(No Model.)

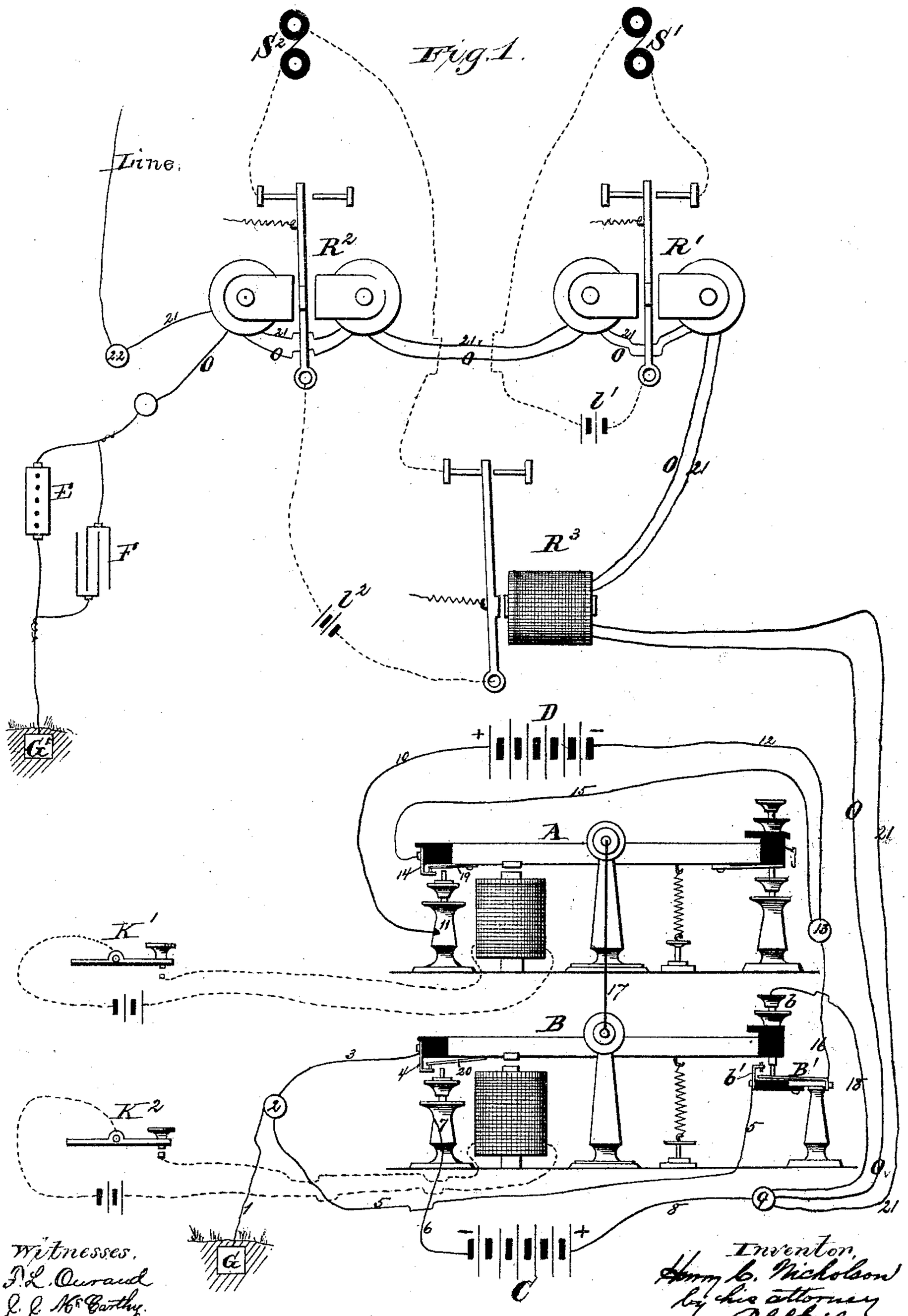
2 Sheets--Sheet 1.

H. C. NICHOLSON.

Multiple Telegraph.

No. 232,749. Patented Sept. 28, 1880.

Fig. 1.



