

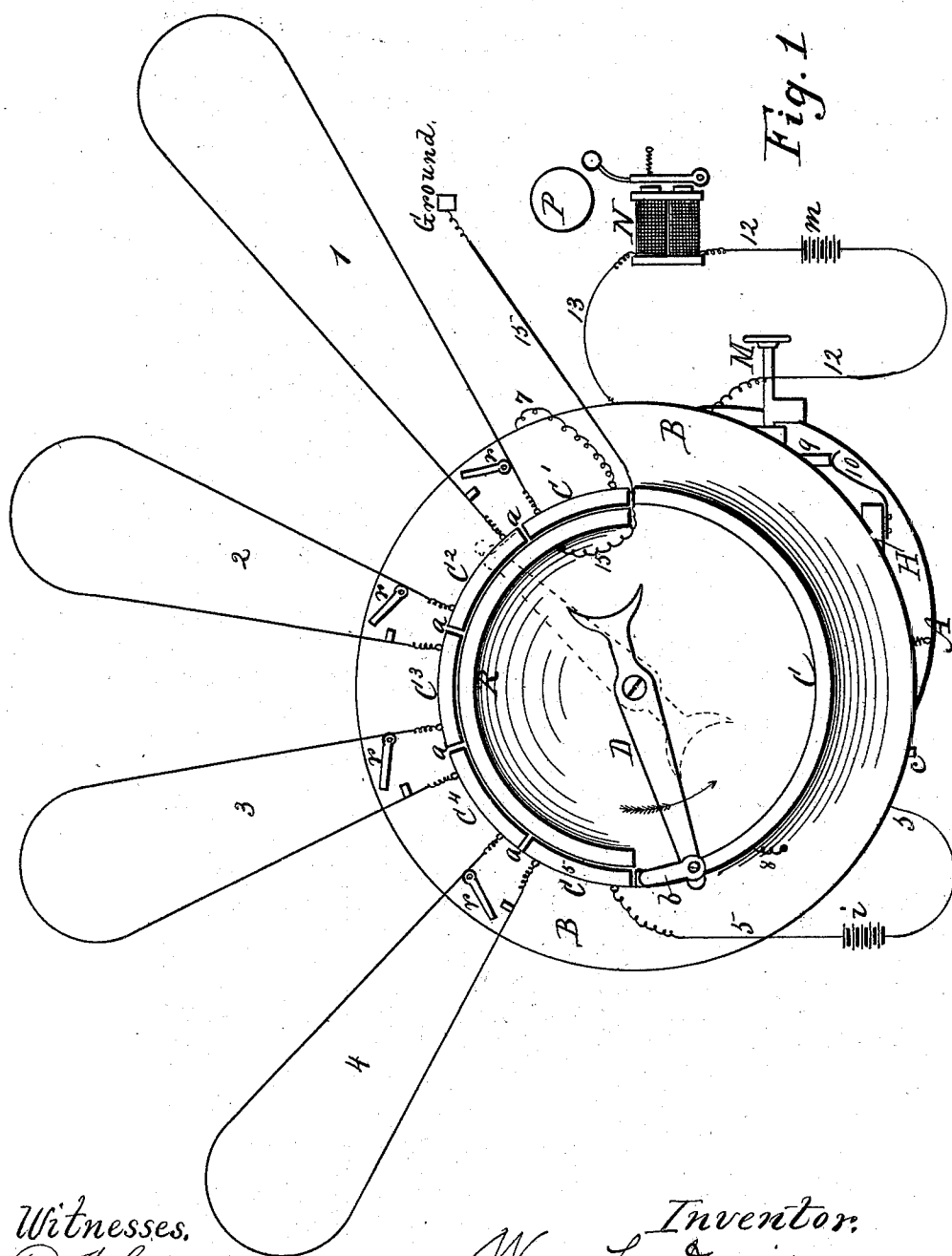
(No Model.)

3 Sheets—Sheet 1.

W. L. DENIO.
ELECTRIC SWITCH.

No. 565,673.

Patented Aug. 11, 1896.



Witnesses,
P. A. Costick
H. G. Osborne

Inventor.
Wm. L. Denio,
per R. F. Osgood, *Atty.*

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Fig. 3.

