J. C. FRANCIS.

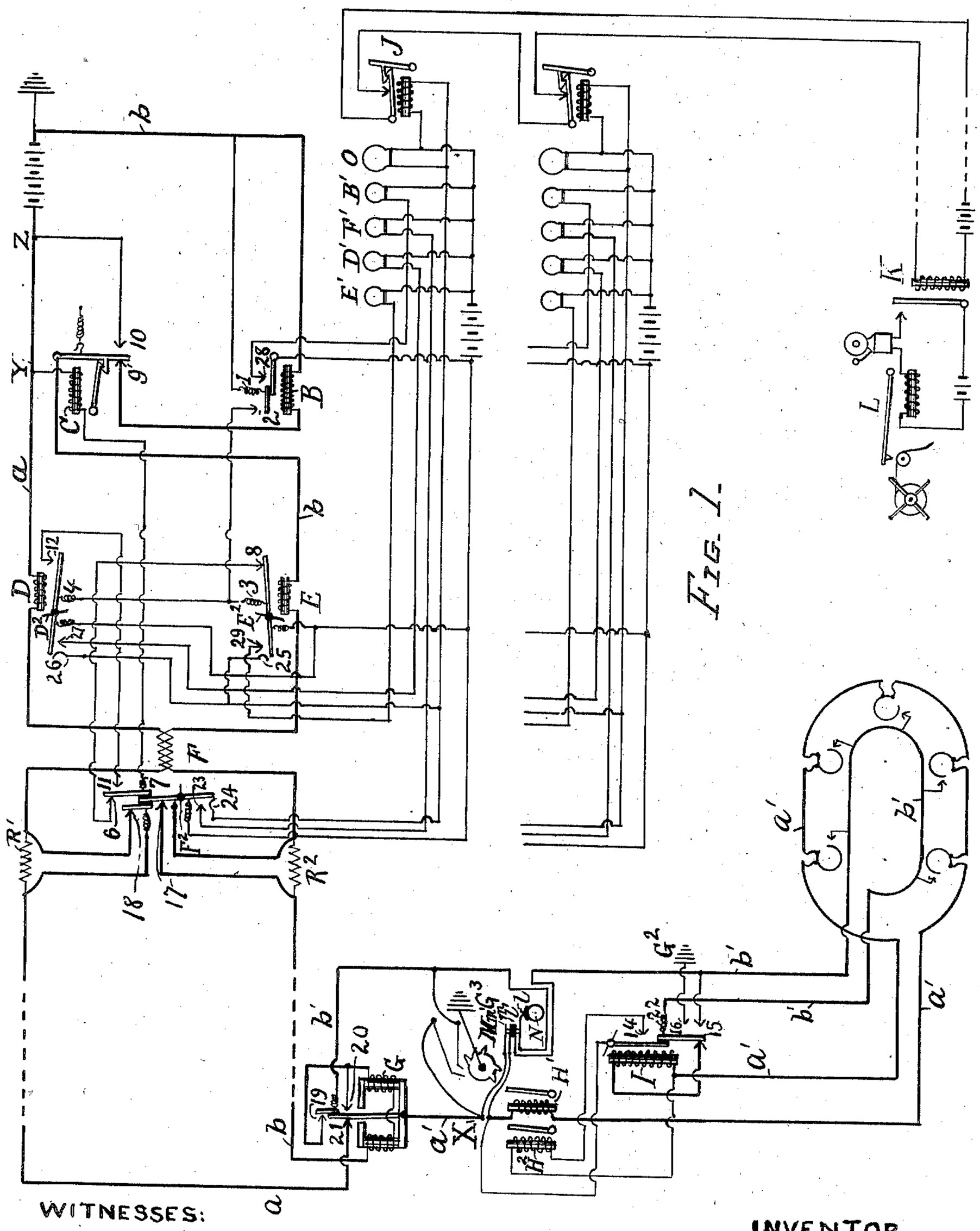
CENTRAL ENERGY ALARM SYSTEM.

APPLICATION FILED NOV. 12, 1906.

966,897.

Patented Aug. 9, 1910.

2 SHEETS—SHEET 1.



WITNESSES:

James T. Law

Samuel W. Balch

INVENTOR

JOHN C FRANCIS.

by Thomas Ewing Jr.

