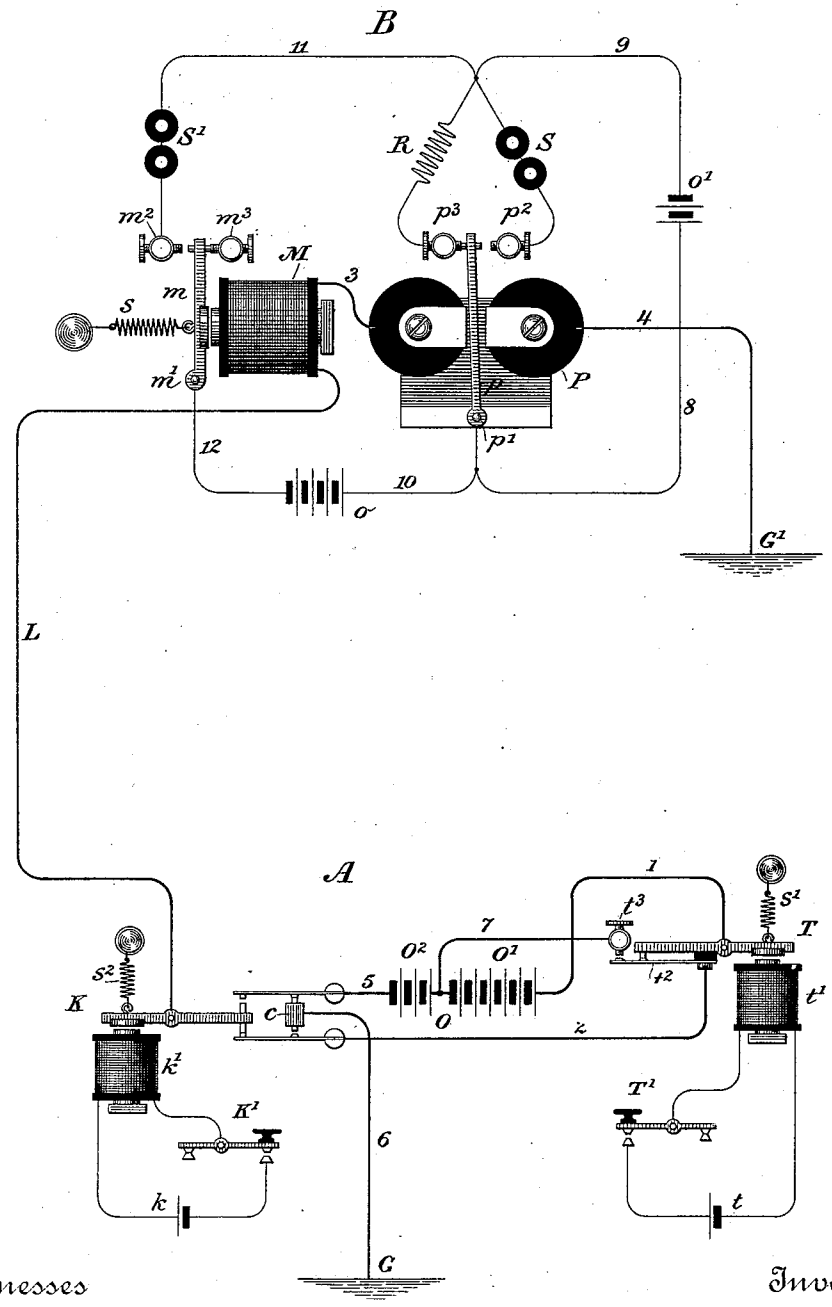
(No Model.) 2 Sheets—Sheet 1.

H. VAN HOEVENBERGH.

MEANS FOR PREVENTING FALSE SIGNALS ON REVERSALS IN QUADRUPLEX TELEGRAPHS.

No. 309,751. Patented Dec. 23, 1884.

Fig. 1.



