(No Model.)

E. WESTON.

ELECTRICAL PROTECTIVE SYSTEM.

No. 389,272. Patented Sept. 11, 1888.

Fig. 1.

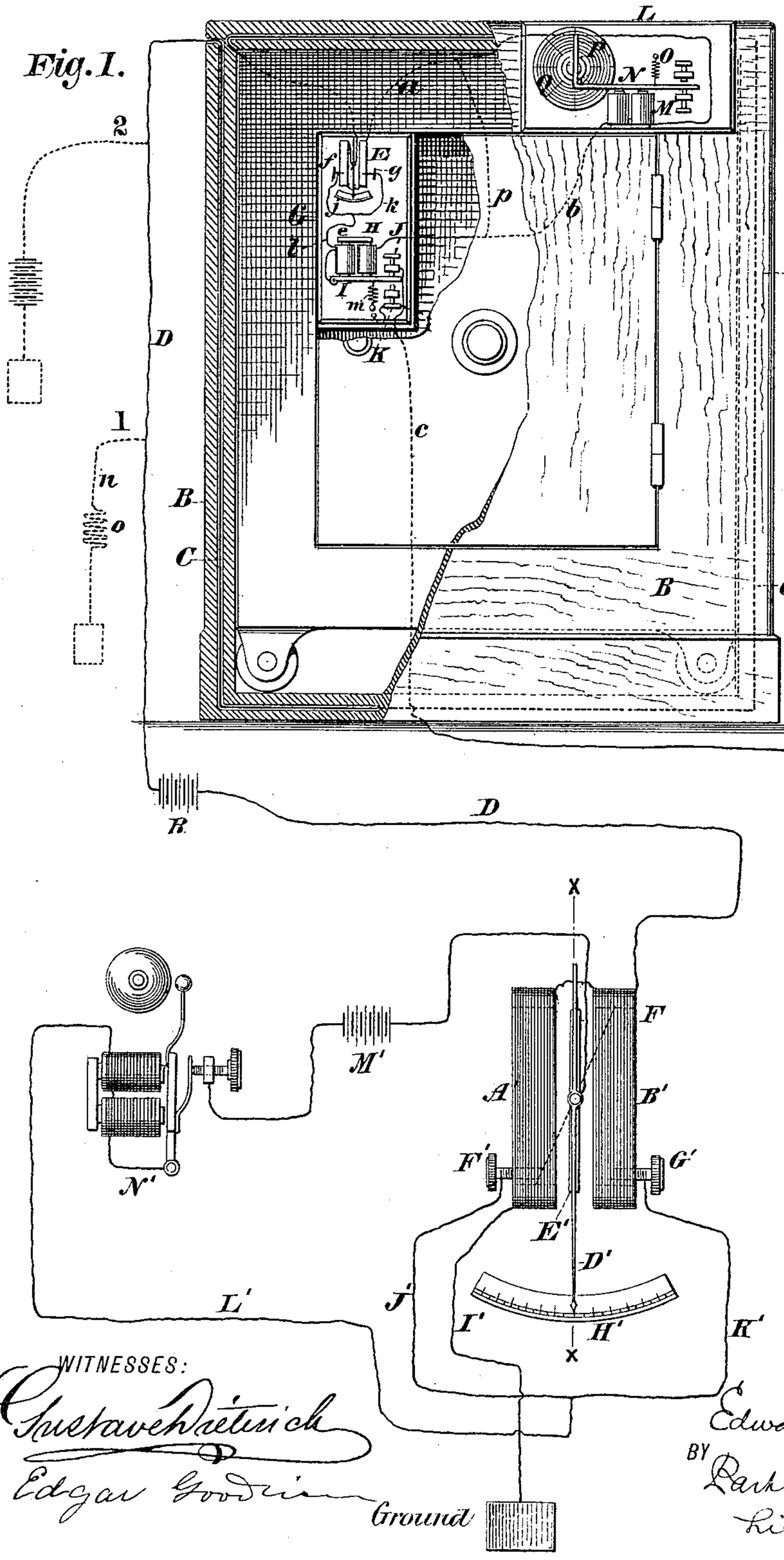
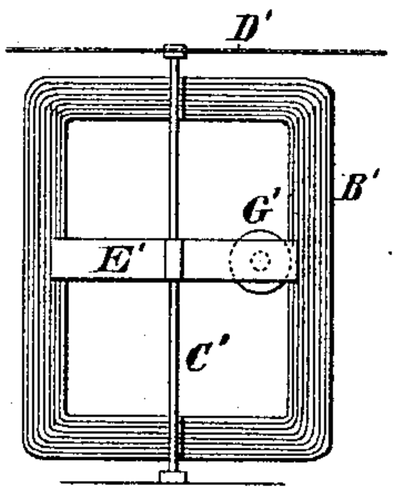


Fig. 2.