ATTORNEY

J. C. FRANCIS.

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2 SHEETS—SHEET 2.

Fig. 2.

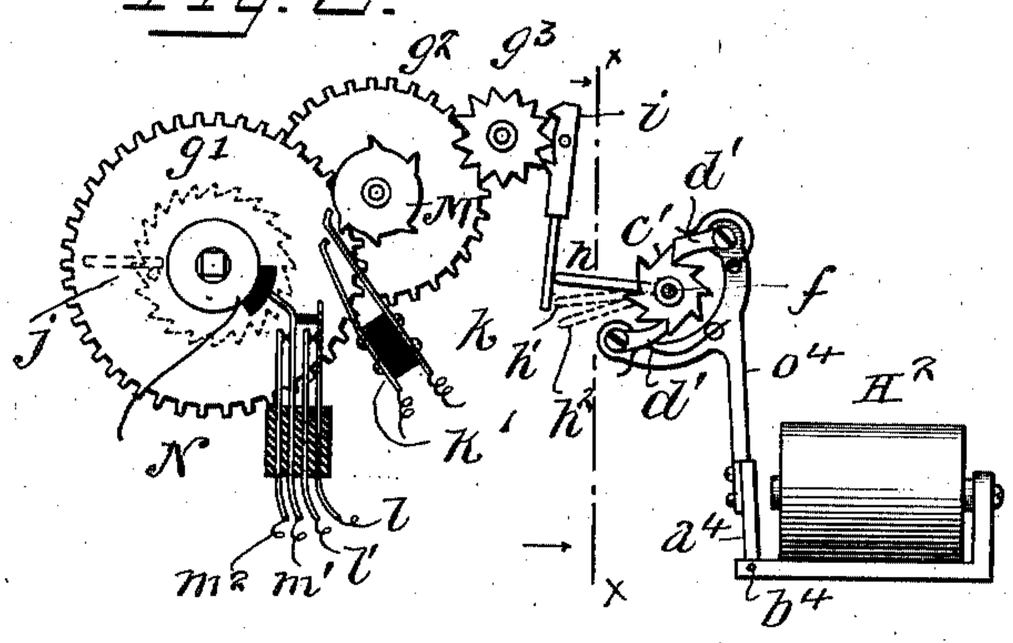

Fig. 3.

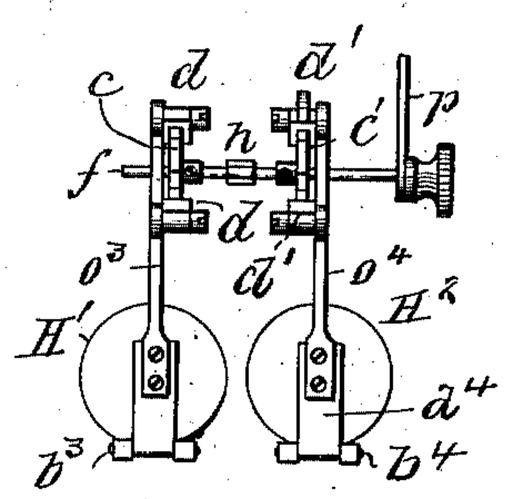

Fig. 4.

Witnesses:
J. N. Millward
May S. McGarry.

Inventor
John C. Francis
By his Attorney
Clark Benjamin

UNITED STATES PATENT OFFICE.

JOHN C. FRANCIS, OF WEST NEW YORK, NEW JERSEY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO UNITED ELECTRIC PROTECTION COMPANY, A CORPORATION OF NEW YORK.

CENTRAL-ENERGY ALARM SYSTEM.

966,897. Specification of Letters Patent. Patented Aug. 9, 1910.

Application filed November 12, 1906. Serial No. 342,961.

To all whom it may concern:

Be it known that I, JOHN C. FRANCIS, a citizen of the United States of America, and a resident of West New York, Hudson county, State of New Jersey, have invented certain new and useful Improvements in Central-Energy Alarm Systems, of which the following is a specification.

