No. 774,831. PATENTED NOV. 15, 1904.

C. COLEMAN.

ELECTRIC BURGLAR ALARM SYSTEM.

APPLICATION FILED DEC. 17, 1896.

NO MODEL.

Fig. 1.

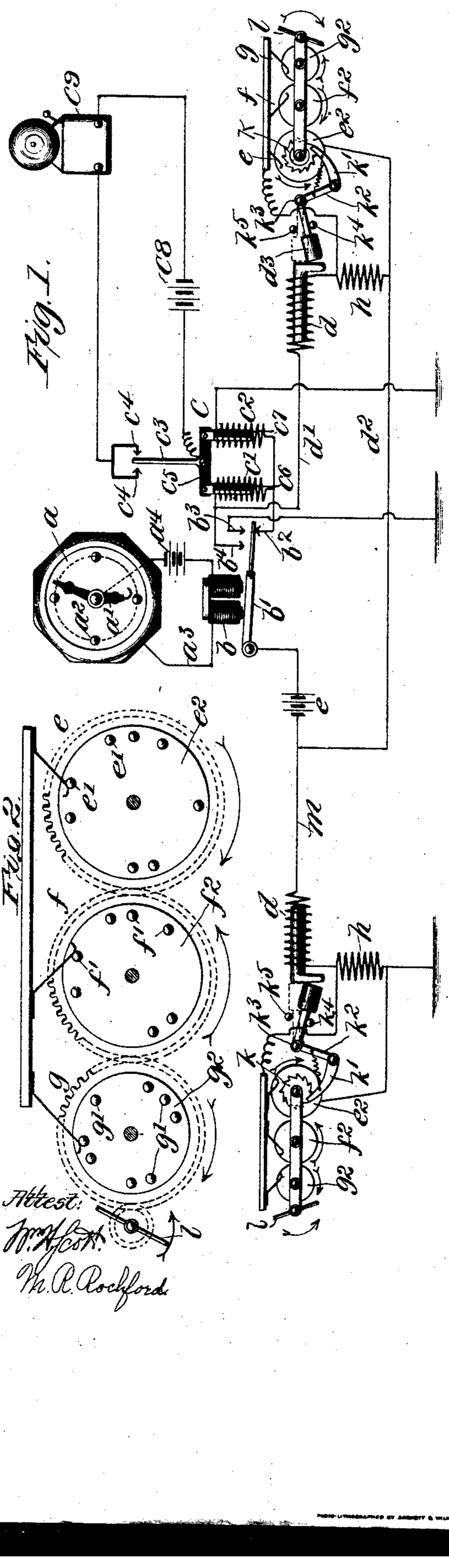
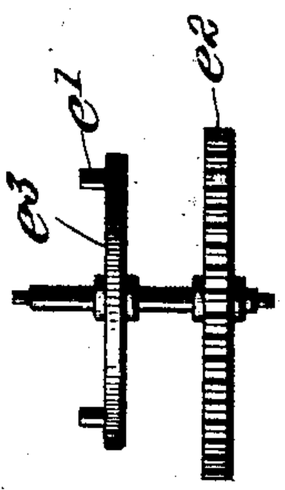


Fig. 2.

Fig. 3.



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No. 774,831. Patented November 15, 1904.

UNITED STATES PATENT OFFICE.

CLYDE COLEMAN, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, OF TWO-THIRDS TO THE BANKERS ELECTRIC PROTECTIVE COMPANY, OF CHICAGO, ILLINOIS.

ELECTRIC BURGLAR-ALARM SYSTEM.

SPECIFICATION forming part of Letters Patent No. 774,831, dated November 15, 1904.

Application filed December 17, 1896. Serial No. 615,956. (No model.)

To all whom it may concern:

Be it known that I, CLYDE COLEMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Electric Burglar-Alarm Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to an electric burglar-alarm system.

My object is to provide a system which will effectually prevent unwarranted tampering with the circuit without sounding the alarm.

Burglar-alarm systems have heretofore been devised having a resistance included in the circuit at the protected district, which effects the sounding of the alarm on being cut from the circuit. It has been possible, however, with such systems to cut out the resistance and interpolate a similar resistance exterior to the protected district, thus permitting the entering of the protected vicinity without sounding the alarm at the alarm-station. To prevent this successful tampering with the circuit, systems have been devised in which the electrical condition of the protective circuit is varied at intervals either at localized points or over the whole circuit, the responsive or alarm-sounding device at the alarm-station being arranged to remain irresponsive to the normal variations, while responding to any abnormal variations to sound an alarm. The present invention belongs to this class of burglar-alarm systems, and in accordance therewith the protective circuit is opened at intervals, either completely or through one of several parallel paths, to cause a series or succession of marked drop or cessation of the current at predetermined intervals. The responsive device at the alarm-station is arranged so that it will not respond to the normal changes, while responding to any abnormal changes to sound an alarm.