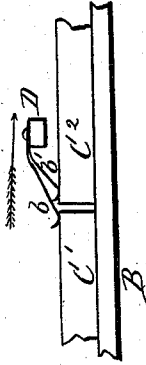
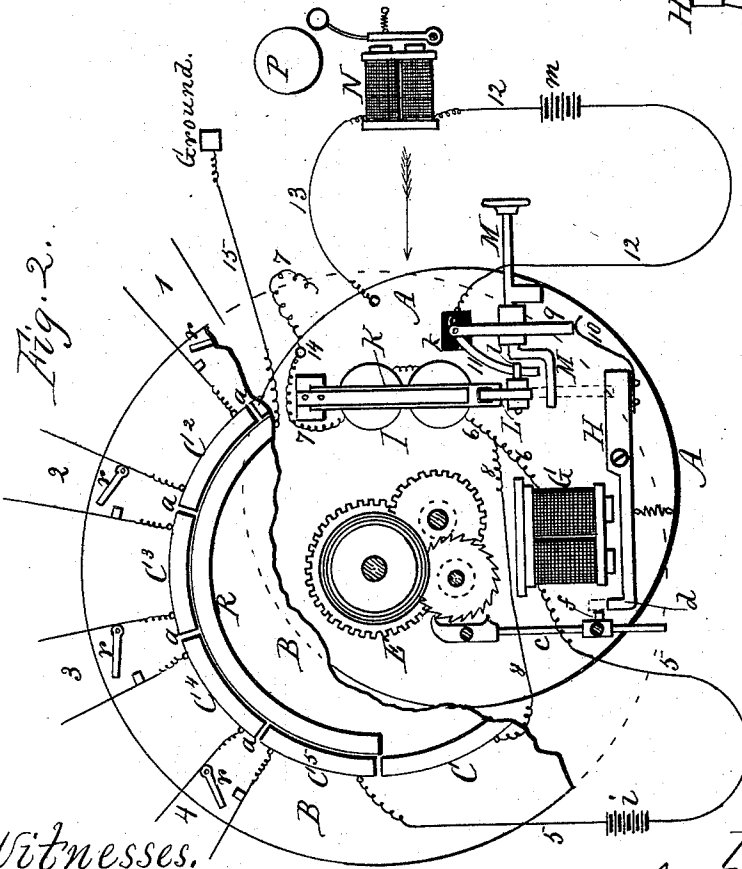
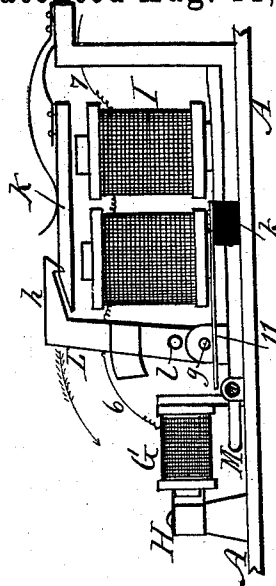


Fig. 4.



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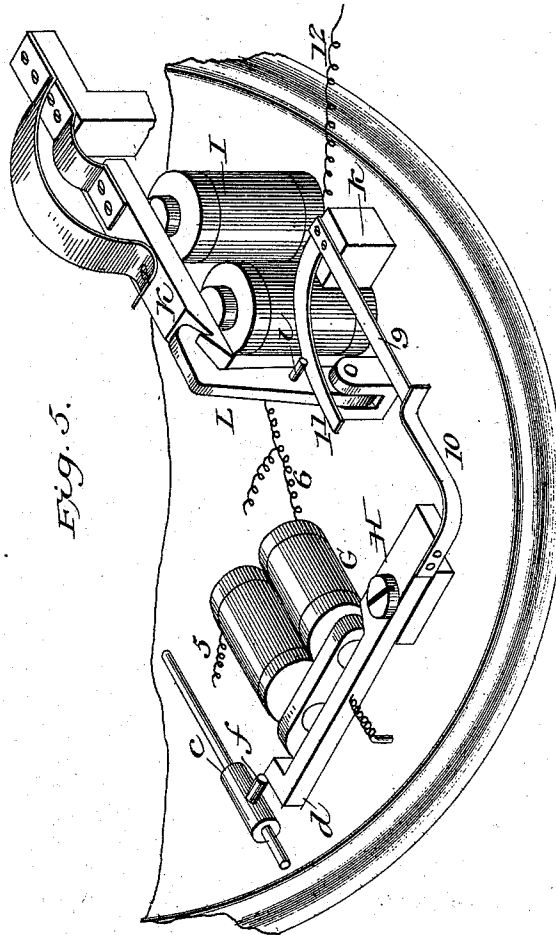


Fig. 5.

