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T. A. EDISON.

SEXTUPLEX TELEGRAPH.

No. 452,913. Patented May 26, 1891.

Fig. 1.

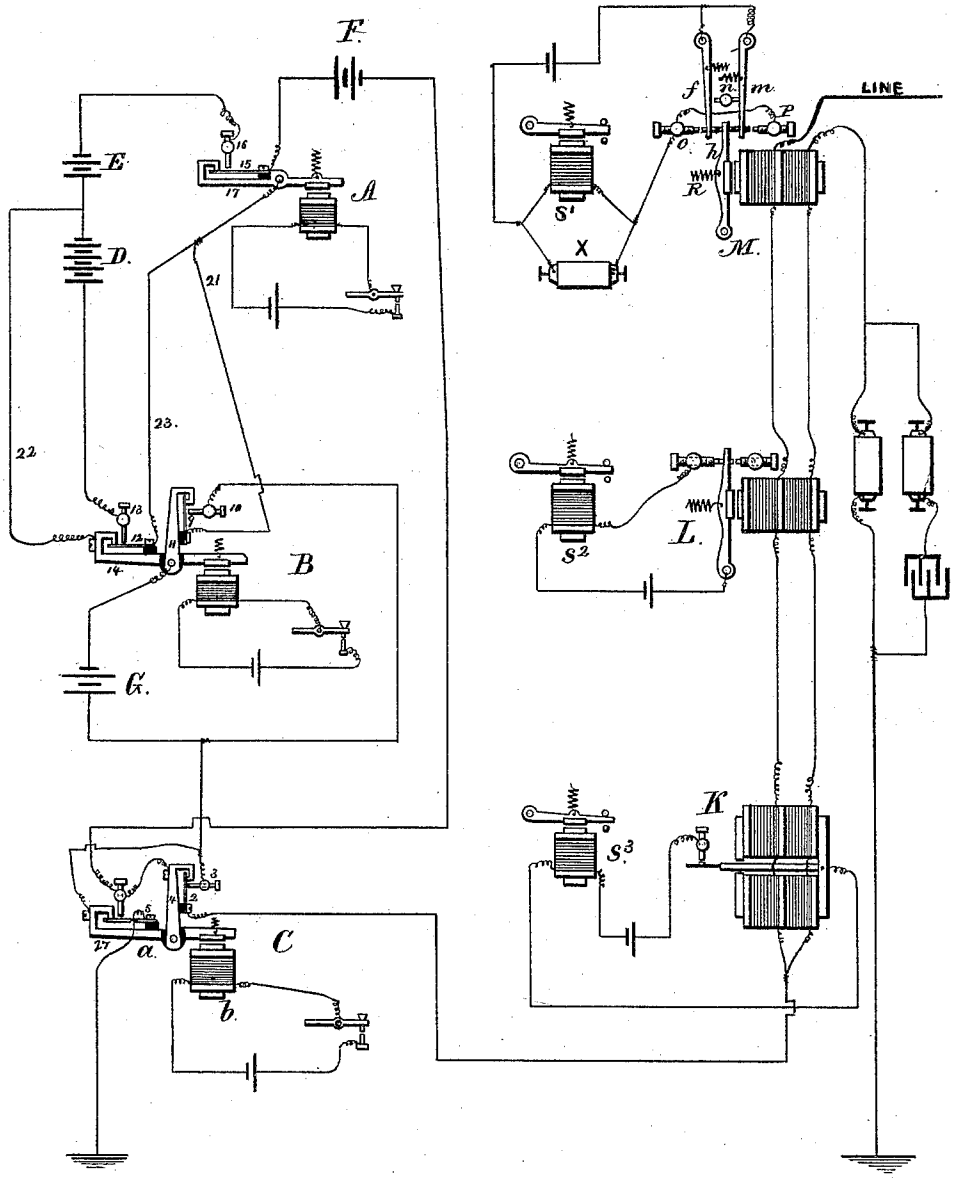

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Fig. 2.

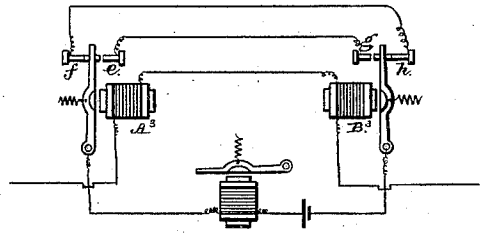

Fig. 3.