Ground

Ground

WITNESSES:

Gustave Dietrich

Edgar Goodrich

INVENTOR,

Edward Weston,

BY Park Benjamin.

His ATTORNEY.

(No Model.)

E. WESTON.

ELECTRICAL PROTECTIVE SYSTEM.

No. 389,272. Patented Sept. 11, 1888.

Fig. 1.

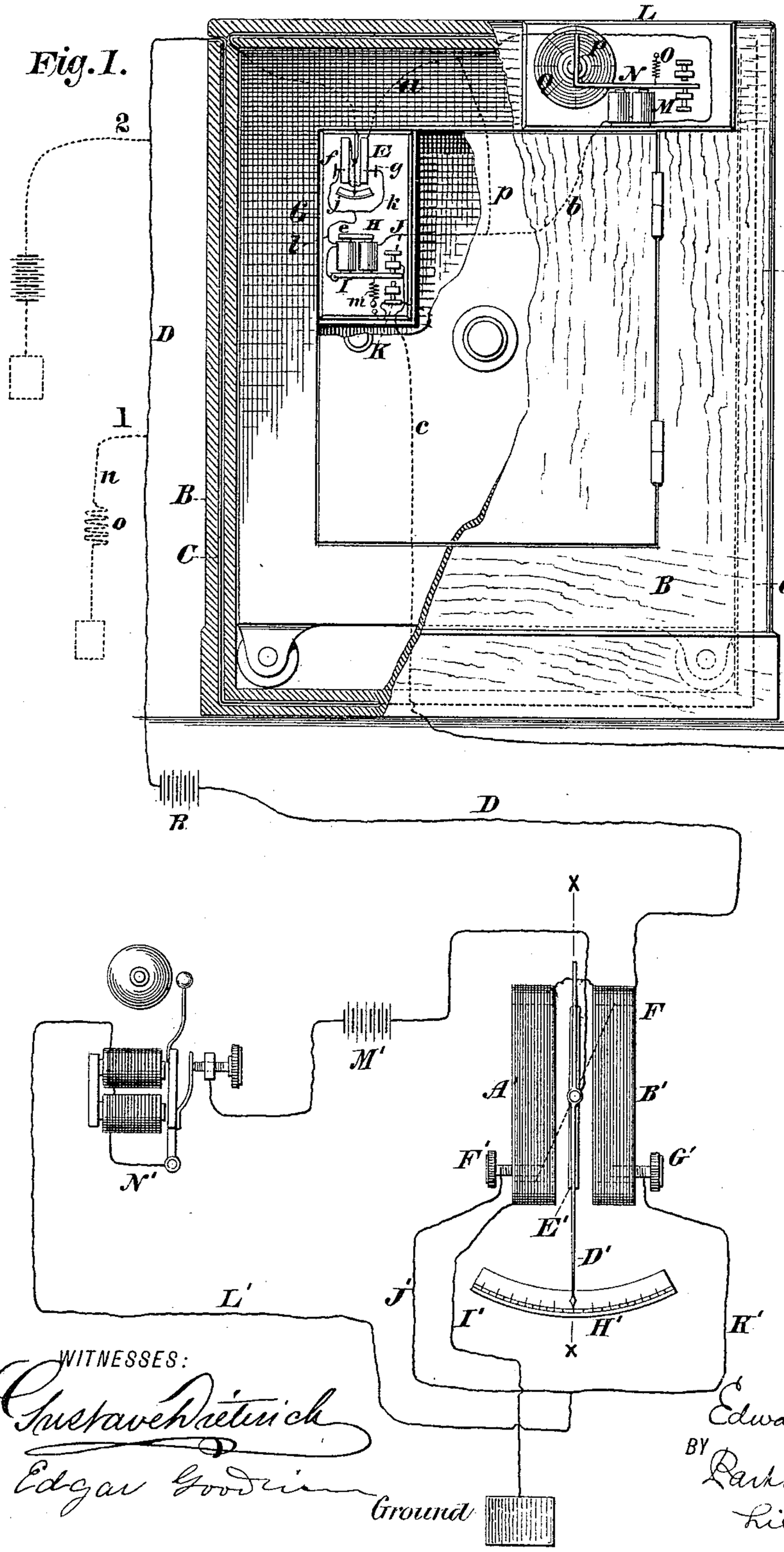
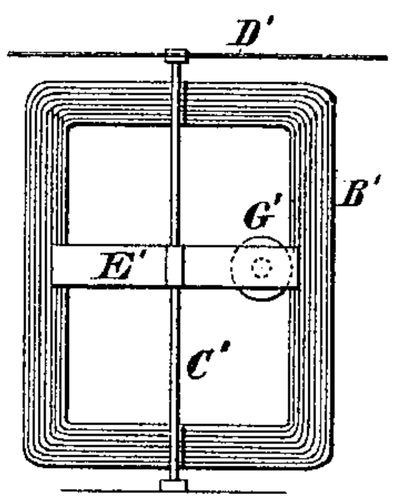