The invention relates to an electrical system organized to receive and translate at a given station, impulses transmitted from a distant station, or stations. Such systems as ordinarily constructed include a metallic line circuit, a transmitting device, and a translating device usually for indicating signals, which devices may be located at relatively distant stations. When an abnormal disturbance of electrical conditions occurs on the circuit, the translating device is usually rendered inoperative.

It is the object of my invention and the same is so organized, that the abnormal disturbance aforesaid shall remedy itself by causing devices to be automatically actuated to restore the efficiency of the system, so that the effect of said disturbance upon the operation of the translating device by the transmitting device shall be neutralized.

In the accompanying drawings—Figure 1 is an electrical diagram wherein the various parts of the apparatus are conventionally and symbolically represented. Fig. 2 is a side elevation of the transmitter. Fig. 3 is a section of the same on the line x, x, of Fig. 2. Fig. 4 shows the construction of a manually operated circuit closer for connecting the wires a', b'.

Similar numbers and letters of reference indicate like parts.

The source of current which is grounded may be any source, and is here represented by the conventional symbol of a primary battery. For convenience in identifying the location of an abnormal disturbance on the circuit, the conductors are herein considered as in four sections, namely, wire a and wire b which include the line extending between the stations, and wire a' and wire b' at the distant or local station.

I will first describe the principal devices associated in the circuit.

Magnet B operates to open and close circuit through magnet C. As here shown, it is normally energized by the small current on the circuit, and when deënergized it closes circuit through magnet C which in turn controls the opening and closing of the line or metallic circuit.

Magnets D and E control the signal indicating mechanism at the central or home station. Under normal conditions both operate simultaneously. In case of an abnormal disturbance occurring on the circuit, one or the other operates in accordance with the location of said disturbance. Magnets D, E and F are normally deënergized and of sufficiently low resistance not to be operated by the normal current decreased by the high resistance of magnet I.

Magnet F is a neutral wound relay. When both of its coils are energized it does not act, but becomes operative only when one coil is energized. Its chief function is to bring an additional resistance into the line upon the occurrence of a ground, in order to avoid such a loss of current from battery to ground, as would not leave sufficient current to energize magnets D or E when signals are transmitted from the distant station.

Magnet G is a pole-changer, and operates to keep the wire a' at the local station always connected to the non-grounded pole of the battery.

Magnets H′ and H² operate through two successive steps to release the mechanism of wheel M to permit said wheel to be rotated by its spring, and so to act as a transmitter of current impulses.

Magnet I has a coil of high resistance and is normally energized. When deënergized it operates to close certain circuits at the local station which, when the thermostat or hand actuated devices operate, convey currents to magnets H′ H² to release the transmitter wheel M.

The means for automatically setting the transmitter wheel M in operation may be any suitably operated signal initiating instruments. In Fig. 4, I show a manually operated device for the purpose, and in Fig. 5, I have indicated thermostats located between the local wires a', b'.

The indicating mechanism at the home or central station is here embodied in the glow lamps E′, D′, F′, B′, O. Lamp O is the normal signal lamp which receives signals from transmitter wheel M. Lamp B′ indicates a break or a ground on the line. Lamp F′ indicates a ground on either wire

a or *b*. Lamp D′ indicates a ground on wire *a*. Lamp E′ indicates a ground on wire *b*.

Magnet J is a relay and repeats the signals given by lamp O to a third station.

Magnet K is in relay circuit with magnet J and normally energized. When this circuit is broken by magnet J, another local circuit is closed at L to sound an alarm bell and make a record on a tape at said third station.

I will now trace the metallic line circuit.

The metallic line circuit proceeds as follows: from battery, to magnet D, one coil of magnet F, contact 18, switch lever of magnet F, wire *a*, contact 21, to armature of magnet G, wire *a′*, one pair of the brushes controlled by cam N, magnet H′ around the loop of *a′*, magnet I, contact 15, loop of *b′*, the other pair of brushes controlled by cam N, contact 19, magnet G, wire *b*, contact 17, switch lever of magnet F, the other coil of magnet F, magnet E, contact 9, and magnet B to battery. The normally open brushes controlled by transmitter wheel M extend respectively from wire *a′* and wire *b′*, and when closed by wheel M bridge the circuit.

There are also the following connections:

A normally open connection and controlling switch at the home station.—This connection extends from point Z on wire *a* near battery to point 10. The magnet C controls a pivoted switch lever to establish contact at either point 9 or point 10.

