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H. C. NICHOLSON.

QUADRUPLEX TELEGRAPH.

No. 332,550. Patented Dec. 15, 1885.

Fig. 1

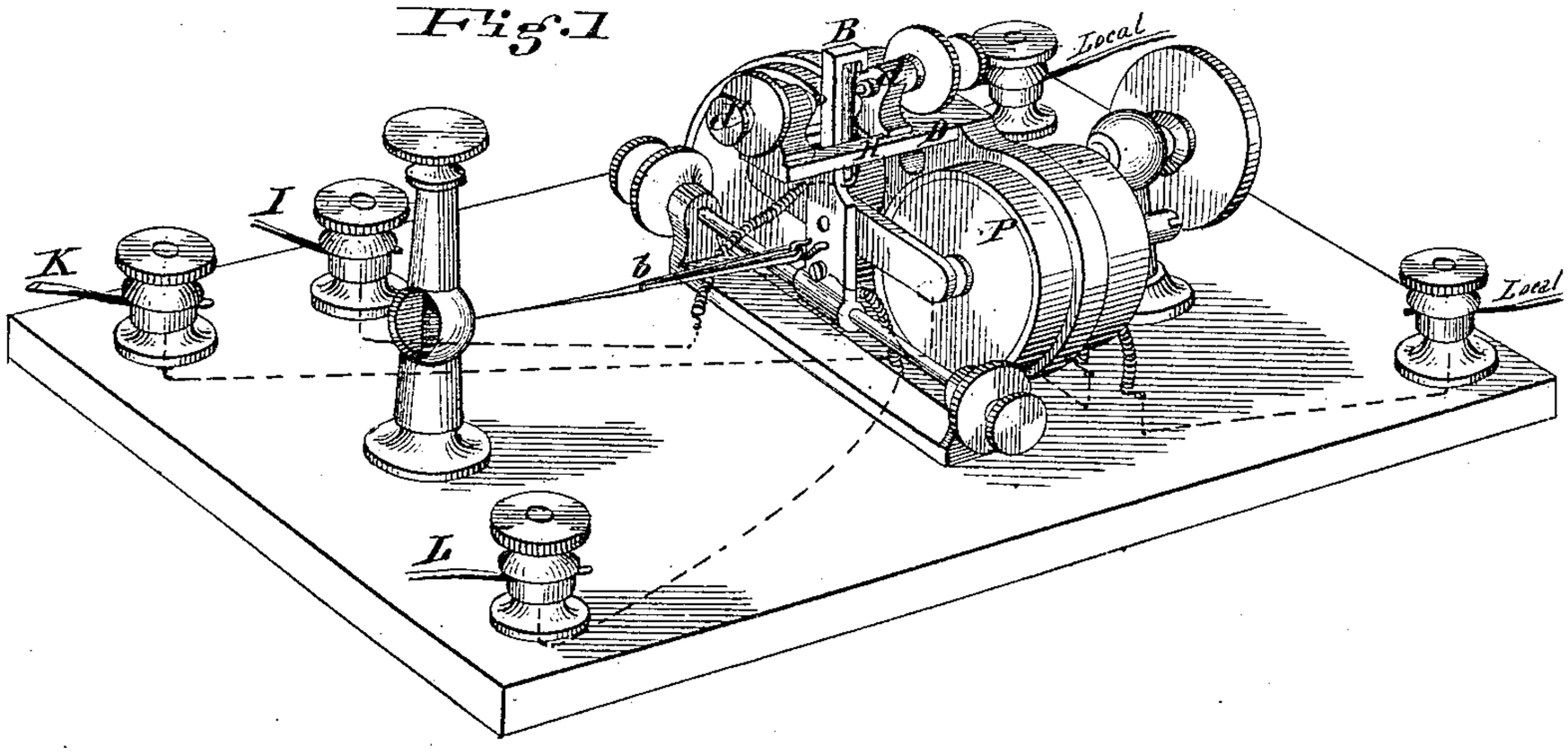

Fig: 2