Fig. 2.



WITNESSES:

Gustave Dietrich

Edgar Goodwin

INVENTOR,

Edward Weston.

BY Park Benjamin.

His ATTORNEY.

UNITED STATES PATENT OFFICE.

EDWARD WESTON, OF NEWARK, NEW JERSEY.

ELECTRICAL PROTECTIVE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 389,272, dated September 11, 1888.

Application filed January 23, 1888. Serial No. 261,656. (No model.)

To all whom it may concern:

Be it known that I, EDWARD WESTON, of Newark, Essex county, New Jersey, have invented a new and useful Improvement in Electrical Protective Systems, of which the following is a specification.

The principle of my invention is as follows: to organize an apparatus or combination of instrumentalities whereby a safe or any other inclosed space or chamber may be protected from improper access by means of electrical mechanism which shall operate upon a variation in the strength of the current traversing the circuit maintained between the place to be protected and the place at which warning or alarm is desired; to further organize said apparatus and instrumentalities so that the result of such variation in the strength of the current shall produce an alarm or signal which shall continuously be given at the distant station, a permanent break of circuit within the closed safe or chamber, and, if desired, a record of the time of the occurrence upon a continuously-moving record-sheet at said protected point; also, so to organize said apparatus and instrumentalities as to render it impossible, by the application of any extraneous means in or to the said circuit, to balance the existing current, or to prevent, by reason of said application, a variation in the strength of said current and consequent operation of the apparatus.

The apparatus and instrumentalities hereinafter set forth constitute an efficient and operative means for carrying the aforesaid principle into practical effect to produce a beneficial result.

My invention is not limited to the precise apparatus and instrumentalities here shown, but includes any and all substantial equivalents thereof whereby substantially like results may be produced.

In the accompanying drawings, Figure 1 represents diagrammatically my apparatus, the various parts not being drawn to any scale. The safe to be protected is shown in front elevation with a portion of the exterior wooden casing and also of the safe-door broken away in order to exhibit the mechanism which is to be located inside the safe or safe-covering. Fig. 2 is a section on the line *x x* of the instrument F, Fig. 1.

Similar letters of reference indicate like parts.

For convenience in explanation my apparatus may be considered as consisting of two principal portions—namely, the devices which are directly applied to the safe or other inclosed place or chamber to be protected, and, second, devices located at the point or station to which it is desired to communicate intelligence of any attempt to obtain access to the interior of the protected safe or of any rupture of the circuit or of any increase or decrease of the strength of the current traversing the circuit, however momentary this change may be.

In the term "variation of current strength," as herein used, I mean to include actual cessation of the current upon the circuit, as when a rupture of said circuit occurs, as well as increase and decrease of current strength. A central station, for example, may be connected with one or more localities to be protected, and at this station the indicating or alarm mechanism may be established and maintained under constant supervision. A line-wire leads from the mechanism at the alarm-station to the safe mechanism, and a battery, preferably located at said station, maintains a constant current upon the circuit, which includes said line-wire and the apparatus.

