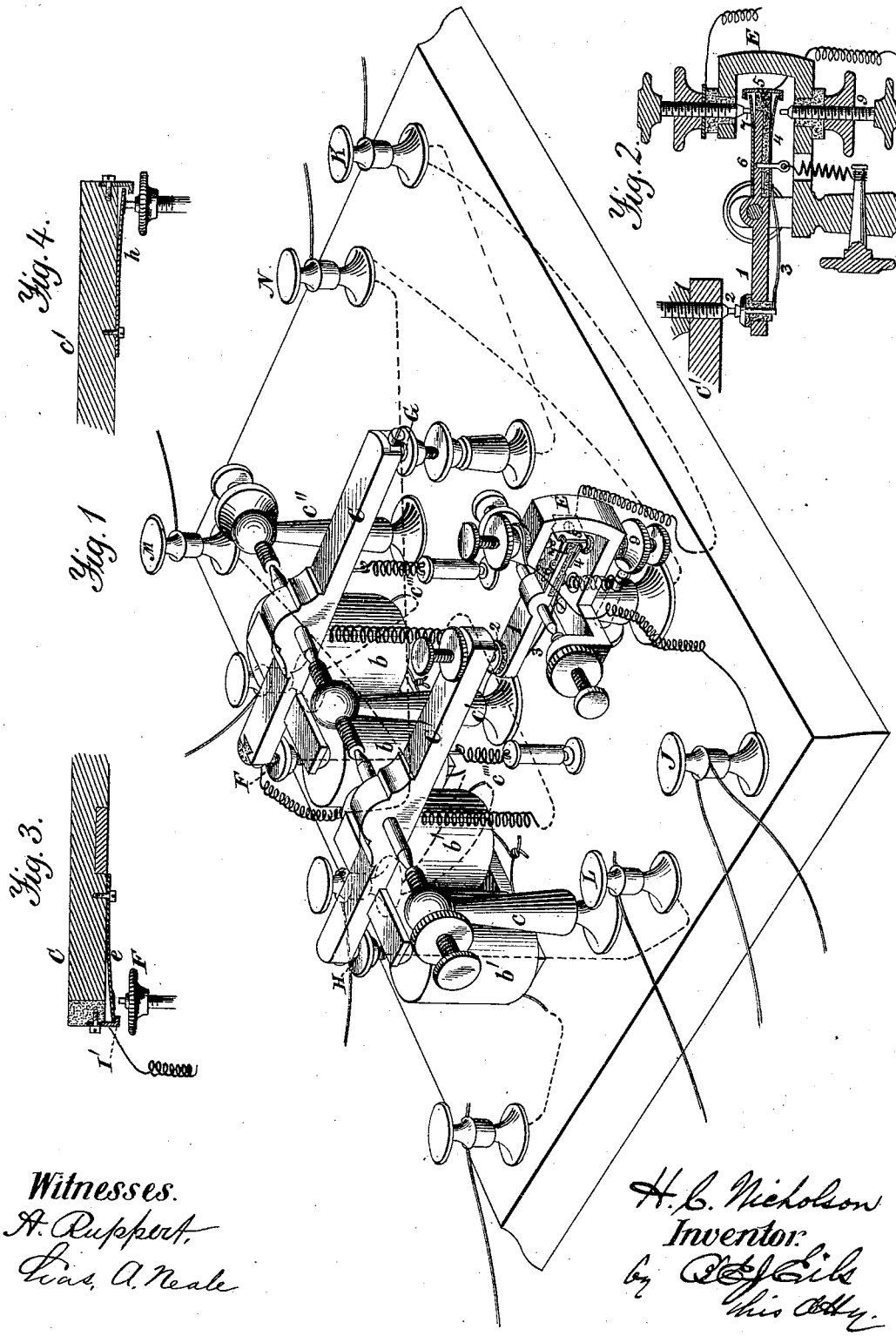
3 Sheets—Sheet 1.

H. C. NICHOLSON.

Quadruplex Telegraphs.

No. 196,248. Patented Oct. 16, 1877.