In the preferred form of my invention I provide at the protected district an electrically-operated circuit-breaker, which normally remains at rest, but is operated at predetermined intervals to successively open the main circuit or a parallel path thereof, preferably the latter, to cause the marked change in the current flowing. To prevent the responsive device from responding to the changes thus produced, I preferably provide a second circuit, usually at the alarm-station, which contains a similar electrically-operated circuit-breaker, and the responsive device is subjected to the joint action of the currents in the two circuits. Means are provided for operating the two circuit-breakers in unison, and the responsive device thus remains irresponsive under the like changes in the two circuits. The circuit-changers are preferably operated through the agency of a clock mechanism or other automatically-operating mechanism for predetermining the times when the circuit-breakers will be operated to open the circuits.

I prefer to employ a circuit-breaker which when operated will open and close the circuit a number of times in uneven succession and employ a circuit-breaker which depends for its operation upon a plurality of independent circuit-breakers which coact in producing a joint circuit-breaking succession. Each element or individual circuit-breaker is constructed to break the circuit at uneven intervals, and the several elements are associated and operated so that their order of operation is continuously changing, thus producing a large number of permutations in the intervals between the successive breaks, which effectually prevent duplication. The resultant series of breaks is thus produced not by a single circuit-breaker whose construction and operation might be determined by a series of readings taken from the circuit, but is produced by the joint action of a plurality of independently-acting elements the separate effects of which are superimposed to produce an effect which is the result of a long series of permutations in the intervals between the breaks. Such a

circuit-breaking device depending for the intervals between the breaks or the length of the breaks upon the joint action of a plurality of separate and independently-acting circuit-breakers whose effects are superimposed I term a "multiple permutating circuit-breaker." The parts may be arranged to produce a series of permutations in which one complete cycle will extend over a series of years, and in this manner the successful interpolation of a circuit-breaker in the protective circuit is effectively prevented.

I am aware that burglar-alarm systems have heretofore been devised in which the protective circuit is opened at intervals by means of a clock mechanism placed at the protective district, a similar and synchronously-operating clock mechanism being situated at the central station for opening a second circuit at the same time, the responsive device being subjected to the joint action of the currents in the two circuits. Such systems require two complicated clock mechanisms, one at the central station and the other at the protected district, the latter requiring frequent visits to wind the same. Furthermore, it is difficult to keep the clock mechanisms in synchronism, and when out of synchronism the alarm is sounded. To avoid trouble from getting out of synchronism troublesome electrical appliances must be added. In accordance with the present invention these difficulties are avoided by the employment of electrically-operated circuit-breakers in the several circuits which are operated at predetermined intervals through the agency of a single predetermining clock mechanism situated at the alarm-station to thus open and close the protective circuit in a predetermined manner, the responsive device remaining irresponsive during the normal breaks in the circuit. The circuit-breakers are arranged to be thrown into operation electrically and then to successively open and close the circuit a number of times, so that two time elements enter into the operation, one being the intervals between the successive actuations of the electrically-operated circuit-breakers through the action of the predeterming clock mechanism and the other the varying intervals between successive breaks in the circuit during a single operation of the multiple permutating circuit-breakers.

I have illustrated my invention in the accompanying drawings, in which—

Figure 1 is a diagram illustrating my invention. Fig. 2 is a detail view of the circuit-breaker. Fig. 3 is a view of a modification thereof.

Like letters refer to like parts in the several figures.