I will first describe the various portions of my apparatus which are disposed at the locality to be protected. For purpose of illustration I here exhibit an arrangement of said apparatus in connection with an ordinary movable safe. It should be understood, however, that I do not in any wise limit my invention to the employment or adaptation of my said devices to the protection of safes or strong boxes, because any electrical workman or other person skilled in the art will readily perceive that they may be employed to afford like protection to rooms, buildings, or, in brief, to any inclosed place to which it is desired to prevent access.

The safe to be protected is represented at A, and is here shown wholly inclosed in a wooden casing, B. Through the walls of this casing a continuous wire, C, is led to and fro,

the parts of said wire being sufficiently numerous and in such contiguity that any breakage through the casing or opening of the door therein will result necessarily in the severing or separation of the wire, or, generally speaking, in a rupture of the circuit in which said wire is included.

In cases where it is desired to protect the doors and windows of an ordinary room any known form of apparatus may be employed in connection with said door or windows which, when a door, for example, is opened, will interrupt the circuit. One extremity of the protecting-wire C is connected to the line-conductor D. The other extremity of said wire is connected to the supporting arbor or shaft of the vibrating needle of a circuit-closer, E. The circuit-closer is here shown substantially in the form of an ordinary galvanometer having two coils, between which the needle is suitably pivoted or suspended. A precisely similar instrument is represented at F on a larger scale, of which a detailed description is given further on in this specification.

The circuit-closer E is arranged in a suitable case, G, which is disposed inside of the safe. Also arranged in said case G is an electro-magnet, H, having a pivoted armature, I, provided with a retracting spring, *m*. In proximity to the said armature are fixed stops or contact-points J and K. The armature I makes contact with the stop J when attracted by the magnet H and falls upon the stop K when released by said magnet.

L is a box or case, which is preferably arranged outside the safe-casing B. It may be provided with a glass cover, so as to allow of inspection of the mechanism within. Said mechanism consists of an electro-magnet, M, having a pivoted armature, N. Said armature is provided with a retracting-spring, O. To the free end of said armature is secured an arm, P, which at its extremity has any suitable form of marking-point, which bears against a record-sheet secured upon the face of a disk, Q. The disk Q is rotated on its central axis by any suitable motor mechanism—such as clock-work—and at some definite speed—as, for example, one revolution in twelve hours. As said disk rotates, the marking-point upon the end of arm P produces upon the record-sheet a continuous visible line or trace.

At R is the main battery, the current from which, after traversing the line-conductor D and protecting-wire C, proceeds through the following circuit: from the needle-arbor of circuit-closer E to the coils of said circuit-closer, by wire *a* (dotted lines) to electro-magnet M, by wire *b* (dotted lines) to electro-magnet H, to armature I of said magnet H, and from said armature, when it is in contact with stop J, to the wire *c*, and so to ground. The circuit above traced is that which normally exists until either an increase or decrease in the strength of the current occurs, as hereinafter explained. It will be observed that both electro-magnets H and M are thus kept energized; also, that the needle or pointer of circuit-closer E occupies a central position, this being the position which it is adjusted to take when the normal and proper current is traversing its coils.

I will now describe the alarm apparatus, which is located at the point to which it is desired to convey warning. Of this apparatus I here show one particular form and arrangement which may be advantageously employed in practice; but I wish it clearly understood that I do not herein limit myself to any specific form or arrangement. Any alarm mechanism capable of being set into operation by variation in current strength in its controlling-current may be employed.

The particular alarm and current indicating devices here illustrated consist, first, of a circuit-closer and current-indicator, F, which, as already stated, is of like construction to the circuit-closer E.

A′ B′ are the two coils.

