(No Model.)

E. A. SPERRY.

ELECTRICAL SWITCH.

No. 396,439. Patented Jan. 22, 1889.

Fig. 1.

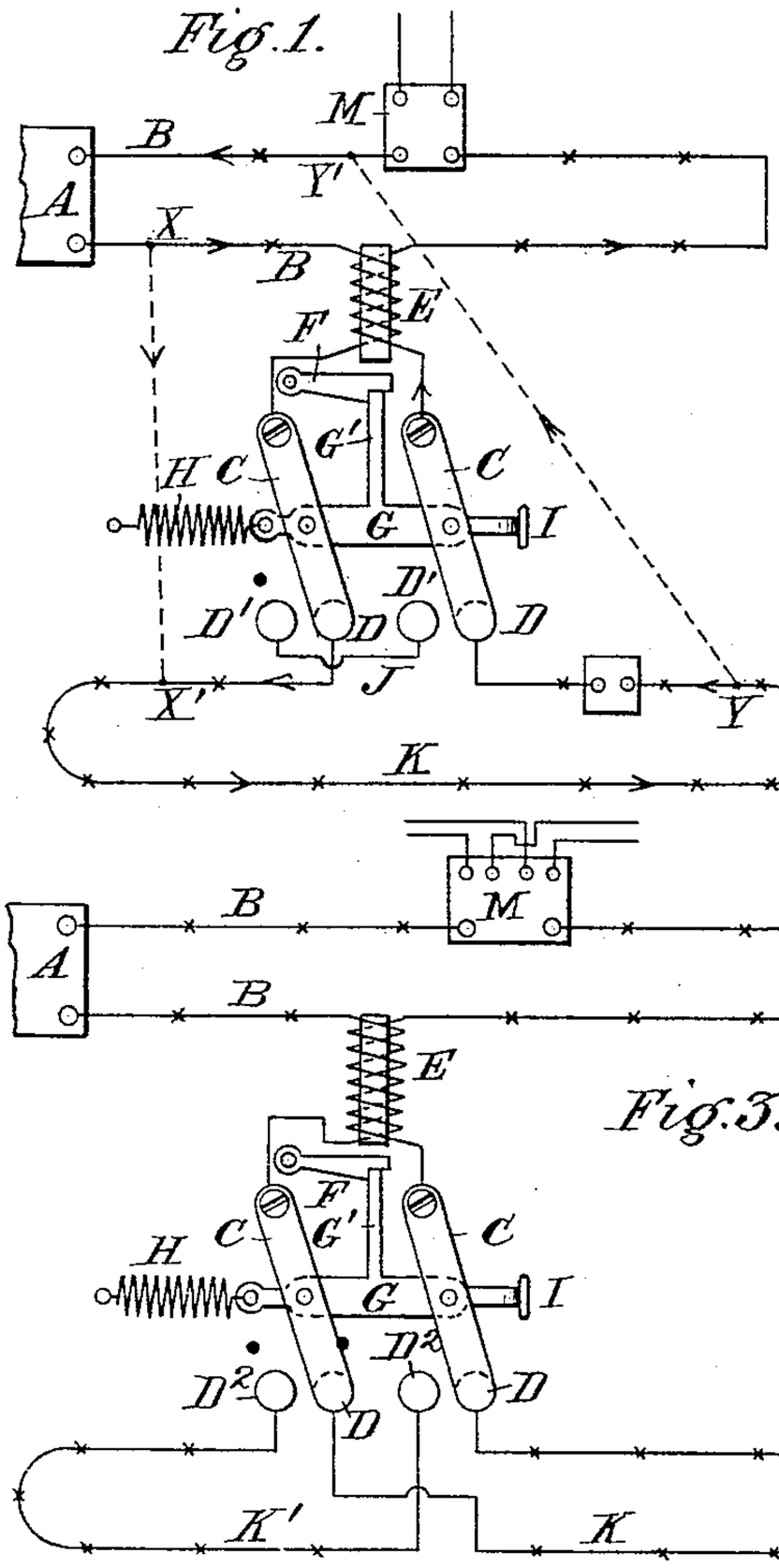


Fig. 2.

