

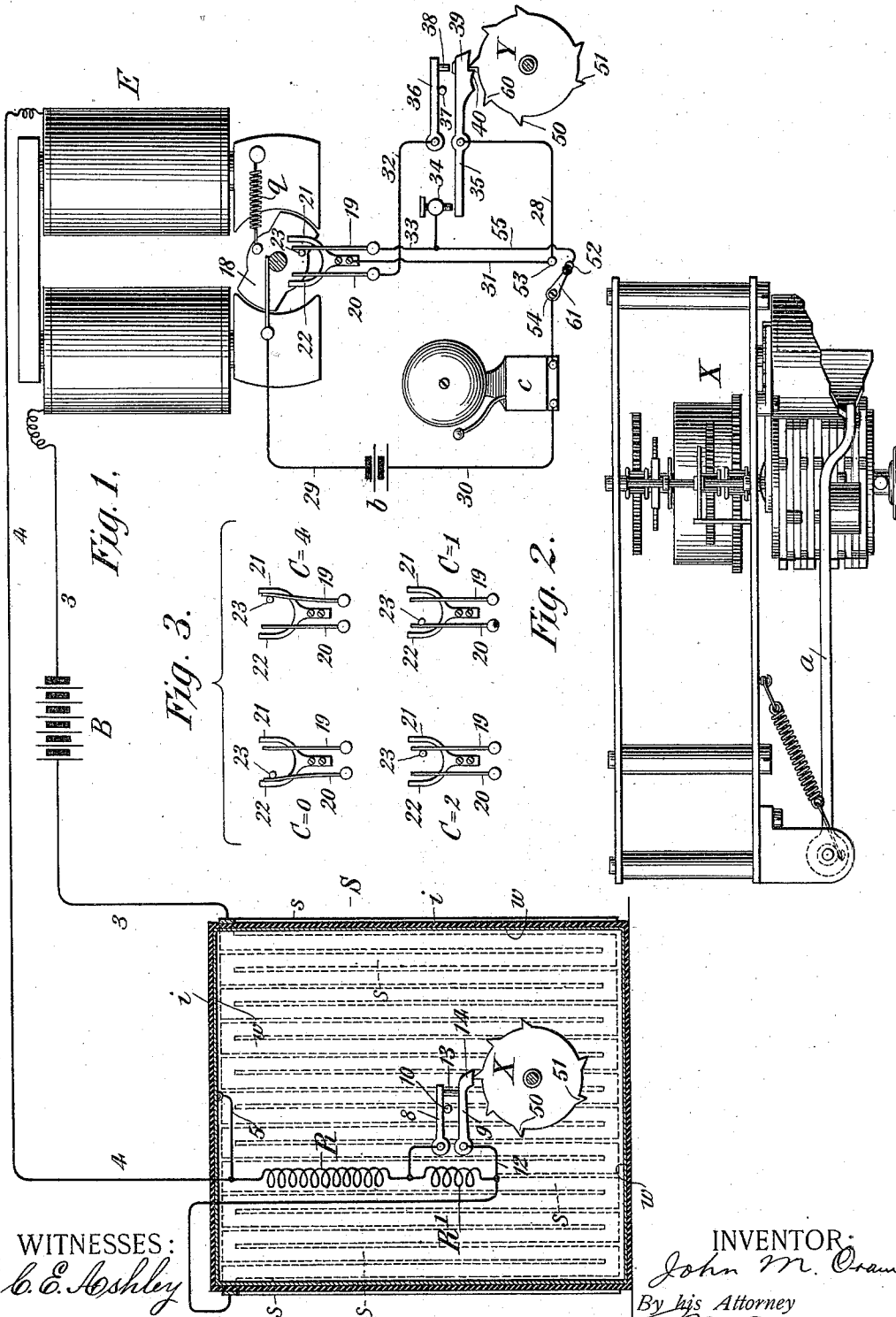
(No Model.)

J. M. ORAM.

APPARATUS FOR PROTECTING ELECTRICAL CIRCUITS.

No. 552,542.

Patented Jan. 7, 1896.



WITNESSES:

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APPARATUS FOR PROTECTING ELECTRICAL CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 552,542, dated January 7, 1896.

Application filed June 4, 1895. Serial No. 551,642. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. ORAM, a citizen of the United States, residing at Dallas, in the county of Dallas, State of Texas, have
5 invented certain new and useful Improvements in Apparatus for Protecting Electrical Circuits Against Unauthorized Interference, of which the following is a specification.

