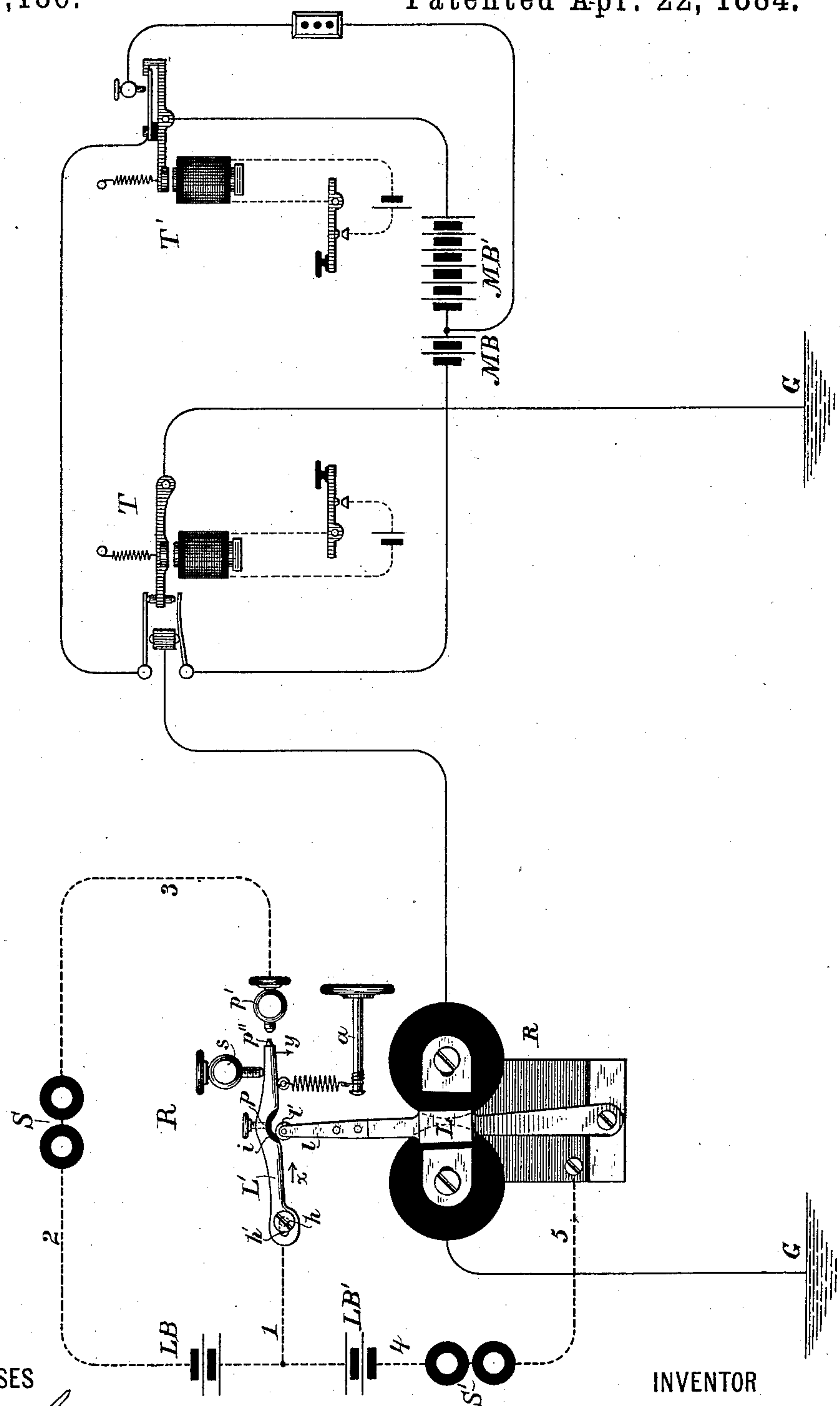


(No Model.)

G. SMITH.  
QUADRUPLIX TELEGRAPH.

No. 297,186.

Patented Apr. 22, 1884.



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 297,186, dated April 22, 1884.

Application filed April 28, 1883. (No model.)

*To all whom it may concern:*

Be it known that I, GERRITT SMITH, a citizen of the United States, residing at Astoria, in the county of Queens and State of New York, have invented certain new and useful Improvements in Diplex or Quadruplex Telegraphs, of which the following is a specification.