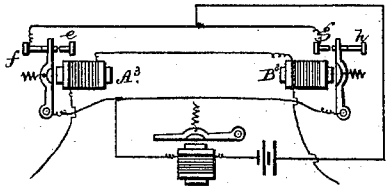

Fig. 4

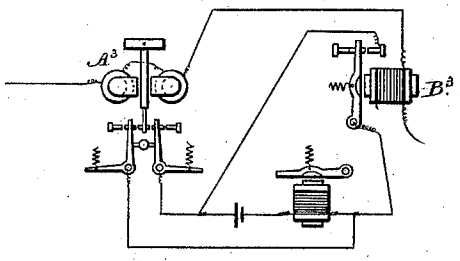

Fig. 5

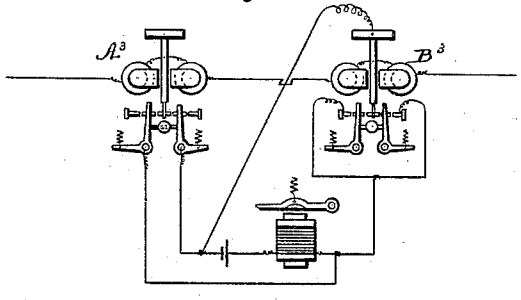

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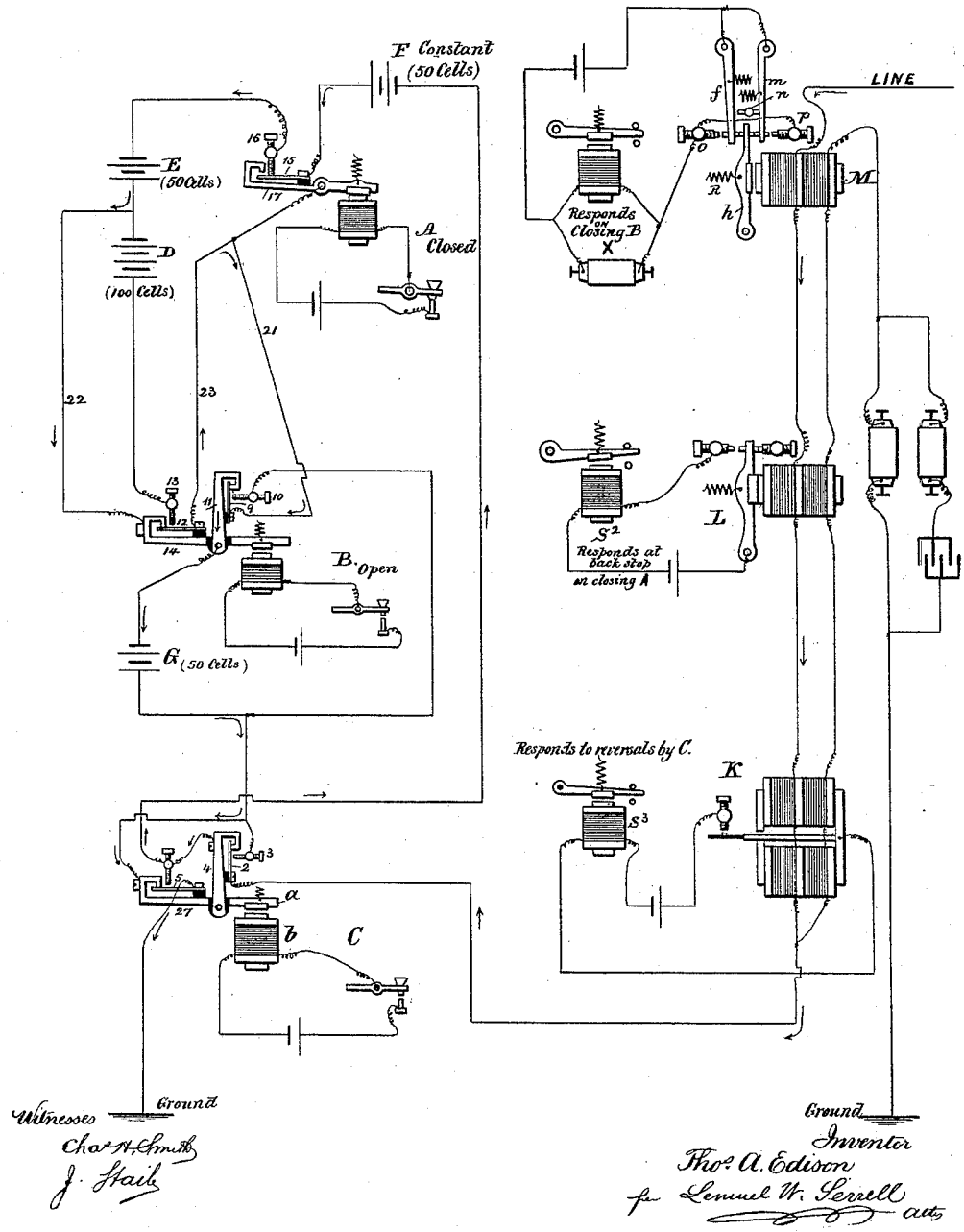
Fig. 6