Witnesses.
A. Ruppert.
Chas. A. Neale

H. C. Nicholson
Inventor.
by Chas. J. Gibbs
his Atty.

3 Sheets—Sheet 2.

H. C. NICHOLSON.

Quadruplex Telegraphs.

No. 196,248. **Patented Oct. 16, 1877.**

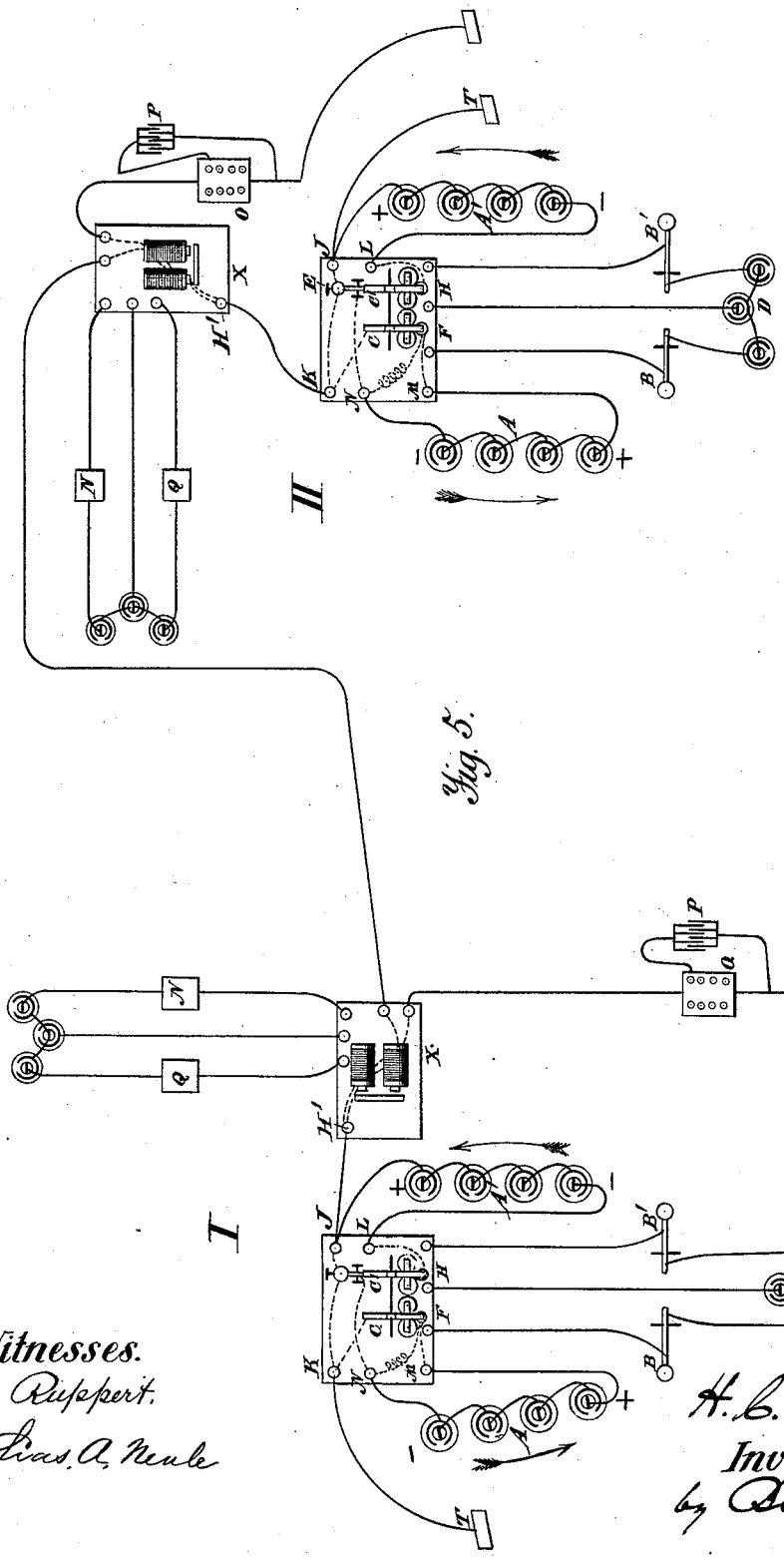


Fig. 5.

