(No Model.) 2 Sheets—Sheet 1.

B. E. J. EILS.

ART OF BIPLEX TELEGRAPHIC TRANSMISSION.

No. 305,908. Patented Sept. 30, 1884.

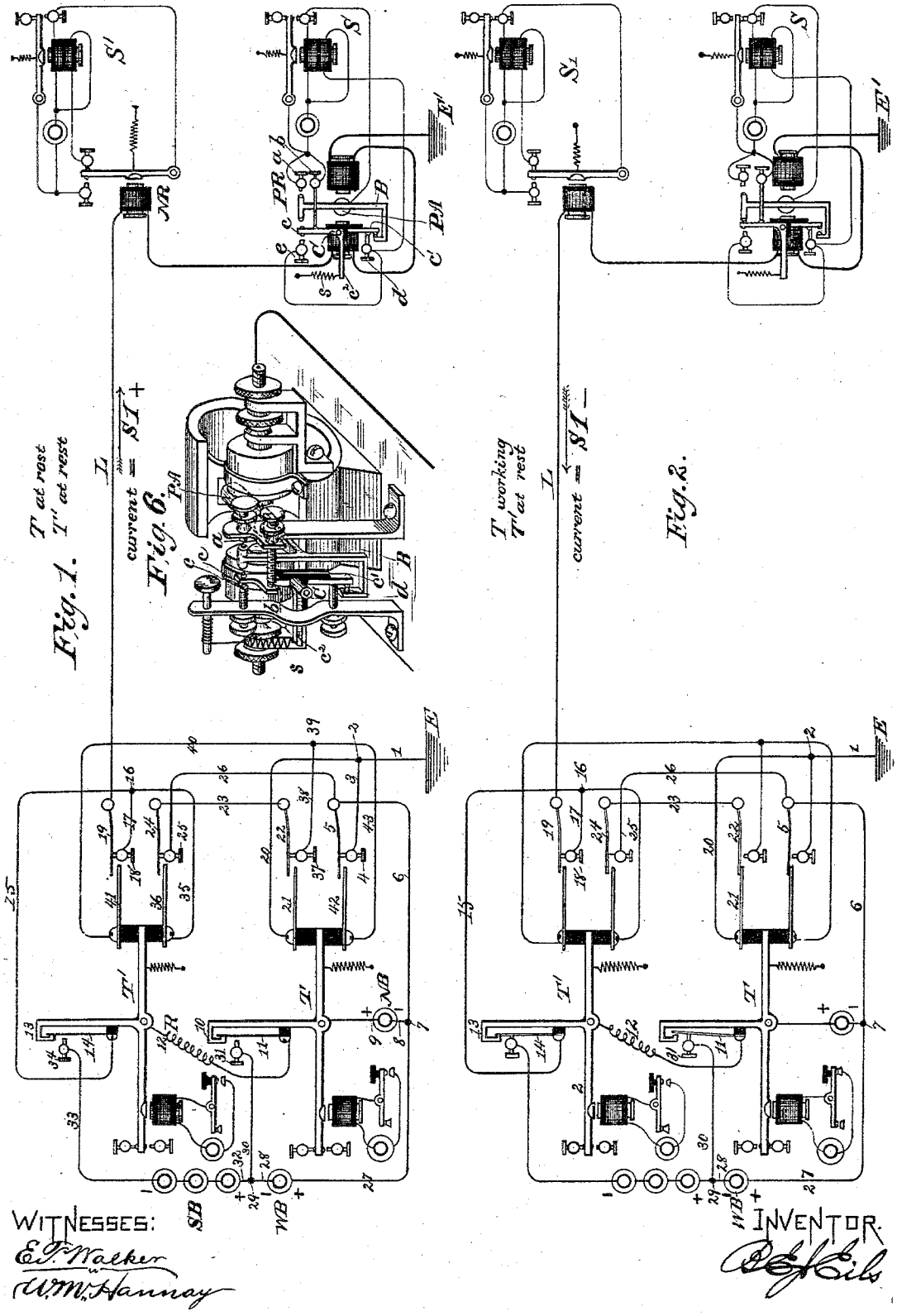

Fig. 1.

Fig. 6.

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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ART OF BIPLEX TELEGRAPHIC TRANSMISSION.