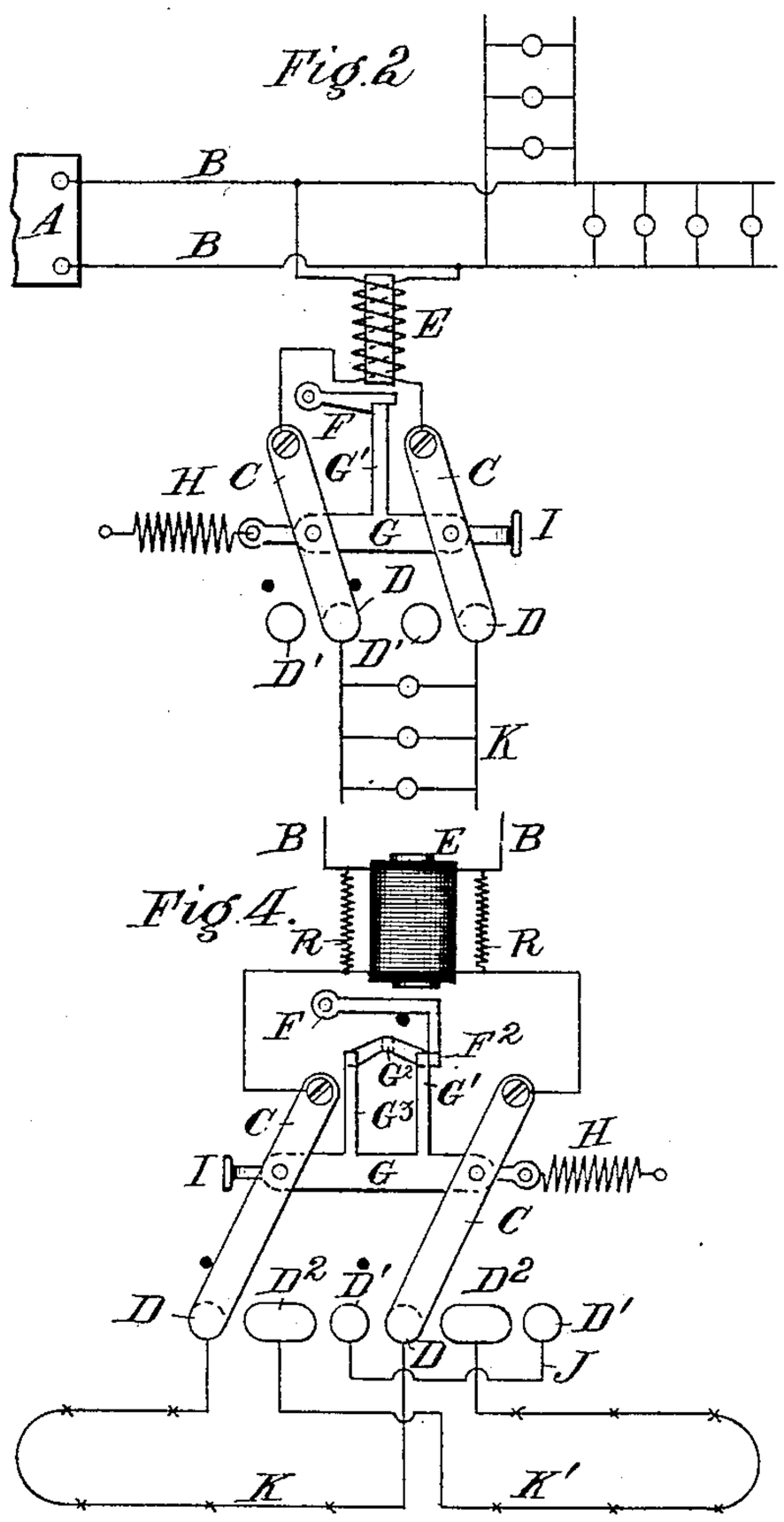
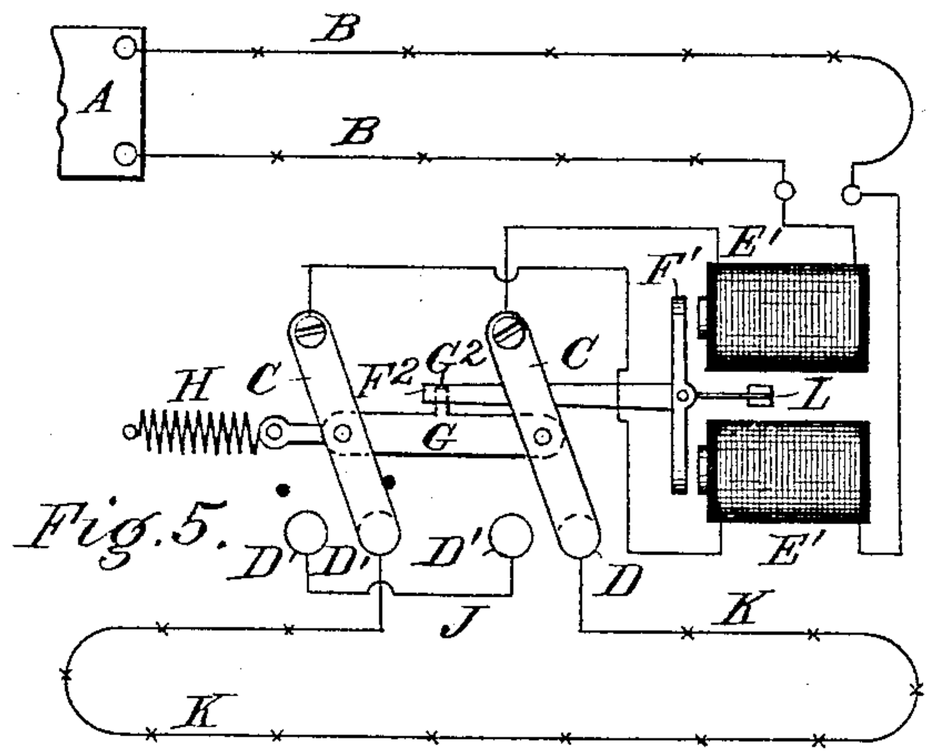


