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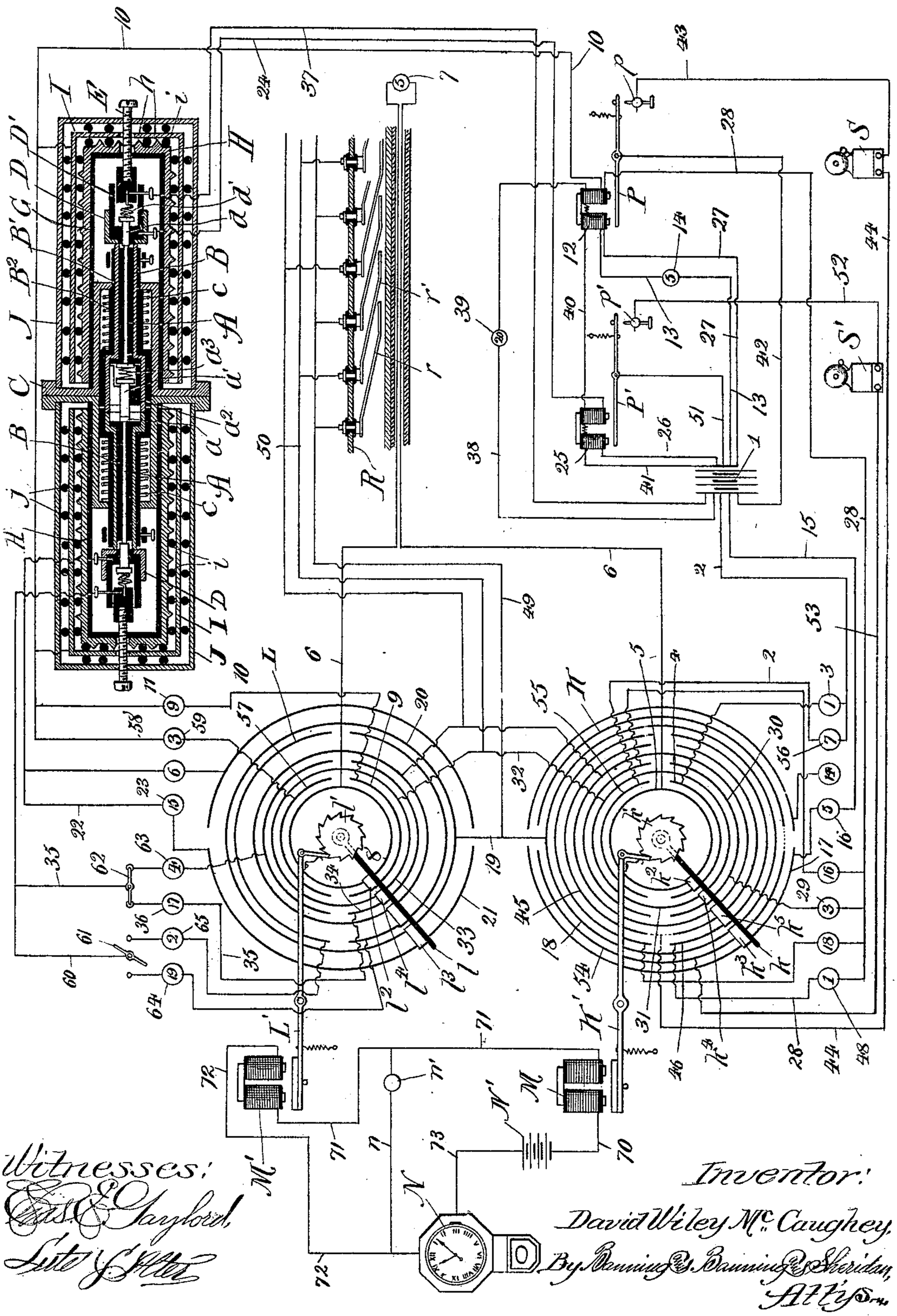
D. W. McCAUGHEY.

ELECTRIC BURGLAR ALARM SYSTEM.

