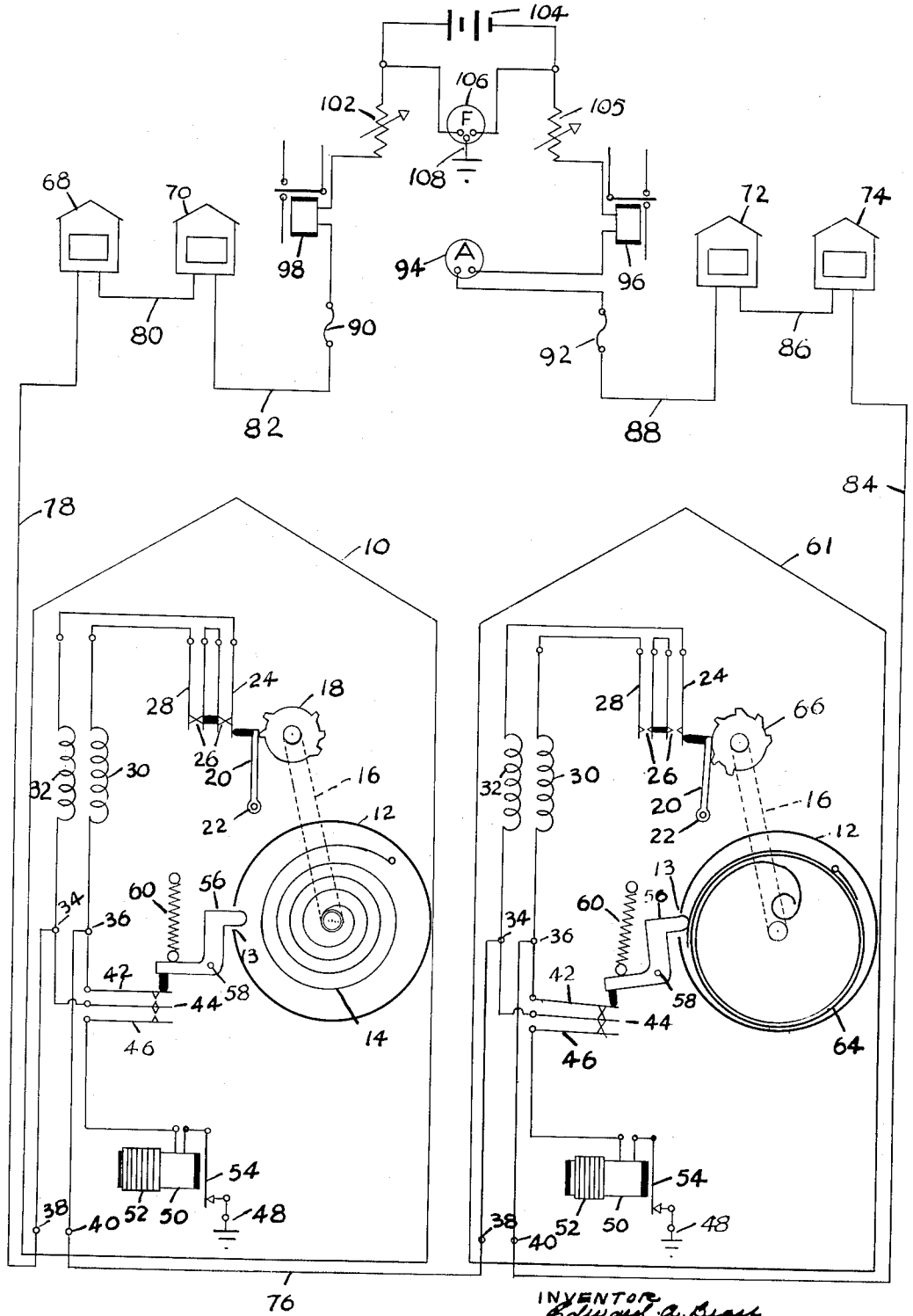
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SPRING CONDITION SIGNAL FOR A SPRING DRIVEN SIGNALING BOX

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SPRING CONDITION SIGNAL FOR A SPRING DRIVEN SIGNALING BOX

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This invention relates to improvements in signalling equipment. More particularly this invention relates to improvements in signaling equipment that can be used in alarm circuits.

It is therefore an object of the present invention to provide improved signaling equipment that can be used in alarm circuits.

