Aug. 8, 1933. J. C. FIELD 1,921,024

ALARM SYSTEM

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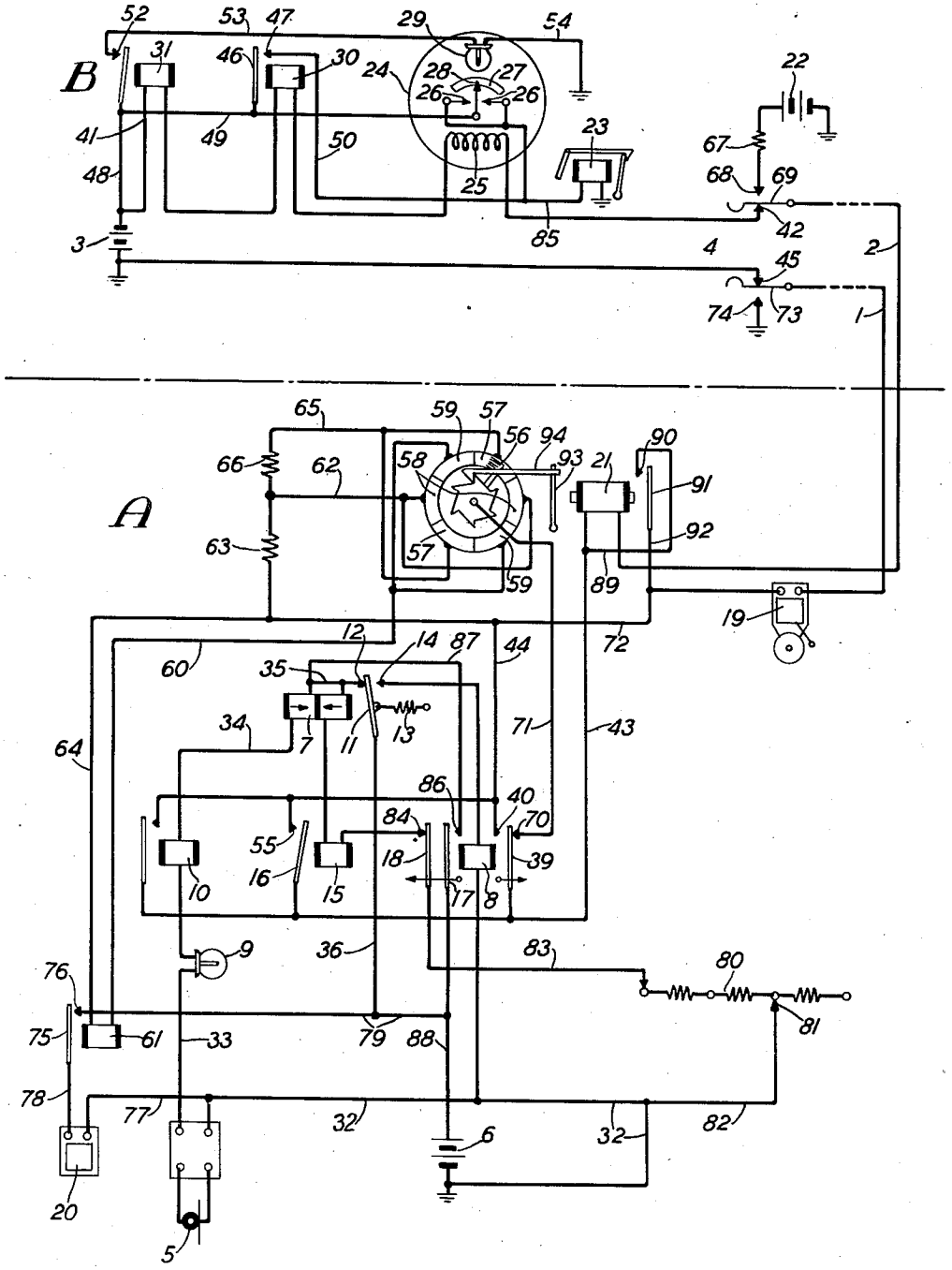

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ALARM SYSTEM

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1 Claim. (Cl. 177—314)

This invention relates to alarm systems and more particularly to burglar alarm systems for protecting vaults and the like by means of a carbon button transmitter mounted on the wall thereof.

