of supervisory current through the solenoid 24', causes the plunger 25' to drop to its lowermost position, and thereby close the contacts 32. This causes the resistor 28 to be short circuited, and fully energizes the solenoid 24, whereupon the plunger 25 strikes the resonant member 26 recurring strokes as long as the contacts 32 remain closed, due to the operation of the interrupter contacts 27. The primary trouble signal 23 will continue to indicate the existence of an abnormal circuit condition in the system, until the cause of the trouble is remedied and the flow of supervisory current reestablished through solenoid 24', whereupon the plunger 25' will be partially raised from its lowermost position, to permit opening of contacts 32.

Referring now to Fig. 2, there is shown a schematic revision of the circuit connections between the various pieces of electrical apparatus illustrated in Fig. 1. That is to say, the showings of the controller A, stations 10, and the trouble signals 23 and 23' have been simplified so as to give an across-the-line diagram, with the contacts operated by full current and supervisory current indicated by the proper legends.

If at any time there should occur a break or ground, where a grounded source is used, in the circuit of the primary trouble signal 23, or should the source B fail, the resulting deenergization of solenoid 24 will permit the plunger 25 to fall to its lowermost position, as shown in Fig. 2. When this occurs, contact 29 is moved out of engagement with contact 30, and into engagement with a stationary contact 33. Thus, the conductor 31 leading from the controller winding 8, is connected directly to the grounded main 3, through contact 33 and a conductor 34, thereby maintaining the flow of supervisory current through the system independently of the solenoid 24' of the auxiliary trouble signal 23, as indicated by the open arrowheads in Fig. 2 and holding the station and signal circuits in operative condition to send an alarm. Movement of the contact 29 to engage contact 33, is accompanied by movement of a contact 35, mechanically connected to contact 29 by an insulating block 36. The contact 35 is connected to contact 30, and its movement by the plunger 25 carries it into engagement with a stationary contact 37 connected to the supply main 4 through a conductor 38 and the resistor 22. Closure of the contacts 35 and 37 therefore connects the solenoid 24' directly across the supply mains 3 and 4, and the resulting current flow shown by solid arrowheads, causes operation of the auxiliary trouble signal 23'. This indicates either trouble in the circuit of the primary trouble signal 23, or failure of the source B, so that at all times, both trouble signals 22 and 23' are under constant supervision.

Should the armature 9 of the controller A be held up, due to the winding 8 remaining fully energized, a pair of normally open contacts 39, in parallel with contacts 32, will be closed by the armature 9. This will have the effect of shortcircuiting the resistor 28 to operate the primary trouble signal 23 until the fault has been remedied and the armature 9 returned to its normal down position, with contacts 39 open.

From the foregoing, it is apparent that by the present invention there is provided an improved arrangement of a fault-indicating means for signal systems, whereby a continuous supervision is obtained for the system, and the fault-indicating signals, as well as the connections therebetween. As a result, any fault occurring in either the supervised system, or in the interconnected circuits of the dual indicating means, is immediately called to attention.

I claim:

1. In combination, an electrical circuit, including current responsive devices and a first fault-indicating signal, means for maintaining a flow of supervisory current through said circuit and signal, with the value of said supervisory current insufficient to cause operation of said devices or signal, a second fault-indicating signal, means for maintaining a flow of supervisory current through said second signal insufficient to cause operation thereof, and means including cross connections between said circuit and said signals, whereby any interruption of supervisory current

through the first signal or circuit serves to operate the second signal, and any interruption of supervisory current through said second signal serves to operate the first signal.

2. In combination, an electric circuit including current responsive devices and a first fault-indicating signal, means for maintaining a flow of supervisory current through said circuit and signal, with the value of said supervisory current insufficient to cause operation of said devices or signal, a second fault-indicating signal, means for maintaining a flow of supervisory current through said second signal insufficient to cause operation thereof, means including cross connections between said circuit and signals, whereby any interruption of supervisory current through the first signal or said circuit serves to operate the second signal, and means provided in said cross connections, actuated in response to interruption of supervisory current through said second signal, for operating the first signal independently of said circuit.

3. In combination, an electric circuit including current responsive devices and a first fault-indicating signal, means for maintaining a flow of supervisory current through said circuit and signal, with the value of said supervisory current insufficient to cause operation of said devices or signal, a second fault-indicating signal, means for maintaining a flow of supervisory current through said second signal insufficient to cause operation thereof, means including cross connections between said circuit and signals, whereby any interruption of supervisory current through the first signal or said circuit serves to operate the second signal, and means provided in said cross connections, actuated in response to interruption of supervisory current through said second signal, for removing the first signal from said circuit, in advance of operating the same, and for maintaining the flow of supervisory current through said circuit.

4. In combination, an electric circuit including current responsive devices and a first fault-indicating signal, means for maintaining a flow of supervisory current through said circuit and signal, with the value of said supervisory current insufficient to cause operation of said devices or signal, a second fault-indicating signal, means for maintaining a flow of supervisory current through said second signal insufficient to cause operation thereof, means including cross connections between said circuit and signals, whereby any interruption of supervisory current through the first signal or said circuit serves to operate the second signal, and means provided in said cross connections, actuated in response to interruption of supervisory current through said second signal, for removing the first signal from said circuit while maintaining the flow of supervisory current through said circuit, followed by operation of the first signal independently of said circuit.

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