In many alarm circuits, and particularly in many fire alarm circuits, a number of signal "boxes" are connected in series with each other and with indicating equipment which is located in a central station. Such alarm circuits are frequently known as full metallic alarm circuits. In such alarm circuits the signal "boxes" can be "set off" to interrupt the circuits and thus transmit signals to the indicating equipment in the central stations. The "boxes" customarily have spring-driven cams which actuate switches to interrupt and re-establish the circuits, thus generating the required signals.

The signal "boxes" of such circuits are frequently provided with normally-open switches that can connect the cam-operated contacts with ground through low resistance paths; those switches closing whenever the mainsprings of the "boxes" run down or break, and also closing when the non-interfering magnets of the "boxes" become de-energized. One such "box" is shown and described in United States Reissue Patent No. 22,514 of Frank R. Bridges. The grounding that occurs when the mainspring of such a "box" is running down has been regarded as being desirable because it enables the "box" to signal even though another "box" has "seized the line"; and the grounding that occurs when the mainspring of such a "box" breaks has been regarded as being desirable because it indicates that some part of the circuit needs attention. However, the grounding in either of these instances, can coact with a "tree ground," a ground in a wet cable, a grounding in another "box" due to the mainspring running down or breaking, or a grounding in another "box" due to the de-energization of the non-interfering magnets to render that intervening portion of the circuit "dead"; thus preventing signalling by the alarm "boxes" in the intervening portion of the circuit. Moreover while the grounding that occurs when the mainspring breaks does indicate that some part of the circuit needs attention, it does not identify that part. As a result, time-consuming tests must be used to determine (*a*) whether the grounding is in the line itself or is in a "box" and (*b*) the location of the "box" if the grounding is in a "box." This, of course, is objectionable. The present invention obviates these objections by providing an alarm "box" which can send a distinctive signal to the control station through the ground whenever the mainspring of that "box" breaks or runs down, but which does not apply a continuous low-resistance ground to the circuit. When that alarm "box" signals through the ground, the operator at the central station can determine immediately whether the ground is in the line itself or is in a "box," and can also determine immediately the location of the "box" if the ground is in a "box." It is therefore an object of the present invention to provide an alarm "box" which can send a distinctive signal through the ground whenever the mainspring breaks or runs down, but which does not apply a continuous low resistance ground to the circuit.

The alarm box provided by the present invention has an actuator that closes a shunt across the signaling circuit and that connects a vibrator, of predetermined frequency, to ground whenever the mainspring breaks or runs down. The shunt completes the full metallic circuit for the other alarm "boxes" of the circuit; and the vibrator sends a signal, through the ground to a frequency indicating device at the central station, which distinctively identifies that alarm "box." Moreover, the combined resistance of the vibrator and the frequency indicating device is high enough that the signal emitted by the vibrator will not actuate the indicating device, at the central station, which responds to signals transmitted to ground through low resistance paths at "boxes" wherein the non-interfering magnets have become de-energized. It is therefore an object of the present invention to provide a signalling "box" with an actuator that shunts the signalling circuit and connects a vibrator to ground when the mainspring relaxes.

The signalling circuit provided by the present invention has a central station with a frequency responsive meter and with a number of signalling "boxes" that each emit a distinctively different signal when the mainspring relaxes, either by running down or by breaking. The distinctively different signals will be indicated at the central station on the frequency responsive meter and will enable prompt replacement or prompt winding of the mainspring which has either broken or run down. With such a circuit, the operators will know immediately when a mainspring is broken or has run down and will know exactly which mainspring has experienced such relaxation. This arrangement facilitates full and immediate maintenance of all parts of the signalling circuit. It is therefore an object of the present invention to provide a signalling circuit which has a central station equipped with a frequency responsive meter and which has a number of signalling "boxes" with vibrators that emit distinctively different frequencies when the mainsprings of those "boxes" relax. Other and further objects and advantages of the present invention should become apparent from an examination of the drawing and accompanying description.

In the drawing and accompanying description a preferred embodiment of the present invention is shown and described but it is to be understood that the drawing and accompanying description are for the purpose of illustration only and do not limit the invention and that the invention will be defined by the appended claims.

The drawing is a schematic diagram of a signalling circuit which has a central station and a number of signalling "boxes." The details of two of those boxes are indicated in the drawing.