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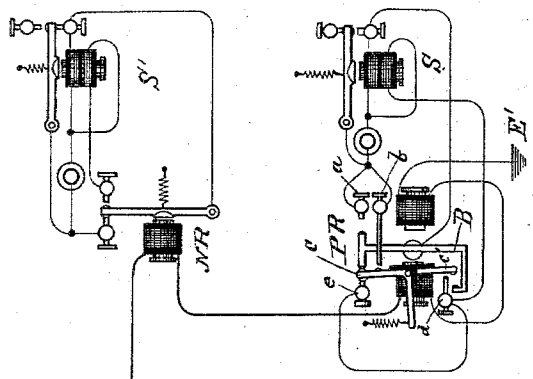
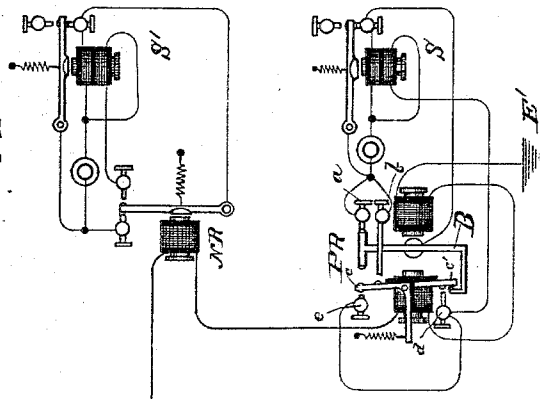


T at rest
T' working
L
current = SA −

Fig. 3



T working
T' working
L
current = SA +

Fig. 4

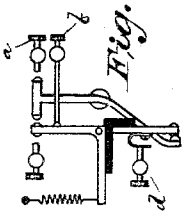
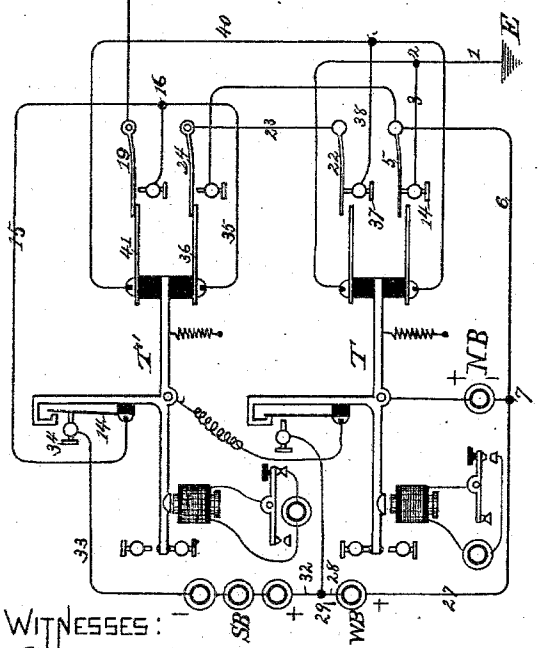
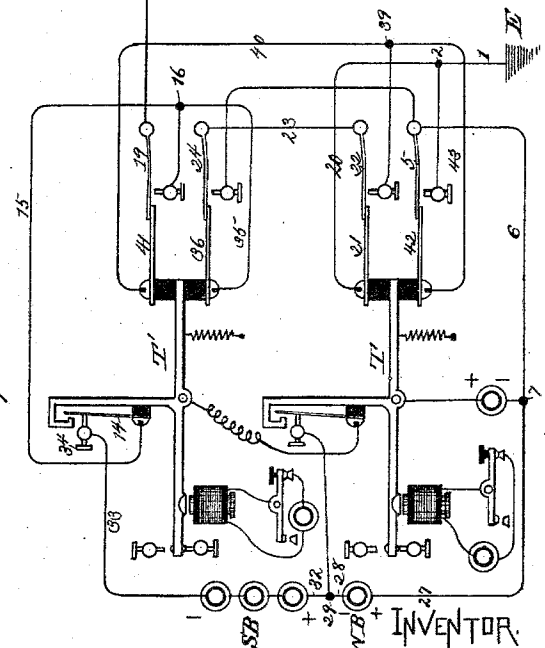


Fig. 5





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UNITED STATES PATENT OFFICE.

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

ART OF BIPLEX TELEGRAPHIC TRANSMISSION.

SPECIFICATION forming part of Letters Patent No. 305,908, dated September 30, 1884.

Application filed May 1, 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 a certain new and useful Improvement of the Art of Diplex Telegraphic Transmission and Apparatus for Practicing said Improvement; 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 improvement of the art of simultaneously transmitting two distinct telegraphic messages in the same direction over a single line-wire, according to which improvement such of the respective signals or portions of signals of the two messages as do not happen to be made simultaneously, or, in other words, are non-concurrent, are transmitted by currents the same in polarity but different in tension, while the concurrent signals or portions of signals of the two messages are transmitted by a reverse current.