A normally open ground connection and means for closing same at the local or distant station.—This connection proceeds from the pivot of switch lever controlled by magnet C, to magnet E, one coil of magnet F, contact 17, wire *b*, magnet G, contact 19, wire *b′*, and to one of the two contact brushes controlled by wheel M. Said wheel is grounded through its journal bearings at G^3. From the other of said brushes the connection proceeds to wire *a′*, contact 21, wire *a*, contact 18, the other coil of magnet F, magnet D and battery. This ground connection when the transmitter wheel is at rest is normally open. When the wheel is set in rotation by a wound spring or in any other suitable way, it causes the brushes to make and break contact in the usual manner to intermittently open and close circuit to ground G^3. By suitably constructing the wheel to make certain definite makes and breaks in the circuit, the device becomes a transmitter of signals from the distant to the central station.

An indicating apparatus for the transmitted signals.—This may be of any suitable construction capable of giving audible or visible signals when impulses are transmitted. In the present embodiment of my invention it includes the magnets D, E, and the glow lamps controlled thereby through connections which will be explained in detail hereafter.

For signaling under normal conditions the operator at the local or distant station may release the transmitter wheel M by means of a manually controlled device, or the same may be released by the agency of a thermostat.

For the purpose of overcoming the effect of an abnormal disturbance on the circuit, such as is due to a break, a crossing or a ground, the following connections are also provided:

Means actuated by abnormal disturbance on the circuit for operating magnet C.— Upon the occurrence of the disturbance, such as a break, the magnet B becomes deënergized, and the pivoted switch lever controlled by said magnet being retracted closes contact at 2. This closes the following path. From battery to Y, magnet C to switch lever controlled by magnet F, point 6, contact 8, switch lever controlled by magnet E, contact 2, switch lever controlled by magnet B, which lever is connected, at 1, back to battery. By reason of the deënergizing of magnet B and the energizing of magnet C, two leads both proceeding from the non-grounded pole of the battery become established, through one of which, depending upon the location of the disturbance in the line, circuit may be closed by the transmitter M to operate the associated signal indicating device. Thus assume the abnormal disturbance to be due to a break occurring in wire *a* or wire *a′* (as, for example, in the wire *a*). Two leads are then established from the non-grounded pole of the battery: one of them dead, because ending at the break, the other live, because a current may be closed through it to ground G^3 by the transmitter M. The dead lead terminating at the break will proceed from battery by wire *a*, to magnet D to one coil of magnet F to contact 18 and to break. The live lead will proceed from battery to Z, to contact 10 to wire *b* to magnet E, to one coil of magnet F to contact 17, wire *b*, magnet G, point 19, wire *b′*, brush of wheel M and to ground G^3 when said wheel in rotating closes circuit to ground. Hence, by reason of the break in wire *a*, conditions are established whereby the magnets E and F both become responsive to signals from transmitter M and correspondingly control the signal indicating means at the home or central station. If, on the other hand, the break occurs in wire *b* or wire *b′* (as, for example, in wire *b*), then the dead lead will proceed from battery to Z, to contact 10, to wire *b* to magnet E to one coil of magnet F to contact 17 and to break. The live lead will proceed from battery to wire *a* to magnet D to one coil of magnet F to contact 18, wire *a*, point 21 to brush of wheel M and to

ground G^3, when said wheel in rotating closes circuit to ground. Hence, by reason of the break in wire *b* the magnet D responds to the signals from transmitter M and correspondingly controls the signal indicating means.

If instead of being due to a break the abnormal disturbance is caused by a ground, then one lead instead of being dead is impaired by the grounding and the other is alive as before. Assume the ground to occur in wire *a* or wire *a'*. The impaired lead is then from battery to magnet D, to one coil of magnet F and through resistance R' to ground, and so back to grounded pole of battery. The live lead is from battery to Z, to contact 10 to wire *b* to magnet E to one coil of magnet F to resistance R^2, wire *b*, magnet G, point 19, wire *b'* brush of wheel M and to ground G^3, when said wheel in rotating closes circuit to ground. It is to be noted that this live lead is the same as that established when a similarly situated break occurs, with these differences. The relay magnet F is no longer neutral, and as it attracts its switch lever, circuit is broken at the contacts 18, 17 and 6, and closed at 11. The current path is then from battery to magnet C, connection 7, contact 11, contact 12, switch lever of magnet D to connection 4 to contact 2, switch lever of magnet B, connection 1 and so to battery. The resistances R' R^2 are no longer shunted. The resistance R' in the impaired lead cuts down the loss of current on that lead, so that sufficient current is caused to flow in the live lead to operate the mechanism. The resistance R^2 in the live lead now performs no function, but as it is very small compared to the whole resistance on that lead, it does no harm.