Witnesses.
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3 Sheets—Sheet 3.

H. C. NICHOLSON.

Quadruplex Telegraphs.

No. 196,248. Patented Oct. 16, 1877.

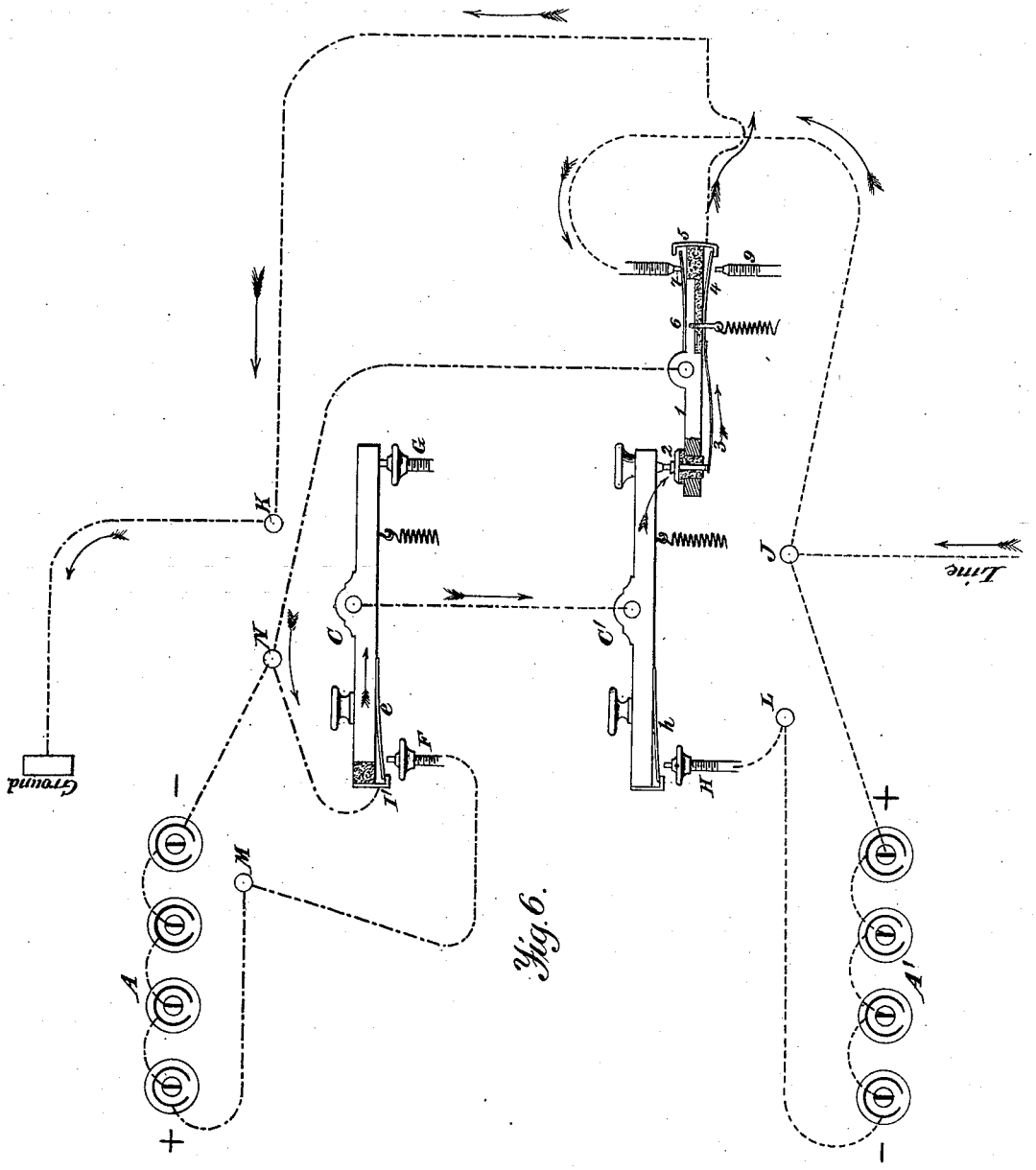

Fig. 6.