An object of the present invention is to provide a burglar alarm system for vaults and the like which will be simple in construction, cheap to manufacture and maintain and yet be very efficient in operation.

Another object of the invention is to provide a burglar alarm system which depends upon a carbon granule transmitter button for operation with means for maintaining the button in a stable condition.

A further object is to provide means for allowing certain changes in current which are caused by the button itself to have no effect on the circuit while changes in the current caused by outside influences cause the alarm to operate.

In the present type of burglar alarm systems employing a carbon granule transmitter button for detecting the vibrations imparted to the structure to be protected, it has been found that a number of false operations have been experienced due to the breathing of the button increasing or decreasing the current through the galvanometer sufficient to close its low or high contacts.

In accordance with the present invention the applicant has not only prevented the breathing of the button from affecting the circuit but has also eliminated the galvanometer and voice frequency relay which heretofore were considered indispensable and essential parts of the circuit. In the above system forming the subject matter of this application, the applicant has not only eliminated a number of pieces of expensive apparatus but has devised a circuit which depends on the change in D. C. resistance of the button when agitated to reduce the current in one winding of the polar relay sufficiently for a second and opposing winding to operate the relay. In addition to this the applicant has provided means in the circuit for keeping the button in a stable condition and responding only to vibrations imparted to the wall, thereby eliminating a chance of false operation due to the breathing action of the button.

In the drawing which discloses a complete system including a central office and a substation, at which there is a vault to be protected, A indicates a vault protector system located at the premises to be protected and B a central office system at which signals are received from the protected premises.

The system at A is connected to the system at B over the line wires 1 and 2, current being supplied to the line by battery 3 located at the central office. Connection is established between the central office and the line wires 1 and 2 leading to the protected premises by means of a key 4.

The normal circuit existing between the protected premises A and the central office B may be traced as follows: negative terminal of central office battery 3 at the central office B, conductor 41, winding of relay 31, winding of relay 30, energizing coil 25 of galvanometer 24, upper inner contact 42 of key 4, upper outer spring contact 69, line wire 2, winding of changer relay 21, conductor 43, armature 39 of relay 8, contact 70, conductor 71, brush 56, segment 57, conductor 65, resistance 66, resistance 63, conductor 72, ringer 19, line wire 1, lower outer spring contact 73 of key 4, lower inner contact 45 to the positive terminal of central office battery 3.

Located at the protected premises is a microphone 5 which may be, for instance, an inertia type microphone such as is disclosed in C. R. Moore Patent 1,426,757. The microphone 5 is energized by a local battery 6 and governs the operation of a differential relay 7. The differential relay 7 controls the operation of a relay 8 which operates to connect the conductors 43 and 44 leading to the line wires 1 and 2 and cause an alarm to be given at the central office B.

In series with the microphone 5 and left-hand winding of the differential relay 7 is a lamp 9 and a relay 10. The left-hand winding of the differential relay 7 has a greater number of turns than the right-hand winding and normally pulls the armature 11 against contact 12 against the action of a retracting spring 13 and the counteracting pull of the right-hand winding.

The normal circuit existing at the protected premises may be traced as follows: negative terminal of local battery 6, conductor 32, microphone 5, conductor 33, lamp 9, relay 10, conductor 34 to the left-hand winding of differential relay 7, conductor 35, front contact 12 of differential relay 7, armature 11, conductor 36, conductor 79, conductor 88 to the positive pole of local battery 6.

When vibrations are imparted to the microphone 5 through the walls of the protected structure such as would be caused by a hammer blow or the like, the D. C. resistance in the microphone 5 is increased to such an extent as to cause a sufficient weakening in the pull of the left-hand winding of the differential relay 7 for it to be overcome by the pull of the right-hand winding and the pull of the retracting spring 13. The armature 11 is brought over against the back contact 14 and brings into circuit connection with the local battery 6 the relay 8 which operates to connect the conductors 43 and

44. The connecting of the conductors 43 and 44 completes a new circuit to the galvanometer 24 located at the central office B. The galvanometer 24 has an energizing coil 25, low and high contacts 26, a calibrated scale 27 and a movable pointer contact 28.