My invention relates to certain improvements in the apparatus which has heretofore been employed at the receiving-station for the reception of two independent sets of telegraph-signals simultaneously in the same direction over one line-wire.

In the telegraphic system now commonly in use for the simultaneous transmission of two signals upon one line in the same direction one message is received upon a polarized relay and the other upon a neutral relay; and the apparatus for reproducing one message is actuated by current reversals, independently of changes of strength, while the apparatus for receiving the second message or signal is operated wholly by change of current strength and independently of reversals, the currents employed being strong positive, weak positive, strong negative, and weak negative; and it is obvious that if an increased strength of current be on the line for actuating the neutral relay, and at the same instant a reversal of current on the line be effected, there will occur a momentary cessation of magnetism in said neutral relay, whereupon its armature will recede from its attracted position, and thereby tend to produce a false signal. To practically avoid this difficulty, I propose to entirely dispense with the neutral relay, and employ only a single polarized relay, which shall actuate devices responsive as well to changes of current strength as to current reversals. To this end I employ a polarized relay of the ordinary Siemens type, having an armature-lever against which rests an auxiliary shuttle-lever. Normally the full strength of battery is on the line and both of two local circuits are open; but when only a weak current is upon the line, said polarized relay-armature remains in nearly a central position, and under such conditions the armature-lever will be in electrical contact with a metallic stud or pin in the auxiliary lever, thereby electrically connecting

the armature-lever with said auxiliary lever. Thus, one of two local circuits is closed, through the polarized relay-armature and auxiliary shuttle-lever, while either positive or negative currents of weak strength are upon the line; and this local circuit is only broken by an increased strength of current, either positive or negative, which will cause the armature-lever to have an increased movement, thus breaking the electrical connection between said armature and auxiliary lever. The auxiliary lever is also provided with means for opening and closing a second local circuit, which is actuated by a reversal, either of a weak or a strong current; but while the reversal of a weak current will not cause the electrical connection between the auxiliary and armature levers to be broken, it will cause a slight movement of the auxiliary lever, which suffices to open and close a local circuit, and this local circuit is opened and closed alike, whether a current reversal occurs when then the line is charged with a weak or a strong current.

My invention also has for its object the obviating of difficulty arising from secondary currents set up in receiving-relays in a multiple-telegraph system. When a current of electricity is passed through the helix of an electro-magnet, the current will be absorbed therein until the core of the said helix is magnetized to saturation, and upon removing the source of electricity a secondary current of discharge from the helix of said electro-magnet will occur, which will be in the same direction or of the same polarity as that of the primary current by which said electro-magnet was magnetized. In case several relays are employed in a single main line, especially if said line is comparatively short and of but little resistance, such secondary currents become a source of great difficulty in multiple transmission. Accordingly my invention has for its further object the employment of only one electro-magnet, instead of two, as has hitherto been the case in systems for receiving multiple transmission arranged as above described.

The accompanying drawing represents my improved receiving-instrument, also a main battery and transmitting-instruments with connections adapted thereto.

M B and M B' are two divisions of the main



battery, preferably in the proportion of one to three, transmitter T being adapted to reverse either or both divisions of main battery in respect to the main line, and transmitter T' to insert or remove the portion M B' from the circuit so controlled by transmitter T. The receiving-relay R, as shown, is the well-known form of Siemens's polarized relay, having, in connection therewith, the additional features hereinafter described. L is the polarized armature of said relay, its extreme end *l* being bifurcated to receive a thin wheel or circular disk of platinum or other metal moving freely upon a pin or bearing in said lever. The auxiliary shuttle-lever L' is a metallic bar placed at right angles to bar L, and having an oblong slot or hole, *h'*, in one end, which hole, with the fixed pin *h*, forms the bearing for bar L' and allows said bar to be moved back and forth in two directions, at right angles to each other, as shown by arrows *x* and *y*. Near the center of the length of L' the side toward L is hollowed out. Its arc and the arc of the circumference of wheel *l'* conform to each other. This hollowed space is furnished with an insulating-bushing, *i*, through which contact-point *p* is placed in a screw-thread, and its point should be adjusted flush with the surface of said insulating bushing *i*, the design being to provide for an electrical contact between *p* and *l'* when desired.

*p'* and *p''* are electrical contact-stops. Stop *s* limits the motion of bar L' in one direction. The free motion of L' and the amount of friction between bars L and L' are regulated by the spring and spindle *a*.

