(No Model.) 2 Sheets—Sheet 1.

H. C. NICHOLSON.

QUADRUPLEX TELEGRAPH.

No. 332,551. Patented Dec. 15, 1885.

Fig. 1.

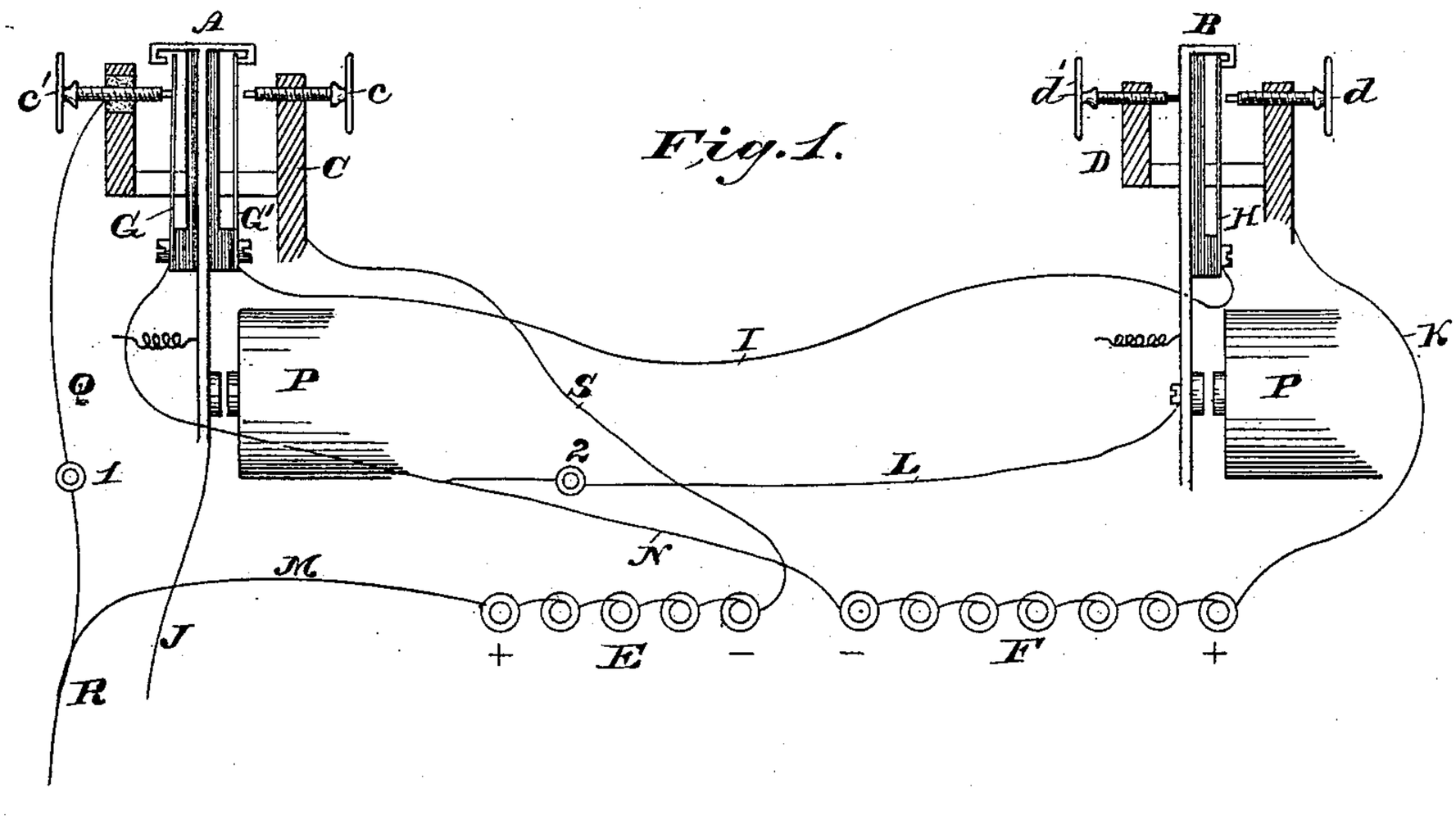
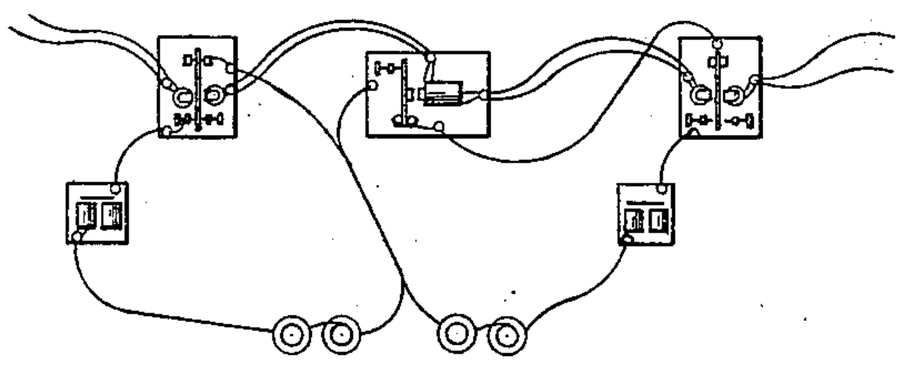


Fig. 2.