Witnesses.
A. Ruppert.
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Inventor.
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his Attys

UNITED STATES PATENT OFFICE.

HENRY C. NICHOLSON, OF KENTON, KY., ASSIGNOR TO THE WESTERN UNION TELEGRAPH COMPANY, OF NEW YORK CITY.

IMPROVEMENT IN QUADRUPLEX TELEGRAPHS.

Specification forming part of Letters Patent No. **196,248**, dated October 16, 1877; application filed September 1, 1877.

To all whom it may concern:

Be it known that I, HENRY C. NICHOLSON, of Kenton, Kenton county, Kentucky, have invented certain new and useful Improvements in Electric Telegraphs, of which the following is a specification:

This invention relates to single-line quadruplex telegraphs, organized to operate with currents differing in polarity and in intensity, according as the keys are actuated separately or simultaneously upon a relay or relays governing the requisite sounders or other suitable instruments of telegraphic communication.

The features hereinafter described and claimed cover a part of my application for Letters Patent, filed October 14, 1874, which has been put in interference with other pending applications, and from which this part has been withdrawn under the existing Rules of Practice in the United States Patent Office.

The improvements now under consideration consist, first, of the combination, with two main batteries or a divided main battery at one station, of two keys, one of which is adapted to govern one of the batteries, while the other, besides controlling the other battery, also determines the polarity of the battery-current sent by the first key; second, in the employment, in a system such as above described, of main batteries normally entirely disconnected from the line; third, of the combination, with one of the keys, of a circuit preserving and reversing lever.

In the accompanying drawings, Figure 1 is a perspective view of my improved keys. Fig. 2 is a vertical section of the reversing portion of the keys. Fig. 3 is a vertical section of the device for breaking or connecting with either ground or line. Fig. 4 is a sectional elevation of the end of one of the keys. Fig. 5 is a diagram of a complete telegraphic circuit by my method. Fig. 6 is a diagram showing the condition of the circuits at a station when both transmitting-keys are open and the line is excited by a current from a distant station.

In Fig. 5, A A′ are main batteries, situated at the ends of a circuit, and furnishing positive and negative currents. B B′ are keys actuating the double transmission-keys C C′ by means of a local battery, D. The keys C C′, as shown in Fig. 1, resting upon bearings *c c′ c″*, are in perfect connection, and are actuated by the local current through magnets *b b′*, upon customary armatures. To keep the armatures free from the magnets, except when influenced by a local current, I provide retaining-springs *c‴ c⁗*. One end of the key C is fitted with an insulated hook, I′, connecting with the frame E of the reverser through point N, as shown by dotted lines, Fig. 1, and has a spring, *e*, to play between this hook and a contact-point, F, connecting with the positive pole of the battery. The other end of key C, when in its normal state, or open, finds a rest on the point G. One end of key C′ has intermittent connection with negative pole of the right battery through point H and point L, and has a spring-connection to facilitate its intermittent play upon a reverser, E, at its other end. This reverser consists, as shown in Figs. 1 and 2, of a lever, 1, hung in frame E by its center, and forms an insulated intermittent connection from key C′ to east wire through connecting-spring 6 and insulated point 7 in the frame E. The spring 6 also forms intermittent connection between frame E and west wire through hook 5. Below spring 4 is an anvil, 9, for breaking the connection between spring 4 and hook 5.

The flow of the currents from the main batteries may be described as follows. It must first be stated, however, that the main batteries are normally disconnected entirely from the line, as will be seen by reference to Fig. 6; and, also, that the connections of the batteries with reference to the line and the ground at one station are the reverse of those at the other station, as clearly shown in Fig. 5.

