(No Model.)

B. E. J. EILS.

QUADRUPLEX TELEGRAPH.

No. 305,909. Patented Sept. 30, 1884.

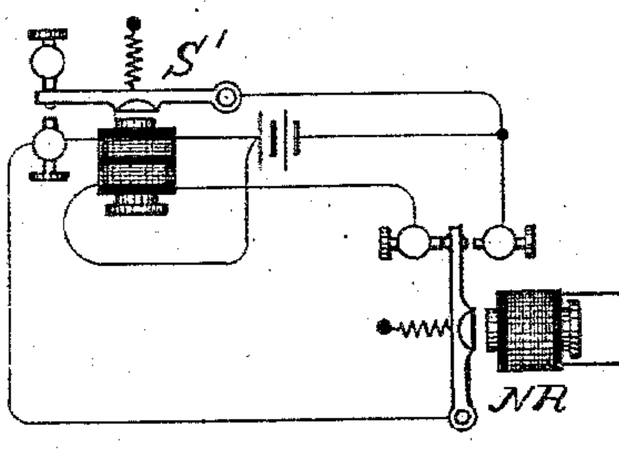


Fig. 1.

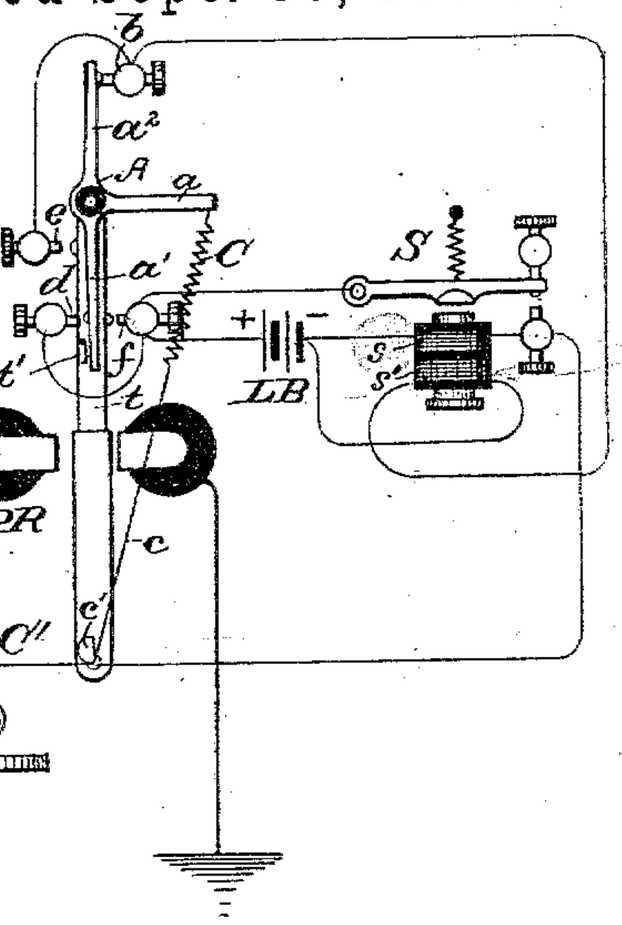
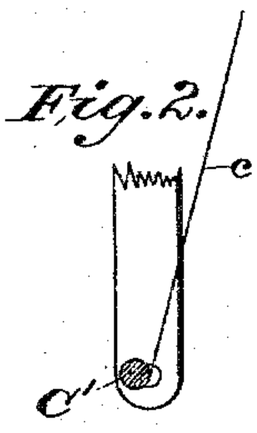