In the drawing the numeral **10** generally denotes a signalling box. This box has a housing **12** for a mainspring **14**. The housing **12** has an opening **13** in the wall thereof. The mainspring **14** is connected to and drives a rotating shaft **16**. A signalling cam **18** is mounted on the shaft and is rotated by that shaft. A cam follower **20** is mounted on a pivot **22** adjacent the signalling cam **18**. The cam follower will rotate about the pivot **22** in response to the lobes on the signalling cam **18**.

A leaf contact **24** is disposed adjacent to cam follower **20** and biases the cam follower **20** toward the signalling cam **18**. A pair of follower contacts **26** are adjacent the leaf contact **24** and are biased for movement to the right. A leaf contact **28** is adjacent the follower contacts **26** and is engageable by one of those follower contacts. In the position of rest of the component parts of the box **10**, as shown in the drawing, the cam follower **20** is held in engagement with the leaf contact **24** and the leaf contact **24** holds the follower contacts **26** in engagement with itself and with the leaf contact **28**. The cam follower **20**

is held in engagement with the leaf contact 24 by one of the lobes on the signalling cam 18. When the cam 18 rotates, the cam follower 20 will be able to move in a clockwise direction to free the leaf contact 24 for movement away from the follower contacts 26 and to free the follower contacts 26 for movement away from the leaf contact 28. However, each succeeding lobe of the cam 18 will return the contacts to the closed circuit position shown in the drawing.

The box 10 has non-interfering coils 30 and 32. The coil 30 is connected to the leaf contact 28 and the coil 32 is connected to the leaf contact 24. The mainspring housing 12, the mainspring 14, the shaft 16, the signalling cam 18, the cam follower 20, the pivot 22, the leaf contacts 24 and 28, the follower contacts 26, and the non-interfering coils 30 and 32 are constructed in a manner and form typical of the corresponding component parts of non-interfering signalling boxes. The construction and form of these component parts is not the essence of the present invention and therefore the details of the construction and form of these component parts is not given.

A junction 34 is provided between the non-interfering coil 32 and the box terminal 38 which is connected to one side of a full metallic signalling circuit. A junction 36 is disposed between the non-interfering coil 30 and the terminal 40 of the box which is connected to the other side of the full metallic signalling circuit. A leaf contact 42 is connected to the junction 36, and the leaf contact 44 is connected to the junction 34. The leaf contacts 42 and 44 are adjacent each other and can be made to engage each other. A leaf contact 46 is adjacent the leaf contact 44 and can be made to engage that leaf contact. Extending between the leaf contact 46 and the ground connection 48 is a vibrator 50 which has shading rings 52 and which has an armature 54. Shading rings 52 will preferably be of a non-magnetic material such as copper or aluminum and those shading rings will determine the rate at which the armature 54 of the vibrator 50 will open and close the circuit between the contact 46 and the ground connection 48. Whenever the vibrator 50 is energized, it will pull the armature 54 toward itself and thus interrupt the circuit; whereupon the armature 54 will move into circuit closing position under the action of a spring. As long as the circuit is closed, the vibrator 50 will continue to cause its armature 54 to make and break the circuit at a predetermined and distinctive rate or frequency.

An actuator 56 is mounted on a pivot 58 adjacent the housing 12 for the mainspring 14, and a lobe on the end of the actuator 56 extends through the opening 13 in the mainspring housing 12. An extension spring 60 engages the actuator 56 and biases that actuator for rotation in a clock-wise direction around the pivot 58. In its normal position, as shown in the drawing, the actuator 56 permits the leaf contacts 42, 44 and 46 to be spaced apart. However, that actuator will respond to a relaxation of the mainspring 14, either due to the running down of the spring or to a breaking of the spring, to rotate in a counter-clock-wise direction to force the leaf contacts 42, 44 and 46 into engagement with each other.