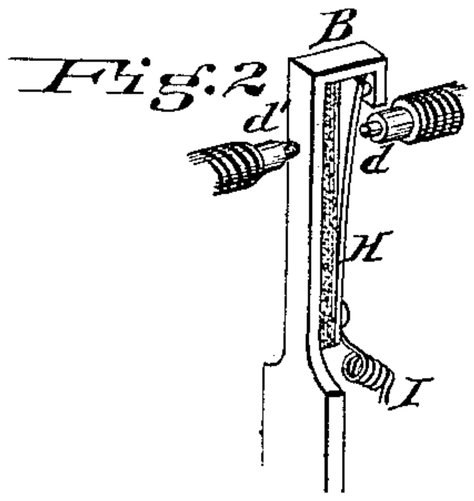

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Fig. 3

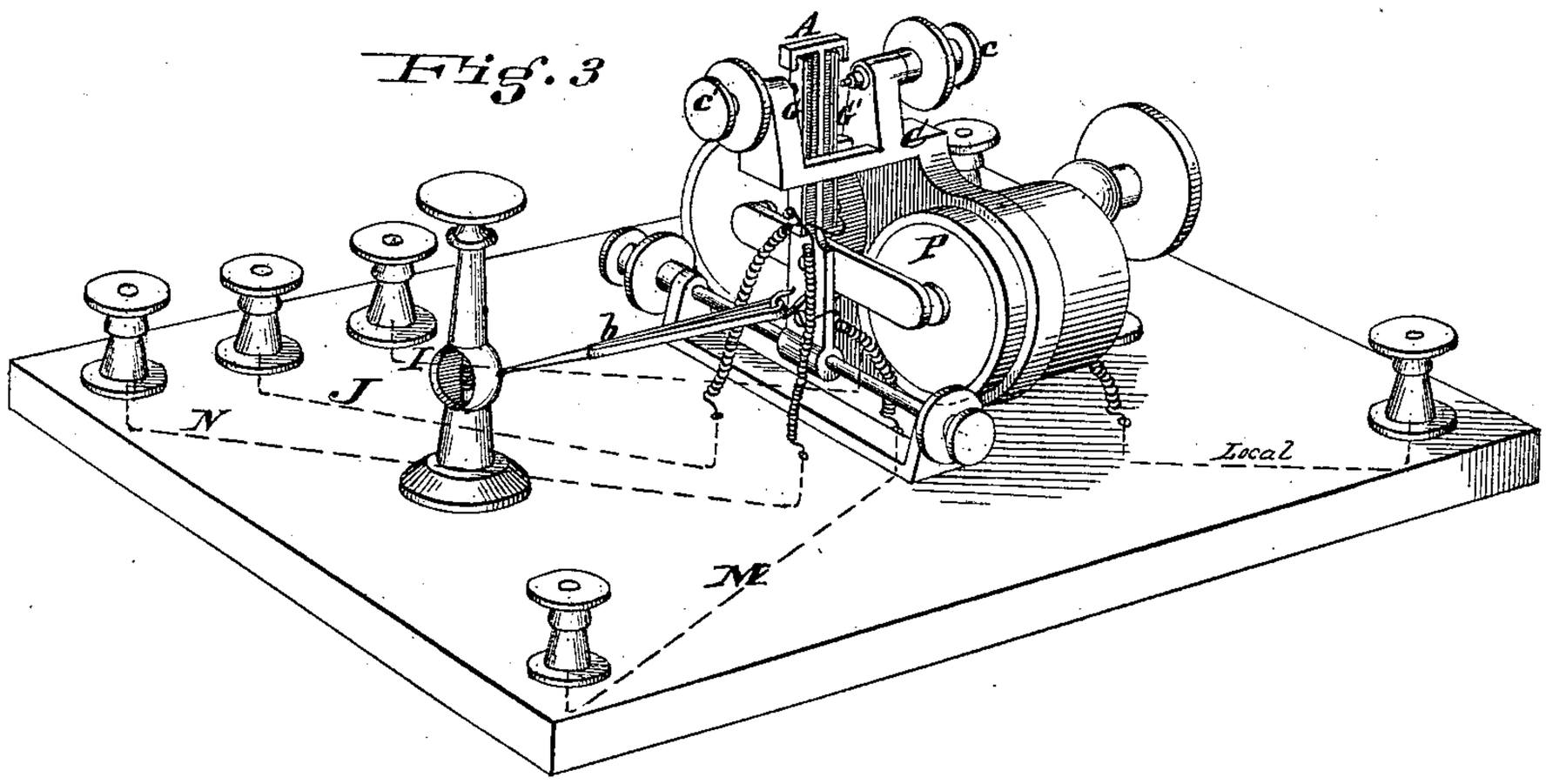
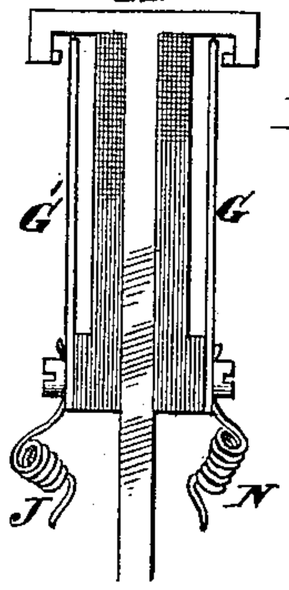