The galvanometer 24 is normally maintained in a balanced condition with the movable pointer contact 28 maintained by its energizing coil 25 in a midway position between its low and high contacts 26—26. Current is supplied to the galvanometer 24 to normally maintain it in this balanced condition by the central office battery 3.

When the relay 8 is brought into operation by the operation of the differential relay 7 and conductors 43 and 44 are connected, the normal circuit including the brush 56 and segment 57 of the changer relay 21 is opened and the new circuit to the galvanometer 24 is completed through armature 39 and front contact 40 of relay 8 and over conductor 44 and conductor 72 to ringer 19 and line wire 1. The increase in current in changer relay 21 causes this relay to pull up armature 91 against contact 90.

The new circuit completed to the galvanometer 24 by connection of the conductors 43 and 44 may be traced as follows: negative terminal of the central office battery 3, conductor 41, winding of relay 31, winding of relay 30, coil 25 of the galvanometer 24, upper inner contact 42 of key 4, upper outer spring contact 69, line wire 2, winding of changer relay 21, conductor 43, armature 39 of relay 8, front contact 40, conductor 44, conductor 72, ringer 19, line wire 1, lower outer spring contact 73 of key 4, lower inner contact 45 to the positive terminal of the central office battery 3. This new circuit to the galvanometer is also made doubly sure of completion through the pulling up of armature 91 against contact 90 by changer relay 21. Contact 90 is connected to conductor 43 by conductor 89. Armature 91 is connected to conductor 72 by conductor 92. When this new circuit is completed to the galvanometer 24 the movable pointer contact 28 is moved into engagement with one of the contacts 26 which brings into circuit connection with the central office battery 3 a drop signal 23 which is operated to advise an attendant at the central office B of disturbances occurring in the microphone 5 at the protected premises. The circuit for the drop signal 23 may be traced as follows: negative terminal of the grounded central office battery 3, conductor 48, conductor 49, movable pointer contact 28 of galvanometer 24, contact 26, conductor 85, winding of drop signal relay 23 to ground.

To make doubly sure of the operation of the drop signal 23 even if incomplete contact is made between the movable pointer 28 and contact 26 of the galvanometer 24, relay 30 which is not operated by the current in the normal circuit, operates when the current is increased by reason of the decrease in resistance in the circuit when the protective circuit is shorted out at armature 39 and contact 40 of relay 8 and pulls up its armature 46 against contact 47 and completes a circuit to the drop signal 23. This circuit may be traced as follows: negative terminal of grounded central office battery 3, conductor 48, conductor 49, armature 46 of relay 30, contact 47, conductor 50, conductor 85, winding of relay 23 to ground.

The lamp 9 at the protected premises is placed in series with the microphone 5 and the left-hand winding of the differential relay 7 to prevent gradual changes of current caused by breathing of the microphone 5 from causing operation of the differential relay 7 and the consequent operation of relay 8 and the operation of the drop signal 23 at the central office B. The filament of the lamp 9 may be of tungsten or any other material, the resistance of which increases with current. Slight and comparatively slow changes in resistance in the microphone 5 caused by its breathing action will have no appreciable effect upon the pull of the left-hand winding of differential relay 7 by reason of the corresponding opposite change in resistance of the lamp 9. Changes in resistance in the microphone 5 (carbon) caused by its breathing action are comparatively slow and any gradual decrease in the resistance of the microphone 5 and the consequent increase in the flow of current through the conductor 33 will be resisted by the lamp 9, the resistance of the filament of which slowly increases with increase in current. Likewise any gradual slight increase in resistance of the microphone 5 caused by its breathing action and the consequent gradual decrease in current flowing through the conductor 33 will be prevented from appreciably affecting the pull of the left-hand winding of differential relay 7 because of the time lag in change of resistance in the filament of the lamp 9.