Witnesses

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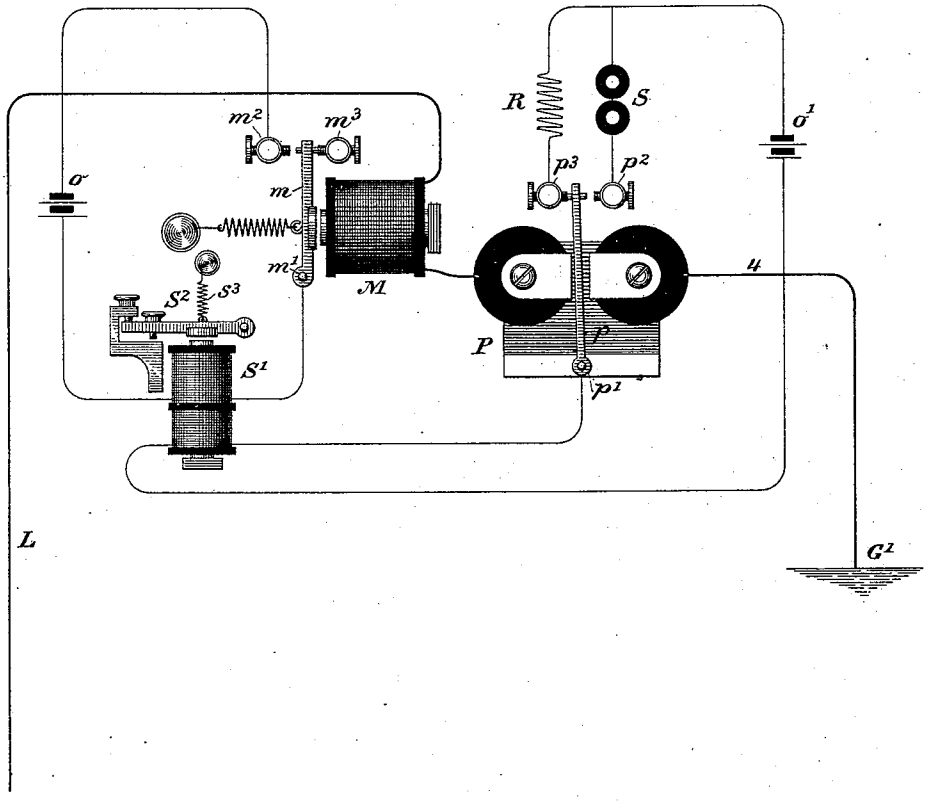
Fig. 2.



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UNITED STATES PATENT OFFICE.

HENRY VAN HOEVENBERGH, OF ELIZABETH, NEW JERSEY.

MEANS FOR PREVENTING FALSE SIGNALS ON REVERSALS IN QUADRUPLEX TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 309,751, dated December 23, 1884.

Application filed June 28, 1884. (No model.)

To all whom it may concern:

Be it known that I, HENRY VAN HOEVENBERGH, a citizen of the United States, residing in Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Quadruplex Telegraphy, of which the following is a specification.

My invention relates to a system of telegraphy in which two independent signals or sets of signals may be simultaneously transmitted in the same direction over a single electric conductor. The different qualities of the electrical impulses transmitted over the main conductor, in respect to their polarity and their strength, are interpreted at the receiving-station by suitable instruments through the agency of a system of local circuits and local batteries, which are so combined and arranged as to avoid the false signals which are produced upon the ordinary receiving-instruments by changes in the static condition of the line when the polarity of the current is reversed during the transmission of a signal.

In the accompanying drawings, which illustrate my invention, Figure 1 is a diagram showing the arrangement of circuits and instruments according to my improved system, A representing the transmitting apparatus at one end of the line, and B the receiving apparatus at the other end of the line; and Fig. 2 is a modification of the receiving apparatus.

Referring first to the transmitting apparatus, in Fig. 1, O is the main battery, divided into two unequal portions, O′ and O^2. The portion O′ consists of, say, twice as many elements as the portion O^2. T is an ordinary transmitter, the signals of which are interpreted at the receiving-station by the neutral relay, as hereinafter explained. This transmitter is preferably worked by means of the finger-key T′, local circuit *t*, and electro-magnet *t′*. K is a pole-changing and circuit-preserving transmitter, the signals of which are interpreted by the polarized relay at the receiving-station, as hereinafter explained. This transmitter is preferably worked by the finger-key K′, local circuit *k*, and electro-magnet *k′*. The above-described apparatus is of the ordinary and well-known construction and arrangement, and forms no part of my invention.