Fig. 4



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QUADRUPLEX TELEGRAPH.

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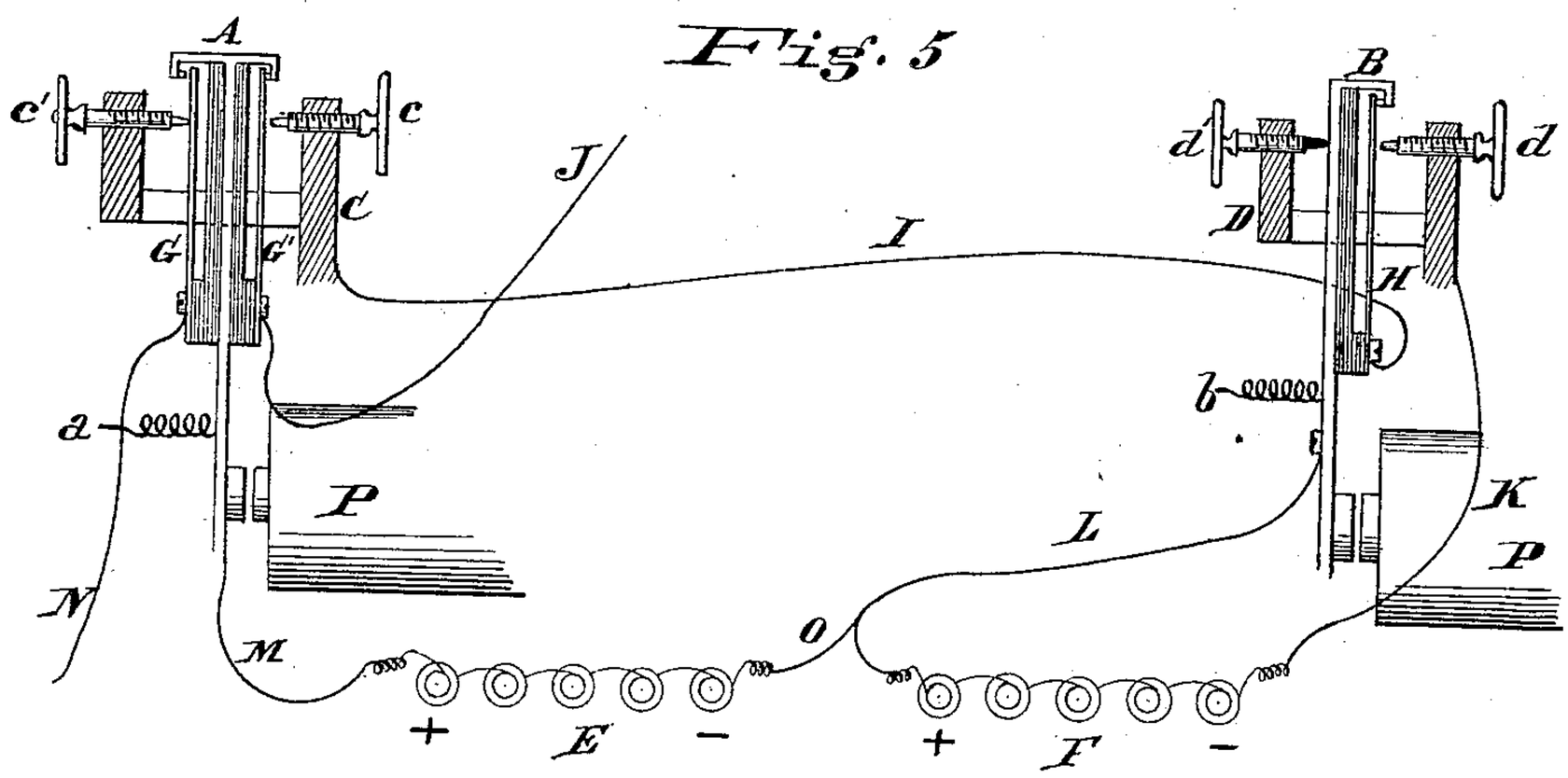
Fig. 5