(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

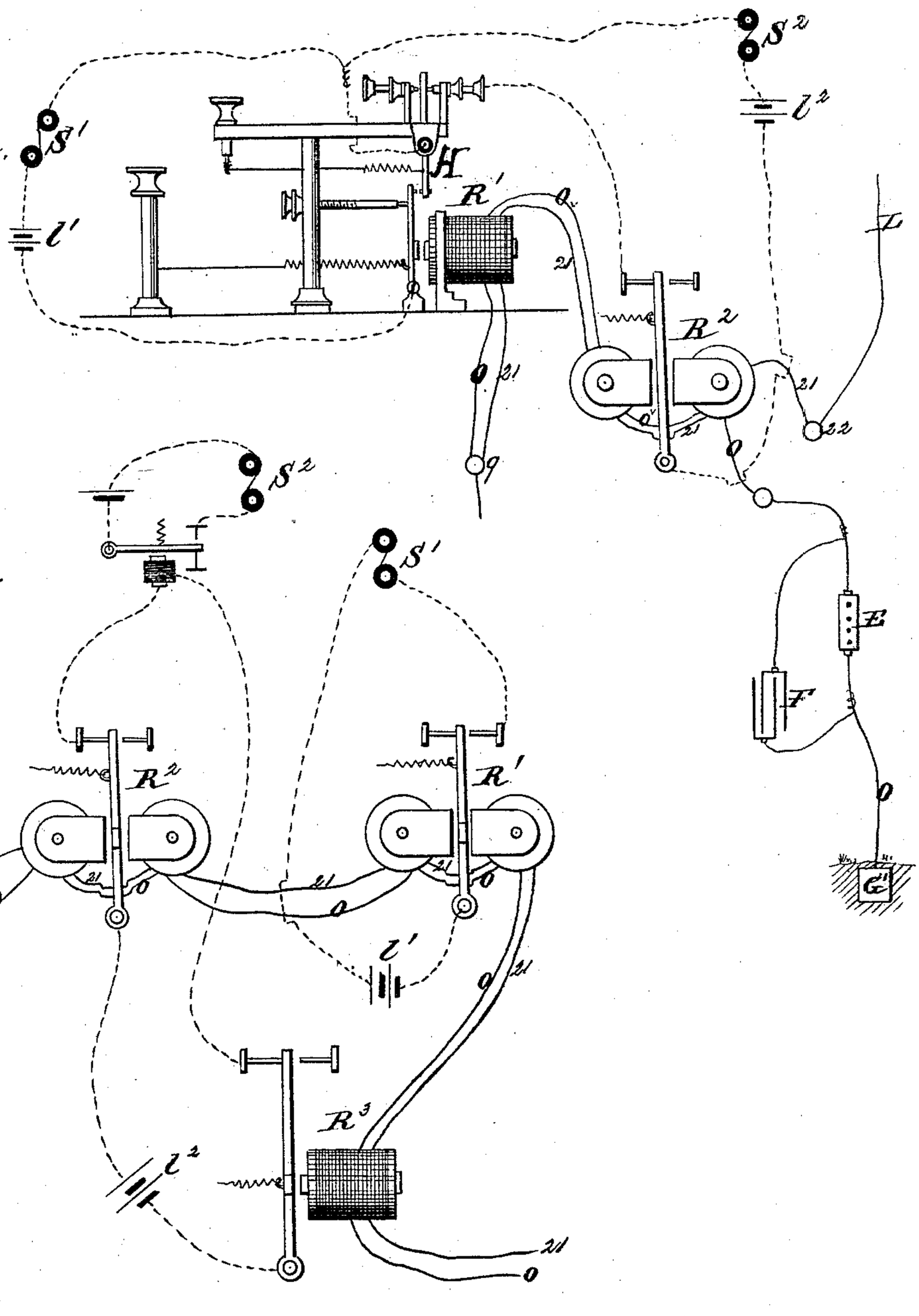

Fig. 3.

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Inventor,
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by his attorney
A. G. Eils

UNITED STATES PATENT OFFICE.

HENRY C. NICHOLSON, OF KENTON, KENTUCKY.

MULTIPLE TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 232,749, dated September 28, 1880.

Application filed March 19, 1880. (No model.)

To all whom it may concern:

Be it known that I, HENRY C. NICHOLSON, a citizen of the United States, residing at Kenton, in the county of Kenton and State of Kentucky, have invented certain new and useful Improvements in Multiple 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, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to double-transmission and quadruplex telegraphs, in which the positive, negative, and increased currents sent out by the two keys or transmitters at the sending-station are made effective at the receiving-station on two receiving-instruments or sounders through the intervention of two polar relays and a common or non-polar relay or its equivalent, the arrangement being such that the positive currents are responded to by one polar relay to operate one—say the first—sounder, the negative currents, by the other polar relay, to operate the second sounder, and the increased currents, by one of the polar relays, operating its own sounder, and by the common relay or its equivalent operating the other sounder in substitution for its polar relay, all substantially as described in my application for Letters Patent filed October 14, 1874, where a supplemental contact-lever is used in lieu of the common relay.