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T. A. EDISON.

SEXTUPLEX TELEGRAPH.

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Fig. 1.

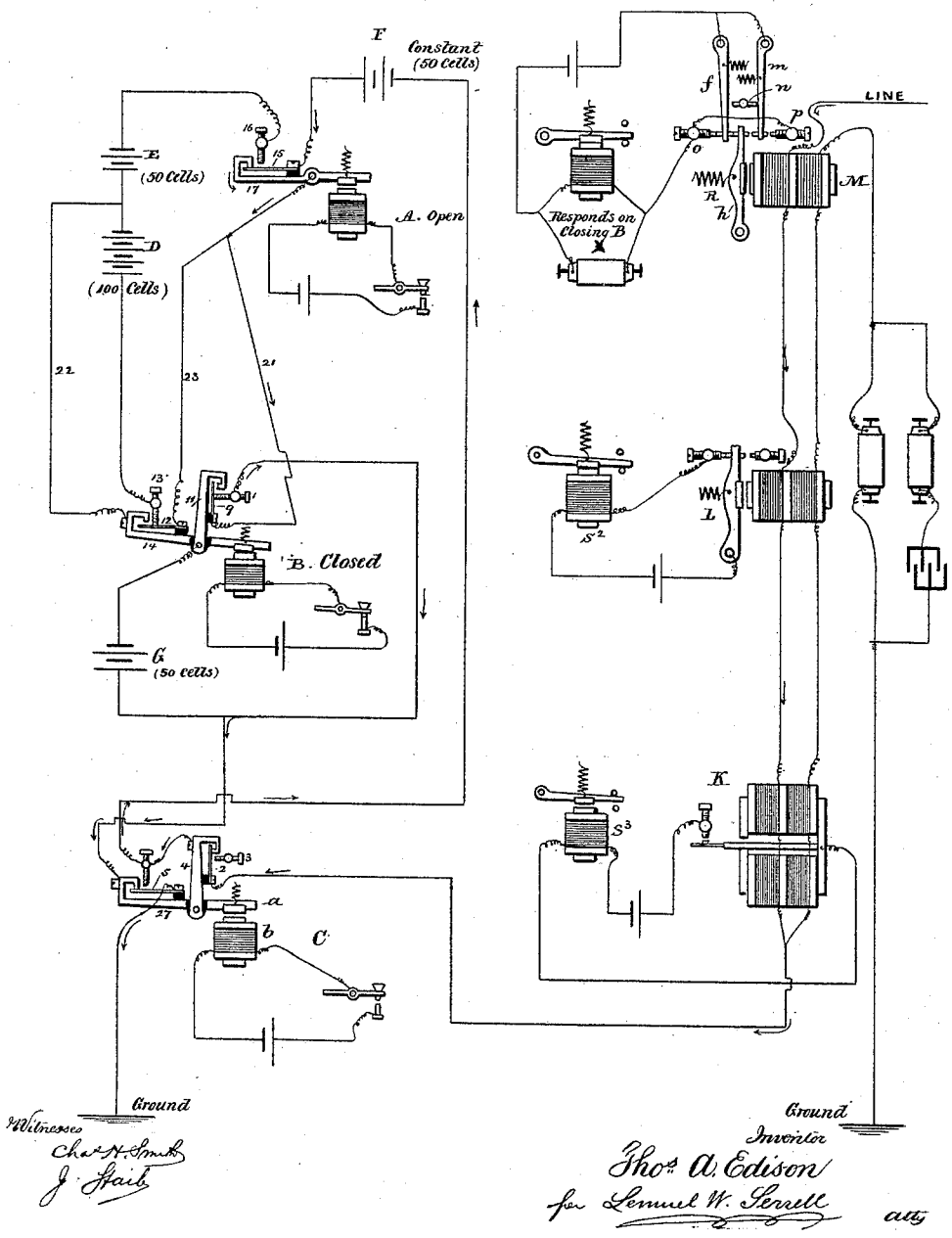

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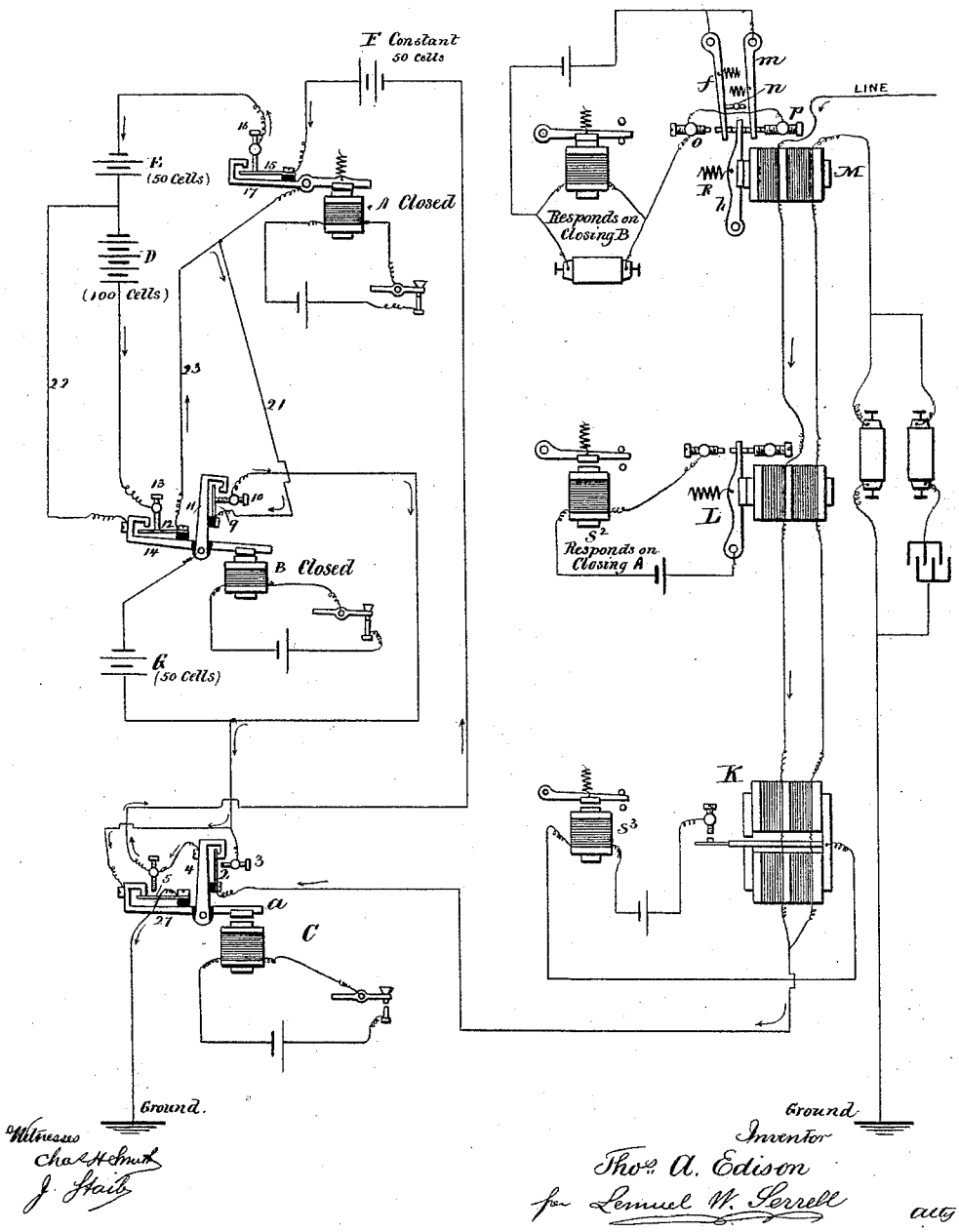
Fig. 8.