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Inventor.

Wm L. Denio.
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Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM L. DENIO, OF ROCHESTER, NEW YORK, ASSIGNOR TO THE
STANDARD ELECTRIC SIGNAL COMPANY, OF SAME PLACE.

ELECTRIC SWITCH.

SPECIFICATION forming part of Letters Patent No. 565,673, dated August 11, 1896.

Application filed January 25, 1894. Serial No. 498,018. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM L. DENIO, of Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Electric Switches; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the drawings accompanying this application.

The object of this improvement is to cut out a loop forming a part of a main circuit in case said loop becomes permanently disabled by a broken wire or otherwise, and to automatically reestablish the circuit through the remainder of the main line, so that no impediment shall be presented to the sending in of signals over the whole circuit, except that which is cut out; also, to detect and locate the particular place where the imperfection exists.

To this end the invention consists in the construction and arrangement hereinafter described, and embodied in the claims.

In the drawings, Figure 1 is a plan view of the apparatus, showing a circuit having several different loops connected therewith and radiating to different points. Fig. 2 is a similar view, partially in horizontal section, to exhibit the operating parts. Fig. 3 is a diagram showing in side elevation the end of the movable circuit-closer and the conducting-ring over which it passes. Fig. 4 is an enlarged side elevation of the magnets and connecting parts, looking in the direction of the arrow at the right in Fig. 2. Fig. 5 is a perspective view of the two magnets G and I and their connections.

In this invention an apparatus is used at a central station or office which I denominate the "differentiating" apparatus. The same consists of a circular case, comprising a metallic base A, to which the operating parts are attached, an insulated plate B, elevated above the base and supported by suitable standards, and a concentric ring composed of a section C, constituting a large portion of the ring, and several segments C¹ C² C³ C⁴ C⁵, &c., forming conductors corresponding in number with the number of different loops 1 2 3 4 5, &c., composing the circuit. There are breaks *a a a* between the said conductors, so that

each conductor is independent of the others, and the loops are each connected with the ends of two conductors, as shown, whereby the current is from one conductor through the loop to the next, and so on.

D is a circuit-closer consisting, as shown in the drawings, of an arm pivoted in the center of the case and provided with two spring-tongues *b b'*, forming contacts which rest in contact with the ring. The tongues are at such a distance apart that when they reach the conductors one rests in contact with one conductor and the other with the next, as shown in Fig. 3.

E is a time mechanism of any suitable kind, provided with an escapement *c* for giving motion to the circuit-closer.

G is an electromagnet, and H an armature operating in connection therewith. When the magnet is charged and the armature drawn up, its end *d* intercepts a point *f* of the escapement *c* and locks the time mechanism and stops the motion of the circuit-closer. When the armature is thrown out, the time mechanism has free action.

I is another magnet, and K its armature.

L is a lever pivoted at *g* and provided with a hook *h* at its top, which catches the armature. When the armature is drawn down by the magnet, the lever is released and falls over backward, as indicated by the arrow, Fig. 4. When so thrown over, it falls behind the end of armature H and locks it in position to prevent the operation of the time mechanism, as before described. The lever L is raised again to connect with armature K by means of a cranked arm M, which is turned by hand.

The electrical connections are as follows: 1 2 3 4, &c., are the various loops in the circuit connected with the conductors, as before stated. 5 is a wire connected with the conductor C⁵, thence extending to magnet G, and provided with a battery *z*. 6 is a wire connecting magnet G with magnet I. 7 is a wire connecting magnet I with conductor C¹, also touching base A at 14. 8 is a wire connecting conductor C³ with wire 6. 9 is a spring attached to an insulated block *k*, and 10 a spring attached to the armature H. When the armature is open, the springs are in con-

tact, as shown, but when it is closed they are separated. 11 is a spring also attached to insulated block *k* and extending out under the heel of lever *L*. When the lever is raised, as shown, the spring is out of contact with it, but when it is thrown back to lock armature *H* a point *l* of the lever comes in contact with the spring. 12 is a wire provided with a local battery *m*, said wire extending from the springs 9 to 11 to a magnet *N*, which controls a gong *P*. 13 is a return-wire connecting magnet *N* with the base *A* of the apparatus.