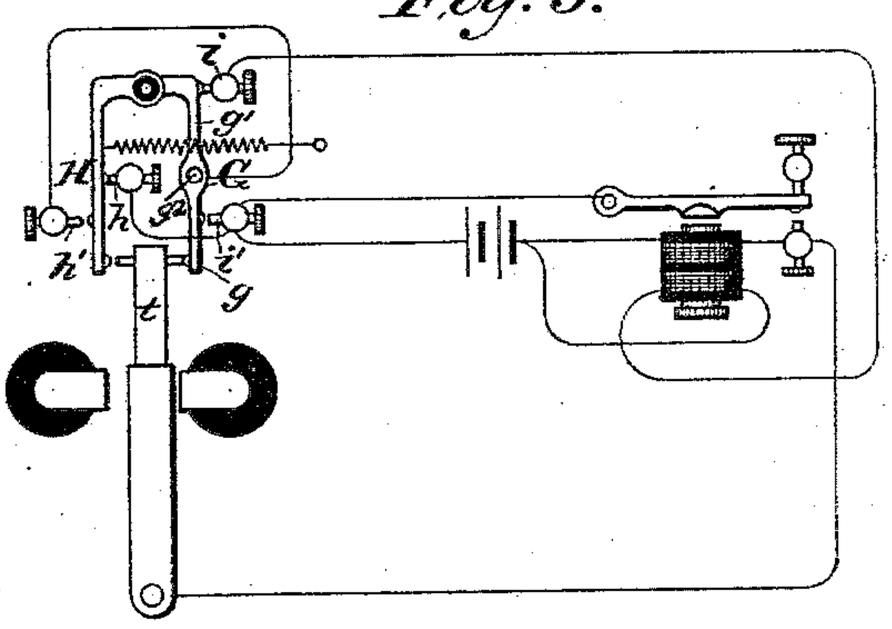
Fig. 2.

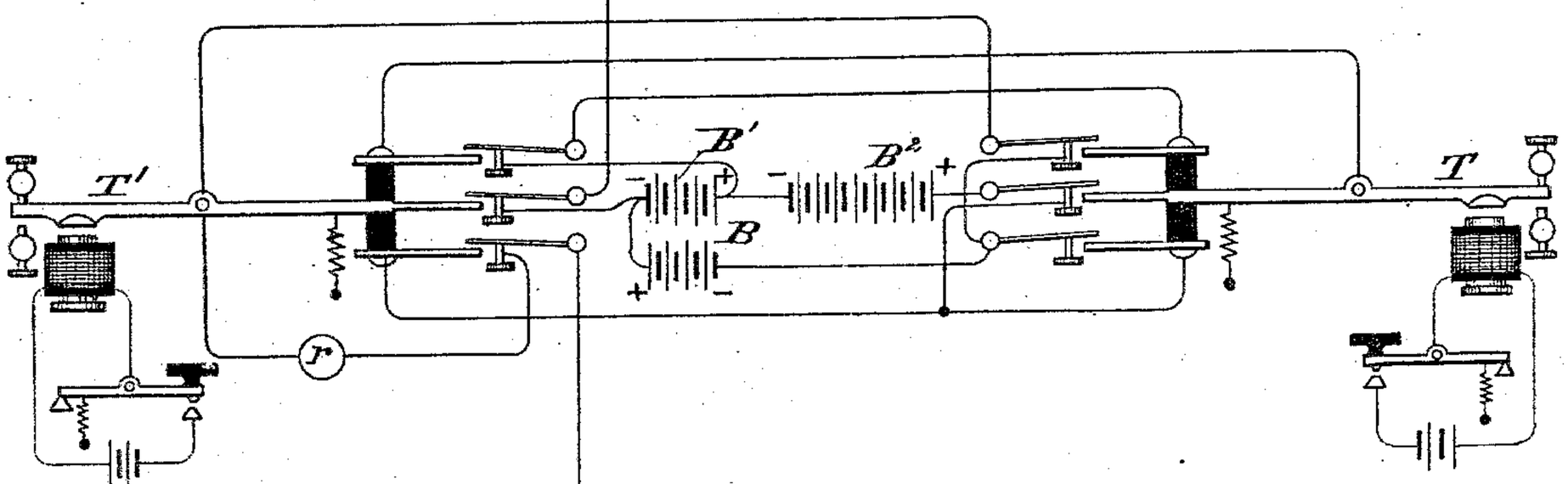


Line Currents:

T and T' at rest = B_+ to line
T alone working = B'_- " "
T' " " = $(B^2_+ B'_+ B)_-$ " "
T and T' " = $(B_+ B'_+ B^2)_+$ " "

Fig. 3.





Witnesses:
Edw. F. Walker
Wm. H. Beale

Inventor:
B. E. J. Eils

UNITED STATES PATENT OFFICE.