Witnesses:
E. J. Walker
A. F. Hodges

Inventor:
Henry C. Nicholson
by his Attorney
D. E. Bowlby

(No Model.) 2 Sheets—Sheet 2.

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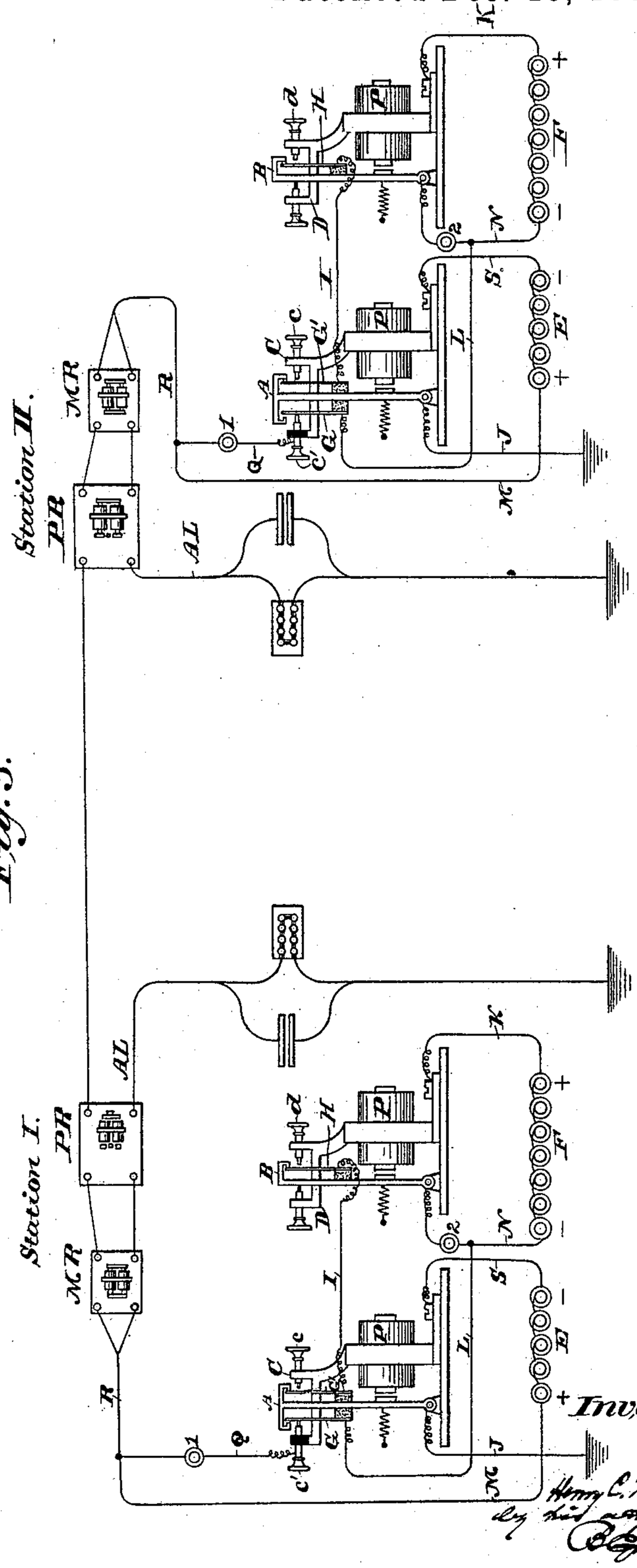

Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY C. NICHOLSON, OF MOUNT WASHINGTON, OHIO, ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK, N. Y.

QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 332,551, dated December 15, 1885.

Application filed September 26, 1885. Serial No. 178,253. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. NICHOLSON, a citizen of the United States, residing at Mount Washington, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Quadruplex Telegraphs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention, which was originally claimed in my application for a United States Patent filed May 11, 1876, but was ruled out of that application by the action of the Patent Office on July 31, 1885, 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 messages simultaneously—two in each direction—of the Morse alphabet, or one in each direction of the Nicholson alphabet, as patented by me in United States Letters Patent No. 112,836, dated March 21, 1871.