A clock mechanism a is provided, the hand a' of which makes contact with a series of terminals a^2 a^2 to periodically close a local circuit a^3, one side of which is connected with the hand a', while the other side is connected with the series of terminals. In the local circuit are included the battery a^4 and the coils b of an electromagnet, the armature b' of which rests normally against a contact b^2 and is adapted when attracted to break contact therewith and engage the back contacts b^3 b^4. The contact b^3 is connected to ground, while the contact b^2 is connected with the ends of the coils c' c^2 of the responsive device c, the coils c^2 being connected to ground, while the coil c' is connected with the back contact b^4 and also with a conductor d', extending to the coil of the electromagnet d, which operates the circuit-breaker. The opposite end of the coil of electromagnet d is connected with the contact fingers or brushes e f g, adapted to engage, respectively, the series of pins e' f' g', carried, respectively, on the gear-wheels e^2 f^2 g^2, Fig. 2, or on separate disks e^3 f^3 g^3, Fig. 3, mounted to rotate with the gear-wheels. The gear-wheels are connected with the conductor d^2, which extends to the pole of battery e, the opposite pole of the battery being connected with the armature b'. In a bridge between the conductor d^2 and the end of the coil of electromagnet d is provided a resistance-coil h. The gear-wheels e^2 f^2 g^2 intesmesh, and the wheel e^2 is mounted to rotate with a ratchet-wheel k, with the teeth of which engages a pawl k', pivoted to the arm of a bell-crank k^2, pivoted at k^3 and carrying upon the opposite arm a weighted armature d^3, situated opposite the pole of electromagnet d and normally resting in a lower position. When a momentary-increased current is sent through electromagnet d, the armature is raised and then descends, thus rocking the bell-crank and advancing the ratchet-wheel k to rotate the gear-wheels. A fan-blade l is geared with the gear-wheels to impart a uniform and definite speed thereto during the descent of the armature. A stop k^4 limits the descent of the armature, the upward movement being limited by the stop k^5. The responsive device c is provided with a pivoted finger or arm c^3, situated between two contacts c^4 c^4 and making contact with one or the other when the responsive device is unbalanced. To the arm is attached a bar c^5, to which are secured the cores c^6 c^7, adapted to be attracted by the coils or solenoids c' c^2. The coils of the responsive device should be placed so that no material induction can take place between them, since such inductive effect might permit the cutting of the protective circuit and the utilization of the current induced therein by the operation of the circuit-breaker in the circuit at the alarm-station to operate interpolated mechanism. In the alarm-circuit are included a battery c^8 and a bell or other signal device c^9. A similar circuit-breaking device is provided at the protected district and connected with the alarm-

station by the conductor m, which is connected with the pole of battery e, the circuit being grounded at the protected district.

Normally current from battery e passes over circuit m through magnet d, resistance h to ground and back to the alarm-station, thence from ground through coil c^2 of the responsive device, contact b^2, armature b' to the battery. Current also passes from battery e, over conductor d^2, through resistance h, magnet d, conductor d', coil c' of the responsive device, contact b^2, armature b' to the battery.

When the electromagnet b is energized by the closing of the local circuit by the clock mechanism a, the armature b' is attracted, thus opening the circuit through the coils c' c^2 and making contact with the contacts b^3 b^4, thus closing circuit from the battery through the electromagnets d d without passing through the coils c' c^2. The resistances of the two circuits are thus decreased to cause an increased current to flow, the currents being of sufficient strength to energize the electromagnets d d to such a degree that they attract and raise the armatures d' d'. The clock mechanism closes the local circuit for a short time only, and upon again opening the circuit the armature descends, thereby rocking the bell-crank and advancing the pawl to rotate the gear-wheels and successively open and close the circuit. When the armature b' is attracted, circuit may be traced from battery e over the protective circuit to ground and from ground at the alarm-station to contact b^3, armature b' to the battery. Circuit may also be traced from the battery, over conductor d^2, through the circuit-breaker, conductor d', contact b^4, armature b' to the battery.

I have illustrated the circuit-breaker as operating to break the circuit through a bridge or circuit in parallel with a resistance h, though the resistance may be omitted and the circuit-breaker act to break the main circuit. By locating the circuit-breaker in a parallel path of the circuit the complete opening of the protective circuit is avoided and arcing at the contacts is prevented. During the operation of the circuit-breaker the current over the protective circuit rises and falls intermittently without ceasing entirely, thus maintaining a current continously upon the protective circuit. When the circuit-breaker thus acts upon a parallel branch of the main circuit, it acts, in effect, to alter the resistance of the circuit to produce a varying current upon the circuit means being provided to prevent the predetermined variations from affecting the responsive device, while the responsive device readily responds to any abnormal variations.

The gear-wheels e^2 f^2 g^2 preferably possess numbers of teeth, such that the numbers have no common multiple less than that obtained by multiplying the several numbers together, as thereby the maximum number of permutations is obtained. Thus one wheel may have forty-seven teeth, another forty-three, and another forty-one.

The electromagnets for controlling the circuit-breakers for best effect should not be placed in the same circuit, but should be placed in separate or individual circuits, since if placed in the same circuit apparatus might be interpolated in the protective circuit to send currents over the protective circuit to operate both electromagnets alike, and thus not sound the alarm. When the electromagnet of the circuit-breaker at the alarm-station is placed in a circuit independent of that containing the controlling-electromagnet at the protected district, any interpolated apparatus, while it may operate the electromagnet at the protected district, will fail to operate the electromagnet at the alarm-station, thus unbalancing the responsive device to sound the alarm.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a protective circuit and a responsive device therein, of an electrically-operated multiple permutating circuit-breaker in said circuit constructed to produce a series of successive breaks or pulsations of current strength each time the same is thrown into operation and comprising a plurality or multiple of conjointly-acting circuit-breaking arms or elements, means for normally counterbalancing the effect thereof upon the responsive device, and electrical means actuated independently of said circuit-breaker and counterbalancing device for operating said circuit-breaker and said counterbalancing device in unison to normally maintain the responsive device quiescent, substantially as described.