(Application filed Apr. 1, 1897.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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ELECTRIC BURGLAR-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 621,361, dated March 21, 1899.

Application filed April 1, 1897. Serial No. 630,224. (No model.)

To all whom it may concern:

Be it known that I, DAVID WILEY McCAUGHEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Electric Burglar-Alarm Systems, of which the following is a specification.

The object of my invention is to provide a simple, economical, and efficient burglar-alarm system; and the invention consists in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawing, the figure represents a diagrammatic view of the different mechanism and electric circuits illustrating the operation of my improvements.

In the art to which this invention relates it is well known that where one or two electric circuits are used short-circuiting can generally be accomplished and the protected structure broken into or opened without ringing the alarm. The principal object of my invention therefore is to provide an electric burglar-alarm and attach it to a protected structure in such manner that the closing of the doors or the windows automatically closes the different circuits, and to combine with these contact-points one or more circuits so divided that each portion of the circuit has one or more resistance-coils. The total resistance, however, is always equal on each circuit, and when one or more of the circuits are short-circuited the resistance of the circuits becomes unequal and acts to sound an alarm or signal.

In describing my structure I will first describe the contact-points, which comprise a pair of central longitudinally-disposed sliding terminal wires A, having contact-points a and a', mounted in independent pockets. These terminals or longitudinal wires A are mounted in insulating-blocks B, formed of hard rubber or other similar substance, and these blocks are in turn mounted in metallic sleeves B′, which preferably surround, inclose, and protect the same, such sleeves being mounted in insulating-sleeves B^2, which are slidingly mounted in metal sleeves or thimbles C and which are held at their outermost limit of motion by means of helical coiled springs c, which are inserted between the shoulder of the sliding sleeve and the inner cap of the metallic thimble.

To better insure contact between the terminal wires, I prefer to make one of the contact-points a' of a separate piece and slidingly mount it in the end of an insulating-block a^2, which the first metallic sleeve incloses and which is connected electrically to the terminal wire by means of a small spring a^3, so that when the parts are in their engaged position, as shown in the diagram, such spring acts as a cushion to compensate for irregularities in the structure or expansion and contraction of the materials and forms a perfect contact.

To better connect the sliding (or movable) terminal with the circuit-wire and to protect the connections from breakage during the motions of the terminal wire, I provide a metallic cap D, arranged in line with and adapted to electrically contact the metallic sleeve B′. This metallic cap is provided with an insulating-block D′, in which is mounted a small metallic plunger d, which in turn is connected with the electric-circuit wire hereinafter described. It will therefore be seen that as the main terminal moves back and forth the position of the connecting-wire is in no way disturbed, and the plunger d, being provided with a spring portion d', serves to make an efficient connection each time the main terminals are brought together.

To adjust the position of the terminals, I provide adjusting-screws E, which sustain the insulating-block D′ in position and by which the insulating-block D′ may be moved in or out, as desired. This screw is threaded in an insulating-thimble G at the end portion thereof, which insulating-thimble surrounds a portion of the metallic thimble and is in turn inclosed by a second metallic thimble H, having projections h on the outside thereof.

To effectually prevent the destruction of the parts by short-circuiting the different circuits and sounding an alarm, a third metallic thimble I is used, which surrounds the second metallic thimble and between which and the second metallic thimble is arranged a series of cushions i. A fourth metallic thimble J is provided, which incloses all of the mechanism, and arranged between it and the third metallic thimble is a series of cushions j. As dif-

ferent wires lead to the second and third metallic thimbles, it will be seen that by attempting to drill the outer inclosing sleeve or thimble the cushions will be compressed and electrical contact made between the second and third metallic thimbles, which, closing a circuit or varying the resistance in other circuits, will sound the alarm, as hereinafter described.

It will be understood, of course, that one terminal is placed in one portion of the protected structure and the other in the movable portion of the protected structure, or both can be put in the movable portion, so that the act of opening or closing a door or window will close such circuit and place the different circuits in operative position. In the drawings a pair of terminals are shown in their closed position; but I have described one only, for the reason that they are in all respects substantially the same in construction and operation.