For purposes of illustration let the increased current be of positive polarity. In that case the common relay would be included in the local circuit of the second sounder under the above arrangement. Now, whenever the line-current is reversed from negative to positive of increased strength, or vice versa, it is of importance to prevent a disturbance in the local circuit of the second sounder, in order to enable it to complete its signal without a break or interruption; yet such reversal is attended by a perceptible momentary suspension of effective electric energy in the main line at a receiving-station distant any considerable length from the sending-station—say one hundred miles or more—and such momentary suspension of effective electric energy must necessarily affect the local circuit of the second sounder at such receiving-station. It is the object of this invention to neutralize disturbances of this character.

To this end it consists in placing the sounder controlled by the common or non-polar relay, as well as by one of the polar relays, in a local circuit closed normally—that is to say, when the armature-levers of both relays rest against their back stops—the sounder responding on back stroke whenever this local circuit is opened by either one of said relays. The armature adjustments will be such that the break in the main-line current at times of reversal will be of shorter duration than the armature time of the relays, so that the armature-lever of the relay, becoming inactive, cannot close the local circuit before the reverse current accumulates sufficient strength in the other relay to move its armature-lever away from the back stop, and thereby make a second break in the local circuit before the other break is closed.

In the annexed drawings, Figure 1 is a diagram of the instruments, battery, and connections at a terminal station of a quadruplex telegraph. Fig. 2 illustrates a modification in the relays, the common or non-polar relay being supplemented by a supplemental contact-lever. Fig. 3 illustrates a modification, showing the application of a normally-open supplemental local circuit.

The quadruplex telegraph, of which a terminal section is here represented, is constructed upon the open main-circuit system described in my application for Letters Patent filed October 14, 1874—that is to say, normally there is no current on the line, although the continuity of conductors from the home ground to the distant ground is always preserved.

The transmitters A and B are continuity-preserving ones, and are preferably operated electrically through the media of electro-magnets and local batteries, the circuits of which are opened and closed by the operation of the ordinary finger-keys K′ and K².

The transmitter B comprises a reverser composed, in this instance, of a contact-spring, B′, a contact-point, *b*, and a hook, *b′*, the contact-point *b* being fixed to, but insulated from, the lever of the transmitter.

The two sections C and D of battery, of equal strength in this instance, are joined up as follows: The ground-plate G is connected by wire 1 to post 2, which is in turn connected to insulated hook 4 on the lever of the transmitter B by wire 3, and to hook *b'* by wire 5. The negative pole of battery C is connected to contact-point 7 of transmitter B by wire 6, while its positive pole is connected to post 9 by wire 8. The positive pole of battery D is connected to contact-point 11 of transmitter A by wire 10, while its negative pole is connected to post 13 by wire 12. A wire, 15, connects insulated hook 14 on the lever of the transmitter A to post 13, and wire 16 connects this post 13 to contact-spring B'. Finally, the transmitters are electrically connected on the line 17, and a wire, 18, connects insulated contact-point *b* on the lever of transmitter B to post 9. The lever of transmitter A has a contact-spring, 19, and the lever of transmitter B has a similar contact-spring, 20.

When both transmitters are open the electric route from ground G to post 9 is by way of the elements 1 2 3 4 20 B 17 A 19 14 15 13 16 B' *b* 18, no battery in circuit.

When transmitter A alone is closed the route from ground G to post 9 is by way of the elements 1 2 3 4 20 B 17 A 19 11 10 D 12 13 16 B' *b* 18, battery D being in circuit with its negative pole to post 9.

When transmitter A' alone is closed the route from the ground G to post 9 is by way of the elements 1 2 5 *b'* B' 16 13 15 14 19 A 17 B 20 7 6 C 8, battery C being in circuit with its positive pole to post 9.

When both transmitters A and B are closed at the same time the route from the ground G to post 9 is by way of the elements 1 2 5 *b'* B' 16 13 12 D 10 11 19 A 17 B 20 7 6 C 8, both batteries, or sections of battery, being in circuit with positive pole of battery C to post 9.

As post 9 is in connection with main line L, as will be presently explained, it will be seen that the operation of the transmitters will send to line currents differing in polarity and intensity. If each section of battery represent a unit of strength, then the varying electrical conditions of the line consequent upon the opening and closing of the transmitters may be stated as follows:

Both transmitters open=no current on line.
Transmitter A closed =1− " "
Transmitter B closed =1+ " "
Transmitters A and B closed=2+" "

The incoming line-currents are made effective through certain relays and receiving-instruments. The terminal post 22 of the line L and the post 9 are connected by a wire, 21, which wire, according to the arrangement shown in Fig. 1, includes three relays—namely, the polar relay R^2, the polar relay R', and the common or non-polar relay R^3.

