(No Model.)

H. L. BAILEY.

ELECTRIC SPARK ARRESTING CIRCUIT AND DEVICE.

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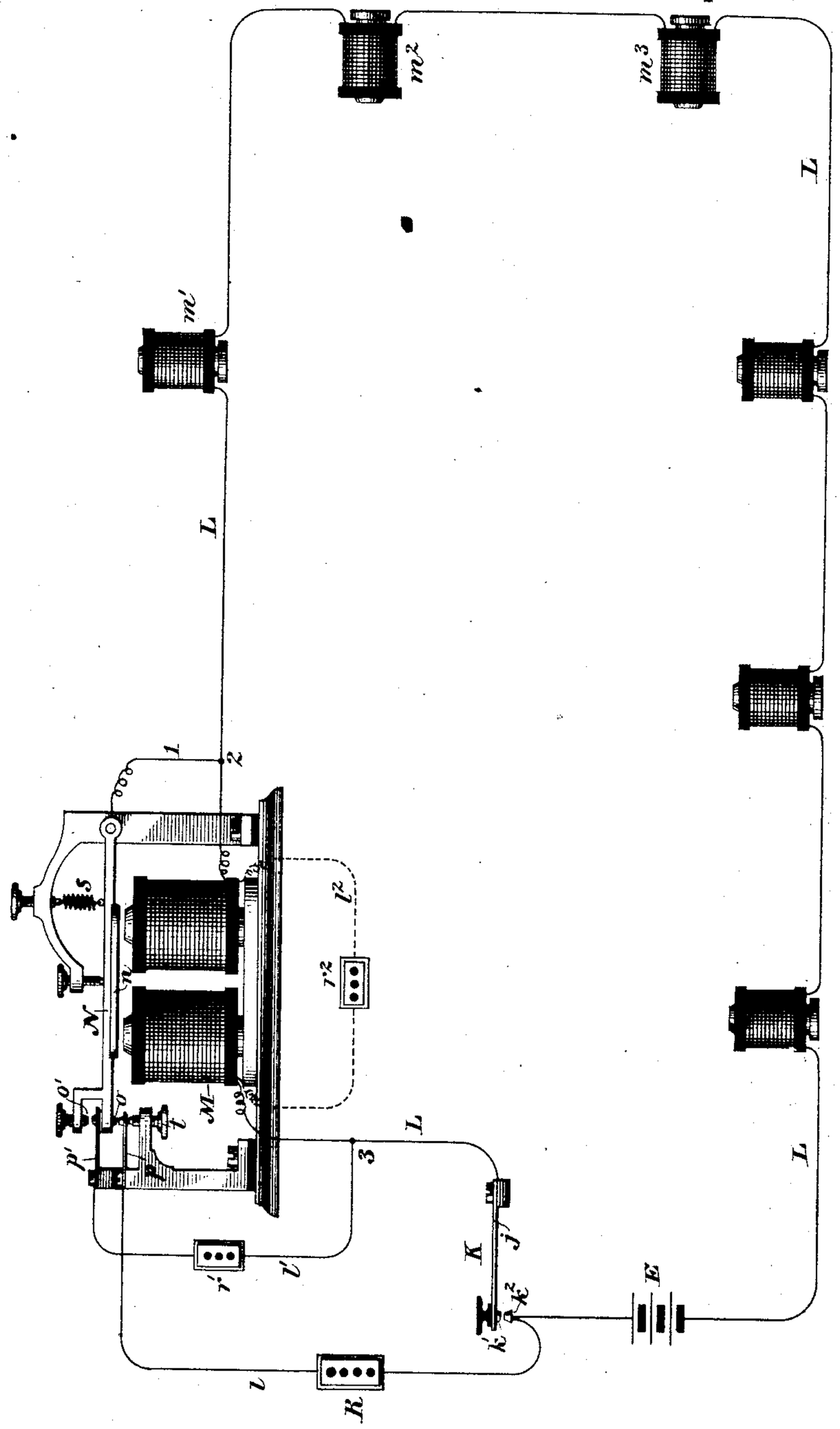

WITNESSES

Wm A. Skinkle
A. Hamilton Morris.

INVENTOR

Henry L. Bailey.

By his Attorneys

Poole Edgecomb & Butler

UNITED STATES PATENT OFFICE.

HENRY L. BAILEY, OF BROOKLYN, ASSIGNOR TO THE TIME TELEGRAPH COMPANY, OF NEW YORK, N. Y.