The terminal 38 of the signalling box 10 is connected by the conductor 78 to a signalling box 68, which in turn is connected by a conductor 80 to a signalling box 70. The signalling box 70 is connected by a conductor 82 to the central station which has a fuse 90, a line relay 98 which operates a signalling device of usual form and operation, and which contains a rheostat 102. The central station also contains a battery 104, a rheostat 105, line relay 96, frequency responsive meter 106, ground connection 108, ammeter 94, and fuse 92. The fuses 90 and 92, the line relays 96 and 98, the rheostats 102 and 105, the battery 104, and the ammeter 94 of the central station are of usual construction and form. The frequency responsive meter 106 is of standard construction and form and can be either an electronic meter or a vibrating reed meter; but its use in a signalling circuit is unique. The central station is connected to a signalling box 72 by the conductor 88, the signalling box 72 is connected to a signalling box 74 by the conductor 86, and the signalling box 74 is connected to the signalling box 61 by the conductor 84. A conductor 76 connects the terminal 40 of the signalling box 10 with the terminal 38 of the signalling box 61. The circuit may have, and will usually have, a considerably larger number of signalling boxes than shown in the drawing; the number of signalling boxes indicated on the drawing being limited for clarity of illustration. Each of the signalling boxes will have a mainspring housing, a mainspring, a shaft, a signalling cam, a cam follower and pivot therefor, leaf contacts and follower contacts controlled by the cam follower, non-interfering coils, an actuator controlled by the mainspring, leaf contacts controlled by the actuator, and a vibrator connected between ground and one of the contacts controlled by the actuator. The only differences between the various signalling boxes of the circuit will be found in the signalling cams and in the characteristic frequency of the vibrators. The signalling cams of the various boxes will have different numbers and combinations of lobes, and the vibrators of the various boxes will have different numbers of shading rings 52.

The signalling box 61 is illustrative of a signalling box wherein the mainspring 64 has broken in the course of a signalling cycle. The cam follower 20 bears against the periphery of the signalling cam 66 rather than against one of the lobes on that cam and thus the leaf contact 24 is out of engagement with the follower contacts 26 and the follower contacts 26 are out of engagement with the leaf contact 28. This means that the series connected signalling circuit is broken and would thus be interrupted and "dead." However, the relaxed spring 64 has rotated the actuator 56 in a counterclock-wise direction about the pivot 58 and against the force of spring 60 to press the leaf contacts 42 and 44 in engagement with each other. These leaf contacts close a normally inactive shunt circuit across the terminals 38 and 40 of the signalling box 61; thus closing the full metallic circuit and rendering it operative. The actuator 56 also presses the leaf contact 44 into engagement with the leaf contact 46, thus placing leaf contact 46 in engagement with both sides of the full metallic circuit. As a result, a circuit is completed from the battery 104 through both sides of the full metallic circuit to the contacts 46 and thence to ground through the vibrator 50 and its armature 54. The circuit returns to the battery 104 through the ground connection 108 at the central station and through either side of the frequency responsive meter 106. The completion of the circuit through the vibrator 50 will cause that vibrator to emit a characteristic frequency which will be registered on the frequency responsive meter 106 at the central station. In this way, the operator at the central station will be given immediate knowledge of the relaxation of a mainspring in a signalling box and will also be given immediate information as to the identity of that box. This facilitates prompt replacing or winding of the relaxed mainspring.

The vibrator 50 will continue to emit its distinctive signal and that signal will continue to be indicated by frequency responsive meter 106. That signal will not interfere with the sending by any other box, through the ground of cam-controlled signals when the non-interfering magnets of those boxes become de-energized because the combined resistance of the vibrator 50 and the frequency responsive meter 106 is so high that the vibrator-emitted signal will not be strong enough to energize relay 96 or relay 98.

By having the leaf contact 46 engageable with the leaf contacts 42 and 44, the present invention assures the emission of the characteristic signal from the vibrator even if one half of the full metallic circuit is broken or grounded. In this way, full and complete safety is assured to the users of the signalling circuit provided by the present invention.

Whereas the drawing and accompanying description have shown and described a preferred embodiment of the present invention, it should be apparent to those skilled in the art that various changes may be made in the form of the present invention without affecting the scope thereof.

What I claim is:

1. In a spring-driven signalling box for use in full metallic signal circuits, a terminal connectible to one side of said metallic circuit, a second terminal connectible to the other side of said metallic circuit, a normally inactive circuit connected to said terminals, a normally open switch in said normally inactive circuit, a ground connection, a second normally open circuit extending between said ground connection and said metallic circuit, a signal-emitter and a second normally open switch in said second normally open circuit, said signal-emitter responding to closure of said second normally open circuit to generate a continuous signal of a frequency that is distinguishable from and will not interfere with the normal signals from said box or other boxes, said second normally open switch responding to closure of said second normally open circuit to apply said continuous signal to said metallic circuit, and an actuator that is adjacent the spring of said box and is movable by relaxation of said spring to close the first said and said second switches to connect the said one and the said other sides of said metallic circuit and to connect said metallic circuit to ground through said signal-emitter.