C′, Fig. 2, is the arbor or pivot, to which is rigidly secured the needle D′, and also a circuit-closing arm or lever, E′. The arbor C′ is supported in any suitable way, (not fully here shown,) and is free to turn in its supports, so that the lever E′ may swing into the openings in the coils A′ B′, and so make contact, as indicated by the dotted lines, Fig. 1, with either of the adjustable stops or contact-points F′ G′. The needle D′ extends over an arc-shaped graduated scale, H′. If, now, the current from the battery be led by wire D through the coils A′ B′, and so to ground by wire I′, it is obvious that the above device will act similarly to an ordinary galvanometer, and the needle D′ will be deflected more or less, proportionately to the strength of the current traversing the coils A′ B′. Said coils are, however, to be so arranged with reference to lever E′, or the apparatus is otherwise to be so constructed, as that when a current of some predetermined strength traverses said coils the needle D′ may take some definite position—as, for example, the central position at which the needle stands in the apparatus, as shown in the instruments E and F. This arrangement or construction can be made by any person skilled in the art. Now, if the strength of the current increases, it follows, in accordance with known laws, that the needle and lever E′ will move in one direction, and if it decreases the needle and lever E′ will swing in the other direction. This increase or decrease of current strength is rendered apparent and visible by the movement of the needle-point over the graduated scale H′.

When the current strength shall have been modified beyond some fixed limit, then the swing of the lever E′ may become extensive enough to bring the lever into contact with one or the other of the stops F′ G′, in accordance with its direction of movement. The result, then, is the closing through either branch wire J′ or K′ of the local circuit L′, which includes the battery M′ and any known alarm mechan-

ism—such, for example, as the ordinary electric gong, N′.

Returning now to the instrument E, this also is provided with stops *f g*, similar to F′ G′, and a circuit-closing lever (not shown) similar to E′, which moves, under the same conditions as already described, into contact with one or the other of said stops *f g*. By said bar the current which passes upon the needle-arbor is diverted through either branch wire *j* or *k* to a wire, *l*, and thence directly to armature I, stop J, and so to ground. In such case the magnets H and M are cut out, and both release their respective armatures.

I will now trace the complete operation of the apparatus. The two instruments E and F are preferably adjusted so that the needles of both stand at the same point on their scales when the normal current which proceeds from battery traverses the apparatus, and so that like variations in the strength of said current produce like motions of the two needles. The normal position of both of said needles is of course at a middle point on the scale, and the levers E′ in said instruments are therefore not in contact with either stop. Then the whole circuit will be from ground through the coils A′ B′ of instrument F at the alarm-station to battery, to line through instrument E and electro-magnets M and H, armature I, stop J at the safe, and so back to ground again. Both magnets M and H attract their armatures. The disk Q is constantly rotated by its clockwork, for as long as this condition of things continues a uniform line is traced by the marking-point on the arm P upon the record-sheet upon said disk Q. The owner of the safe seeing this continuous line thus has proof that no interference with his protecting-circuit has taken place. Now, suppose that from any cause the current strength in the circuit is changed. At the circuit-closer F contact is at once made by the bar E′ with one of the stops F′ or G′, and local circuit is closed through the alarm which sounds. Inasmuch as contact with the stop F′ or G′ is maintained, this alarm continues sounding indefinitely. Furthermore, the attendant at the alarm-station is also aware that circuit has been permanently broken inside of the safe, (in the manner shortly to be explained,) and that therefore the safe is no longer protected. Hence he cannot restore protection by any resetting of the apparatus at his station, but must send some one to the safe itself to do so. If, besides this, only the owner, for example, of the safe can open its door, it obviously becomes necessary to call up the owner before the door can be opened, so as to obtain the desired access. Consequently three important results are secured—namely, first, the continuous sounding of the alarm at the station; second, it is made necessary to visit the safe in order to reset the apparatus, and, third, actual access to the interior of the safe is rendered needful, and this may involve direct personal notification of the occurrence to the owner. Simultaneously with the closing of contact in the instrument F, the similar instrument, E, inside the safe operates to close contact with one or the other of its stops, *f* or *g*. The current is thus at once diverted to earth by wire *j* or wire *k*, and thence to wire *l*, armature I, stop J, and wire *c*, and the magnets M and H are cut out. Both magnets being so de energized, the armature N of magnet M is lifted by its spring O, and the armature I of magnet H falls by gravity and also by the action of its retracting-spring *m*, and finally rests upon the stop S, which is merely a support for said armature and is not in any part of the circuit. The results then are as follows:

First, by reason of the rising of the armature N of magnet M the marking-point on the end of arm P makes during its upward travel a short radial trace on the record-sheet, and then of course begins a circular trace on a different part of the sheet, so that the new trace will not be in prolongation of the old one. This changed direction and position of the traced line obviously shows upon the continuously-moving record sheet, which is suitably divided for hours and fractions, the moment when the change occurred.