ELECTRIC-SPARK-ARRESTING CIRCUIT AND DEVICE.

SPECIFICATION forming part of Letters Patent No. 284,354, dated September 4, 1883.

Application filed April 25, 1883. (No model.)

To all whom it may concern:

Be it known that I, HENRY L. BAILEY, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Electric-Spark-Arresting Circuits and Devices, of which the following is a specification.

The object of my invention is to provide means for preventing the occurrence of the disruptive electric discharges which tend to take place at each interruption of an electric current traversing a circuit in which is included a series of electro-magnets at the points where the conductor traversed by such a current is broken.

The invention consists in applying to a circuit-closing device a non-inductive shunt-circuit which is automatically brought into action when the electro-magnets are vitalized, and which serves as a path for the induced currents which are incident to the magnetic discharge of the electro-magnets around the contact or circuit-closing points. The non-inductive shunt-circuit is completed after the completion of the battery-connections, and they remain so completed a sufficient time after the interruption of these connections to permit the required discharge.

The invention further consists in providing a supplemental shunt-circuit of a similar character for neutralizing the induced current or inductive discharge of an electro-magnet employed for controlling the connections of the first-named shunt-circuit. The connections of the supplemental shunt-circuit are controlled in essentially the same manner as those of the principal shunt-circuit.

The accompanying drawing is a diagram illustrating the application of my invention to an electric circuit, including a series of electro-magnets, which may be employed for any required purpose. The dotted lines in the drawing illustrate a modification of the organization of the apparatus.

Referring to the drawing, L represents a main line, in which is included a series of electro-magnets, m' m^2 m^3, &c. A battery, E, is included in the main line L, and the circuit-connections of this battery are completed by means of a manual or automatic circuit-closer, K, of any suitable character, in a well-known manner.

The circuit-closer K which I have represented consists, merely, of a lever, *j*, carrying a contact-point, k', which, when the lever is depressed, makes electrical connection with the corresponding contact-point, k^2. The point k' is electrically connected with one terminal of the main line L, and thus through the electro-magnets *m* with one pole of the battery E, while the contact-point k^2 is connected directly with the opposite pole of the battery E. When the key K is depressed, the circuit of the battery E will be completed through all of the electro-magnets in the system, and the latter will be vitalized. Immediately upon the interruption of the circuit at the points k' k^2, the magnetic discharge of the cores of the electro-magnets will induce in the coils of each magnet a momentary electric impulse in a manner well understood.

In an extended system, as the impulses from the several electro-magnets are added to each other a current of considerable strength tends to traverse the main line L. If unprovided for, such a current will occasion a disruptive discharge at the circuit-closing points k' and k^2, and these points soon become corroded and unserviceable. For the purpose of neutralizing such currents, I provide a shunt-circuit, *l*, including a non-inductive resistance, R, preferably approximately equal to the resistance of the main line. The connections of this circuit are completed around the contact-points k' and k^2 immediately after the main circuit is completed, and it remains closed a sufficient time after the interruption of the connection at the points k' and k^2 to permit the induced current to pass through the shunt-circuit *l*, thereby avoiding the contact-points.

The device which I employ for controlling the connections of the shunt-circuit *l* consists of an electro-magnet, M, included in the circuit of the main line L, and provided with an armature, *n*, and armature-lever N. An adjustable retractile spring, *s*, is provided, for normally maintaining the armature and its lever away from the poles of the electro-magnet. At the extremity of the armature-lever

N is carried a contact-point, *o*, which, when the lever is drawn toward the poles of the electro-magnet in response to a current transmitted over the main line L, makes contact with a flexible circuit-closing spring, *p*, projecting into its path. The spring *p* yields to the pressure exerted by the lever N, and the extent of its flexure may be adjusted by means of a suitable limiting-screw, *t*. The armature N is electrically connected by a conductor, 1, with the main-line conductor L at a point, 2. The circuit-closing spring *p* is electrically connected with one terminal of the shunt-circuit *l*, the other terminal of which is connected with the contact-point k^2 of the circuit-closer K. The parts are so adjusted that normally the contact-point *o* is out of contact with the spring *p*, and the connections of the shunt-circuit *l* are thus normally open. Immediately after closing the circuit-closer K, a circuit will be completed through the conductor *l* at the point *o*, and after the interruption of the connections at $k' k^2$, by the action of the circuit-closer K, this circuit will remain closed until the spring *p* has resumed its normal position. The time which elapses after the interruption of the circuit at $k' k^2$ before the interruption of the shunt-circuit connections is sufficient to permit the discharge of the induced current around the points k' and k^2. It will be observed, however, that the coils of the electro-magnet M are included in the portion of the main line L between the point 2 and the circuit-closer K, and whatever current is induced in the coils of this magnet by the magnetic discharge of its cores would tend to produce a spark at the points *k*. To prevent such a discharge, I provide a supplemental non-inductive shunt-circuit, *l'*, the connections of which are completed around the coils of the electro-magnet M in a manner precisely similar to that described in connection with the circuit *l*. One terminal of the conductor *l'* is electrically connected with the main line L at a point, 3, and the opposite terminal with an insulated flexible circuit-closing spring, *p'*. An adjustable contact-point, *o'*, is carried upon the extremity of the lever N, which contact-point is brought by the movements of the lever into connection with the corresponding contact-spring, *p'*, as described with reference to the point *o* and spring *p*.