2. In a spring-driven signalling box for use in full metallic signal circuits, a terminal connectible to one side of said metallic circuit, a second terminal connectible to the other side of said metallic circuit, a normally inactive circuit connected to said terminals, a normally open switch in said normally inactive circuit, a ground connection, a second normally open circuit extending between said ground connection and the first said normally open circuit, a signal-emitter and a second normally open switch in said second normally open circuit, said signal-emitter responding to closure of said second normally open circuit to generate a continuous signal of a frequency that is distinguishable from and will not interfere with the normal signals from said box or other boxes, said second normally open switch responding to closure of said second normally open circuit to apply said continuous signal to said metallic circuit, and an actuator that is adjacent the spring of said box and is movable by relaxation of said spring to close the first said and said second switches to connect the said one and the said other sides of said metallic circuit and to connect both sides of said metallic circuit to ground through the first said normally open circuit and through said signal-emitter.

3. In a spring-driven signalling box of the non-interfering type for use in full metallic signal circuits, a terminal connectible to one side of said metallic circuit, a second terminal connectible to the other side of said metallic circuit, a normally inactive circuit connected intermediate said terminals and the non-interfering coils of said box, a normally open switch in said normally inactive circuit, a ground connection, a second normally open circuit extending between said ground connection and said metallic circuit, a signal-emitter and a second normally open switch in said second normally open circuit, said signal-emitter responding to closures of said second normally open circuit to generate a continuous signal of a frequency that is distinguishable from and will not interfere with the normal signals from said box or other boxes, said second normally open switch responding to closure of said second normally open circuit to apply said continuous signal to said metallic circuit, and an actuator that is adjacent the spring of said box and is movable by relaxation of said spring to close the first said and said second switches to connect the said one and the said other sides of said metallic circuit and to connect said metallic circuit to ground through said signal-emitter.

4. In a spring-driven signalling box for use in signal circuits, a terminal connectible to a signal circuit, a ground connection, a normally inactive circuit between said terminal and said ground connection, a signal-emitter and a normally open switch in said normally open circuit, said signal-emitter responding to closure of said normally open circuit to generate a continuous signal of a frequency that is distinguishable from and will not interfere with the normal signals from said box or other boxes, said normally open switch responding to closure of said normally open circuit to apply said continuous signal to said terminal, and an actuator that is adjacent the spring of said box and is movable by relaxation of said spring to close said spring and connect said signal circuit to ground through said signal-emitter.

5. In a full metallic signal circuit which has a plurality of spring driven alarm boxes, a metallic conductor extending between and connecting said alarm boxes, and a frequency response meter, the improvement which comprises a connection between said meter and one side of said circuit, a connection between said meter and the other side of said circuit, a connection between said meter and ground, a frequency transmitter in each of said alarm boxes that transmits a signal of different frequency than the signal transmitted by the frequency transmitter of every other said alarm box, and of a different frequency than the normal signals of each said box and said other boxes, a connection between said frequency transmitter and ground, a normally open connection between said frequency transmitter and said one side of said circuit, a normally open connection between said frequency transmitter and said other side of said circuit, and an actuator that closes said normally open connections when the spring of said alarm box relaxes.

6. In a full metallic signal circuit which has a plurality of alarm boxes, a metallic conductor extending between and connecting said alarm boxes, and a frequency response meter, the improvement which comprises a connection between said meter and said circuit, a connection between said meter and ground, a frequency transmitter in each of said alarm boxes that transmits a signal of a different frequency than the signal transmitted by the frequency transmitter of every other said alarm box, and of a different frequency than the normal signals of each said box and said other boxes, a connection between said frequency transmitter and ground, a normally open connection between said frequency transmitter and said circuit, and an actuator that closes said normally open connection when the spring of said alarm box relaxes.

7. In a metallic signal circuit which has a plurality of alarm boxes, a metallic conductor extending between and connecting said alarm boxes, and a frequency response meter, the improvement which comprises a connection between said meter and said circuit, a connection between said meter and ground, frequency transmitters in said alarm boxes, said frequency transmitters being adapted to provide a plurality of different signals that are distinctively different from and will not interfere with the normal signals from said boxes, normally open switches between said frequency transmitters and ground, and actuators that selectively close said switches, said frequency transmitters being magnetically shaded circuit interrupters of selectively different shading.

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