My invention consists of the combination, at one station, of two unequal main-line batteries normally out of circuit and two transmitting-keys, one of which, besides independently controlling one of the batteries, also controls the connections of the contact-points of the other key in such manner as to determine the polarity of the current from the battery put to line by the latter.

It further consists of the combination, with said transmitting devices at one station, of two independent relays at the other station, one of which responds to line-currents of a given polarity, irrespective of tension, while the other responds to line-currents of a given tension, irrespective of the polarity.

In the annexed drawings, Figure 1 is a diagram illustrating the uneven batteries, keys, and connections. Fig. 2 is a diagram illustrating three relays that would be required if main-line batteries of equal strength were employed. Fig. 3 is a diagram illustrating my invention as embodied in a quadruplex telegraph.

The arrangement and construction of the wires and keys are as follows: The double key A vibrates between the points *c c'*. The point *c'* is insulated in the frame C, so that it cannot connect in common with the point *c* to wire S. The point *c* is connected to the minus end of battery E by wire S, the point *c'*, through spark-coil 1, to line R by wire Q, the spring G to key B, through spark-coil 2, by wire L, and to minus end of battery F by tap-wire N, the plus end of battery E to line-wire R by wire M, the key A to ground-wire J, and the plus end of battery F to point *d* by wire K.

The passage of the main current under the various positions of the manipulating-keys is as follows: When both keys are open, the main line is complete from wire R through wire Q, spark-coil 1, point *c'*, spring G, wire L, spark-coil 2, key B, spring H, wire I, spring G', key A, and thence to ground at wire J, leaving both batteries E and F out of circuit, the resistance of which is represented by the spark-coils 1 and 2.

When the key A is closed in the act of sending a message, the spring G leaves point *c'* and engages with the hook end of key A, and the spring G' leaves the hook end of key A and engages with the point *c*, after which the currents play as follows: from line R, through wire M, positive end of battery E, (which thus presents plus polarity to line,) wire S, point *c*, spring G', wire I, spring H, key B, wire L, spark-coil 2, spring G, key A, and thence to ground J, leaving out battery F, the resistance of which is represented by spark-coil 2.

When the key B is closed, the spring H leaves hook end of the key and engages with point *d*, when the currents play as follows: from line R, through spark-coil 1, wire Q, point *c'*, spring G, wire L, tap-wire N, to minus end of battery F, (which thus presents minus polarity to line,) thence through wire K, point *d*, spring H, wire I, spring G', hook-key A, and thence to ground at J, thus leaving out battery E, whose resistance is represented by spark-coil 1.

When both keys are closed in the act of sending two dispatches simultaneously, the play of the currents is as follows: from line R, through wire M, to plus end of battery E, wire S, point *c*, spring G', wire I, spring H, point *d*, wire K, to plus end of battery F,

wire N, spring G, hook-key A, and thence to ground J, taking in both batteries with a plus presentation to line.

I am enabled to employ but two relays at the distant station—one a polarized relay for receiving the current from the lesser battery, and the other a non-polarized relay adjusted to resist the current of the lesser battery, but capable of operation under the current of the increased or larger battery. If the batteries E F were of equal size, two polarized relays and one non-polarized relay adjusted to respond only to currents from the two batteries combined would be required at the distant station, as illustrated in Fig. 2.

Fig. 3 clearly shows my invention adapted for simultaneously sending and receiving messages at both stations I and II, at each of which there is a transmitting apparatus such as I have described, a polarized relay, P R, a non-polarized relay, M R, and an artificial line, A L. The relays are ordinary so-called "differential relays," having one coil in the main-line circuit and an opposing coil in the artificial-line circuit, all as will be readily understood from said figure by persons skilled in the art.

I claim as my invention—

1. The combination, at one station of an open main-line circuit, substantially as specified, of two unequal main batteries and two electrically-connected transmitting-keys, one of which—say the first key—simply opens and closes a battery connecting through the second key with the main line, while the second key successively reverses the direction of the main-line circuit through the circuit-connections between the two keys, and by such reversal either determines or reverses the polarity of the battery controlled by the first key, according as said first key is open or closed.

2. The combination, substantially as specified, at one station of an open main-line circuit, of two unequal main batteries and two electrically-connected transmitting-keys, one of which—say the first key—simply opens and closes a battery connecting through the second key with the main line, while the second key successively reverses the direction of the main-line circuit through the circuit-connections between the two keys, and by such reversal either determines or reverses the polarity of the battery controlled by the first key, according as said first key is open or closed, and at another station of a relay controlled by change of polarity and a relay controlled by change of tension, arranged to simultaneously receive two messages.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY C. NICHOLSON.

Witnesses:

DAVID S. OLIVER,

GEO. J. MURRAY.