Let the keys at station 11 be in their normal condition—that is, stand open. If, now, the right key C′ of station 1 be depressed, a positive current will proceed from the right battery A′ of such station to line by way of point J, and reach the earth T at the distant station 11 by the following route at said station 11, namely, through point K; thence through the reverser by way of hook 5 and springs 3 and 4; thence through the keys C′ and C; thence, by way of spring *e* and hook I′ of key C, through point N; thence back through the re-

verser by way of its elements 1, 6, and 7; and thence, finally, through point J. The negative pole of battery A′ at station 1 is at the same time brought in connection with the ground T at this station, completing the circuit by way of point L, point H, keys C′ and C, and points G and K, if such points are connected, as shown; otherwise, the route from key C passes, by way of its spring *e* and hook I′, to point N; thence through the reverser by way of its elements 1, 6, and 5; and thence, finally, through point K.

When the left key C is depressed at station 1, a negative current will proceed from the left or west of battery A of that station to the line by way of point N; thence through the reverser by way of its parts 1, 6, and 7; and thence through point J. It will reach the earth T at station 11 by the same route described as the one followed by the positive current. The positive pole of battery A at station 1, to complete the circuit, is at the same time brought in connection with the earth T at this station by way of point M, point F, keys C and C′; thence through the reverser by way of its parts 2, 3, 4, and 5; and thence, finally, through point K.

When both keys are depressed simultaneously, battery A at station 1 will be reversed, so that its negative pole, instead of connecting with the line, will be to the earth T at this station by way of point N, through the reverser by way of its parts 1, 6, and 5, and through point K. At the same time its positive pole forms a connection with the negative pole of the battery A′, so that the batteries join forces by way of point M, point or post F, keys C and C′, spring *h* of key C′, post H, and point L. The result is that a positive current of increased intensity proceeds to line through point J from the positive pole of battery A′, reaching the earth T at station 11 by the route heretofore described, while the negative pole of battery A, by connecting with the the earth T at station 1, in the manner already stated, completes the circuit.

A depression of either one or both keys C and C′ at station 11, while the keys at station 1 stand open, will cause circuits to be made through the stations in the same manner, except that the batteries here being reversed, the line-currents consequent upon the closing of either one or both keys will also be of reverse polarity. The outgoing current is divided at the post H′ of relay X, Fig. 5, into two currents of equal intensity, which run, in opposite directions, through the helices of an ordinary differential electro-magnet of this relay, neutralizing each other so as to leave the electro-magnet unaffected. One of the currents then passes through the line to the distant station, while the other makes a short circuit through the rheostat O and condenser P, the resistance of which is regulated to equal that of the line.

An incoming current passing through only one of the helices of the differential electro-magnet will produce an effect thereon. The play and interplay of the currents is quite complicated; but a lengthy explanation thereof would be out of place, since any one skilled in the art can, from the foregoing description, readily formulate the different conditions that may arise. It is sufficient to state, generally, that the play of the keys at one station controls always in the same degree the nature of the effective currents of the differential magnet at the relay at the other station.

The relay controls the effect of the different currents on the local circuits of the two receiving-instruments or sounders N and Q in such a manner that only the one or the other of these will operate, according as the differential magnet is excited by a negative or a positive current, either not exceeding a certain intensity, while both sounders will operate when the differential magnet is excited by a current of increased tension.

These results may be accomplished by the introduction of such relays and local circuits as set forth in the description and drawings of the other branch of my invention, under the original application of October 14, 1874.

It will be observed that I use the combination, at one station, of two electrically-connected keys, one of which, when operated, reverses the polarity of the line-current controlled by the other. To this combination I make no claim in this application, because the claim covering that combination remains in the original application of October 14, 1874.

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

1. The combination, substantially as specified, with the main line at one station, of two main batteries, or a divided battery and two keys, one key being adapted to close the circuit of one of the batteries or sections, and the other to close the circuit of the other battery or section, as well as to determine the polarity of the battery-current sent by the first key.

2. The combination, substantially as specified, with the main line at one station, of two main batteries, or a divided battery, normally entirely disconnected from the line, and two keys, one key being adapted to close the circuit of one of the batteries or sections, and the other to close the other battery or section, as well as to determine the polarity of the battery-current sent by the first key.

3. The combination, substantially as specified, of the key C′ and the circuit preserving and reversing lever.

In testimony whereof I have signed my name to the foregoing specification in the presence of two subscribing witnesses.

HENRY C. NICHOLSON.

Witnesses:
CHAS. A. NEALE,
JNO. D. PATTEN.