To prevent the short-circuiting of the wires and still further prevent the sounding of an alarm by manipulating the wires in the manner known to skilled experts, I provide one or more electric circuits and two or more automatically-operated switches, through which current passes to the different circuits, and I divide each of these circuits into two or more parts, having one or more resistance-coils on each part, the whole so arranged that the switches are moved step by step by a regulating-motor at periodic intervals of time. In this way the position and amount of the resistance between different portions of the circuits are changed, so that if an attempt be made to find the direction of current or amount of resistance by well-known mechanisms designed for that purpose at one period of time it will afford no clue for a different period, and if such an attempt be subsequently made the magnets will be energized and an alarm sounded. To provide means to accomplish this result and arrange the circuits in this manner, I prefer to use a primary circular switch K and arrange it in the signal station, and a second circular switch L and arrange it in the protected structure, such switches being formed of a number of segmental or circular metallic switch-bars, and which have insulated arms k and l running out therefrom. These arms are preferably pivoted or secured to ratchets k' and l', which are moved in a step-by-step manner by means of armature-levers K′ and L′, arranged adjacent to magnets M and M′. These magnets are energized by means of a regulator-clock N, so that at periodic intervals of time an electric circuit is closed and the magnets energized and deënergized to move the switch-lever arms around in a step-by-step manner, so as to change the flow of current from one circuit to another, as hereinafter described. A plurality of circuits is provided and connected with the switches above named and one or more signals, one or more of the circuits being led through the wires of the protected structure, so that a variation in the resistance or the short-circuiting of any of such circuits will energize one or more of the magnets and sound one or more of the signals. It will be noticed from an inspection of the drawing that these switches are made of two or more sets of metallic switch-blocks, and in order to better describe the operation of the same I will indicate the flow of current through the circuits, magnets, and alarms, as shown in the drawing. As shown in the diagrammatic view, the contact-points in the doors are closed, so that current will flow from battery 1 through wire 2, which has the resistance-coil 3, to block 4 in the switch K, through cross-brush k^2 to switch-block 5, through wire 6, which is passed through the walls of the protected structure and has the resistance-coil 7, thence to switch-block 8 of the switch in the protected structure, across brush l^2 to switch-block 9, thence by wire 10, which contains the resistance-coil 11, through the electromagnet 12, and back by wire 13, which contains the resistance-coil 14, to the other pole of the battery. It will be found by adding up the resistance of the different coils on this circuit that the total amount of resistance is twenty ohms, which are noted as follows: the resistance-coil 3 has one ohm resistance; the resistance-coil 7, five ohms; the resistance-coil 11, nine ohms, and the resistance-coil 14, five ohms, making a total resistance of twenty ohms. At the same time an additional current flows from the battery through wire 15, which contains the resistance-coil 16, to the switch-segment 17, thence across brush k^3 to the switch-segment 18, thence by wire 19 to the switch-segment 20, which is contained in the protected-structure switch, across by brush l^3 to switch-circle 21, thence by wire 22, which contains resistance-coil 23, to the second metallic sleeve H, thence to the first metallic sleeve B′ of the terminal contact, through both metallic sleeves B′ and H of both the terminals, and out by wire 24 to magnet 25, and back by wire 26 to the battery. It will be found by adding up the resistance of this circuit that it also amounts to twenty ohms, and for convenience I will mark the resistance of each resistance-coil on the coil itself. I have adopted this method throughout the entire drawing, which will explain the reason for apparently having two figures representing the same element or part. A third circuit is formed by arranging the wires and other parts so that current flows from the battery through wire 37, central terminal wires A A, thence by wire 35, which contains a resistance-coil 36, to switch-segment 34, thence by contact-brush l^4 to the switch-circle 33, thence by wire 32 to switch-segment 31, across brush k^4 to switch-segment 30, thence by wire 28, which contains the resistance-coil 29, to magnet 12, and back by wire 27 to battery. It will also be found in following this circuit that the total resistance is again twenty ohms.