Assume the ground to occur in wire *b*. The impaired lead is then from battery to Z, contact 10, wire *b*, magnet E to one coil of magnet F to resistance R^2 to ground, and so back to grounded pole of battery. The live lead is from battery to wire *a*, magnet D, to one coil of magnet F, resistance R', wire *a*, point 21, to brush of wheel M and to ground G^3, when said wheel in rotating closes circuit to ground. The resistance conditions are the converse of those already stated. It is evident also that one of these leads, as before, includes the magnet D, and the other, the magnet E, and that current being established through one of said leads actuates either the magnet D or E, and hence the indicating means associated with said magnet.

In the case of a cross between wire *a* and *b*, magnets D and E are energized so that they cannot respond to impulses from wheel M. The magnet I at the local station being deënergized, closes contacts 15, 16, thus grounding wire *b'* at G^2. As a consequence of the ground at the battery and at G^2, magnets E and B will fail. The failing of B, as before, closes circuit through C, opening contact 9 and closing contact 10, thus forming two parallel leads, both impaired to the extent of being tied together by the cross between *a* and *b*. One lead is from battery to Z, to magnet D, one coil of magnet F, contact 18, wire *a*, over the cross to wire *b*, magnet G, contact 20, wire *a'*, to brush of transmitter wheel M. The other lead proceeds from battery to Z, contact 10, magnet E, one coil of magnet F, contact 17, wire *b*, magnet G, contact 20, wire *a'* and the same brush of wheel M. When the transmitter wheel is actuated the relays D, E and F all respond in unison.

The circuit at the distant station includes the wire *a'* and *b'* and may be considered as beginning at the switch lever of magnet G and ending at contact 19.. In this circuit, by reason of the pole changing function of magnet G, the wire *a'* is kept connected to the non-grounded pole of the battery.

The high resistance coil on magnet I reduces the current on the whole circuit sufficiently to prevent the operation of magnet D, magnet E and magnet H', but not so much as to prevent the efficient energizing of magnet B.

I will assume that there are to be several points at the local station from which the system may be set in operation, either by hand or automatically. To this end, in Fig. 1 I show the wires *a'* and *b'* in the form of elliptical loops, the loop of *a'* surrounding the loop of *b'*. Across these loops I show, diagrammatically a number of circuit closing thermostats, or I may use a device such as shown in Fig. 4 and described hereafter in detail.

When a crossing is effected between the loops of *a'* and *b'*, either by a thermostat or by the hand device, magnet I is deënergized, thereby opening contact 15 and closing contacts 16 and 14. Current then proceeds from switch lever of magnet G to point X, to magnet H', loop of *a'*, and to the circuit closer at the crossing; and also in shunt from point X to contact 14, magnet H^2 and loop of *a'* to the said circuit closer. Then through the circuit closer to loop of *b'*, contact 16 to ground G^2. This energizes magnets H' and H^2, which, in the manner hereafter described, control the mechanism of wheel M. The circuit closer is now operated to break the circuit on wire *a'* at the point of connection on said line. That deënergizes magnets H' and H^2, and as a result the transmitter wheel is released, so that it can be rotated by its spring to send current impulses over the line.

The above-described operation of the part of the circuit at the local station, including wires *a'* and *b'*, applies to all conditions

normal or abnormal on the part including the wire *a* and wire *b*.

The signal indicating means.—I will now describe in detail the means at the home or central station for indicating the impulses transmitted by wheel M.