BETTE E. J. EILS, OF WASHINGTON, DISTRICT OF COLUMBIA.

QUADRUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 305,909, dated September 30, 1884.

Application filed August 7, 1884. (No model.)

To all whom it may concern:

Be it known that I, BETTE E. J. EILS, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Diplex and 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 consists of an apparatus for practicing the improvement of the art of simultaneously transmitting two distinct messages in the same direction over a single-line wire, described and claimed in my application for United States Letters Patent, filed May 1, 1884, Serial No. 130,001. The novel features, except such as are claimed in other applications, hereinafter referred to, are clearly pointed out in the claims at the close of this specification.

In order that my invention may be clearly understood, I have illustrated it in the annexed drawings, and will proceed to describe it as embodied in a diplex telegraph which any person skilled in the art can readily convert into a quadruplex telegraph by providing each end of the line with transmitting as well as receiving devices and by duplexing the relays.

Figure 1 of the drawings is a diagram illustrating the condition of the parts when both transmitters are at rest.

A main battery divided into three sections, B B′ B^2, and controlled by two keys or transmitters, T and T′, is employed to furnish the line-currents. Battery-sections B and B′ are of equal strength, and battery-section B^2 is twice as strong as either of the others, so that a current from all three sections combined will be four times as strong as a current from section B or from section B′. The margin between the strength of a current from battery-section B (or B′) and that from the three battery-sections combined may be changed at will by increasing or decreasing the strength of battery-section B^2. The transmitters shown are substantially like the transmitters described in M. G. Farmer's United States Patent No. 21,329, operated by local electro-magnets brought into action by the operation of ordinary finger-keys. The battery-sections are connected through the transmitters to the earth E and line L in the manner clearly shown. The currents sent to line under the four possible relative positions of the transmitters are concisely pointed out in the following table: T and T′ at rest=B+ to line; T alone working=B′— to line; T′ alone working=(B^2+B′+B)—to line; T and T′ working=(B+B′+B^2)+ to line. A resistance, *r*, is inserted in the connections between the transmitters, to maintain the resistance of the line-circuit at uniformity.

The signals of transmitter T′ are transmitted by high-potential currents which operate the neutral relay NR, so adjusted as to respond only to such high-potential currents. These signals are reproduced by sounder S′, operated by a local circuit, such as described and claimed in my application for a United States patent, filed January 28, 1884, Serial No. 118,999.

The signals of transmitter T are transmitted by a low-potential negative current in case transmitter T′ is at rest, but by a high potential positive current when transmitter T′ is working. These signals are reproduced by sounder S, which is controlled by a polarized relay, PR, constructed as follows, being preferably a modified form of a Siemens polarized relay. The armature-tongue *t* carries an insulated pivoted T-lever, A. A retractile spring, C, is applied to the arm *a* of the lever, the cord *c*, by which the spring is adjusted, being drawn over a dull knife-edge, *c′*, coincident with the axis on which the armature and its tongue *t* turn. The stress of spring C holds the arm *a′* of lever A normally in contact with the contact-point *t′* on armature-tongue *t*, but has no tendency to turn the armature. The same effect may be attained by mounting the adjusting-spindle C′ parallel, but eccentrically, to the axis on which the armature turns, as indicated in Fig. 2. When both transmitters are at rest, the low-potential positive line-current then flowing so polarizes the relay PR that its armature presses arm a^2 of contact-lever A against contact-screw *b;* but the power of the relay-magnet is insufficient to overcome the stress of spring C, which will, therefore, continue to hold arm *a′* of the lever in contact with contact-point *t′* on the armature-tongue. When transmitter T is alone working, the low-potential negative line-current then flowing reverses the polarity of the relay PR, which causes its armature to move so as to put arm *a′* of lever A in contact with con-

