

F. L. POPE.  
ELECTROMAGNETIC MOVEMENT.

No. 103,077.

Patented May 17, 1870.

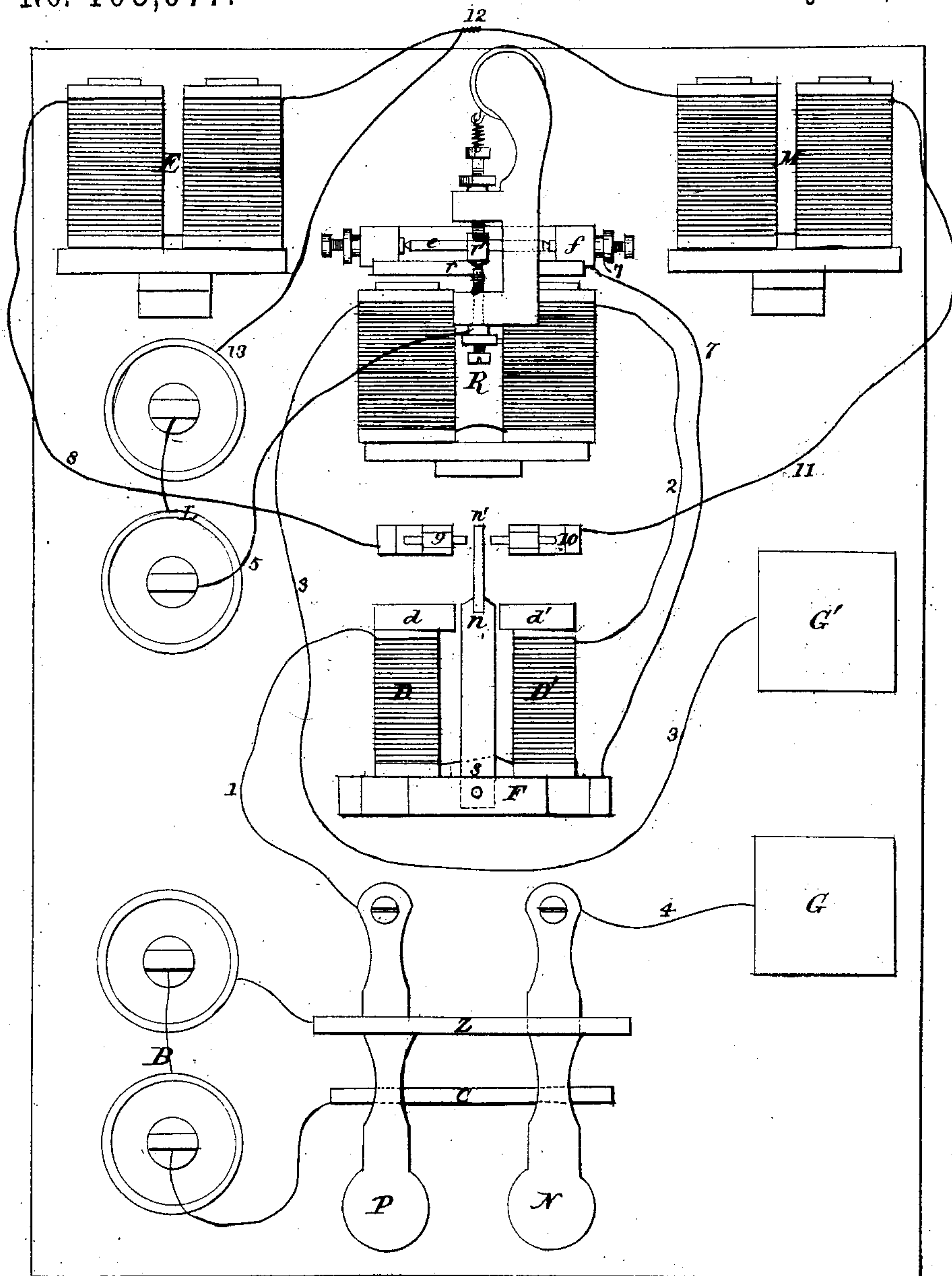


Fig: 1

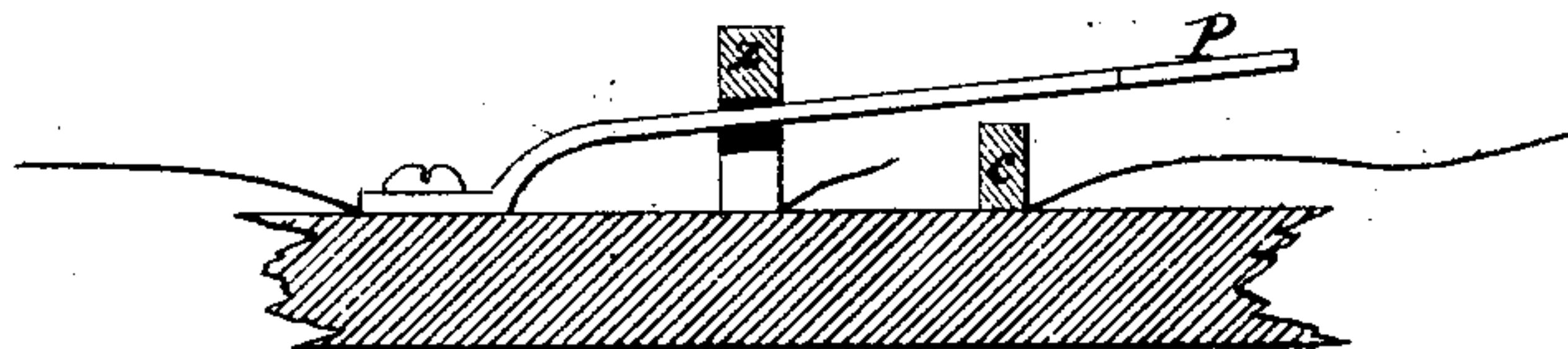


Fig: 2.

Witnesses  
J. B. Beecher  
M. M. Livingston

Inventor Frank L. Pope,



# United States Patent Office.

FRANK L. POPE, OF ELIZABETH, NEW JERSEY.

Letters Patent No. 103,077, dated May 17, 1870.

## IMPROVED ELECTRO-MAGNETIC MOVEMENT.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, FRANK L. POPE, of Elizabeth, in the county of Union and State of New Jersey, have invented a new and improved Electro-Magnetic Movement; and I hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, which forms a part of this specification.

In the employment of electro-magnetic apparatus for signaling, telegraphing, or producing other mechanical effects, at a considerable distance, it is frequently desirable to actuate either of two entirely distinct sets of apparatus at pleasure, without interfering with the other, and it is also desirable to accomplish this result by a single conducting circuit extending from one point to the other. For instance, in an electro-magnetic railway signaling apparatus, one signal, indicating "safety," and another and distinct signal indicating "danger," may be arranged so that either of them can be caused to act at pleasure; or, in a printing-telegraph, one set of apparatus may be employed to rotate the type-wheel until it is brought into the proper position, while another and distinct set of apparatus may be employed to obtain the impression of the type upon paper. It is, therefore, obvious that a device of such character may be applied to various other useful purposes.

This invention is intended to accomplish the result above specified in a more effectual manner than is possible by any of the methods heretofore in use, by the employment of a local or secondary battery, in combination with a relay magnet of the usual construction, and a polarized switch, by means of which the current of said local battery may be directed at pleasure through either of two distinct electro-magnets, each of which may be made to actuate an independent device. The action of the polarized switch is determined by the nature of the electrical current transmitted, whether positive or negative. The employment of a local or secondary battery permits of great electro-magnetic power being brought into action at any desired point, however remote, in the manner above described, by the use of a comparatively feeble current upon the main conducting wire, as will be hereinafter more fully described.

