UNITED STATES PATENT OFFICE.

MINOR M. DAVIS, OF BROOKLYN, NEW YORK.

DUPLEX AND DIPLEX TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 541,994, dated July 2, 1895.

Application filed April 18, 1895. Serial No. 546,168. (No model.)

To all whom it may concern:

Be it known that I, MINOR M. DAVIS, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have made certain new and useful Improvements in Duplex and Diplex Telegraphy, of which the following is a specification.

The object of my invention is to provide a transmitting device of such a character that the spark, heat, and fusion existing and liable to occur in the use of dynamo-electric machinery or equivalent low-resistance sources, such as secondary batteries, is rendered harmless or obviated.

My improvement is specially useful in a pole-changing transmitter where the succession of currents to line is abruptly changed from a maximum positive to a maximum negative.

In transmitters of the class described it is desirable and even necessary to employ such a combination of levers that the emitted sound shall be sharp, distinct, and readable, while the tendency to "chatter" or "rattle" when the lever engages with its stop shall be minimized. If the lever of a transmitter chatters or rattles, sparking and fusing at the contact points are aggravated and extremely troublesome. To avoid this it is necessary to limit the length of the stroke to as short an excursion as possible, while the dots and dashes must not be shortened and the sound must be sufficiently loud or well identified.

My invention embodies the employment of fixed contact-points with movable contact-points, the latter consisting of unequally-pivoted spring-retracted levers so arranged that the longer arm of the lever shall engage with the contact-stop and the shorter arm of the lever shall engage with the actuating-lever or armature-bar, by means of which the levers are operated, either directly or through the medium of an electromagnet and a local circuit. By this arrangement of levers a slight extent of movement of the actuating-lever produces a wide, abrupt, and sudden opening at the contact-points, and even if the actuating-lever rattles or chatters its slightest movement at its point of engagement with the contact-levers results in an extended, abrupt, and sudden opening at the contact-point, an opening too great to permit of sparking, accomplished with the utmost rapidity of movement.

I have found my transmitter especially useful in connection with the arrangement of dynamos devised by Francis W. Jones, in which four separate machines are employed, one pair being of high electromotive force and opposite polarity and one pair of low electromotive force and opposite polarity. In connection with these dynamos there are employed two dependent pole-changing transmitters—that is, the transmitters move together or coincidently, the one operating to reverse the polarity of current from one pair of dynamos, the other performing the same function for the other pair of dynamos, and an independent transmitter operates to put one or the other pair of dynamos in connection with the main line.

The accompanying drawings illustrate my invention.

Figure 1 shows my improved transmitter and its application to a polar duplex, and Fig. 2 shows my improved transmitter and its application to a diplex telegraph arrangement.

In both figures P is a pole-changing transmitter. There are two movable contacts consisting of two unequally pivoted levers x and y, pivoted at 40 and 41, respectively, the location of the fulcrum or pivot being about two-thirds the length of the lever from the fixed electrical contacts 2 and 3. The operating or actuating lever a mechanically connects or contacts with the shorter arms of said levers through the medium of the rod of insulating material i. It is to be noticed that the length of i is such that when x contacts with 2 and y is separated from 3, the said mechanical connecting piece i is slightly separated from x, and vice versa. The two levers x and y are spring retracted, the retracting force being applied to the shorter arms, and in the embodiment of my invention illustrated, one spring s is employed with a proper adjusting device to draw the shorter ends of the two levers toward each other. The two levers are shown electrically united, forming the movable terminal of the line, while the fixed contacts 2 and 3 form, respectively, the terminals of two dynamos d and d' of opposite polarity, respectively.

S is a well-known polarized relay, differen-

tially wound, included in the main line L. The actuating-lever *a* is preferably controlled by means of an electromagnet, local circuit, and circuit-closing key.

As shown in the drawings, dynamo *d'* is connected to line. If the key of the transmitter be closed, the initial movement of the actuating-lever *a* breaks contact between lever *x* and the fixed contact 2 abruptly, and the extent of separation between the contact-points is multiplied or extended, as compared with the slightest movement of the actuating-lever *a*. The contact points 2 and *x* are separated with an abruptness and snap characteristic of the action of a spring, and it results from this that any wavering, and any tendency to chatter, or rattle, on the part of the lever *a* will be ineffective to produce sparking at contact-point 2, because any movement due to *a*, separating it from its upper limit stop, has moved contact *x* abruptly, separating it from point 2 sufficiently to break any arc, or tendency to arc, that might otherwise result. The return movement of the lever *a* breaks the contact between the lever *y* and contact-point 3 in the same way. Following the break between contacts *x* and 2, contact is made between *y* and 3, the dynamo of negative polarity being thus substituted for the dynamo of positive polarity in connection with the line, and the polarized relay S responds in a manner well understood in the art.