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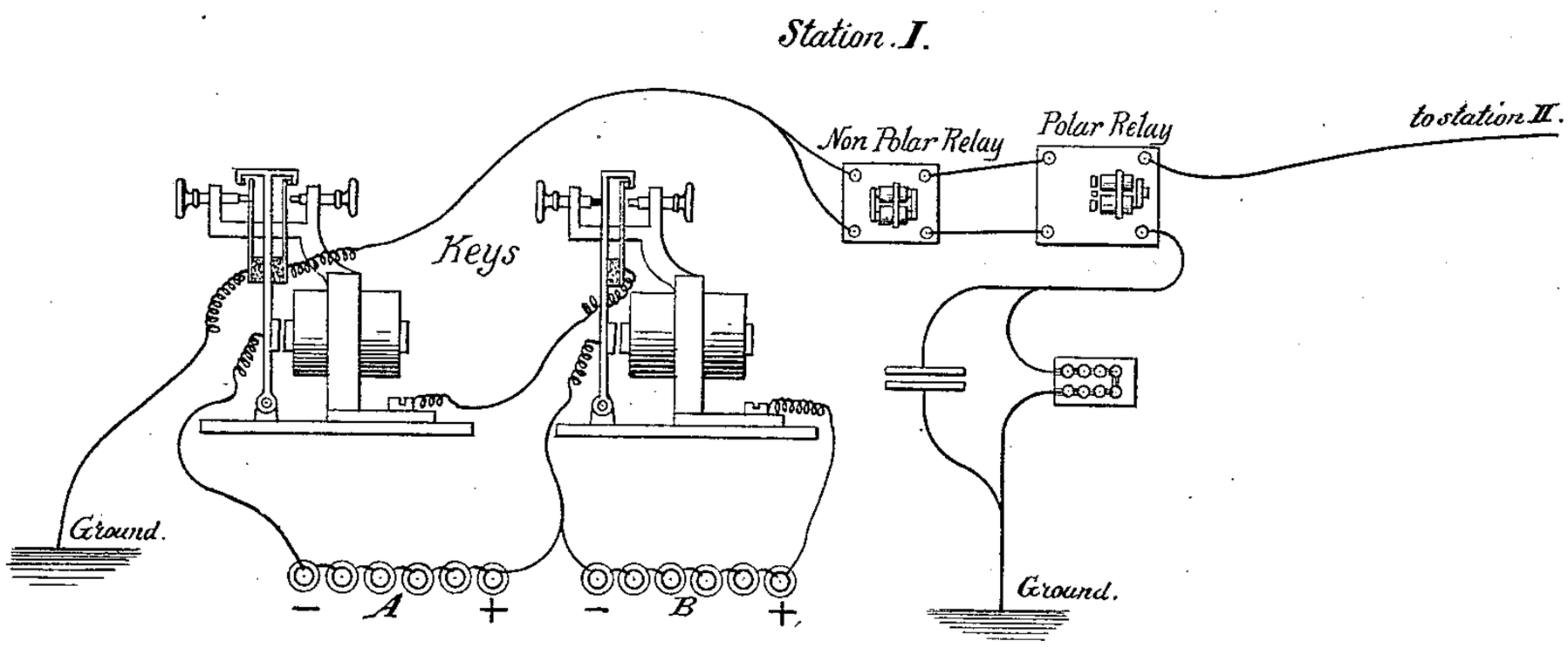
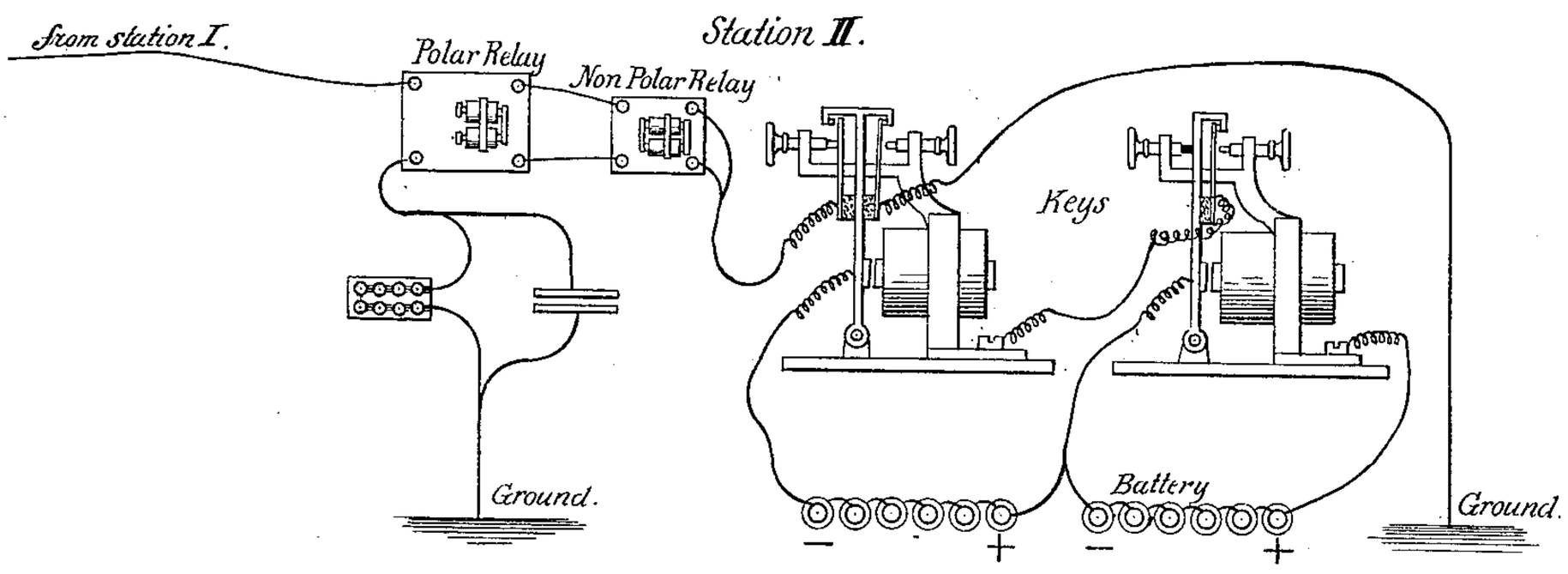