The lamp O: This is controlled by magnets D, E and F. The system being in normal condition the first closing of circuit to ground by wheel M, deënergizes magnet B, which closes circuit through magnet C to produce the parallel leads already described. Magnets D, E and F are then energized. The switch levers of D, E, F are thus operated to close contact 26 at D, 25 at E, and 24 at F. The local circuit here shown as including an additional battery proceeds as follows: from battery to switch lever of magnet E, to contact 25, to lamp O and back to local battery. Also from local battery to switch lever of magnet D, to contact 26, to lamp O and back to local battery. Also from local battery, to switch lever of magnet F, to contact 24, to lamp O and back to local battery. Hence the current impulses from wheel M vary the condition of the light of lamp O, conformably to said impulses, and so produce a predetermined visual signal.

The lamp B′ is controlled as follows: Upon a break or ground occurring, magnet B fails, as already described. Its switch lever closes contact 28. The circuit then proceeds from local battery to switch lever of magnet B, to contact 28, to lamp B′ and back to local battery.

The lamp F′ is controlled as follows: Upon the occurrence of a ground on the line, the magnet F becomes energized, as already described, thus closing circuit at 23. The circuit then proceeds from local battery to switch lever of magnet F, to contact 23, to lamp F′ and back to local battery.

The lamp D′ is controlled as follows: A ground on line *a* energizes magnet D and closes contact at 27. The circuit then proceeds from local battery to switch lever of magnet D to contact 27, to lamp D′ and back to local battery.

The lamp E′ is controlled as follows: A ground on wire *b* energizes magnet E and closes contact 29. The circuit proceeds from local battery to switch lever of magnet E to contact 29, to lamp E′ and back to local battery.

The magnet J being bridged across lamp O, repeats the impulses to magnet K at another station with which it is in local circuit including another battery. At said third station the signals are audibly produced by a bell, and recorded by any suitable automatic device, as indicated in the drawing, Fig. 1.

I have shown a duplicate set of lamps and magnet J, to indicate that another main line circuit may be connected to the magnet K so that both systems will send in signals which will be rendered audible and recorded at one final station.

To prevent the respective switch levers of magnets D, E, F from closing their final stop contacts when energized by quick impulses produced by wheel M, the movement of said levers may be retarded by fans D^2, E^2 or F^2 on said levers.

I will now describe the transmitter at the local station H′:

H′ and H^2 are the actuating magnets having armatures a^3 and a^4 which are pivoted at b^3 and b^4. The levers o^3 and o^4, which are attached to the armatures a^3 and a^4, carry the pawls *d d* and *d′ d′*. These pawls engage in the ratchet wheels *c* and *c′*. The wheels *c* and *c′*, and the lever *h* are fastened rigidly to the shaft *f*. The train of wheels g' g^2 and g^3 have an escapement *i* which is normally locked by the lever *h*, and *j* is a stop which locks the movement when g' has made one revolution. The normally open spring contacts *k* and *k′* are connected respectively to each member of the circuit, and when the transmitter wheel M is revolved, are alternately closed and opened. The normally closed spring contacts *l* and *l′* and m' m^2 are operated by cam N to automatically open both members of the circuit between the transmitter and the house circuit while the transmitter is running, so that any local circuit troubles cannot affect the transmission of fire signals. The knob and pointer *p* are for the purpose of resetting the lever *h*. When either of the magnets H′ or H^2, or both together, receive an impulse of current, the ratchet wheel *c* will be moved one tooth, thus placing the lever *h* in the position shown by dotted lines *h′*, and when either H′ or H^2, or both, become deënergized, the ratchet wheel *c* will be moved another tooth, which places the lever *h* in the position shown by dotted line h^2, thus unlocking the escapement *i*, and allowing the movement to transmit the alarm by wheel M and springs *k* and *k′*, connected to wires *a′* and *b′* respectively.

Fig. 4 shows an actuating device for manually closing circuit across wires *a′*, *b′*, in which the terminals of wire *a′* connect to springs f^5 and e^5 through lever R. The wire *b′* is attached to the spring g^5 and continues on without opening the circuit. The operation of pulling down the hook of lever R first establishes the cross between f^5 e^5 and g^5, and when the lever is pulled all the way down to meet stop *s*, the cross is broken and a break in wire *a′* is opened between f^5 and e^5.