Fig. 3.

Fig. 4.

Fig. 5.



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ELECTRICAL SWITCH.

SPECIFICATION forming part of Letters Patent No. 396,439, dated January 22, 1889.

Application filed November 23, 1886. Serial No. 219,654. (No model.)

To all whom it may concern:

Be it known that I, ELMER A. SPERRY, 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 Electrical Switches, 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 automatic switches, and has for its object to provide an electric switch which shall automatically switch out a portion of the electric circuit from which a portion of the current has been diverted.

It is well known that the current-intensity upon the main line near or at the point where the loop or branch circuit leaves the main line is only equal in the + and — limb or limbs each side of the loop or branches when there is no third passage or escape of the current from some point within said loop to that part of the main line outside of a switch or outside of the points of juncture of loop and main line. In other words, the exact current as to quantity per second passes out of the loop upon the main line at the one extremity that passes from said main line in upon the loop at the other, providing there is no other escape, in which case, however, there is a difference, and it is this difference or the differential action of the currents upon the main line at or near the terminus of the loop that I propose to utilize to automatically change the main-line connectors from one loop to the next or another loop. Some of the means I employ to accomplish this result are illustrated in the accompanying drawings.

Figure 1 is a diagrammatic view of an ordinary double-line switch as used in my system upon the main line of an electric-light circuit for the purpose of changing the electrical connections from one loop to another. Fig. 2 shows its adaptation for an incandescent circuit. Fig. 3 shows a switch in which the differential action serves to change the contacts of the switch onto a new loop in which translating devices are located. Fig. 4 shows a varied form of Fig. 3, in which a second change is made. Fig. 5 shows a varied form of Fig. 1, in which the balance is upon the armature by the equal magnetic effect of separate electro-magnets being in the main circuit in the path of each switch-arm.

Similar letters of reference indicate like parts in the various figures.

A represents a generator of electricity; B B, the wires of the "main line;" C C, the switch-arms, and D D and D′ D′ the contact buttons or pieces forming the terminals of the various loop-circuits.

In Figs. 3 and 4 D^2 D^2 indicate the terminals of a second circuit, in which the lamps are indicated by crosses.