To energize and deënergize the magnets on the alarm-circuits, I provide an auxiliary current and circuit which starts from the battery and flows through wire 38, which contains resistance-coil 39 of twenty ohms, thence by magnet 12, through wire 40, through magnet 25, and back by wire 41 to battery. It will be understood that on magnet 12 there are four coils of wire, two coils of which lead from and form a portion of the auxiliary circuit and direct the flow of current in the one direction, while the two regular circuits, of which wires 28 and 10 form a part, are wound in the opposite direction and permit two flows of current and tend to offset the action of the current flowing in the other direction on the poles of the magnet. In other words, the magnet is a differentially-wound magnet having a constant flow of current in each direction. Should any one attempt to interfere with the circuits by crossing or connecting wires 10 and 37, such wires being connected with different poles of the battery, a short-circuit would take place, when, as will be noticed, there would be a circuit with only five ohms resistance. There would, therefore, be a greater volume of current flowing in one direction than the other and the poles of the magnet 12 would be energized to draw up the armature-lever arm P, so that its opposite end would contact with the post *p*, and current would flow from the battery through wire 42, through the armature-lever P, post *p*, thence by wire 43, through the signal S, sounding the same, thence by wire 44 to the switch-segment 45, thence by switch-brush k^5 to segment 46, thence by wire 28, which contains the resistance-coil 48, to magnet 12, and thence back by wire 27 to battery, sounding the alarm S, above indicated. Such alarm being in the alarm-station, notifies the keeper of such station that a circuit is being broken or tampered with.

To protect the walls of the structure, as shown in the diagram, the wire 6 is run between the walls and between such inner and outer walls. Located inside the walls is an insulated strip R, having a number of terminal springs, so that if the exterior wall be drilled in the direction indicated by the arrow the drill will pierce the same and contact a terminal *r*, so as to push it against the terminal *r'* and short-circuit the same. Current will then flow from battery 1 through wire 15, resistance-coil 16, segment 17, switch-brush k^3 to switch circle or segment 18, thence by wire 49 to the spring-terminal *r*, thence through spring-terminal *r'* back by wire 50 to wire 32, then to switch-circle 31, switch-brush k^4, to switch-segment 30, thence through wire 28, one portion of which contains resistance-coil 29, through the magnet 12, and back by wire 27 to battery. This action in effect creates a third circuit of twelve ohms resistance, so that it acts to energize the magnet, to raise the armature-lever P, and, as before described, to sound the alarm S. It will thus be seen that if any attempt be made to tamper with the walls or with the circuits the resistance of one or more of such circuits is increased or decreased, and as a consequence the electromagnets brought into action to close a circuit and sound an alarm or alarms. If the door of the safe be opened or the window of a house raised, the circuit that flows through the terminals will be broken and ring both of the bells by the action of the current that flows from the battery through wire 38, resistance-coil 39, magnet 12, wire 40, magnet 25, and wire 41 to battery. This action energizes the electromagnets to such an extent that the armature-lever P' is raised and current flows from the battery through wire 51, through the armature-lever P', post *p'*, wire 52, through signal S', wire 53 to switch-segment 54, by switch-brush k^3 to switch-segment 17, thence by wire 15, which contains resistance-coil 16, back to battery and rings the alarm S'. At the same time the magnet 12 is energized, raising its armature-lever P, so as to contact the post *p*, and, as hereinbefore described, current will flow through the circuit which includes the signal S, thus ringing both alarms to show that the door of the safe has been opened or its terminal wire A broken.