The object of my invention is to provide for
10 sounding an alarm or giving suitable indication whenever the normal operation of an electrical circuit is changed from a predetermined condition.

My invention is an improvement upon a
15 method of and apparatus for protecting electrical circuits, such as is described and illustrated in Letters Patent of the United States issued upon my application, and numbered
20 537,932, dated April 23, 1895. In said Letters Patent there is a protected structure, such as a safe or vault, surrounded with a series of convolutions of an electrical conductor, such as a tin-foil strip, included in circuit
25 with an artificial resistance. A sheet of foil or other suitable conductor is placed near to but insulated from said strip and electrically connected to said circuit at a point upon the side of said artificial resistance opposite said foil-strip, the arrangement being such that the
30 breaking of the foil-strip breaks the circuit, and the electrical connection of the strip and sheet operates to short-circuit the artificial resistance. In addition to this I have there provided for a continuously-operating signal-
35 transmitter, located within the protected structure, and for changing the signal so transmitted according to a predetermined plan or pattern, varying said signal from time to time as regards the intervals or character of the signal, or both, in a manner known
40 only to the watchman stationed near an electromagnetic receiving-instrument at a central point or station. The signal-transmitter operates by varying the strength of line-current and the receiving-instrument operates a local
45 circuit and alarm responding to four conditions of the main circuit as follows: first, line open, no current; second, line closed, all resistance out, current strength a maximum; third, line closed, all resistance in, current strength a minimum; fourth, line closed, smaller section of resistance cut out, current

strength intermediate. In the above-described patented method and apparatus the alarm or indication of interference depends
55 upon an interruption of or departure from the predetermined continuous succession of signals or normal conditions, and it is necessary for the watchman to keep continuously on the alert to detect any such variation in
60 the recorded or received signals and conditions. Now my present improvements are designed to render continuous watching in order to detect variations from the described signals and conditions unnecessary, and to
65 provide for sounding an alarm or giving any suitable indication when any variation from normal conditions or predetermined signals occur, and at such times only.

My improvements, therefore, consist in
70 combining with a protected structure, arranged substantially as described, an electrical circuit, an alarm or indicator, a continuously-operating signal-transmitter at the protected structure operating to affect or influence the alarm or indicator, and a second
75 or duplicate continuously-operating signal-transmitter located at the watchman's station, operating in unison with the first-named signal-transmitter to affect the alarm or indicator equally and oppositely as regards the
80 first-named transmitter, whereby a signal is sounded or an alarm given only when the two transmitters are out of unison or when one is changed, varied, or interfered with in an
85 unauthorized manner.

As herein shown and described by me, the first transmitter operates to make and break the alarm or indicator circuit, and the second transmitter operates in unison to make and
90 break said circuit—that is to say, when one transmitter makes the alarm-circuit the second transmitter, if in unison, breaks said circuit, and vice versa, and any failure in approximately or substantially accurate correspondence or unison results in sounding or
95 indicating such failure.

The accompanying drawings illustrate my invention.

Figure 1 is a complete schematic drawing
100 of the construction and arrangement of the circuit and apparatus. Fig. 2 is a top plan view of the motive power and mechanism of the continuously-operating transmitters, and

Fig. 3 shows the various positions of the relay contact-points when influenced by the various conditions of the main line.

S is a safe or protected structure, upon the outside of which are a convoluted strip of conducting material of any suitable character, such as tin-foil *s*, and a sheet of conducting material, such as tin-foil *w*, arranged in a parallel plane, separated from the strip *s* by a sheet of insulating material *z*.

The electromagnet E at a central station is in a main circuit 3 4 with the strip of foil *s* and main battery B. At the protected station there is an artificial resistance in two sections R R', normally in the main circuit. The convoluted strip *s* is in circuit between the resistance and the magnet E, and a point in said circuit upon the opposite side of said resistance is electrically connected to the sheet of foil *w* by conductor 5. It results from this that when strip *s* and sheet *w* are in any manner electrically connected resistances R and R' are cut out and a maximum current—say a current of four units—flows in the main circuit. To these variations magnet E always responds, operating alarm *c* through local circuit 29 *b* 30 *c* 31, one branch of the fixed double contact 21 22 and point 23 on the rotary armature 18, the extra contact-springs 19 and 20 yielding to allow local connection to be made, as shown in the two first diagrams of Fig. 3, where C equals 0 and C equals 4.