The main circuit is normally closed, and extends from battery *i* through wire 5, magnet *G*, wire 6, wire 8, conducting-section *C*, tongues *b b'*, arm *D*, down through its shaft into the base *A* to point 14, through wire 7, conductor *C'*, the several loops 1 2 3 4 and conductors *C² C³ C⁴ C⁵*, and wire 5 back to battery *i*. Under these conditions magnet *G* is charged, armature *H* is drawn up, the time mechanism is locked, and the arm *D* is held stationary; but in case the circuit is opened, by sending in a signal or by the breakage or other disarrangement of the wires in any part of the circuit, magnet *G* is demagnetized, the armature *H* is drawn back, the time mechanism released, and arm *D* set in motion.

In case of sounding a signal the circuit is alternately opened and closed, and the arm *D* makes only intermittent movements to correspond; but in case of breakage of a wire the circuit is permanently opened, and the arm *D* makes continuous movement forward, passing over the conducting-section *C*. Supposing the break to be in loop 1, the arm *D* will continue its movements till the tongues *b b'* cover the break *a* between the two conductors *C' C²*, and complete the circuit between said two conductors which before passed through the wires 1 1. When the arm *D* reaches this point, the circuit is changed, passing from battery *i* through wire 5, magnet *G*, wire 6, magnet *I*, wire 7, conductor *C'*, tongues *b b'*, then at the break between *C' C²*, then on and through wires 2 3 4, and wire 5 back to battery *i*. The charging of magnet *I* draws down armature *k* and releases lever *L*, which then falls back and locks armature *H* and stops the time mechanism, as before described. Consequently the arm *D* remains at the break between conductors *C' C²*, and maintains the integrity of the main circuit, notwithstanding that portion which is defective is cut out. In the same manner the moving arm will close the circuit between any two of the other conductors. The loop in which the defect is located is indicated by the position of the moving arm on the dial. When the break is identified, the circuit between the broken wires can be temporarily closed by a switch *r* while the wires are being repaired, and the arm *D* can be moved back to its original position ready for new action.

At every vibration of armature *H* the spring 10 is brought in contact with spring 9, there-

by ringing the gong, and in the case of a broken wire the lever *L*, falling in contact with the spring 11, makes a permanent connection therewith and sounds a continuous alarm on the gong, thereby indicating the difficulty.

It is obvious that this apparatus is operative where there is only one loop extending from the main circuit and two conductors with which said loop connects.

R is a part-ring also mounted on the insulated plate *B* and connected with the ground by a wire 15, the same serving as a lightning-arrester.

In ordinary fire-circuits there are many side circuits or loops forming part of the main circuit, and in case any one of them is broken the current through the main line is cut off. The object of this invention is to automatically close the main circuit when any one of said lines is disabled or cut out. This is done in the manner before indicated, the loops 1 2 3 indicating such side lines. The opening of the circuit in any one of the loops releases the circuit-closer *D*, which then revolves to the point where the break exists and establishes a short circuit across the loop, leaving the latter cut out.

Having described my invention, I do not claim simply and broadly a movable circuit-closer actuated by the breaking of the circuit and making the connection across the break;

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

1. The combination of a movable circuit-closer driven by suitable mechanism, a conducting-ring provided with breaks, forming segments over which the circuit-closer rests, a main circuit connected with the conducting-ring, a magnet for controlling the mechanism that operates the circuit-closer, a second magnet provided with suitable attachments for locking the armature of the first magnet and permanently restraining the operating mechanism, and suitable electrical connections controlling the magnets, as described.

2. The combination of a conducting-ring made in separate segments with breaks between them, a main circuit connected with the conducting-ring, side loops forming parts of the main circuit connected with the several segments, a circuit-closer resting over the ring and provided with contacts resting on the ring, a time mechanism for operating the circuit-closer, a magnet for controlling the time mechanism, a second magnet for locking the armature of the first one, and suitable electrical connections for controlling the magnets, as described.

3. The combination of a movable circuit-closer, a time-movement for operating the circuit-closer, a magnet provided with an armature for holding the escapement of the time-movement, a second magnet, a lever held by the second magnet, and suitable electrical connections, the whole so arranged

that when the lever is released it falls and locks the armature of the first magnet and restrains the time-movement as herein shown and described.

5 4. The combination of a movable circuit-closer, a time-movement for operating the same, a magnet controlling the time-movement, a second magnet for locking the armature of the first magnet and restraining the
10 time-movement, an interior conducting-seg-

ment independent of the conducting-ring, and a grounded wire connected therewith, as and for the purpose specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing
15 witnesses.

WILLIAM L. DENIO.

Witnesses:

R. F. OSGOOD,
CHAS. A. WIDENER.