E shows an electric magnet wound by two sets of conductors and so adjusted as to each other that when the same current traverses each in opposite directions there is no magnetic effect from the same upon the common core. These two coils on the main line form the path for the current as it goes into and comes from the loop or branch, or a portion of same, as is shown in Fig. 4. F indicates the armature of said magnet. The switch-arms are connected by an insulated strip, G, pivoted to each for the purpose of simultaneous movement. An upward projection, G′, of this strip engages the armature and serves to retain the contact-arms upon one set of contact-pieces or loop-terminals. The spring H serves to move the switch when the armature releases the same. A handle is provided at I to facilitate the movement of the switch-arm.

The letters D′ D′ indicate the terminals of the final loop.

J, K, and K′ indicate loop-circuits, in which various translating devices may be arranged. The construction of the oppositely-projecting lateral retaining-contacts in Fig. 4 is such that as the armature F is raised it breaks contact with G′ but engages with G^2. When the armature again drops or returns to its former position, it engages the stop G^3, which holds the lower extremities of the levers upon the right side of the elongated central contacts, and upon the circuit K′ until the armature F is again drawn upward, when a still further movement of the arm takes place and the loop J is brought into circuit.

The varied form shown in Fig. 5 may be described as follows: A centrally-pivoted ar-

mature, F′, is provided with a centralizing-spring, L, and a laterally-projecting stop, F^2, at the extremity of a projection, as shown. This stop engages an opposite laterally-projecting stop, G^2, upon the strip G, which may be released by a movement of the stop in either direction, upward or downward, from the central position.

The letter M, Figs. 1 and 3, illustrates the outside view of a loop-switch working upon the same main circuit, which may be like or unlike the first. When the loop or branch is in the normal working condition, the path of the current is upon the main line throughout one coil of the helix to the switch-arm, to the loop, thence around the loop-circuit to the other terminal, and thence to the other switch-arm through the other coil of the magnet upon the main line. In practice I prefer to wind the magnet in each switch with two strands simultaneously, the first ends of which are attached to the outer main lines and the last ends to the switch-arms, or vice versa. In this way the currents are opposite and the magnetic effects are equal.

Having thus fully described the arrangements of parts in these diagrams, I will proceed to explain their action.

Referring now to Fig. 1, it will be considered that the current flows from the generator A, through the circuit B in direction of the arrows, the lower terminal being maintained at a higher potential than the upper one. In its progress it traverses one of the coils upon the magnet E, thence through the switch-arm to the loop and around the same, energizing the various translating devices therein, thence to the other switch-arm, through the remaining and opposing coil upon the magnet E, thence out upon the main circuit. The spring H is given a tension by the movement of the arms to the right, in which position the system is retained by the catch upon the under side of the armature, which armature is placed before the core of the magnet E, and which is attracted by the same whenever there is any appreciable difference between the incoming and outgoing currents. Suppose the loop K to be in an iron building, for instance, and a contact or ground exist between the wire and the iron of the building at any point upon said loop, as X′ or Y. As yet there is no interference with the normal operation of the system; but should another contact or ground occur upon the outside circuit or any of its loops, or even in the generator A, the current will then divide, part passing between the two points of ground, as from X to X′ or Y to Y′, leaving only a part of the normal current to flow through one of the coils upon the magnet E. The current intensity in the other will remain or even rise above the normal, owing to the decreased resistance exterior to the generator. The differential magnetizing effect thus obtained serves to energize the core, attract the armature F, releasing the stop G′, and thus allow the spring H to draw the contact-point over onto the other set of terminals, D′ D′, thus removing from circuit altogether the faulty or grounded loop and allowing for repairs, while no stoppage occurs on the main line, the current upon which is now led into the other loop, J. If the one or more co-operating grounds or crosses exist in other loops provided with a switch, such as has been described, they will also be removed from circuit by changing the connection into a new loop, leaving the line perfectly clear. However, if the other cross exists in the main line, its presence being thus indicated, the same may be removed after the plant has stopped, it being readily understood, however, that its operation upon a multiple circuit, such as is shown in Fig. 2, is substantially the same as upon the series circuit just described. The generator should be automatically controlled in each case for best general results.