In the accompanying drawing—

Figure 1 is a plan view of the apparatus.

Figure 2 is a vertical longitudinal central section of one of the transmitting keys, showing its electrical connections.

B designates the main battery, which, we are to assume, is placed at the transmitting station. Its positive pole is in electrical connection with the metallic bar C, and its negative pole in similar connection with the metallic bridge Z.

P and N are two flexible metallic levers or transmitting keys, so arranged that their flexibility tends to keep them constantly in contact with, and therefore in electrical connection with the bridge Z, as may be more clearly understood by reference to fig. 2. It will be seen, by reference more particularly to fig. 2, that whenever and so soon as the key P or the other key N is depressed, its electrical connection with the bridge Z is broken, and another connection established with the bar C.

The key N is permanently connected with the earth or ground-plate G by the wire 4.

All the parts of the apparatus above described are to be situated at the transmitting station.

A wire or other suitable conductor, 1, is connected with the key P at the transmitting station, and it extends from thence to the apparatus located at the receiving station. The distance between these two points is immaterial, so long as electrical communication may be conveniently maintained by means of telegraphic apparatus of the ordinary or any adequate construction.

D D' is an electro-magnet, consisting of two soft-iron cores, of the usual form, enveloped in helices of insulated wire, said cores being secured to a keeper, F, of soft iron; and *d d'* are rectangular pieces of soft iron attached to said cores, and forming the poles of the electro-magnet.

A polarized steel bar, *n s*, is pivoted at its end *s* to the keeper F, its opposite extremity, *n*, being free to vibrate laterally between the poles *d d'*, its motion being limited by the brass arm *n'* coming in contact with the stops 9 and 10.

R is a relay magnet of the usual construction, its soft-iron armature *r* being attached to a vertical lever, *r'*, moving upon an arbor, *e*, and so arranged that when the attraction of the electro-magnet R is exerted upon said armature *r*, the lever *r'* is brought in contact with the screw 6, and the circuit of a local battery completed, as will be hereinafter more fully described.