In order that the line-currents sent out from a station may not operate the relays at such sending-station, any known or preferred duplex system may be used to neutralize the effect of outgoing line-currents on the home-relays. The system shown consists of what is termed an "artificial" line, O, which proceeds from post 9 to ground G', and includes helices of wire wound around the magnet of the relays R', R^2, and R^3 in a direction opposed to the winding of the helices included in wire 21, the opposed helices being of equal power. The artificial line further includes a rheostat or adjustable resistance, E, so that the strength of the current may be equally divided between the main line L and the artificial line O, and the required neutralization in the relays effected. It further includes a condenser, F, to neutralize the return current due to the static induction of the line.

Polar relay R' will respond to all incoming positive currents, polar relay R^2 to all incoming negative currents, and the common or non-polar relay to incoming positive currents of a strength developed only when both sections C and D of the battery at the distant station are in circuit, the retracting-spring of the armature of the common relay being strong enough to overcome the magnetic force developed in its magnets by a current from only one section of battery.

Sounder S' is operated by local battery *l'*, the circuit of which is preferably normally open, and is closed by the armature of relay R' in response to incoming positive currents.

Sounder S^2 is operated by local battery l^2, the circuit of which includes the armature of polar relay R^2, as well as the armature of the common or non-polar relay R^3. The sounder S^2 therefore signals on back stroke when the circuit of battery l^2 is opened, which may be occasioned either by the armature of relay R^2 in response to a negative current or by the armature of relay R^3 in response to a high-tension positive current. Thus sounder S' will always respond to transmitter B at the distant station, and sounder S^2 will always respond to transmitter A at the distant station irrespective of the necessarily infinitely mixed order of the operation of said transmitters. Whenever, in the operation of these transmitters, a period of closure of transmitter A overlaps either one or both ends of a period or periods of closure of transmitter B, a reversal or reversals of the line-current will occur from negative to high-tension positive, or vice versa, as the case may be. Hence at such times the duty of causing the required continuous signal on sounder S^2 is divided between the relays R^2 and R^3, and these relays will cause such an uninterrupted signal to be given by sounder S^2, notwithstanding that the sending-station may be so distant, as to make the momentary suspension of electric energy attending a reversal of current perceptible at the receiving-station, for the armature time of these relays exceeds in duration the neutral period of the reversal, so that the forward stroke of one of these ar-

matures will begin before the back stroke of the other is completed. Hence a second break will be made in this local circuit before the other break is closed.

Fig. 2 shows the form of my invention when a supplemental contact-lever, H, is combined with polar relay R′ to take the place of the common or non-polar relay. This arrangement is substantially the same as that described in my application for Letters Patent filed October 14, 1874, with the important exception (important on long lines) that the circuit of the local battery l^2, operating sounder S^2, is normally closed, as and for the purpose heretofore explained. I consider this an inferior form of my invention, because on reversals from negative to high-tension positive the armature of polar relay R′ has to complete its ordinary forward stroke before it can move the supplemental contact-lever, so that there is a loss of time in the operation of the supplemental contact-lever on such reversals, although on reversals from high-tension positive to negative this supplementary contact-lever is as prompt and effective as the common or non-polar relay.

It will be seen that both forms of my invention are based upon the use of a normally-closed local circuit for one of the sounders, which circuit contains two circuit-breakers operating automatically and being independent of each other. By omitting the artificial line O and its adjuncts the quadruplex station shown will become a station of a double-transmission telegraph embodying my invention.

For the purpose of duplexing, the bridge method may be used instead of the differential method shown.

The sounder S^2 may be placed in the normally-open circuit of a supplemental local battery, and its place in the normally-closed circuit of local battery l^2 filled by a receiving-magnet or repeating-sounder, as shown in Fig. 3.

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

1. The combination, substantially as before set forth, of a receiving-instrument or sounder, a local battery the circuit of which is normally closed, and two independent local circuit-breakers, one of which breaks said local circuit in response to line-currents of proper polarity, while the other breaks said local circuit in response to high-tension line-currents.

2. The combination, substantially as before set forth, of a receiving-instrument or sounder, a local battery the circuit of which is normally closed, a polar relay, and a common or non-polar relay operating only in response to high-tension line-currents, both said relays being included in such local circuit.

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

HENRY C. NICHOLSON.

Witnesses:
J. B. HUME,
DAVID HARRIS.