Fig. 6.



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by his attorney
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UNITED STATES PATENT OFFICE.

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QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 332,550, dated December 15, 1885.

Application filed May 11, 1876.

To all whom it may concern:

Be it known that I, HENRY C. NICHOLSON, of Kenton, Kenton county, State of Kentucky, have invented an Improvement in Electrical Telegraphs, of which the following is a specification.

My invention relates to devices for manipulating electrical currents on a single line-wire with usual ground-connections, so as to admit of the sending of four signals simultaneously, two in each direction, the most that will be required in sending one message in each direction of the Nicholson alphabet, as patented by me in Letters Patent numbered 112,836, March 21, 1871.

My invention consists, in the first part, in a system of telegraphy of such a construction and arrangement of parts as that by proper manipulation the currents from a pair of batteries of equal size (the left of which at all times remains in circuit with main line) may present themselves as follows, viz: plus polarity to line from single left battery when both manipulating-keys are open; minus polarity to line from single left battery when left or reversing key is closed; minus polarity to line from both right and left batteries when both keys are closed, and plus polarity to line from both right and left batteries when single or right manipulating-key is closed, and thus requiring but two relays (one a polarized relay, and the other a non-polarized relay of increased resisting powers) at the distant station to receive the message from even batteries; and my invention consists, in the second part, in transmitting devices, of a key for manipulating the main-line current, consisting of two insulated spring self-contact points and two outside contact-points for the said spring-points to play against, the whole acting in different capacities to reverse the direction of the main-line current, and consequently its polarity in a certain direction; and this form of key cannot only be used in the manner specified in the first part of this preamble, but when slightly modified can also be used in other combinations, which I have shown in another application filed September 26, 1885, which is a division hereof.

In the accompanying drawings, Figure 1 is a perspective view of my improved left main battery-key. Fig. 2 is a detailed view of the key. Fig. 3 is a perspective view of the right main battery-key. Fig. 4 is a detailed view of the key. Fig. 5 is a diagram illustrating the even batteries, keys, and connections. Fig. 6 is a diagram of a system in which the batteries are so connected to the keys that only one polarized and one non-polarized relay need be used at a station.

A and B are the manipulating-keys for the currents from main batteries E and F. These keys are caused to control the currents by means of local batteries and keys acting upon the armatures to attract them with springs *a b* to resist. The key A is provided with insulated springs G G′, whose ends play between the double-hooked end of the key and two contact-points, *c c′*, in the frame C of the local relay P. The key B is provided with an insulated spring, H, which plays between the hooked end of the key and the point *d* in the relay-frame D. The whole keys A and B play bodily between the respective points *c c′* and *d d′*, the latter point, *d′*, being merely an insulated rest. These keys are, as shown in Figs. 1 and 3 of the drawings, mounted suitably upon frames provided with binding-posts for the several wire-connections.

Referring descriptively to Fig. 5, I is a local wire connecting the frame C of key A to the spring H of key B.

J is the main-line wire connecting to the spring G′, while the ground-wire N leads from the spring G. The key A is connected by wire M to the plus end of battery E, while a tap-wire, O, connects the minus end of said battery to a wire, L, which connects the plus end of battery F with the key B. The minus end of battery F connects by wire K to the point *d* of key B.

When the keys A B are connected, as shown in Fig. 5, with contact-points *c c′* in connection with line I, the manipulation of the keys will play the currents as follows: In order to at all times keep the main-line circuit intact when the keys A B are both open, the wires are connected to complete the main circuit

from line to ground as follows: from line J, through spring G′, key A, wire M, battery E, loop or tap O, wire L, key B, spring H, and wire I, to point *c′*, spring G, and thence to ground at N.

When the left key, A, is closed in the act of sending a signal to the distant station, the connection from line to ground is as follows: from line J, through spring G′, point *c*, frame C, line I, spring H, key B, wire L O, battery E, wire M, key A, spring G, and thence to ground through wire N. It will be observed here that the polarity of the battery to the line is reversed from that presented when the key A was open, and in this reversal of polarity lies the power of actuating the suitably-polarized relay at the distant station. When the key A is closed, the spring G′ leaves the hook of the key and engages with the point *c*, and the spring G leaves the point *c′* and engages with the hook of key A.