2. The combination with a protective circuit and an individual circuit, of a responsive device under the influence of the currents in both circuits, an electrically-operated multiple permutating circuit-breaker in each of said circuits each constructed to produce a series of successive breaks or pulsations of current strength each time the same is thrown into operation and each comprising a plurality or multiple of conjointly-acting circuit-breaking arms or elements, and electrical means actuated independently of said circuit-breakers for throwing both of said circuit-breakers into operation in unison to normally maintain the responsive device quiescent, substantially as described.

3. The combination with a protective circuit and an individual circuit, of a responsive device under the influence of the currents of both circuits, a multiple permutating circuit-breaker in each of said circuits comprising a plurality or multiple of conjointly-acting cir-

cuit-breaking arms or elements, a self-operating propelling device associated with each of said circuit-breakers and arranged to operate the circuit-breakers to produce a series of successive breaks or pulsations of current strength each time the same is thrown into operation, and electrical means controlled from the central station for storing in said propelling devices the energy necessary to operate the same for the period of time required to produce the said series of successive breaks or pulsations of current strength, substantially as described.

4. The combination with a protective circuit, of a responsive device therein, a permutating device at the protected structure for varying the normal condition of the circuit, means for counterbalancing the effect of said permutating device and maintaining the responsive device quiescent during said normal variations, a pair of propelling devices normally out of operative position and arranged to operate the permutating device and counterbalancing device when operative, electrical means controlled from the central station for moving said propelling devices into operative position, and means to release said devices and permit them to operate.

5. The combination with a protective circuit and a responsive device therein, of an electrically-operated circuit-varying device arranged when operated to momentarily change the condition of the circuit and restore the same to the normal again, means for normally counterbalancing the effect upon said responsive device, and electrical means actuated independently of said circuit-varying device, and said counterbalancing device for operating said circuit-varying device and said counterbalancing device in unison to normally maintain the responsive device quiescent, substantially as described.

6. In an electric protective system, the combination with two separate circuits, of a responsive device having two coils one in each of said circuits and relatively non-inductive, a circuit-varying device in one of said circuits, means for counterbalancing the effect in the other, and means controlled by each circuit for respectively operating said varying device and said means.

7. A main protective circuit extending from the central station to the district to be protected, a circuit-varying device at the protected district, a separate circuit at the central station, means for counterbalancing the effect of said circuit-varying device, a responsive device under the influence of the current in both of said circuits, means controlled by each circuit for respectively operating said circuit-varying device and said counterbalancing means, and means for preventing the counterbalancing means from producing disturbances in the main circuit.

8. A protective circuit, a resistance therein, a contact device for short-circuiting said resistance and placed in parallel therewith, a power-storing actuating means for actuating said short-circuiting means and connected in series with said resistance, means for counterbalancing the effect of said short-circuiting device, a responsive device irresponsive to the normal variations, whereby the resistance may be short-circuited without affecting the circuit through the power-storing means, and means coöperating with the counterbalancing means for rendering the same effective.

9. A protective circuit, a circuit-varying device at the protected district, means for counterbalancing the effect of said circuit-varying device at the central station, a responsive device rendered thereby irresponsive to normal variations, devices for actuating said circuit-varying device and said counterbalancing means, means for setting the same in operation simultaneously, means for predetermining the length of time of the operation thereof, and means for imparting energy to operate said devices after allowing sufficient time for both to come to rest, substantially as described.

10. A protective circuit, a circuit-varying device at the protected district, a means for counterbalancing the effect of said circuit-varying device at the central station, a responsive device rendered thereby irresponsive to normal variations, an operating device for actuating said circuit-varying device and said counterbalancing means, means for periodically setting the same in operation simultaneously, means for predetermining the length of time of the operation thereof, and means for periodically furnishing energy to said operating devices at greater intervals of time than the period of operation of said operating devices, substantially as described.

11. A protective circuit, a permutating device therein, a responsive device and means for counterbalancing the effect of said permutating device, said permutating device comprising a plurality of contact devices for opening and closing the circuit a number of times in rapid succession each time the permutating device is operated, said contact devices being connected in parallel with each other, substantially as described.

12. A protective circuit, a permutating device therein, a responsive device, means for counterbalancing the effect of said permutating device, said permutating device comprising a plurality of contact devices for opening and closing the circuit and connected in parallel with each other, a differential gearing between said several contact devices, and means for rotating said gearing at intervals, substantially as described.

13. A protective circuit, a permutating device therein, a responsive device, means for counterbalancing the effect of said permutat-

ing device, said permutating device comprising a plurality of contact devices for opening and closing the circuit and connected in parallel with each other, and a resistance connected in parallel with said several contact devices, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

CLYDE COLEMAN.

Witnesses:
W. CLYDE JONES,
M. R. ROCHFORD.