The transmitter X located within the protected structure S consists of a series of wheels or disks upon an arbor, to which a motor imparts uniform movement of rotation. The arrangement and succession of the wheels upon the arbor may be changed at will, and the periphery of the wheels is notched or provided with teeth in groups, separated by spaces or arranged in any suitable characteristic manner. An arm *a*, carrying a circuit-changing device, is in position to engage with the periphery of the notched wheels, one after another, the change from one wheel to another being performed automatically and periodically, as described in my prior-granted patent above referred to. The circuit-closer shown in Fig. 1 consists of two pivoted contact-levers 8 and 9. 10 is a limiting-stop for the lever 8, and 13 is a contact on the lever 8 in position to engage with the contact 9. A foot 14 on the arm 9 rides upon the periphery of the toothed wheels. The transmitter X operates when a tooth or projection passes under the projection 14 on the arm 9 to short-circuit the resistance R', and the armature local point 23 on magnet E takes up its position in contact with spring-contact 19. When circuit-closing levers 8 and 9 of transmitter X are out of contact R' is in circuit and local point 23, under the influence of retracting-spring *g*, makes contact with spring-contact 20. These two positions are shown in the third and fourth diagrams of Fig. 3, where C equals 2 and C equals 1.

At the watchman's station there is a transmitter Y, exactly like transmitter X, and capable of the same changes as regards the character and arrangement of the signal transmitted. X and Y operate simultaneously and their signals are transmitted in substantial unison. Both are operated by a spring-motor and are in reality chronometers, although I may employ any known form of motor and may maintain synchronism and unison in any known or suitable manner.

The spring-contact 19 is a terminal of local-circuit branch 33, and spring-contact 20 is a terminal of local-circuit branch 32, both branches being connected with the alarm by conductor 28. The transmitter Y has a circuit-breaker composed of pivoted levers 35 and 36. 37 is a limit-stop for 36, and 38 is its contact-point. One end of 35 makes contact with contact-stop 34. Its opposite end is furnished with a curved foot 39, riding on the periphery of the transmitting-wheels Y. On the surface of foot 39, midway its ends, is a tooth 40. When 39 rides on the tooth of Y, circuit is open at 34. When a tooth of the wheel at Y engages tooth 40, circuit is closed at 38. At all other times it is open.

The operation is as follows: When the circuit is broken, or when the artificial resistance R R' is cut out, the contact 23 of electromagnet E is carried to its extreme limit in one direction or the other, making contact when the circuit is broken with point 22, and when the resistance is cut out with point 21, the local circuit is completed through 31 *c* 30 *b* 29 18, and this circuit is never made or broken in any other manner and is always maintained in a responsive condition. If transmitters X and Y are set to transmit the same signals in unison, the normal condition of operation X operates to close the alarm-circuit, and Y operates to open it, while Y operates to close said circuit when X operates to open it. As shown in the drawings, the foot 14 of transmitter X, when riding on a projection, cuts out resistance R', and the contact 23 engages the contact 19, closing the alarm-circuit at that point. Coincidentally the foot 39 of transmitter Y, riding on a projection, breaks the alarm-circuit at 34. When the foot 14 of transmitter X falls to the periphery of the wheel, resistance R' is cut into circuit and the contact 23 engages with contact 20. If during this time the tooth 40 of Y has reached the tooth 40 on the foot 39, the alarm-circuit is closed at 38 and an alarm is sounded. If, however, the transmitters are in unison, as shown in Fig. 1, the circuit will remain open at 38. If the foot 39 of transmitter Y rides between the teeth 50 and 51, the alarm-circuit will be closed at 34; but during this time the foot 14 of transmitter X, if said transmitter is in unison, will be in position between the teeth 50 and 51, R' will be in circuit, and the alarm-circuit will be closed at 20 23 and open at 38 and 19. If, however, X is out of unison and the foot 14 of X should

be riding upon a tooth or projection, the alarm-circuit would be closed at both 19 and 34, and an alarm would sound.

I have arranged a switch in the local or alarm circuit to provide for conditions of the protected premises and circuits existing during the time the safe or protected structure is not under the care of the watchman at the central station, and I have added electrical connections in said circuit, controlled by said switch, so arranged that the act of closing the safe or protected structure will sound an alarm intended to notify the watchman that the structure is again placed under his care, when he will assume charge and change the switch to operate the local or alarm circuit in accordance with the co-operative plan hereinbefore described.