Any sudden and comparatively great increase in resistance in the microphone 5 such as would result from a hammer blow on the wall of the protected structure and the consequent sudden lessening to an appreciable degree of the amount of current flowing in the conductor 33 will result in a sufficient weakening of the pull of the left-hand winding of differential relay 7 to allow the pull of the right-hand winding and the pull of the retracting spring 13 to overcome it and bring the armature 11 over against contact 14 and complete the circuit to relay 8 which upon pulling up its armature 39 against contact 40 will close the circuit to galvanometer 24 at the central office B over conductor 44 and result in the display of a signal at the central office B as above described.

The relay 10 is not operated normally by the normal current passing through the microphone 5 but will operate to connect the conductors 43 and 44 and close the circuit to the galvanometer 24 at the central office B and cause the display of a signal thereat should the microphone 5 be short-circuited or an exceptionally strong current applied thereto.

In the event of a break occurring in the system at the protected premises, such as would be caused by disconnection of the local battery 6, or any opening in the circuit of the local battery 6, relay 15 which is normally operated to pull up its armature 16 will release its armature and cause a connection between the conductors 43 and 44 which will close the circuit to the galvanometer 24 of the central office B and will result in the display of a signal thereat.

When the differential relay 7 is operated to allow armature 11 to be moved over against the back contact 14 to cause the operation of relay 8 and the operation of a signal at the central office B, the circuit of the normally operated relay 15 is opened and armature 16 moves over against the contact 55 and connects conductors 43 and 44. This makes doubly sure the connection of conductors 43 and 44 when differential relay 7 is brought into operation by action

of the microphone 5. In the event of there being incomplete connection between armature 39 and front contact 40 of relay 8, the new circuit of the galvanometer 24 at the central office B will be completed by armature 16 and contact 55 of the normally operated relay 15. It will be seen therefore that there is provided in this system insurance against inoperation, due to dirty or oxidized contacts. For instance if incomplete contact is made between armature 16 and contact 55 of relay 15, the circuit to the galvanometer 24 at the central office B is completed by connection between the armature 39 and front contact 40 of relay 8, and vice versa, if there should be incomplete connection between the armature 39 and the front contact 40 of relay 8, the circuit to the galvanometer 24 at the central office B is completed by the connection of armature 16 and contact 55 of relay 15.

The normal circuit through relay 15 may be traced as follows: negative terminal of local battery 6, conductor 32, conductor 82, contact 81, resistance element 80, conductor 83, armature 18, contact 84, winding of relay 15, right-hand winding of differential relay 7, contact 12, armature 11, conductor 36, conductor 79, conductor 88 to the positive terminal of local battery 6.

The relay 8 has two left-hand armatures 17 and 18 which pull up when the relay operates. The extreme left-hand armature 18 when pulled up opens the circuit through the winding of relay 15 and the right-hand winding of differential relay 7, and makes this right-hand winding inactive. The rendering inactive of the right-hand winding of differential relay 7 by opening of the circuit at armature 18 of relay 8, allows the left-hand winding of differential relay 7 to pull the armature 11 over against contact 12, and makes positive the restoration to normal of the differential relay 7. When relay 8 is operated to pull up its armature 18 and open the circuit of the right-hand winding of differential relay 7, it also pulls up armature 17 against contact 86 and completes the circuit of the left-hand winding of differential relay 7. This circuit may be traced as follows: negative terminal of local battery 6, conductor 32, microphone 5, conductor 33, lamp 9, winding of relay 10, conductor 34, left-hand winding of differential relay 7, conductor 87, contact 86, armature 17, conductor 88, to the positive terminal of local battery 6.

For testing purposes a buzzer 20 is located in close proximity to the microphone 5 at the protected premises. This buzzer 20 may be operated from the central station B to set up vibrations in the walls of the protected structure and cause operation of the microphone 5 and the consequent operation of differential relay 7 and the relay 8 and the display of the signal at the central station B.

To simulate certain conditions likely to occur and to make tests of the condition of the system, the changer relay 21 is provided with a pivoted arm 93 which by means of a pawl 94 rotates a brush 56 over a set of contact segments 57—57, 58—58 and 59—59. Segments 57—57 are connected to conductor 72 through conductor 65, resistance 66 and resistance 63. Segments 58—58 are connected to conductor 72 through conductor 62 and resistance 63. Segments 59—59 are in electrical connection with buzzer relay 61 over conductor 60.