Referring to the receiving apparatus, P is a receiving-magnet, provided with a polarized vibrating armature *p*, pivoted at its lower end *p′*, and moving to and fro at its upper end between the contact-stops p^2 and p^3. M is an ordinary neutral relay. Its armature *m* is pivoted at its lower end *m′*, and it vibrates at its upper end between the contact-stops m^2 and m^3. These two receiving-magnets P and M are connected in series in the main line. *o* and *o′* are local batteries connected with the armatures of the two receiving-magnets, and with the two receiving-instruments or sounders S and S′. R is an artificial resistance equal or approximately equal to the resistance of the electro-magnet of the sounder S. The main line may be traced from the earth at G at the transmitting-station through the main battery O, the pole-changer K, the line L, the receiving neutral relay M, and polarized relay P, and to the ground at G′. The operation of the system is as follows: When the line is at rest and both keys are in their normal position, as shown in Fig. 1, the whole of the main battery O is to line, and the circuit passes from the positive end of the battery through the wire 1 to the transmitter T, thence through the wire 2 to the pole-changing transmitter K, thence through the main line L to the neutral relay M at the receiving-station, thence by the wire 3 to the polarized relay P, and thence by wire 4 to the ground at G′. From the other end of the battery the circuit leads through the wire 5 to the stop *c* of the circuit-controller K, and by the wire 6 to the ground at G. When the transmitter T is depressed, which is done by depressing the key T′, thus closing the local circuit *t* through the magnet *t′*, the contact spring t^2 is brought against the contact-stop t^3, and the circuit is then formed through the lesser portion O^2 of the main battery, the connections being from the positive pole at the point O^3, through the wire 7, to the contact-stop t^3, spring t^2, wire 2, stop *c* of the pole-changer K, and line L, to the receiving-instruments M and P, and to the ground at G′, while the connections from the other pole of the battery O^2 remain as before. It is evident, therefore, that the operation of the transmitter T is to send the current alternately from the whole of the battery O and the portion thereof O^2 into the main line.

Referring now to the neutral relay M at the receiving-station, the armature of this relay is normally drawn away from its poles by the retracting-spring *s*. The tension given to this spring is sufficient to draw the armature *m* away from the magnet when the latter is acted upon by the portion O^2 only of the battery; but when the entire battery is passing through its coils the increased magnetism resulting therefrom overcomes the tension of the spring *s* and holds the armature to its poles or against the stop m^3. The alternate changes in the strength of the current, therefore, which pass over the line by the operation of the transmitter T are interpreted by the magnet M, its armature *m* being drawn against the contact-stop m^2 when the transmitter T is depressed, and is drawn by the magnet against the stop m^3 when the transmitter R is raised. The polarized relay responds, in a manner well understood, to the changes in the polarity of the current passing through its coils without reference to its strength. When, therefore, the pole-changing transmitter K is operated by means of the key K', local circuit *k*, and magnet *k'*, thereby changing the polarity of the current to line, the armature *p* of the polarized receiving-magnet P plays to and fro between the stops p^2 and p^3. When the pole-changing transmitter K is at rest, the positive pole of the battery (whether of the whole battery or of the portion O^2 only) is to line, as has already been explained, and the polarity of the magnet P is so arranged that its armature *p* is carried to the left side, and is held against the stop p^3. When the reversing transmitter K is depressed, the battery O has its poles interchanged with respect to the line and earth, and the negative pole of the battery (whether of the whole battery or of the portion O^2 only) is put to line, thus reversing the current therefrom. The armature *p* of the magnet P is then carried to the right and rests against the contact-stop q^2. The selective action of the local circuits upon the classes of signals transmitted over the main line to the receivers will now be explained. The local batteries *o* and *o'* are connected in a single local circuit or form separate local circuits, according to the positions of the armatures of the two receiving-magnets. In order to explain their operation, let us suppose the line to be at rest, as shown in the drawings. The entire main battery O being to line by its positive pole, the neutral relay M holds its armature *m* against the stop m^3. The polarized relay P holds its armature *p* to the left against the contact-stop p^3. It will be seen, now, that neither the sounder S nor the sounder S' will be operated. In regard to the sounder S, its circuit may be traced from the positive pole of the battery *o'* through the wire 8 to the armature *p* and contact-stop p^3, resistance R, wire 9, to the negative pole of the local battery. The sounder S is therefore, in fact, in an open shunt-circuit; and in regard to the sounder S' the battery o^2 may be traced through the positive pole, through the wire 10, to the armature *p*, contact-stop p^3, resistance R, wire 11, to the sounder S', contact-stop m^2. At this point the circuit is open, as the armature *m* is held against the stop m^3. If, now, the transmitter T is depressed, the battery portion O' is cut out of the circuit and the portion O^2 only is sent to line. The only result upon the receiving-instruments is to release the armature *m*, and the latter is drawn by the spring *s* against the contact-stop m^2. It will readily be understood that the sounder S' will now operate, for its circuit may be traced in the same manner as before from the positive pole of the local battery first around to the magnet and the contact-stop m^2, thence through the armature and wire 12 to the negative pole of the same battery. It is evident, also, that the polarized relay P will not be affected by this action, for the main battery, though reduced in strength, remains with the same pole to line. When the transmitter T is released, the spring s^2, attached thereto, instantly restores the whole of the main battery to line, the receiving-magnet M recalls its armature, and the circuit of the sounder S' is again broken. Thus it will be seen that the ordinary Morse signals may be produced upon the sounder S' by the operation of the transmitter T.