The wire 1 coming from the transmitting station connects with the helices of the electro-magnet D D', which actuates the polarized switch; from thence the circuit passes through the wire 2 to the helices of the relay magnet R, and thence to the earth or ground-plate G by the wire 3. The circuit between G and G' may, of course, be completed either by the earth or by a return wire, as may be found most convenient in each particular case in which the apparatus is employed.

The circuit of the local battery L at the receiving station may be traced as follows: Commencing at the positive pole of the battery 5, thence to the screw 6, lever *r'*, armature *r*, arbor *e*, frame *f*, and wire 7, to



the keeper F, and thence through the polarized bar *n s* to the arm *n'*. From this point it passes either through the stop 9, wire 8, and electro-magnet E to the point 12, or through the stop 10, wire 11, and electro-magnet M to the same point, its course depending upon which of the two stops, 9 or 10, the arm *n'* may be in contact with at any particular time. From the point 12 the circuit returns directly to the other pole of the local battery L at 13.

The manner in which I obtain the desired result by the use of the above-described apparatus is as follows:

By an inspection of the connections and the description hereinbefore given, it will be understood that, by depressing the key P, a positive current from the battery B passes over the line wire 1 to the receiving apparatus at a distant station, while the key N, on the contrary, when depressed, transmits a negative current of the same intensity from the same battery. As the main circuit passes through both the electro-magnet D D' and the electro-magnet R, it is obvious that by a well-known law of electro-magnetism the polarity of both these magnets will be reversed with each reversal of the current from positive to negative or from negative to positive. The armature of the magnet R being of soft iron, its action will be precisely the same in effect, whatever may be the nature of the exciting current; but the permanently-magnetized bar *n s* will constantly retain a fixed polarity. Under the influence of a positive current the pole *d* attracts the end of bar *n*, while at the same time the pole *d'* repels it. A negative current, on the contrary, by reversing the polarity of *d* and *d'*, causes the latter to attract and the former to repel the bar. It may be briefly stated, therefore, that a positive current deflects the bar *n s* to the left, closing the local circuit upon the stop 9, while a negative current deflects the said bar to the right, closing the local circuit upon the stop 10.

Any number of successive currents of the same polarity may be transmitted, during which time the bar *n s* will remain in the same position to which it was first attracted, for the reason that when the main circuit is entirely broken the mutual attraction of the permanent magnet *n s* and the soft-iron pole *d* or *d'* retains it in the said position. The electro-magnet R, however, will continue to close and break the local circuit, in a manner corresponding exactly to the closing and breaking of the main circuit at the transmitting station, regardless of the polarity of the currents which are transmitted. The polarity of the current, acting upon the bar *n s*, determines which of the electro-magnets E and M shall be acted upon by the local battery, the current of said battery being switched from one of said electro-magnets to the other by the said polarized bar hereinbefore described.

It will be, therefore, readily understood that the successive closing and breaking of the main circuit by the positive key P will, by means of the relay R and the local circuit connected therewith, cause a corresponding action of the electro-magnet E, while the electro-magnet M may be operated in like manner by means of the negative key N, and that this may be done in respect to either without affecting the other. The electro-magnets E and M may be employed to actuate any suitable apparatus for the purpose of signaling, telegraphing, &c.

It is evident that any number of receiving or signaling instruments may be placed at different points, and operated simultaneously in unison by means of a single main battery and transmitting apparatus, by continuing the wire 3 to the next set of apparatus, instead of to the ground-plate G, and so on indefinitely.

I do not confine myself solely to the within-described method of constructing a polarized switch, as permanent and electro-magnets may be combined in many different ways to produce the same or a similar result. Nor do I confine myself to the particular mode of constructing the transmitting apparatus herein described, as the said apparatus may be constructed and arranged in several ways, so that positive or negative currents may be transmitted at pleasure. The polarized bar or switch *n s* may also be arranged so as to be operated upon by the relay magnet R, instead of by a separate magnet, as described, if found preferable.

I do not claim as new the arrangement of two electro-magnets at a distant station in such a manner that either one may be operated at pleasure independent of the other, by means of positive and negative currents transmitted from a main battery through a single circuit or series of conductors, as this device has been heretofore employed.

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

1. The combination of a polarized switch with a relay magnet placed in or operated by the same main circuit, substantially as and for the purpose set forth.
2. The combination of a polarized switch, relay magnet, and local battery, with two electro-magnets actuated by said local battery, substantially as described and for the purpose specified.
3. The combination of an apparatus for transmitting positive and negative currents with a polarized switch, relay magnet, local battery, and two electro-magnets, the whole combined, arranged, and operating substantially as specified.

FRANK L. POPE.

Witnesses:

T. B. BEECHER,  
M. M. LIVINGSTON.