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y.

SEXTUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 452,913, dated May 26, 1891.

Application filed June 2, 1877.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented an Improvement in Sextuplex Telegraphs, of which the following is a specification.

The object of this invention is to transmit six independent messages over one wire at the same time, three in one direction and three in the opposite direction.

In my application No. 140, filed simultaneously herewith, instruments are represented for simultaneous transmission of three messages in each direction. I do not therefore herein lay claim, broadly, to instruments having these general features of construction or operation. The present are to be regarded as modifications and improvements thereon.

My present invention relates to the peculiar combination and arrangement of instruments, circuits, and batteries hereinafter set forth, whereby this object is accomplished in such a manner as to cause the two messages transmitted by an increase and decrease in the strength of the current to be received with great distinctness upon the respective sounders and to prevent the change in the polarity of the current from mutilating the signals composing the messages.

In the drawings, Figure 1 is a diagram representing the arrangement of instruments and connections at one end of the line, the connection at the other terminal being precisely the same; and Figs. 2, 3, 4, and 5 represent modifications of the receiving-instruments. Fig. 6 represents the keys and circuits with the key A closed. Fig. 7 shows the same parts with the key B closed, and Fig. 8 shows the position of the parts with keys A and B closed. In these Figs. 6, 7, and 8 the receiving-instruments are represented as responding to the adjoining keys. It is, however, to be understood that the instruments which respond are at the distant station.

C is the transmitter, which serves to reverse the direction of the flow of the current over the line from the battery F, which battery remains constantly on the line, and any additional battery which may be inserted or withdrawn from the circuit by the manipulation of the transmitters A and B. The reversal of the direction of the flow of the current over the wire sets in motion the tongue of the polarized relay K at the distant station. The attraction of the lever *a*, containing the reversing devices, by the magnet *b* causes a reversal of the direction of the flow of the current over the line, and the tongue of K is moved to one of its poles, and the recession of the lever from the magnet of C causes the current to flow over the wire in an opposite direction and the tongue of K to be attracted to its other pole. This movement of the tongue operates the sounder S^3 by a local circuit and battery. This action takes place whether the battery F only is in circuit or battery D and E are also in circuit or when the batteries G F are in circuit.

For convenience in explanation the batteries F, E, and G are spoken of as composed of fifty elements or cells each, while the battery D is composed of one hundred cells or elements.

Having described the method of transmitting by reversals of the direction of the flow of the current over the wire, I will now describe the method of transmitting increased and decreased currents to effect the transmission of two other messages in the same direction.

A is a transmitter whose magnet is operated by local battery and hand-key in local circuit in the usual manner. Now, supposing that the lever of B is unattracted by its magnet, the battery G is in the line-circuit. (In describing the working of the system hereinafter all mention of the battery F is omitted which remains constantly in circuit, the receiving instruments being adjusted over it. Hence I will speak as if no battery were on the line.) This being the case and A being closed, the battery E will be thrown in circuit, and this, added to the battery G, will be one hundred cells. This passing over the line to the distant station will cause the lever of the relay L to be attracted and its sounder will open, it being adjusted to respond either to one hundred or one hundred and fifty cells, but nothing less. By the use of a repeating sounder provided with a back point as connected to the lever of L, the sounder S^2 be-

ing worked by it, the signal may be reversed and the sounder S^2 closed when the lever of A is attracted. I have not shown this, as it would complicate the connections. It is obvious that if the transmitter B remain open or unattracted by its magnet the signal will be made upon the relay L by the combined power of the batteries E and G. Now, supposing both transmitters A B are closed, the effect of the closing of B is to disconnect the battery G from the line and throw in the battery D of one hundred cells. Then the lever of the receiving-magnet L will be attracted by one hundred and fifty cells instead of one hundred when B was open. Now while B is closed A is open, and batteries D and E are both disconnected from the circuit and no battery is on the line and the lever of L is unattracted. Hence all the alteration in the signaling of A, made by the working of the transmitter B, is from one hundred to one hundred and fifty cells, which does not interfere with the receiver L in the slightest degree.