I claim:

1. The combination of a normally grounded current source, a normally closed line cir-

cuit, a normally open connection from the non-grounded pole of said source, a switch for opening the line circuit and closing said connection, a ground connection from line located between said switch and said non-grounded pole, means for controlling circuit to said ground connection, means actuated by an abnormal disturbance of electrical conditions on the circuit for operating said switch and signal indicating devices in circuit respectively located on opposite sides of said ground connection: said disturbance operating said switch to close said first named normally open connection and break said line circuit, and thereby establishing a current path around said disturbance to said ground connection, so that thereafter the subsequent controlling of circuit to said ground connection by said controlling means shall operate the indicating device in said current path.

2. The combination of a source of current grounded at one pole, a metallic circuit normally energized by said source, a ground connection for said circuit, a circuit closer in said ground connection, a translating device controlled by said circuit closer, and means operated by an abnormal disturbance of electrical conditions on the circuit for automatically neutralizing the effect of said disturbance upon the operation of said translating device by said circuit closer.

3. The combination of a grounded source of current, a line circuit, signal indicating means, means actuated upon the occurrence of a ground on the line and by said ground for establishing current leads from the non-grounded pole of the source of current, one of said leads being connected through ground back to battery, and a transmitter operating through the other of said leads to actuate said indicating means.

4. The combination of a grounded source of current, a line circuit, signal indicating means, means actuated upon the occurrence of a ground on the line and by said ground for establishing current leads from the non-grounded pole of the source of current, both of said leads being connected through ground back to battery, and a transmitter operating through one of said leads to actuate said indicating means.

5. The combination of a grounded source of current, a line circuit, signal indicating means, means actuated upon the occurrence of a crossing in the line and by said crossing for establishing current leads from the non-grounded pole of the source of current to the crossing, and a transmitter operating through said leads to actuate said indicating means.

6. The combination of a grounded source of current, a line circuit, signal indicating means, means actuated upon the occurrence of a crossing in the line and by said crossing for establishing current leads from the non-grounded pole of the source of current, and a transmitter for sending current impulses through said leads to actuate said indicating means.

7. The combination of a source of current, a line circuit, signal indicating means, signal transmitting means located at a distant station, means operated by an abnormal disturbance of electrical conditions on the circuit for automatically restoring the electrical relations between said transmitting and receiving means changed by said disturbance, and, at said distant station, a pole-changer for keeping the live leads of said current connected with the non-grounded pole of said current source.

8. The combination of a source of current grounded at one pole, a normally closed metallic circuit including said source, a translating device in said circuit, a ground connection from said circuit, a transmitter in said ground connection, and means operated by an abnormal disturbance in the electrical conditions on said circuit for establishing a new current lead around the disturbance point and from the non-grounded pole of said source to said transmitter.

9. The combination of a source of current grounded at one pole, a normally closed metallic circuit including said source, a translating device in said circuit, a second translating device, a ground connection from said circuit, a transmitter in said ground connection, and means operated by an abnormal disturbance in the electrical conditions on said circuit for establishing a new current lead including said second translating device around the disturbance point and from the non-grounded pole of said source to said transmitter.

10. The combination of a source of current grounded at one pole, a normally closed metallic circuit including said source, a translating device in said circuit, a ground connection from said circuit, a transmitter in said ground connection, a normally open shunt across said metallic circuit, and means operated by an abnormal disturbance in the electrical conditions on said metallic circuit for opening said metallic circuit and closing circuit through said shunt from the non-grounded pole of said source to said transmitter.

11. The combination of a source of current, a metallic circuit normally energized thereby, a plurality of translating devices, and means operated by an abnormal disturbance of electrical conditions on the circuit for establishing current leads including said translating devices and for selectively controlling said translating devices to indicate the character of said disturbance.

12. The combination of a source of current, a metallic circuit normally energized thereby, a transmitter, a translating device controlled by said transmitter, a plurality of abnormal disturbance indicating devices, and means operated by an abnormal disturbance of electrical conditions on the circuit for establishing current leads controlling said indicating devices selectively to indicate the character of the disturbance.

Signed by me at New York city this tenth day of November, 1906.

JOHN C. FRANCIS.

Witnesses:

SAMUEL W. BALCH,

HUGH H. SENIOR.