Referring to Fig. 2, I have shown my pole-changing transmitter in combination with the arrangement for diplex transmission devised by Francis W. Jones. *d* is a dynamo-machine of low electromotive force and positive polarity. *d'* is a similar machine of the same electromotive force and negative polarity. D and D' are dynamos of high electromotive force and positive and negative polarity, respectively. P is my improved pole-changing transmitter, hereinbefore described. The actuating-lever *a* carries a supplemental lever I, from which it is insulated. The lever I is the actuating-lever of a dependent transmitter including the movable contact *c* and the fixed contact *e*. T is the well-known form of continuity-preserving transmitter composed of hooked lever 9, carrying the insulated spring 10, having the fixed contact 11. S is a polarized differential relay. N is a neutral differential relay, and R is an artificial resistance, all included in the main line L. The two pole-changing transmitters are operated by an electromagnet, local circuit, and key, and the independent transmitter T is similarly operated. Dynamo D' is connected with fixed contact 3 of transmitter P through the resistance 33 by the wire 23. Dynamo D is connected through resistance 32 by wire 22 with the fixed contact 2 of said transmitter. The levers *x* and *y* are electrically united and are connected by the main-line fragment 1 with the fixed contact 11 of the transmitter T. Dynamo *d'* is connected through resistance 31 and wire 21 with fixed contact *e* of the dependent transmitter. Dynamo *d* is connected through resistance 30 and wire 20 with lever I of the dependent transmitter. The movable contact *c* of the dependent transmitter is connected through the main-line fragment 1' with lever 9 of transmitter T. The main line L is connected with insulated spring 10 of transmitter T.

When transmitter T is operated, main line L is alternately connected through 10, 9, and 1' with the dependent transmitter and low electromotive force dynamos, and through 10, 11, and 1 with levers *x* and *y* and the high electromotive force dynamos D and D'. In the latter case the operation of the transmitter P rapidly changes the line from the maximum positive to the maximum negative dynamo and the sparking heretofore incident to such changes is obviated and avoided by the sudden, abrupt, and extended break between the levers *x* and *y* and the fixed contacts 2 and 3, respectively, and any inequality in the action of the actuating-lever *a* is rendered harmless by the arrangement of the unequally-pivoted levers and the fixed contacts located at the end of the longer arms thereof.

I may insulate the levers *x* and *y* from each other and connect them to the two dynamos, respectively, and I may electrically unite the fixed contacts 2 and 3, connecting them to the main line without departing from my invention; and I may substitute secondary batteries for the dynamo-machines shown, as I believe them to be substantial equivalents as sources of electrical energy, on account of their low internal resistance.

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

1. In a duplex or diplex telegraph the combination at the receiving station of an electromagnetic receiving instrument located in a main line, and at the transmitting station a transmitter located in said main line, composed of a fixed contact, a movable contact consisting of an unequally pivoted lever the longer arm of which is in position to engage with said fixed contact, an actuating lever mechanically connecting with the shorter arm of the first named lever, an electro-magnet and local circuit for controlling said actuating lever, a retractor for the unequally pivoted lever normally tending to hold it in engagement with said fixed contact, an electrical connection between the main line and one of said contacts and an electrical connection between the terminal of a grounded dynamo-electric machine and the other contact, all arranged and operating substantially as described.

2. In a duplex or diplex telegraph, at the transmitting station, a pole changing transmitter consisting of two fixed contact points connected with dynamo-electric generators or other suitable sources of electricity respectively, a movable contact consisting of an unequally pivoted lever, the longer arm of which

is in position to contact with a fixed dynamo terminal or source of electricity, an electro-magnet, an armature therefor mechanically connecting with the shorter arm of the first named lever, and an electrical connection between the main line and said first named lever, substantially as described.

3. In a duplex or diplex telegraph, at the transmitting station, a transmitting device consisting of two fixed contact points, two movable contact points formed of two similar, unequally pivoted, spring retracted levers, an actuating lever mechanically connecting with the shorter arms of the two first named levers, electrical connections between the main line and one pair of contact points, between one of the second pair of contacts and a positive dynamo pole or source, and between the other contact of said pair and a negative dynamo pole or source, substantially as described.

4. In a duplex or diplex telegraph the combination of a polarized receiving instrument in the main line at the receiving station; and at the transmitting station a pole changing transmitter consisting of two fixed contact points forming respectively, the terminals of dynamos or sources of electricity of opposite polarity, a pair of similar, unequally pivoted, spring retracted levers electrically connected together and to the main line, the longer arms of said levers being in position to engage with said fixed contacts, respectively; an actuating lever mechanically connected with the shorter arms of said levers and means for operating said actuating lever, substantially as described.