It will be readily seen from the foregoing that this differential action of the ingoing and outgoing currents to change the line-connectors to a new loop-circuit may be utilized in various ways, some of which are as follows:

One simple form of switch embodying the principle as shown in Fig. 3, in which the loop J, Fig. 1, is extended and working devices are shown therein. This auxiliary circuit K′ is thrown into circuit whenever a ground occurs simultaneously upon the loop K and outside circuit.

Fig. 4 shows the same feature, with the exception that the arms make a still further advance upon the operation from the ground in the loop K′, as will readily be understood. As the laterally-projecting catch of finger F^2 of the armature F rises, it loses contact with stop G. This allows the system to be drawn to the right by spring H, until intercepted by laterally-projecting finger G^2, in which position the terminals of the switch-arms are in contact with the elongated terminals D^2 D^2. When the armature again falls, the contact last named is broken and the further movement is intercepted when the catch G^3 is reached by that of F^2. The electrical connections have, however, as yet not been changed, but simply slide along upon the elongated terminals D′ D′. Upon the second operating ground in loop K this last catch is broken and the main-line circuit is again changed to the final loop J.

The alternate form shown in Fig. 5 illustrates an alternate form of differential magnetic devices. Two magnets are so adjusted as to act equally and opposedly upon a common armature centrally pivoted and so organized that when a movement takes place in either direction from this central position the switch mechanism will be released. This is accomplished by a laterally-projecting finger, G^2, and an opposite laterally-projecting catch, E^2, connected with the armature.

It will also be readily understood that contact devices may be provided other than the

arms herein mentioned—as, for instance, springs or mercury-contacts—without departing from the spirit of my invention; also, weights could be used in lieu of springs; but in all cases I prefer that the magnet E should be in the main circuit and not in the loop or branch circuit.

It is important that the operating-magnet should be constantly in the main circuit in order that its action may continue long enough to break any current which might arise from the switching out of the loop.

What I claim is—

1. In combination with a double switch adapted to be operated by a spring or equivalent, a catch organized to oppose said spring, and an electro-magnetic core wound with two coils of equal magnetizing effect, which are placed one in the circuit with each switch-arm, said magnet placed so as to control and operate the catch, substantially as and for the purpose specified.

2. An electrical switch provided with two simultaneously-moving arms, a retracting device previously energized, an armature operating a catch to retain said arms in opposition to said retracting device, and differential electro-magnet in circuit with each of the two arms of said switch adapted to control the said catch, as and for purpose specified.

3. In combination with the main circuit, a duplex switch forming a connection between said main circuit and a loop or branch circuit, a differential magnetic system, the opposing helices of which are in electrical connection one with each arm of the switch, and an actuating mechanism, said magnet placed so as to control and operate the actuating mechanism and the latter to operate the switch, substantially as and for the purpose specified.

4. In a duplex switch, the combination, with simultaneously-moving switch-arms, of a retracting device, a catch to hold the same, and a magnet operating said catch having two helices, one in circuit with each switch-arm, substantially as and for the purpose specified.

5. Two loop or branch circuits terminating each in two electrical contacts, in combination with a duplex switch the arms of which are adapted to operate in connection with said contacts, and which are in connection with the main circuit through two electro-magnetic helices which oppose each other, and connecting mechanism consisting of the catch and spring or its equivalent for operating said switch, said magnet placed so as to control and operate the catch, substantially as and for the purpose specified.

6. The duplex switch, substantially such as described, in combination with two differentially-acting electric helices, the circuits through which being those passing the arms of the switch, said magnets being located between said switch-arms and the points of production of the electrical currents upon the circuit, substantially as specified and shown.

7. The combination of a main line with a service-loop thereon, a duplex switch whose arms complete the connections with the main line, a differential magnet through which the loop-current passes in opposite directions, a retracting-spring connected with such switch, and a catch to hold such switch, said catch controlled by the magnet, so as when released to release the switch and permit the loop to be cut out of the main line.

In witness whereof I have hereunto subscribed my name this 20th day of November, A. D. 1886.

ELMER A. SPERRY.

Witnesses:
GEO. LAWRENCE, Jr.,
J. G. MARSH.