Second, the main circuit is permanently broken by the sudden dropping of the armature I of magnet H. It is obviously impossible from the outside of the closed safe to re-energize the magnet H. To do this it is necessary to move the armature I of said magnet into contact with the stop J, and then and only then circuit through magnet H is established; but to do this the door of the safe must be opened, so that said armature may be lifted by hand to the pole of the magnet.

I have now pointed out the operation of my apparatus both at the safe and at the alarm station, and I desire now to call attention to the practical impossibility of preventing or interfering with this operation by any manipulation of the current at any point of the circuit. It is clear that the above-described results must necessarily follow any actual rupture of the circuit, no matter where occurring; but suppose an attempt is made to cut the safe out of the circuit, without affecting the mechanism at the alarm station, by means of a ground-connection including an artificial resistance equaling that of the safe mechanism and connections interposed between said portion of the system and the battery—say, for example, at the point *l*, where *n* is a branch wire leading to ground, and *o* a resistance-coil in said wire, (dotted lines.) The instant this branch connection is made the battery-current will divide, part going to ground through the branch *n* and part to ground through the line D, safe-connections, and wire *c;* but the current through the safe mechanism is thus weakened, and the moment it becomes weakened sufficiently to cause the arm or lever of circuit-closer E to make contact with stop *f* or *g*, then magnet H becomes cut out, as already explained, its armature I drops suddenly, and

the circuit is ruptured, with the results already noted. It will also be apparent that the interposition of a battery (as indicated by dotted lines at 2, Fig. 1) between the main battery R and the safe mechanism for the purpose of maintaining a current through said mechanism of equal strength to that delivered to said main battery (the object being in these circumstances to cut the main circuit within producing either an alarm or the operation of the safe mechanism) will be equally futile. To add battery simply increases the current strength. The circuit-closer E then establishes contact with the opposite stop to that with which contact is closed when the current is weakened. Again, the armature of magnet H drops suddenly, and again the circuit is permanently broken.

It is impossible to interpose either battery or resistance directly or in branch from the main circuit or to tamper with the existing current in any way in an effort to balance it. Before any balance can possibly be made, the bar in the circuit-closer E will reach a stop and the circuit will break. The same result will follow short-circuiting of any part of the main circuit, the resistance then decreasing and the current strength increasing.

The object of the divided scale on the instrument F is to enable it to act visibly as a current-indicator, showing the extent of current-fluctuations too small in extent to effect the closing of contact with either stop. It is also useful for adjusting the instrument.

If desired, the recording mechanism which is contained in the box L on the safe may be omitted, circuit then being completed directly to electro-magnet H by a wire, *p*, as indicated by dotted lines, Fig. 1, or for the recording mechanism here shown any other electric recording mechanism capable of recording periods of make and break of circuit may be substituted. So, also, in lieu of the instruments E F, I may substitute any other circuit-closing device containing a body moving in one direction when the current weakens and in the opposite direction when it strengthens, and by reason of said motion establishing a circuit by contact with a fixed body at either end of its path.

In another application for Letters Patent filed by me simultaneously herewith, Serial No. 262,177, I have fully described and claimed an electrical alarm system operating upon a variation in strength of current on the line. In lieu of the alarm mechanism at the central station described in my present application, I may employ the recording and alarm mechanism and circuit-connections set forth as located at said station in my said application, Serial No. 262,177, and operating as therein explained to produce a record of the period and duration of variation of current strength, and also, if desired, an alarm. So, also, in lieu of the mechanism described as arranged at the alarm-station in said application, No. 262,177, I may employ the specific apparatus herein set forth as located at the corresponding station. An instrument precisely similar to instruments E and F is also fully described and shown in my said application, Serial No. 262,177. It is to be understood, however, that I do not claim in my present application the subject-matter of the claims of my said application, Serial No. 262,177.