5. In a diplex telegraph the combination, at the receiving station, of two receiving instruments in the main line, one responsive to variations in intensity, the other responsive to variations in polarity of the main line current; at the transmitting station, two dynamos or sources of electricity of high electro-motive-force and respectively opposite polarity, two dynamos or sources of electricity of low electro-motive-force and respectively opposite polarity, a pole changing transmitter consisting of two unequally pivoted, spring retracted levers and two fixed contacts in position to engage with the longer arms of said levers, respectively; an actuating lever mechanically connecting with the shorter arms of said levers, an electrical connection between one pair of said contacts and a contact point in an independent transmitter, an electrical connection between the other pair of contacts and the pair of dynamos or sources of high electro-motive force, respectively, a dependent pole changing transmitter consisting of a contact lever and two contact points with which said lever engages at or near its limit of movement, an electrical connection between two of said contacts and the terminals of the low electro-motive-force dynamos or sources, respectively, an electrical connection between the remaining one of the last named contacts and a contact point in said independent transmitter, and an electrical connection between a third contact point in said independent transmitter, and the main line, the whole being so arranged that the operation of the pole changing transmitters reverses the polarity of the dynamos or sources of electricity of both pairs and the operation of the independent transmitter determines which pair of dynamos or sources of electricity shall be placed in connection with the main line, substantially as described.

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(No Model.) 2 Sheets—Sheet 1.

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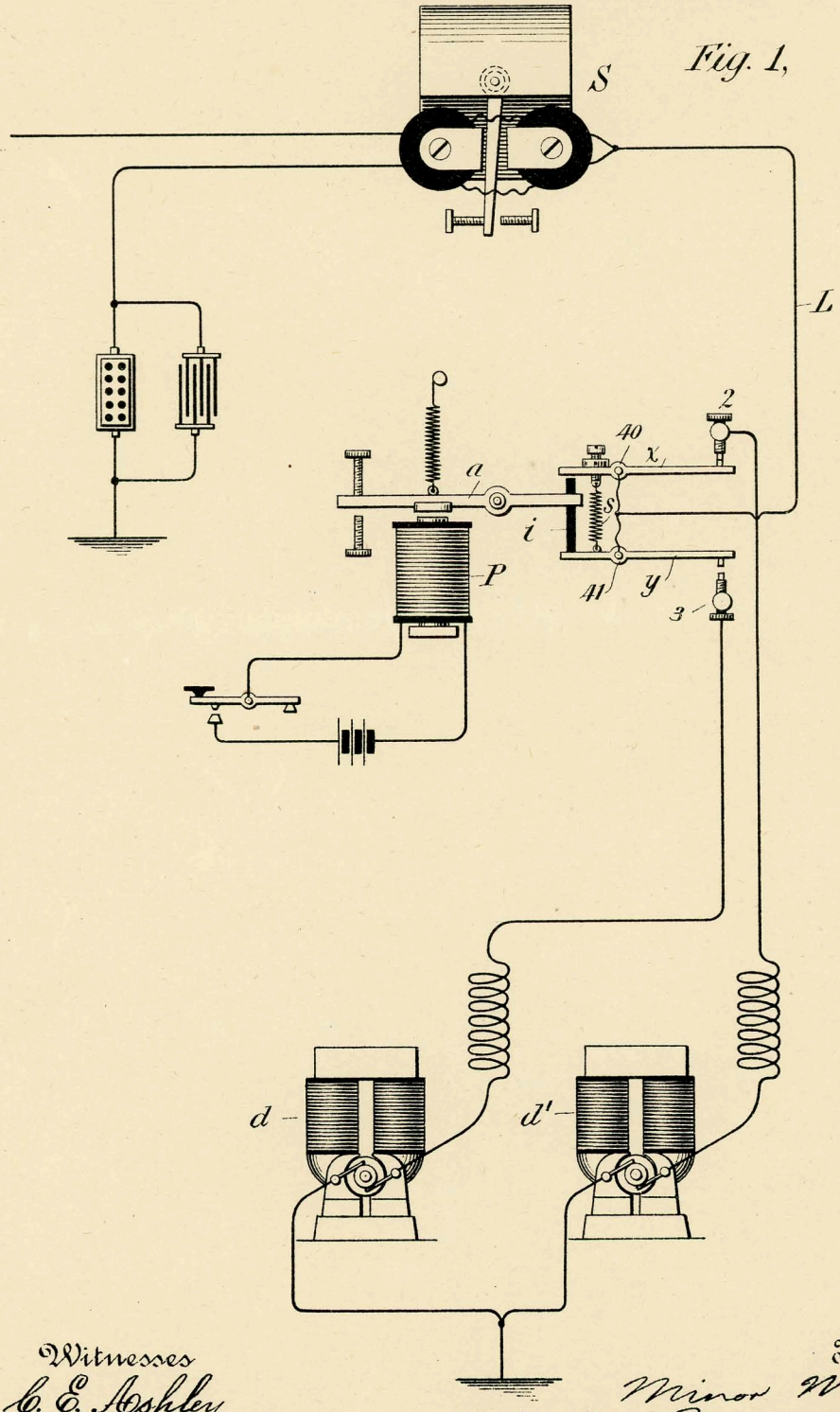
Fig. 1,