The changer relay 21 will not operate to pull up pivoted arm 93 and cause rotation of the brush 56 over the segments 57—57, 58—58 and 59—59 by current supplied by the central office battery 3, but will operate to pull up pivoted arm 93 and move the brush 56 the space of one segment each time a high potential battery 22 is brought into circuit connection by operation of the key 4. When the brush 56 is on either of the segments 57—57 it is in series connection with the resistance elements 66 and 63 and conductor 72. When the brush 56 is on either of the segments 58—58 it is in series connection with resistance 63 and conductor 72 and the resistance 66 is shorted out. When the brush 56 is on either of the segments 59—59 both of the resistances 66 and 63 are shorted out and the brush 56 is electrically connected to buzzer relay 61 over conductor 60.

The normal circuit is as previously described with the brush 56 engaging one of the segments 57—57 and with both resistance elements 66 and 63 included in the circuit. Under this condition the movable contact member 28 of galvanometer 24 is in its central position, as shown midway between the fixed contacts 26—26.

By operating key 4 and bringing into the circuit the high potential battery 22 the changer relay 21 will operate to move pivoted arm 93 and the pawl 94 to move the brush 56 around to the next segment which is 58. This will cause shorting out of the resistance 66. When the key 4 is released and the central office battery 3 is again brought into the circuit, the increase in current in the circuit due to the removal therefrom of the resistance 66 will result in a slight deflection of the movable pointer contact 28 of the galvanometer 24. The normal circuit for operation of the changer relay 21 may be traced as follows: grounded high potential battery 22, resistance 67, contact 68, upper outer spring contact 69 of key 4, line wire 2, winding of changer relay 21, conductor 43, armature 39 of relay 8, back contact 70, conductor 71, brush 56, segment 57, conductor 65, resistance 66, resistance 63, conductor 72, ringer 19, line wire 1, lower outer spring contact 73 of key 4, contact 74 to ground.

By again operating key 4 the changer relay 21 will cause movement of the pivoted arm 93 and pawl 94 and the rotation of the brush 56 to the next segment which is 59. When the brush 56 is moved to segment 59 both resistance 66 and resistance 63 are shorted out and buzzer relay 61 which is connected to segment 59 by conductor 60 and to conductor 72 by conductor 64 is brought into the circuit and caused to operate to pull up armature 75 against contact 76 and close the circuit to the buzzer 20 from the local battery 6. When the key 4 is released and the central office battery 3 is again brought into circuit the increased current therein resulting from the removal from the circuit of the resistance elements 66 and 63 results in a still further deflection of the movable pointer contact 28 of the galvanometer 24. The circuit now established may be traced as follows: negative terminal of central office battery 3, conductor 41, winding of relay 31, winding of relay 30, energizing coil 25 of galvanometer 24, upper inner contact 42 of key 4, upper outer spring contact 69, line wire 2, winding of changer relay 21, conductor 43, armature 39 of relay 8, contact 70, conductor 71, brush 56, segment 59, conductor 60, winding of buzzer relay 61, conductor 64, conductor 72, ringer 19, line wire

1, lower outer spring contact 73 of key 4, lower inner contact 45 to the positive terminal of central office battery 3.

The buzzer circuit above referred to which is closed by operation of the buzzer relay 61 when the brush 56 is moved to segment 59 may be traced as follows: negative terminal of local battery 6, conductor 32, conductor 77, buzzer 20, conductor 78, armature 75 of relay 61, contact 76, conductor 79, conductor 88 to the positive terminal of local battery 6.