When the keys A and B are both closed in the act of sending two signals to the distant station, as in sending one of the compound signals of the Nicholson alphabet, the currents from both batteries E and F are brought (as they necessarily must be) into use as follows: The spring H leaves the hook B and engages with the point *d* in frame D. The circuit is then complete from line J, spring G′, point *c* in frame C, wire I, spring H, point *d*, wire K, battery F, battery E, wire M, hook-key A, spring G, and thence to ground through wire N. It will be seen that the polarity in this instance is the same to line that it is when the double key A alone is closed, and consequently the polarized relay at the distant station will be actuated, as also a relay of increased tension by reason of increased battery strength—viz., both batteries.

When the key B is closed alone in the act of sending a signal, the currents play as follows: from line J, spring G′, key A, battery E, through wire M, battery F, wire K, point *d*, spring H, wire I, point *c′*, spring G, and thence to ground through wire N. Thus the right key employs both batteries to actuate the non-polarized relay. In the above arrangement I employ equal batteries, with one of them at all times in circuit, and employ but two relays at the distant station to receive the signals—viz., a polarized relay of plus polarity, capable of being operated by the minus current from a single battery, and a non-polarized relay of increased tension, capable of being operated only by the combined tension of both batteries.

Fig. 6 clearly shows such a system adapted for simultaneously sending and receiving messages at both stations I and II, the relays at each station being ordinary so-called "differential relays," each having one coil in the main-line circuit and an opposing coil in an artificial-line circuit, all as will be readily understood from said figure by persons skilled in the art. This apparatus is used for the transmission of messages by the Nicholson alphabet, and the finger-keys (not shown) in the local circuits of the line-current manipulating-keys A and B are placed close together, after the fashion illustrated in my aforesaid patent.

The messages may be received by registers; but when they are received by sound the two sounders at each station are likewise placed near each other, and should sufficiently differ in tone or pitch to be clearly distinguishable by the receiving-operator.

I claim—

1. The combination at one station of two independently-operated keys connected in the same circuit, one serving to control the polarity of the line-current, and the other, whenever operated, to control the tension of the line-current, without in any instance changing its polarity, substantially as specified.

2. The combination, substantially as specified, with the main line at one station, of a relay controlled by change of polarity and a relay controlled by change of tension, arranged to simultaneously receive two signals, and at another station two independently-operated keys connected in the same circuit, one serving to control the polarity of the line-current, and the other, whenever operated, to control the tension of the line-current, without in any instance changing its polarity.

3. In telegraphic transmitting devices, the combination of keys A, G, G′, and B H, secured to play, respectively, between points *c c′* and *d d′*, with ground-connection N, line-connection J, local connections I K L O M, and even batteries E F, the whole to operate substantially as and for the purpose specified.

4. In telegraph transmitting devices, the key A, provided with insulated contact-springs G G′, situated to play between two contact-points, *c c′*, for the purpose substantially as specified.

5. The combination at one station, substantially as specified, of two separate main batteries, or two sections of a main battery, and two independently-operated keys connected in the same circuit—one serving to control the polarity of the line-current and the other to control the tension of the line-current—by alternately opening and closing one of the batteries, without in any instance changing the polarity of said current.

6. The combination, with a telegraphic circuit and battery, of two keys at one station, acting independently—one to reverse the polarity and the other to increase or decrease the strength of current—and two receiving-instruments at the other station, operated independently, one by the change of polarity, and the other by the change in the strength of the current.

7. In combination with a telegraphic cir-

cuit, a battery, a portion of which is permanently in the line-circuit, and two independent keys or transmitters, the first key so constructed as to reverse the polarity of whatever current is passing from the battery to line without reference to the position of the second, and the second key so arranged as to increase or decrease the strength of the current in action at pleasure, without reference to the position of the first.

In testimony of which invention I hereunto set my hand.

HENRY C. NICHOLSON.

Witnesses:

JOHN E. JONES,

J. L. WARTMANN.