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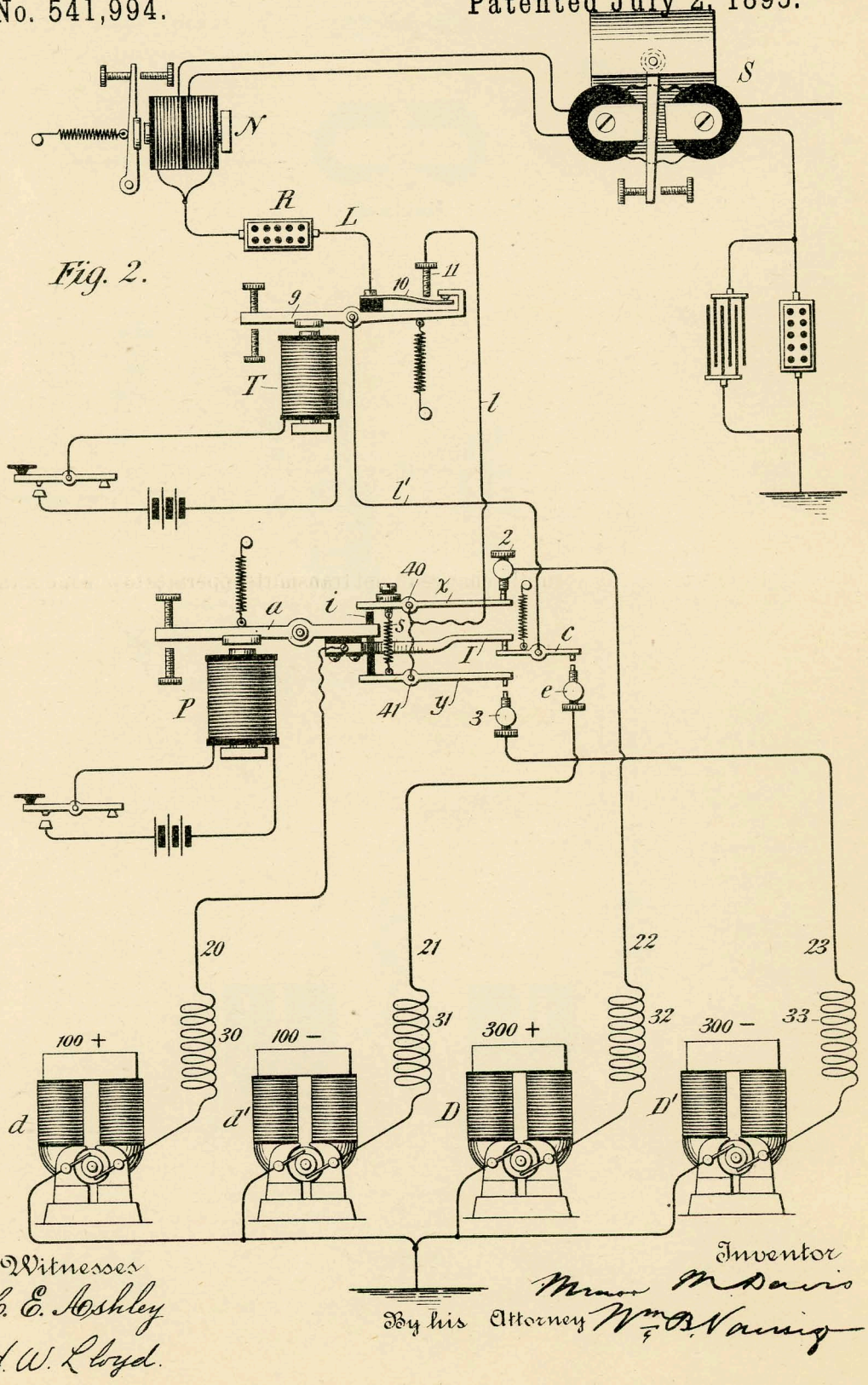

Fig. 2.

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