Referring now to the pole-changing key K and the means for transmitting signals thereby, as has been explained, the armature *p* of the relay P rests against the left contact-stop, p^3, when the line is in the condition shown in the drawings—that is, with the positive pole of the battery to the line. When the lever K is depressed by means of the key K', local circuit *k*, and magnet *k'*, the main battery is reversed, the negative pole goes to line, the armature *p* moves to the right, and rests against the contact-stop p^2. This actuates the sounder S, for its circuit may be traced from the battery *o'*, as before, by wire 8, armature *p*, contact-stop p^2, sounder, and wire 9, to the battery. When the lever K is released, its spring s^2 restores the former condition of affairs—that is to say, the battery is changed back, so that the positive pole goes to line, the armature *p* returns to its left stop, p^3, and the circuit of the sounder S is open. Thus it will be seen that telegraph-signals will be produced upon the sounder S by operating the lever K of the pole-changing key.

It is evident that the operations of the two transmitters T and K in no wise interfere with each other, but that each will independently reproduce its signals upon its proper sounder at the receiving-station.

It will now be shown how false signals upon the relay M and sounder S' are avoided by this system. These false signals, as is well known, are generally produced upon the neutral relay at the instant of reversal of the main battery, or when the conection between the line and the battery is made and broken. When the pole-changer K is operated, it is evident that

there will be an instant at each reversal when there is no current upon the main line. At this instant the spring S of the neutral relay M will begin to draw the armature-lever m toward the stop m^2. The polarized armature p of the relay P will remain against one of the stops, p^2 or p^3, for it will not move until the reversed current begins to act. Before the armature-lever m, however, has reached the stop m^2 the armature p will have left its stop and will be on its way between its two contact-stops. When in this position, no false signals can be given upon the sounder S′, for the following reason: The local batteries o and o' have their positive poles opposed to each other. The battery o consists of two elements in series. The battery o' consists of one element only—that is, the battery o has twice the electro-motive force of the battery o'. The sounder S is adapted to respond to the current of the battery o' of one element. The sounder S′ is adjusted to respond only to the full current of the battery o of two elements. When the armature p is in its middle position, therefore, the current from the battery o, passing through the wires 10 and 8 to the battery o', is reduced to half its strength thereby, and, passing by the wires 9 and 11 to the magnet S′, and then to the other pole of the battery o, is insufficient to work the sounder S′. At the instant of reversal, therefore, when the impulses ordinarily causing false signals arise, the local circuits are in such condition that the false signals cannot in any manner affect the sounders. When both transmitting-keys T and K are depressed at the same time, each of the receiving-magnets responds to its own signal independently. Thus the armature p is drawn to the right of the contact-stop p^2, though of course only with the force due to the action of the battery-section o^2, while the armature m of the relay-magnet M, being attracted by the magnet with only the force due to the battery-section o^2, is drawn by the spring s against the contact-stop m^2, and its signal is recorded by the sounder S′.