S and S' are two receiving-sounders responding to the operation of transmitters T and T', respectively. The circuit of sounder S extends from one pole of local battery L B, via wire *l*, to lever L'. The opposite pole of L B is connected by wire 2, helix of sounder S, and wire 3 to contact-stop *p'*. S' is connected in circuit with local battery L B', via wire 4, helix of S', wire 5 to armature-lever L, from the other pole of L B' by the wire *l* (common to both locals) to bar L' to point *p*.

The operation may be described as follows: The transmitters T and T' and relay R are shown in their normal position, a current of — 4 to line, armature-lever L and auxiliary shuttle-lever L' in their extreme minus position, and both local circuits open. If T be closed, T' remaining open, a current of + 4 to line, armature-lever L will pass to its extreme plus position, and by force of its frictional connection with L' will impart to L' a longitudinal movement sufficient to make contact between *p'* and *p''*. The circuit of L B is formed through the elements *p'* 3, S, 2, L B, *l*, L', *p''*, and sounder S responds. In this movement of L from one extreme position to the opposite extreme, L passes over point *p*; but the contact between *l'* and *p* is found, in practice, of too short duration to affect sounder S'. With T' closed, T open, a current of — 1, ar-

mature L assumes a nearly central position, and the circuit of L B' is completed through the elements 5, L, *l'*, *p*, L', *l*, L B', 4, S', and sounder S' responds. With T and T' both closed, a current + 1, L assumes a position nearly central, but is actuated to move L' in its longitudinal direction sufficiently to form contact between *p'* and *p''*, while it maintains electrical contact between *l'* and *p*, thus completing the local circuits of both sounders S and S'. It is thus seen that sounder S always responds to reversals, whether of the entire main battery or of the smaller end only, and that sounder S' responds to an increase or decrease of current strength only.

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

1. A receiving-instrument having one armature, and an auxiliary shuttle-lever in continuous mechanical contact therewith and controlled thereby, responsive to changes in the polarity and in the strength of line-current, either or both.

2. A receiving-instrument composed of an electro-magnet and having one armature, and an auxiliary shuttle-lever in continuous mechanical contact therewith and controlled thereby, responsive to changes in the polarity and in the strength of line-current, either or both, and capable by combined action of assuming four different positions.

3. A receiving-instrument composed of an electro-magnet having one armature, and an auxiliary lever in contact therewith, responsive to changes in the polarity and in the strength of line-current, either or both, in combination with two independent sounding or recording instruments.

4. The combination, in a diplex telegraph, of two independent keys or transmitters, a main battery or batteries controlled by said keys, a main line, a relay having an armature-bar, and an auxiliary lever in continuous mechanical contact therewith and controlled thereby, and two independent sounders of recording instruments.

5. A key or transmitter arranged to vary the strength of line-current, a key or transmitter arranged to vary the polarity of the current controlled by the first key or transmitter, a receiving-relay having one armature, and an auxiliary lever responsive to changes in the strength and in the polarity of line-current, either or both, and two independent sounding or recording instruments.

6. A main-line receiving-instrument having one armature-bar responsive both to changes in polarity and variations in the strength of main-line current, an auxiliary lever in contact therewith, and two receiving-sounders, with their local circuits so arranged that upon a change of polarity in the main-line current one of said sounders will alone respond, and upon a change in the strength of said main-line current the second of said sounders will alone respond.



7. A main-line receiving-instrument having one armature-lever responsive either to changes of polarity or changes of strength in the main-line current, in connection with a pivoted lever capable of motion in four directions, and having an electrical terminal connection with each of two local circuits for operating separate receiving-sounders, and two contact-points, forming, respectively, the opposite terminal of said local circuits, whereby, upon a change of polarity in the main-line current, said armature-lever will complete one local circuit, and upon a change of strength in said current said armature-lever will complete a second local circuit, substantially as described.

8. A main-line receiving-instrument responsive to changes in the polarity and to

changes of strength in the main-line current, either or both, two receiving-sounders with their local circuits, a movable electrical connection common to one terminal of both of said local circuits, a movable contact-point, forming the second terminal of one local circuit, and a fixed contact-point, forming the second terminal of the second of said local circuits, whereby, upon a change in the polarity of the main-line current, one local circuit will be completed or broken, and upon a change in the strength of said main-line current the other local circuit will be completed or broken, substantially as described.

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Witnesses:

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WM. ARNOUX.