I claim—

1. A source of electricity, a line conductor extending between two stations, and in the circuit thereof a circuit-breaker, such as a coil and a body of inductive material in the circuit, the said body being movable and in the field of force of said coil located at one station, and an alarm or signal mechanism at the other station, the said circuit-breaker being controlled by the said body of inductive material and of the said circuit-breaker and alarm or signal mechanism being controlled and operating the first to open circuit, the second to produce an alarm or signal automatically and simultaneously at the respective stations by variation in current strength upon the intervening line, substantially as described.

2. A source of electricity, a line-conductor extending between two stations, and in the circuit thereof a circuit-breaker, such as a coil and a body of inductive material in the circuit, the said body being movable and in the field of force of said coil located at one station, and an alarm or signal mechanism at the other station, the said circuit-breaker being controlled by said body of inductive material and operated to break circuit by variation of current strength upon the intervening line, and the alarm mechanism being operated and controlled by the said opening of the circuit to produce an alarm, substantially as described.

3. A source of electricity and in circuit therewith a line-conductor, an electro-magnet, an armature, and a contact-point, the said magnet normally holding said armature against said contact-point and so establishing circuit, in combination with a movable body of inductive material in the field of force of said conductor, and also in its circuit, a contact-point wherewith said body of inductive material may make contact, and a shunt around said magnet from said contact-point to said armature, the said body of inductive material being operated and controlled by variation of current strength upon the line to move against said contact-point and establish circuit to said armature through said shunt, thus cutting out said magnet and causing said armature to be released and so to break line-circuit, substantially as described.

4. A source of electricity and in circuit therewith a line-conductor, a recording mechanism, (consisting, substantially, of an electro-magnet in the circuit, an armature, a moving record-surface, and a marking-point controlled by said armature and producing a line or trace on said surface,) a movable body of inductive material in the line-circuit and also disposed in the field of force thereof, a contact-point

located at each end of the path of vibration of said body of inductive material, and a branch conductor extending from said contact-points around said recording mechanism to ground or return, the said body of inductive material being operated and controlled by a variation of the strength of the current on main line to move into contact with one or the other of said points and so to divert line-current from said recording mechanism, substantially as described.

5. A source of electricity and in circuit therewith a line-conductor, a movable body of inductive material, the said body also being disposed in the field of force of said conductor, a recording mechanism, (consisting, substantially, of an electro-magnet in the circuit, an armature, a moving record-surface, and a marking-point controlled by said armature and producing a line or trace on said surface,) an electro-magnet, an armature therefor, and a stop wherewith said armature closes line-circuit when attracted by said magnet, in combination with a shunt around said magnet and recording mechanism extending from a stop in the path of said movable body of inductive material to the said last-mentioned armature, the said body of inductive material being operated and controlled by a variation of current strength on main line to move into contact with the stop in its path and so to divert line-current through said shunt and around said recording mechanism and electro-magnet, substantially as described.

6. A source of electricity and in circuit therewith a line-conductor, a vibrating body of inductive material, the said body also being disposed in the field of force of said conductor, an electro-magnet, and an armature therefor, the said armature operating to close main-line circuit when attracted by said magnet, in combination with a loop-conductor extending from contact-points respectively located at each end of the path of vibration of said body to said armature, the said vibrating body being operated and controlled by a variation of current strength on main line to make contact with one or the other of said points and so to divert the line-current from said electro-magnet, substantially as described.

7. A source of electricity, a line-conductor in circuit therewith connecting separated stations, and at one station a freely-movable body of inductive material in the circuit of said conductor and supported in the field of force thereof, an electro-magnet, an armature, a contact-point wherewith said armature makes contact when attracted by said magnet, ground or return connection from said contact-point, two contact-stops at opposite ends of the path of said movable body, and connections from said stops to said armature, and at the other station a freely-movable body of inductive material supported in the field of force of said line-conductor, a ground or return connection from said line-conductor, two contact-stops respectively at opposite ends of the path of said movable body, and a local circuit including a source of electricity, an alarm mechanism, said movable body, and said two contact-stops, both of said movable bodies at said respective stations being simultaneously actuated by either an increase or decrease in strength of current on the line to make contact with one or the other of their stops and so to break the main circuit at one station and establish local circuit at the other station, substantially as described.

EDWARD WESTON.

Witnesses:
PARK BENJAMIN,
EDGAR GOODWIN.