In Fig. 2 I have shown a modified form of receiving apparatus, differing from that already described only in the form of the sounder-magnet used with the relay M. In this figure the line L passes, as in Fig. 1, through the magnet M, thence to the magnet P, and by the wire 4 to the ground at G′. In this modification the local circuits o and o' are of the same strength and independent in their circuits. The operation of the armature p of the receiving-magnet P, its contacts, and the sounder S is in all respects the same as in the receiving apparatus shown in Fig. 1, and already described. The sounder S′ has a magnet of different construction from the magnet S′ in Fig. 1. It has two separate coils, one of which is in circuit with the battery o. The other is in circuit with the battery o'. Its armature responds only to the combined action of both batteries. The battery o' is at all times acting upon it, for the armature p, which is always upon one or the other of its contact-stops, keeps the circuit practically constantly completed. The armature S^2 is held away from its poles by the spring s^3 with a force sufficient to overcome the effect of the battery o' alone; but when the armature m of the magnet M is drawn against its contact m^2 by means of its spring—that is, when the portion o^2 only of the main battery is passing over the main line—then the battery o is completed through the coils of the magnet S′, and its armature is operated in the same manner as has been explained with reference to Fig. 1. In this form, also, false signals upon the relay M and the sounder S′ are avoided in practically the same way as has been described with reference to Fig. 1, for such signals can only be manifested upon the sounder S′ when both battery-circuits are closed through its coils, and this can only be the case when the armature p is against one or the other of the contact-stops, p^2 or p^3.

In actual practice it is found that false signals never appear, even though the armature m is given an exceedingly small distance for play between the contact m^2 and stop m^3, for the reason that the polarized armature p always moves between its contacts so quickly that neither the relay M nor the local magnet S′ has time to cause any movement of their respective armatures.

Any ordinary or well-known system of duplex telegraphy in opposite directions may be applied to or combined with the apparatus which has been described, in order to constitute a quadruplex system.

I claim—

1. The combination, substantially as hereinbefore set forth, of a local battery the circuit of which is controlled by a main-line relay, a receiving-instrument included in said circuit, an opposing local battery in said circuit, two branch conductors for said batteries, the circuits through which are controlled by a second main-line relay, and a second receiving-instrument included in one of said branch circuits.

2. The combination, substantially as hereinbefore set forth, of a local battery whose circuit is controlled by a main-line relay, a receiving-instrument included in said circuit, an opposing local battery of less strength than the first-named local battery, two branch circuits for said batteries, a receiving-instrument included in one of said branch circuits, and an artificial resistance included in the other, and means, substantially such as described, for completing one or the other of said branch circuits at will.

3. The combination, substantially as hereinbefore set forth, of a local battery, a circuit therefor, a receiving-instrument included in said circuit, means, substantially such as described, for completing the circuit-connections of said battery through said receiving-instrument under the influence of main-line currents having a given quality, a second lo-

cal battery tending to oppose the effects of the first-named local battery, a second circuit for said batteries having two branches, a receiving-instrument included in one of said branches, an artificial resistance included in the other, and a polarized armature which serves to complete the circuit-connections through one or the other of said branches, accordingly as said polarized armature is actuated by currents of one or of the other polarity.

4. The combination, substantially as hereinbefore set forth, of a polarized and a neutral armature, each actuated by main-line circuits, two local receiving-instruments, and two local batteries for actuating the same, the connections of one of said local receiving-instruments being controlled by both of said main-line relays, while the connections of the other local receiving-instrument are controlled by one of said main-line relays.

5. The combination, substantially as hereinbefore set forth, with a polarized and a neutral relay, each actuated by main-line currents, of two local receiving-instruments, two local batteries, the connections of which batteries are controlled by said polarized and neutral relays, two branch circuits between said batteries, in one of which branch circuits one of said receiving-instruments is included, two contact-stops applied to the armature of said polarized relay and constituting the terminals of said branch circuits, respectively.

In testimony whereof I have hereunto subscribed my name this 24th day of June, A. D. 1884.

HENRY VAN HOEVENBERGH.

Witnesses:
DANL. W. EDGECOMB,
CHARLES A. TERRY.