It will be seen thus that when the armature-lever is depressed the respective terminals of the coils of the electro-magnet M will be connected with each other through the conductor *l'*, spring *p'*, contact-point *o'*, armature-lever N, and conductor 1, and that these connections will be completed and interrupted simultaneously with those of the conductor *l*. An adjustable non-inductive artificial resistance, *r'*, is included in the conductor *l'*, preferably approximately equal to the resistance of the electro-magnet M. The time during which this circuit shall remain closed relative to the completion of the circuit through the conductor *l*, may be controlled by adjusting the point *o'* and the limiting-stop *t*.

In some instances it may be advisable to apply a permanent shunt-circuit to the electro-magnet M, such as is indicated in the drawings in dotted lines at l^2. This modification consists merely in replacing the conductor *l'* and resistance *r'*, together with the contact-spring at *p'* and point *o'*, by a conductor, l^2, the opposite terminals of which are connected directly with the coils of the magnet M through a resistance, r^2, similar to the resistance *r'*.

In some instances it may be found desirable to apply a circuit-controlling device similar to that described with reference to the electro-magnet M to any of the electro-magnets *m*. This may be done by employing the movements of the armature of such magnet in a manner precisely similar to that already described with reference to the armature *n* and lever N.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, of a battery, a main line, a series of electro-magnets included therein, a circuit-closer adapted to transmit electric impulses from said battery upon said main line, an armature and armature-lever applied to one of said electro-magnets, two contact-points carried upon said armature-lever, two flexible springs, respectively extending into the path of said contact-points, and two non-inductive shunt-circuits, one of said shunt-circuits being completed around said circuit-closing device and the other around the coils of said electro-magnet by the movement of said armature and armature-lever toward the poles of said electro-magnet.

2. The combination, substantially as hereinbefore set forth, of a battery, a main line, a series of electro-magnets included therein, a circuit-closing device for completing the circuit of said battery through the coils of said electro-magnets, an armature applied to one of said electro-magnets and actuated in response to electric currents traversing its coils, a shunt-circuit the connections of which are completed around said electro-magnet and said circuit-closing device by the movements of said armature toward the poles of said electro-magnet, and a non-inductive resistance included in said shunt-circuit, which resistance is approximately equal to the resistance of the main-line circuit.

3. The combination, substantially as hereinbefore set forth, of a battery, a main line, a series of electro-magnets included therein, a circuit-closing device for completing the circuit of said battery through the coils of said electro-magnets, a normally-open shunt-circuit around the contact-points of said circuit-closing device, an armature acting in response to electric currents traversing the coils of said electro-magnets to automatically complete the connections of said shunt-circuit.

4. The combination, substantially as hereinbefore set forth, of a battery, a main line, a series of electro-magnets respectively included therein, a circuit-closer for completing the connections of said main line through said electro-magnets, an armature and armature-lever applied to one of said electro-magnets, a shunt-circuit the connections of which are completed by the movements of said armature-lever in response to a current traversing the coils of said electro-magnet, means for continuing the connections of said shunt-circuit momentarily after the interruption of the first-named circuit-connection, and a non-inductive shunt-circuit around the coils of said electro-magnet.

5. The combination, substantially as hereinbefore set forth, of an electro-magnet, M, its armature *m*, the contact-points *o* and *o'*, the contact-springs *p* and *p'*, and the non-inductive shunt-circuits *l* and *l'*, the connections of which are respectively completed through the action of said armature.

In testimony whereof I have hereunto subscribed my name this 24th day of April, A. D. 1883. HENRY L. BAILEY.

Witnesses:
DANIEL W. EDGECOMB,
CHARLES A. TERRY.