Buzzer 20 upon being brought into operation will set up vibrations in the wall structure of the protected vault and will set into operation the microphone 5 which will cause sudden and comparatively large changes in resistance in the circuit including the left-hand winding of differential relay 7. These sudden and comparatively large changes in resistance in the circuit leading to the left-hand winding of differential relay 7 will result in a lessening of the pull of the left-hand winding of differential relay 7 to such an extent as to allow the pull of the right-hand winding and the pull of the retracting spring 13 to move the armature 11 over against contact 14 and will bring into operation relay 8 which will pull up its armature 39 against contact 40 and close the circuit over the conductors 43 and 44 to the galvanometer 24 at the central office. This operation of the microphone 5 caused by vibrations set up by the buzzer 20 will result in a signal being displayed at the central office in the same manner as when the wall of the protected structure is set into vibration by a blow from a hammer or the like. The operation of the buzzer 20 and the consequent operation of the microphone 5 and the causing of the signal to be displayed at the central office will indicate to an operator at the central office B that the system is in operating condition.

To serve as signaling means to indicate to an operator at the central office certain conditions existing in the system, there is shown at the central office B, in addition to the drop relay 23 and the galvanometer 24, a lamp 29. The lamp 29 is controlled by relay 31 and is provided to indicate an open in the normal circuit. In series with the energizing coil 25 of the galvanometer 24 are relays 30 and 31. Relay 30 controls the operation of the drop relay 23 which is an additional controlling means for the drop signal to the controlling of it through the galvanometer 24. Relay 31 which is normally operated to pull up its armature, will release its armature when there is an open in the normal circuit and bring into circuit connection the lamp 29. The circuit for lamp 29 may be traced as follows: negative terminal of grounded central office battery 3, conductor 48, armature of relay 31, contact 52, conductor 53, lamp 29, conductor 54 to ground.

In order to provide adjustment facilities in regard to the condition of differential relay 7 which has in series with its left-hand winding the lamp 9 and relay 10, there is provided in series with the right-hand winding and the relay 15 an adjustable resistance 80 which merely for the purpose of illustration has been shown as comprising three sections, or three resistance coils connected in series. Each of these coils may be of a different value to the others. These resistance elements may be brought into series connection with relay 15 and the right-hand winding of differential relay 7 by movement of the movable contact member 81. The circuit including these resistance elements may be traced as follows: negative terminal of local battery 6, conductor 32, conductor 82, movable contact 81, resistance element 80, or any portion thereof, conductor 83, armature 18 of relay 8, contact 84, winding of relay 15, right-hand winding of differential relay 7, contact 12, armature 1, conductor 36, conductor 79, conductor 88 to the positive terminal of local battery 6. By including in the circuit containing the right-hand winding of differential relay 7 various portions of the adjustable resistance 80, the pull of the right-hand winding of differential relay 7 may be so adjusted with respect to the pull of the retracting spring 13 and the pull of the left-hand winding as to make the differential relay 7 very sensitive and this circuit may be so adjusted that comparatively slight decreases in current caused by breathing of the microphone 5 will not cause the differential relay 7 to operate, but comparatively large changes in resistance occurring in the microphone caused by vibrations imparted to the wall structure to which the microphone is attached, will change the condition of relay 7 to such an extent that the pull of the left-hand winding which contains a greater number of turns than the right-hand winding will be overcome by the pull of the right-hand winding and the pull of the retracting spring 13.

The ringer 19 is not operated by current from the central office battery 3, but is only operated when the high potential battery 22 is brought into the circuit and indicates to an attendant at the protected premises that tests are being made from the central office of the condition of the system.

It will be apparent that various modifications may be made in the system disclosed and described, such for instance as replacement of the lamp 9 by any suitable resistance element, the resistance of which will increase with current and which will prevent comparatively small changes in resistance of the microphone 5 from affecting the differential relay 7, without departing from the spirit of the invention as set forth in the following claim.

What is claimed is:

In a protective system for vaults and the like having a carbon granular transmitter button operated by vibrations imparted to the vault structure, an electrical circuit including said transmitter button, a circuit closing relay controlled by operation of the said transmitter button and an alarm-controlled by said circuit closing relay, a resistance element connected between said transmitter button and said circuit closing relay, said resistance element having the characteristic of slowly increasing in resistance with an increase in current and slowly decreasing in resistance with a decrease in current and preventing slow changes in the resistance of said transmitter button caused by breathing action of the carbon in said transmitter button from effecting operation of said circuit closing relay.

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