tact-screw *d*, arm a^2 breaking from screw *b*, spring C still holding arm *a'* in contact with contact-point *t'*. When transmitter T' is alone working, the high-potential negative line current then flowing polarizes relay PR in the same direction, but so strongly that its armature overcomes the stress of spring C and rocks lever A on contact-screw *d*, so that its arm *a'* breaks away from contact-point *t'* and screw *b*, while armature-tongue *t* makes contact with contact-screw *e*. When both transmitters are simultaneously working, the high-potential positive line-current then flowing so intensifies the normal polarization of relay PR that its armature overcomes the stress of spring C and rocks lever A on contact-screw *b*, so that its arm *a'* breaks away from contact-point *t'*, while armature-tongue *t* makes contact with contact-screw *f*. The local circuit controlled by relay PR is also substantially like the local circuit described and claimed in my application for a United States patent, filed January 28, 1884, Serial No. 118,999. The positive pole of the local battery LB is permanently connected with the contact-screws *d* and *f* and the armature-lever of the sounder. The negative pole of the local battery is permanently connected to one end of the polarizing-helix *s* of the differential sounder-magnet, the other end of which helix is permanently connected with the armature-tongue of the relay PR. This negative pole is also permanently connected to one end of the depolarizing-helix *s'* of the differential sounder-magnet, the other end of which helix is permanently connected to the contact-screws *b* and *e*.

It will be readily observed that the electromagnet of sounder S will be polarized whenever the relay PR is polarized by a low-potential negative line-current, or by a high-potential positive line-current; also, that said sounder-magnet will be depolarized whenever the relay PR is polarized by a low-potential positive line-current, or by a high-potential negative line-current; also, that the movement of the armature and lever A due to a change from a low-potential negative to a high-potential positive line-current, or vice versa, will not disturb the polarization of the sounder-magnet through the polarizing branch, because the closure of the depolarizing branch is too fleeting to make any impression on the sounder-magnet; also, that in the movement of the armature and lever A due to a change from a low-potential positive to a high-potential negative line-current, or vice versa, the closure of the primary local circuit is so fleeting that the sounder-magnet will not be polarized. On long circuits the depolarizing branch of each sounder-magnet may be further controlled by a subsidiary neutral relay in the main-line circuit, and so adjusted as to respond to all line-currents, it being arranged to operate substantially as described, and claimed in my application for a United States patent, filed February 19, 1884, Serial No. 121,242.

While I much prefer the use of my own locals, as before described, it is obvious that other locals may be used instead—for instance, such as are described in United States Patent No. 274,112.

Battery-section B may be omitted without changing the general *modus operandi*, but it must be used whenever subsidiary neutral relays are employed, to aid in controlling the depolarizing branches of the sounder-magnets.

The polarized relay described in my aforesaid application, Serial No. 130,001, is a modified form of polarized relay PR, herein described, and may be used in lieu thereof.

The polarized relay shown in Fig. 3 is another substitute for relay PR. In this substitute the armature-tongue is confronted on one side by the arm *g* of a lever, G, pivoted at g^2, and on the other side by a lever, H, pivoted to but insulated from the arm *g'* of lever G. The retractile spring is applied to lever H, tending to hold said lever in contact with contact-screw *h*, and lever G in contact with contact-screw *i*. The movement of lever G in the other direction is limited by contact-screw *i'*, and that of lever H by contact-screw *h'*. Contact-screw *h* is so located with reference to the point where the retractile spring is attached to lever H that it will require the same force to turn either lever by the armature tongue in opposition to the retractile spring. The local circuit is applied as clearly shown. I regard the two levers G and H as the equivalent of the T-lever.

I claim as my invention—

1. The combination, at one station, substantially as before set forth, of two keys or transmitters, two batteries, or two sections of a battery, and connections, substantially such as described, whereby the transmitters, when working separately, send to line currents the same in polarity but different in tension, while both transmitters, when working simultaneously, send a reverse current to line.

2. The combination, at one station, substantially as before set forth, of two keys or transmitters, three batteries or battery-sections, and connections, substantially such as described, whereby the transmitters, when working separately, send to line currents the same in polarity but different in tension, while both transmitters, whether at rest or working simultaneously, send reverse currents of correspondingly different tension.

3. The combination, substantially as before set forth, of the armature-tongue of a polarized relay, and a T-lever, and its retractile spring for opposing the movement of the armature-tongue in either direction.

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

B. E. J. EILS.

Witnesses:
C. A. NEALE,
EDW. T. WALKER.