I will now explain the transmisssion and reception of the other messages. Suppose A is open and B also open, no current will pass to the line from either batteries E or D, but the battery G will be included in circuit, and the current from it passing over the line will cause the lever of the relay M to leave the point O and come in contact with the lever *m;* but it can go no farther, as the tension on the retractile spring holding the lever *m* against *n* is greater than the attraction of the magnet. Hence the local circuit will be broken. If now the transmitter B is closed, the battery G is disconnected, and no battery is upon the line. Hence the retractile spring R of M will cause its lever to draw the lever *f* in contact with its back point O and close the local circuit. Hence the closing-signal is made by a cessation of the circuit. While thus closed, suppose the transmitter A closes, the batteries D and E, making one hundred and fifty cells, are thrown into the main line, and the lever of M is attracted with such force that it carries the lever *m* to the point P and the sounder still remains closed. There is a slight break in the continuity of the local circuit in the passage of the lever *h* of the magnet M from one point to the other, but it is so slight that by the use of the shunt X the self-induction of the sounder itself is sufficient to bridge it over. While the local current is closed on the front point P and A is opened, the lever flies back to the point O, still keeping the sounder closed. If now the transmitter B is open and A closed, the batteries G and E of one hundred cells are in circuit. This causes the lever of the magnet M to be drawn to the lever *m*, but one hundred cells are insufficient to overcome its retractile spring. Hence the lever does not connect with the front points and the local circuit remains open. So it will be seen that while a strength of one hundred cells produces no effect upon the sounder of M, either the addition of fifty cells to the one hundred or a total cessation of the current produces the signaling upon the sounder of M and a second message can be sent. The lever *f* of the magnet or relay *m* might be dispensed with and the local current connected to the levers *h* and *m* instead of *f* and *m;* but I prefer to use the lever *f*, as it prevents by its inertia the mutilation of the signals due to reversals. The effect of the reversals when both the back and front points *o* and *p* are used is much less than if only one point were used, because at the moment when the lever flies away from the point *p* it touches the point *o* for an instant, and thus serves to generate an induced and direct current in the sounder of M, tending to bridge over the break in the continuity. The effect of the reversals upon the relay L is rendered harmless by employing a back point and repeating-sounder of any of the devices which I have already patented and are well known in this connection and for this purpose.

I will now trace the line connections in the various positions of the transmitters A, B, and C. The method of reversing the direction of the current in the line from the batteries F or E, D, and G being well known, it will be unnecessary to describe it. The line enters the reversion at the spring 2, (C being opened,) thence to the arm 4 to the battery F, thence to the spring 15 (A and B being open) to the arm 17, thence *via* the wire 21 to the spring 9 to the lever or arm 11, thence to the battery G, binder 3 to the lever 27, thence to the spring 5 to the earth. The closing of the transmitter C merely reverses the direction of the current from G and F on the line without altering the tension or strength. In the position described F and G are in circuit, and if the battery 1 is not taken into consideration there are fifty cells in circuit. Now suppose A be closed. The lines pass, as before described, through C to the battery F, thence to the spring 15 to the point 16, thence to the battery E, thence *via* wire 22 to lever 14, thence to the spring 12, thence *via* wire 23 and 21 to the spring 9 through to 11, the battery G and earth through C. This adds the batteries E and G together and places one hundred cells in circuit. This causes the relay L to respond, as before described. If while A is closed B be closed, the tracing will be as follows: The line passes from the transmitter C to the battery F, spring 15, point 16, battery E, battery D, point 13, spring 12, wire 23, wire 21, spring 9, point 10 to the earth through C, thus placing E and D only in circuit and subtracting G or one hundred and fifty cells. This acting upon the lever of M causes it to close the local circuit. If B is kept closed while A is opened, the line passes from C to the spring 15, thence to 17 to wire 21, thence to spring 9 on B to point 10 to earth through C, thus taking all batteries off the line, and the lever of M falls back and closes the local circuit at its back point O.