I have devised a number of different forms of transmitting and receiving apparatuses suitable for the practice of the above-stated improvement, but will describe only one form of such transmitting and receiving apparatuses as embodied in the diplex telegraph which I have illustrated as one practical means for working said improvement. The novel features of the apparatus are substantially embodied and claimed, respectively, in my application for United States Patent filed July 12, 1884, Serial No. 137,577, and August 7, 1884, Serial No. 139,896.

The annexed drawings illustrate 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 battery and transmitting as well as receiving devices, and by duplexing the relays.

Figure 1 is a diagram illustrating the condition of the parts when both transmitters are at rest. Fig. 2 is a diagram illustrating the position of the parts when one of the transmitters is working. Fig. 3 is a diagram illustrating the position of the parts when the other transmitter is working. Fig. 4 is a diagram illustrating the position of the parts when both transmitters are working simultaneously. Fig. 5 is a diagram of my polarized relay detached. Fig. 6 is a perspective view of my polarized relay, some minor details being omitted.

The keys or transmitters T and T′ are exactly alike in mechanical construction, and are substantially like the keys described in M. G. Farmer's United States Patent No. 21,329. They may be operated directly by the hands of the operator, or, as shown in the drawings, by local electro-magnets brought into action on working ordinary finger-keys. These transmitters control three batteries, (marked, respectively, NB, WB, and SB.) The batteries NB and WB are of equal strength; but I prefer to make the battery SB of greater strength than is possessed by either of the other two, in order to increase the difference between the current strengths or tensions. Batteries WB and SB are in reality two sections of one battery. Transmitter T has nine contact-points—namely, hook 10, spring 11, screw 31, finger 21, spring 22, screw 37, finger 42, spring 5, and screw 4. Transmitter T′ has also nine contact-points—namely, hook 13, spring 14, screw 34, finger 41, spring 19, screw 18, finger 36, spring 24, and screw 25. These eighteen contact-points are connected with respect to one another, earth, batteries, and line as clearly shown in the drawings. When both transmitters are at rest, as shown in Fig. 1, the current from earth E to line L is formed by the conductors 1, 2, 3, 4, 5, 6, 7, 8, NB, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, and 19. Battery NB is in circuit with its positive or + pole to line. When transmitter T is working and transmitter T′ is at rest, as shown in Fig. 2, the circuit from earth E to line L is formed by the conductors 1, 2, 20, 21, 22, 23, 24, 25, 26, 5, 6, 7, 27, WB, 28, 29, 30, 31, 11, 12, 13, 14, 15, 16, 17, 18, and 19. Battery WB is in circuit with its negative or — pole to line. When transmitter T′ is working and transmitter T is at rest, as shown in Fig. 3, the circuit from earth E to line L is formed by the conductors 1, 2, 3, 4, 5, 6, 7, 27, WB, 28, 29, 32, SB, 33, 34, 14, 15, 16, 35, 36, 24, 23, 22, 38, 39, 40, 41, and 19. Batteries WB and SB are connected and in circuit with their negative

or — pole to line. When both transmitters are working, as shown in Fig. 4, the circuit from earth E to line L is formed by the conductors 1, 2, 20, 21, 22, 23, 24, 36, 35, 16, 15, 14, 34, 33, SB, 32, 29, 28, WB, 27, 7, 6, 5, 42, 43, 39, 40, 41, and 19. Batteries SB and WB are connected and in circuit with their positive or + pole to line. The following tabular statement will show concisely the strength and direction of the line-currents flowing, respectively, under the above-recited four possible conditions of the transmitters, on the assumption that the strength of battery WB and of NB is represented by S1, and the strength of battery SB by S3:

Both transmitters at rest=line-current S1+.
Transmitter T working=line-current S1—.
Transmitter T′ working=line-current S4—.
Transmitters T and T′ working=line-current S4+.