The switch-lever 61 is pivoted at 54 and is capable of taking position upon points 53 or 52. A branch conductor 55 connects the point 52 with the conductor 33 and contact 19. Normally the arm 61 rests upon the contact 53 and the operation is as first described. When the safe is opened the main circuit is broken, point 23 engages point 22 and an alarm is sounded. The watchman now places switch-arm 61 upon contact 52, stopping the alarm and opening its branch circuit at 53. Point 23 is separated from 19 and the alarm-circuit branch is open at that point. At the proper time and when the safe is first closed, the circuit of battery B being closed, the relay E responds, point 23 is brought into contact with point 19, and a circuit is closed *via* 19, 33, 55, 52, 61, 54, *c*, 30, *b*, 29, 18, and 23, alarm *c* responds, the watchman now changes switch-arm 61 to point 53, and the normal operation of the two co-operating signal-transmitters is begun and continues as first above described.

What I claim, and desire to secure by Letters Patent, is—

1. The combination, in an arrangement of apparatus for protecting electrical circuits, of an electric circuit, an indicator or alarm in said circuit, a signal transmitter at one point or station operating in said circuit to produce a predetermined effect, a second signal transmitter, at a second point or station, operating said circuit to produce an effect substantially equal and opposite to the effect normally produced by said first transmitter and means for normally operating said transmitters in unison, substantially as described.

2. The combination, in an apparatus for protecting electrical circuits against unauthorized interference, of a variable signal transmitter at the protected station, an electrical circuit, an indicator or alarm in said circuit, a second variable signal transmitter, two circuit changers operated, respectively, by said transmitters one of which changes said circuit to produce a predetermined effect, the other of which changes said circuit to produce an opposite effect and means for normally operating said transmitters simultaneously, substantially as described.

3. The combination of two automatic signal transmitters arranged to transmit duplicate signals, a circuit changer for the first transmitter arranged to produce a predetermined effect, a circuit changer for the second transmitter arranged to produce an equal and opposite effect, electrical circuits and connections controlled by said transmitters, an indicator or alarm controlled by said circuits, and means for normally operating said circuit changers in unison whereby indication or alarm is apparent under abnormal conditions only, substantially as described.

4. The combination of two compound signal transmitters arranged to transmit duplicate signals, one of which breaks circuit when the other closes circuit, an electrical circuit for said transmitters, an indicator or alarm in said circuit, and means for normally operating said transmitters in unison, whereby said alarm responds only when the transmitters are out of unison, substantially as described.

5. The combination of a relay or receiving instrument, a local circuit therefor having two or more branches, two or more contact points in said circuit, one for each branch, a contact point operated by said relay to complete said local circuit through either of said contact points, a manually operated switch in said local circuit to make the circuit of one branch and break that of the other, an alarm or indicator and a local battery common to both said branches, a main circuit containing the coils of said relay, a main battery, an artificial resistance and means for short circuiting said resistance and for opening said circuit, all arranged and operating substantially as described.

6. The combination of two automatic signal transmitters operated in unison located, respectively, at two separated stations, an electric circuit containing an alarm or indicator, an electro magnetic relay operating circuit changing points in said circuit, a main electric circuit containing said relay coils, a circuit changer controlled by one of said transmitters in said main circuit and a circuit breaker controlled by the second transmitter in said alarm circuit, all arranged and operating, substantially as described.

7. The combination, at one station, of an inclosure, a main electric circuit containing an artificial resistance, a fragile section of conductor and circuit closing points in proximity, connected to opposite sides of said resistance, a relay in said main circuit at a second station, responsive to breaks and variations of current in said circuit, a local circuit controlled by said relay, an indicator or alarm in said circuit and two automatic transmitters located at said stations, respectively, and operating in unison to control said alarm circuit, substantially as described.

8. The combination, at one station, of an electric circuit, an alarm or indicator in said circuit, a relay having circuit closing points in said circuit, a second circuit closer in said

circuit, an automatic signal transmitter to operate said circuit closer, a main circuit containing the coils of said relay and at a second station an artificial resistance, a circuit closer
5 to cut in and out said resistance, and an automatic signal transmitter to operate said circuit closer, substantially as described.

9. The combination, at one station, of an electric circuit, an alarm or indicator in said
10 circuit, a relay controlling circuit closing points in said circuit, a second circuit closer in said circuit, an automatic signal transmitter to operate said circuit closer, a main circuit containing the coils of said relay, an artificial

resistance in said circuit at a second station, 15
an inclosure, such as a safe or vault, circuit closing devices located outside of the walls of said inclosure, connected to points in said circuit upon opposite sides of said resistance, and an automatic signal transmitter located 20
within said inclosure operating in the main circuit in unison with the first named transmitter, substantially as described.

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Witnesses:

ED. T. MOORE,
JOHN FROST.