To set forth the current strength and manipulation in signaling more clearly and in a general way, I state that the message that is transmitted by A and received on L is sent thus: for a closing signal, one hundred cells or one hundred and fifty cells. For an opening signal, nothing or fifty cells are on the line. The constant battery F is not taken into account.

The second message transmitted by B and received on M is sent thus: for a closing signal, nothing or one hundred and fifty cells; for an opening signal, fifty cells or one hundred cells.

The third message transmitted by C and received on K is sent thus: for a closing signal, a positive current; for an opening signal, a negative current, or vice versa.

The modifications of the relay M to meet the various conditions of long and short circuits, convenience, &c., are shown in Figs. 2, 3, 4, and 5. All these modifications are intended to replace the relay M (shown in Fig. 1) under certain conditions. In Fig. 2, A^3 and B^3 are relays. A^3 is adjusted to respond to fifty cells, while B^3 responds only to one hundred and fifty or more. The levers of both play between platina contact-points *e f g h*. When the transmitter B is open, the battery G of fifty cells is on the line, and this causes the lever of A^3 to be attracted to the point *e*, thus breaking the local circuit and the sounder is open. If the the transmitter B is closed, G is disconnected, and there being no current upon the line the lever of A^3 comes in contact with its back contact-point *f* and closes the sounder. If at the moment A be closed, the batteries E and D are thrown in circuit and both levers are thrown forward in contact with their front points, *e* and *g* still keeping the sounder closed, the sounder may be shunted through a rheostat to prevent the slight effect due to a momentary break in the continuity of the local circuit in the passes of the levers from their back to their front points or a repeating-sounder used.

In Fig. 3 precisely the same action takes place, the connections of the wires only being varied.

In Fig. 4 I substitute for one of the neutral relays a polarized relay, with extra levers for centering its tongue in a middle position in such a manner that when no current circulates, by reason of the transmitter B being closed, the extra lever will hold the tongue of A^3 in the center and cause the local circuit to be closed; but if the transmitter B is opened fifty cells pass to the line and the sounder is opened. When the transmitters A and B are closed, the relay B^3 closes the sounder on its front point.

In Fig. 5 are shown two polarized relays, A^3 being adjusted to respond to fifty cells and B^3 to one hundred and fifty. The action is the same as the other modification, except that the reversals of the current has much less effect on the sounder than when neutral relays are used.

I claim as my invention—

1. In a sextuplex telegraph, the key B, having two circuit preserving and changing springs, the circuit-reversing key C, and the circuit preserving and changing key A, in combination with the batteries F E D G and circuit-connections, substantially as specified, for applying the combined power of the batteries E D F to the line, or cutting out the batteries D or G, as set forth.

2. In a sextuplex telegraph, the combination, with transmitting-keys and means, substantially as described, operating to send the proper currents, of three receiving-instruments, the first of which responds to reversals in the polarity of the current, the second responds to either of two currents that are above a medium strength, and the third responds to a current of the greatest strength, or to no current from the transmitting-batteries, substantially as set forth.

3. The receiving-instrument M, having the two spring-levers *f m*, stop *n*, armature-lever *h* between the levers *f m*, and contact-points *o* P, in combination with the sounder, local battery, and circuit-connections, substantially as set forth, so as to cause the sounder to respond to strong currents or to no currents, substantially as specified.

4. In a sextuplex telegraph, the combination, with the reversing-key C and instrument K, that responds to current reversals, of the keys B and A, batteries E F D G, circuit-connections, and receiving-relays L M, and sounders arranged substantially as specified, so that the key B when closed lessens the battery-current to line, and the key A increases the strength of battery to line, and both keys apply the highest battery power to line, the receivers L M being arranged and adjusted to respond to the respective strengths of battery, substantially as set forth.

Signed by me this 31st day of May, A. D. 1877.

THOS. A. EDISON.

Witnesses:
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