It will be observed that battery NB, which is normally in circuit, is cut out by operating either transmitter; also, that the current consequent upon working transmitter T separately has the same polarity as the current consequent upon working transmitter T′ separately, and that these currents differ in tension only; also, that the current consequent upon simultaneously working both transmitters has a polarity opposite to that of the currents consequent upon working either transmitter separately. Under the arrangement shown, transmitter T, when working, sends a weak current to line, while the working of transmitter T′, either alone or simultaneously with transmitter T, causes a stronger current to flow. The signals transmitted by transmitter T′ are received at the distant station by a neutral relay, NR, and reproduced by a sounder, S′, controlled by said relay through the medium of a local circuit, such as described and claimed in my application for United States Letters Patent filed January 28, 1884, Serial No. 118,999. The relay NR is so adjusted that it responds only when both batteries WB and SB are in circuit. The signals transmitted by transmitter T are received by the double polarized relay PR, and reproduced by a sounder, S, controlled by said relay through the medium of a local circuit, also substantially such as described and claimed in my aforesaid application for United States Letters Patent, but adapted to the peculiarities of construction of relay PR, which peculiarities consist in providing its polarized armature PA with a cross contact-bar, B, to operate in conjunction with the arms *c* and *c′* of a T-shaped contact-lever, C, and four contact-screws, *a b d e*. One pole of the local battery is permanently connected to the contact-screws *a* and *b*, and the other pole is permanently connected to the polarized armature PA, and also, by a branch wire, to the contact-screws *d* and *e*, as clearly shown in the drawings. The arms *c* and *c′* of contact-lever C are insulated from each other, and are of equal length. The arm c^2 serves the purpose of applying the retractile spring *s*, which is so adjusted that the contact-lever can only be turned by the bar B of armature PA when the latter is deflected by a current from the combined batteries WB and SB. The current of positive polarity from battery NB holds armature PA in the position shown in Fig. 1, its bar B being in contact with arm *c′* of contact-lever C, which arm is also in contact with contact-screw *d*. When transmitter T is working alone, the current of negative polarity from battery WB deflects armature PA, so as to cause its bar B to first break contact with arm *c′* and then make contact with arm *c*, which arm is and remains in contact with contact-screw *b*. The local circuit is thus completed, and sounder S responds. If transmitter T′ be depressed to send a signal while transmitter T is working, the current of positive polarity from the combined batteries SB and WB will cause a deflection of armature PA in the opposite direction, the effects of which change are, first, bar B breaks from arm *c*, which does not, however, disturb the sounder, because the first branch circuit closed by the armature-lever of the sounder remains closed; second, bar B makes contact with arm *c′* and closes the second branch of the local, but only so momentarily—for the contact between arm *c′* and contact-screw *d* is immediately broken by the onward movement of the armature PA, the bar B of which now overcomes the retractile spring *s*—that it does not effect the discharge of the sounder-magnet, which remains charged through the first branch circuit; third, bar B makes contact with contact-screw *a*, re-establishing the main local circuit. Contact-screws *a* and *e* are so adjusted with reference to bar B of the armature PA and contact-lever C that no contact is established between arm *c* and screw *e* when bar B makes contact with screw *a*. When transmitter T′ is working alone, the current of negative polarity from the combined batteries WB and SB deflects armature PA with such force that its bar B turns the contact-lever C and establishes contact through arm *c* with contact-screw *e*, the local circuit being established through contact-screw *b* so momentarily only that the sounder-magnet does not become charged. At the termination of a signal sent by transmitter T, the electro-magnet of sounder S is discharged through the medium of the second branch of the local circuit, established through contact-screw *d* or contact-screw *e*, according as transmitter T′ is at rest or working at the time. The lever C should have a yielding contact either for contact-screw *d*, as shown in Fig. 5, or for contact-screw *b*. On long circuits the second branch of each local circuit 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 and operating substantially as described and claimed in my application for United States Letters Patent filed February 19, A. D. 1884, Serial No. 121,242. The polarized relay may be one of the Siemens type. Ordinarily battery NB may be omitted, as is obvious, with-

out changing the general *modus operandi;* but it must be used whenever subsidiary neutral relays are employed to aid in controlling the second branch of the local circuits. When this diplex is converted into a quadruplex, a resistance, R, equal to the internal resistance of battery SB should be inserted in wire 12, and in case battery NB is omitted a resistance equal to the internal resistance of battery WB should be put in its place.

The feature of closing the second or depolarizing branch of the local circuit of relay PR through a contact-lever and its contact-screw is claimed in my application for a United States Patent filed July 12, 1884, Serial No. 137,577, where said feature is shown in its most simple form.

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

I claim as my invention—

The improvement of the art of simultaneously transmitting two distinct telegraphic messages in the same direction over a single line-wire, which consists in transmitting the non-concurrent signals and portions of signals of the two messages by sending to line currents alike in polarity but differing in tension, and the concurrent signals and portions of signals of the two messages by sending a reverse current to line, substantially as before set forth.

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

B. E. J. EILS.

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