It will be noticed, as above suggested, that the switch-levers move in a step-by-step direction, so that sooner or later its brushes come over the breaks on such switch-segments and cross over to the opposite switch-segments to contact the same. The switch-lever *k* will, as above suggested, pass over, so that its brush will contact the segment 55, and current will flow from the battery through wire 2, which includes resistance-coil 56, cutting out resistance-coil 3, to the segment 55, thence by brush k^2 to switch circle or segment 5, thence by wire 6 through the walls of the safe, which includes the resistance-coil 7. At the same time the switch-lever *l* has been moved around, so that its brush connects the switch-circle 8 with switch-segment 57, and current flows across brush l^2 to such switch-segment 57, thence by wire 58, which includes resistance-coil 59, cutting out resistance-coil 17, until it meets with wire 10, thence back by wire 10 through magnet 12, thence by wire 13, which includes resistance-coil 14, to battery. It will be noticed that resistance-coils 3 and 17 have been cut out and resistance-coils 56 and 59 have been cut in, but that the resistance is still twenty ohms. The position of the various resistance-coils has been varied or new resistance-coils have been added and old ones cut out, which makes the arrangement of circuits more intricate and puzzling to experts in electric matters. The same is true of the other circuits which have been before described. The resistance, as suggested, remains constant, but the disposition of the resistance is varied at certain predetermined intervals of time.

In order to have the arrangement absolutely

under the control of the operator, it may be desirable at times to have two sets of circuits which connect with the wire 35, as shown, with the switch in the protected structure. To accomplish this result, I provide a wire 60 with a switch 61, and also provide a wire 35 with a switch 62, so that the wires which contain the resistance-coils 36 and 63 may be thrown out of circuit, and the switch-lever 61 moved into position, and the wires which contain the resistance-coils 64 and 65 thrown into action. In this way different circuits are provided, having their resistance disposed at different positions above and below the switchboards. This arrangement makes it still more complicated, rendering it practically impossible for experts to locate the condition and resistance of the circuits or open or tamper with the terminals or circuits without sounding alarms or signals.

From an inspection of the diagrammatic view it will be seen that the circuit which includes the regulator and which has the two magnets M and M′ has a connecting-wire *n* entirely within the alarm-station and provided with a resistance *n′* of such a nature as to compel the flow of current through the longer circuit, so that ordinarily current will flow from the battery N′ through wire 70, magnet M, wire 71, magnet M′, wire 72 to the regulator N and back by wire 73 to battery. If for any reason the circuit that embraces the magnet M′ be mutilated or broken, current will flow across the connecting-wire *n* and establish a circuit which includes the regulator, battery, and magnet M, which being energized at periodic intervals of time operates on the armature-lever K to move the switch-lever *k* around in step-by-step rotation, the same as before the wire passing magnet M′ was cut. As soon as it crosses the break on the switch-segments, the switch-lever *l* in the switch of the protected structure remaining stationary, it establishes a circuit of different resistance either above or below twenty ohms, so that an alarm is sounded on one or both of the signals. As the circuits have been hereinbefore described with sufficient clearness to enable those skilled in the art to follow and understand the same it will be unnecessary to here follow the new circuits, for the reason that it would only tend toward prolixity and confusion.

While I have described my invention with more or less minuteness as regards details of arrangement and construction and as being embodied in certain precise forms, I do not desire to be limited thereto unduly any more than is pointed out in the claims. On the contrary, I contemplate all proper changes in form, construction, and arrangement, the omission of immaterial elements and substitution of equivalents as circumstances may suggest or render expedient.

I claim—

1. In an electric burglar-alarm system, the combination of an electric battery, at least two electric circuits connected therewith and so arranged with relation to each other that current flows through the circuits in opposite directions, electric resistant mediums disposed at different positions on the circuits, a differentially-wound magnet on both of such circuits arranged in connection therewith so that when the circuits are in operation the magnet is inactive, but when one of such circuits is broken or its resistance varied the magnet operates its armature, and an alarm-circuit connected with and including the armature of such electromagnet so that when the magnet attracts its armature the circuit is closed and an alarm sounded, substantially as described.

2. In an electric-alarm system, the combination of a circuit having its resistance disposed at different intervals or positions on the circuit, an electromagnet on such circuit arranged when energized to close an alarm-circuit, an alarm-circuit arranged to be closed by such magnet when such magnet is energized and sound an alarm, an auxiliary circuit of resistance equal to the other circuit connected with the electromagnet and having its coils wound differentially on such magnet so that when the resistance of either of such circuits is lowered or varied the magnet is energized, the alarm-circuit closed and the alarm sounded, and means for changing the position of the resistance on the main circuit, substantially as described.

3. In an electric-alarm system, the combination of a plurality of circuits of substantially the same resistance and having their resistance disposed at different intervals or positions on their circuits, an electromagnet on one or all of such circuits arranged when energized to close an alarm-circuit and sound an alarm, an alarm-circuit arranged to be closed by such magnet when such magnet is energized and sound an alarm, an auxiliary circuit of resistance equal to each of the other circuits connected with the electromagnet and having its coils wound around differentially on such magnet so that when the resistance of one or more of such circuits is lowered or varied the magnet is energized, the alarm-circuit closed and the alarm sounded, and means for changing the position of the resistance on any or all of such circuits, substantially as described.

4. In an electric-alarm system, the combination of a plurality of circuits of substantially the same resistance and having their resistance disposed at different positions on their circuits, an electromagnet on one or all of such circuits arranged to be energized whenever the resistance of any of the circuits is lowered or varied and close an alarm-circuit and sound an alarm, an alarm-circuit arranged to be closed by such magnet when such magnet is energized, an auxiliary circuit of constant resistance connected with the electromagnet and having its coils wound around differentially on such magnet, a switch on the

first-named circuits adapted to be operated in a step-by-step manner and connected with two or more points to each circuit, each point having electric resisting mediums of different values so that when the switch is moved the position of the resisting mediums of the circuit is automatically changed in a reciprocal manner, and means for moving the switch at desired times, substantially as described.

5. In an electric-alarm system, the combination of a plurality of circuits of substantially the same resistance and having their resistance disposed at different positions on their circuits, an electromagnet on one or all of such circuits arranged to be energized whenever the resistance of any of the circuits is lowered or varied and close an alarm-circuit and sound an alarm, an alarm-circuit arranged to be closed by such magnet when such magnet is energized, an auxiliary circuit of constant resistance connected with the electromagnet and having its coils wound around differentially on such magnet, circuit-wires arranged inside or adjacent to the walls of a protected structure and provided with movable terminals so that as the protected structure is drilled through or broken through the terminals are forced together to create a short circuit or circuits and change or vary the resistance of the circuits which connect with the electromagnets which act to energize the magnet close the alarm-circuit and sound the alarm, substantially as described.

6. In an electric-alarm system, the combination of a plurality of circuits of substantially the same resistance and having their resistance disposed at different intervals or positions on their circuits, an electromagnet on such circuit arranged when energized to close an alarm-circuit and sound an alarm, an alarm-circuit arranged to be closed by such magnet when such magnet is energized, an auxiliary circuit of constant resistance connected with the electromagnet and having its coils wound around differentially on such magnet so that when the resistance of one or more of such circuits is lowered or varied the magnet is energized, the alarm-circuit closed and the alarm sounded, and terminals arranged on such circuits and adapted to be opened or closed so that when the circuits are broken by such terminals the resistance of one or more of the circuits which connect with the electromagnet is varied which acts to energize the same and sound the alarm, substantially as described.

7. In an electric-alarm system, the combination of a contact-point, means for insulating the same, a metallic sleeve surrounding and inclosing the contact-point and provided with lateral projections, a second metallic sleeve or thimble, and means for yieldingly holding such sleeves or thimbles apart but arranged to yield when an attempt to drill or break the same is made and form electric contacts and short circuits between the same, substantially as described.

8. In an electric burglar-alarm system, the combination of two movable switches arranged to be operated in a step-by-step manner for changing the resistance of one or more electric circuits, an armature-lever for each switch to operate the same in a step-by-step manner, an electromagnet for each armature-lever arranged when energized to operate the levers, an electric circuit embracing a regulator a source of electric energy and both of such magnets, and a connecting-wire having a resistance thereon to normally compel the current to flow through the main circuit and when one of such circuits is broken to form a shorter circuit so that one of the switches remains inoperative while the other is operated to vary the resistance of one or all of such circuits with which the switches are connected, substantially as described.

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