(No Model.) 2 Sheets—Sheet 1.

B THOMPSON.

DUPLEX TELEGRAPH.

No. 261,788. Patented July 25, 1882.

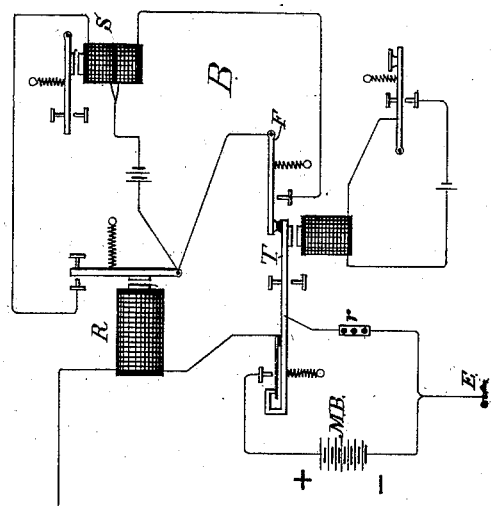


Fig. 1.

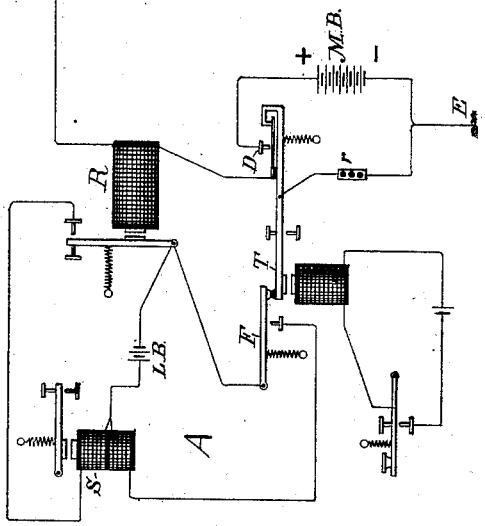
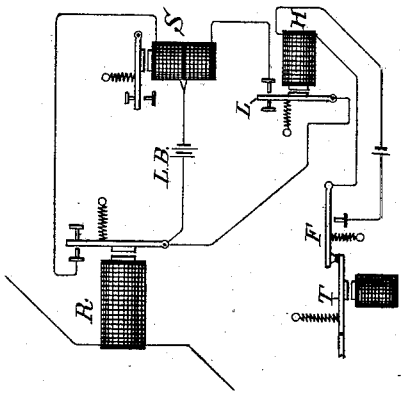


Fig. 2.



ATTEST:

J. A. Wurdle.

Thos. Toomey.

INVENTOR:

Benj. Thompson

by R. S. Townsend

Atty.

N. PETERS. Photo-Lithographer, Washington, D. C.

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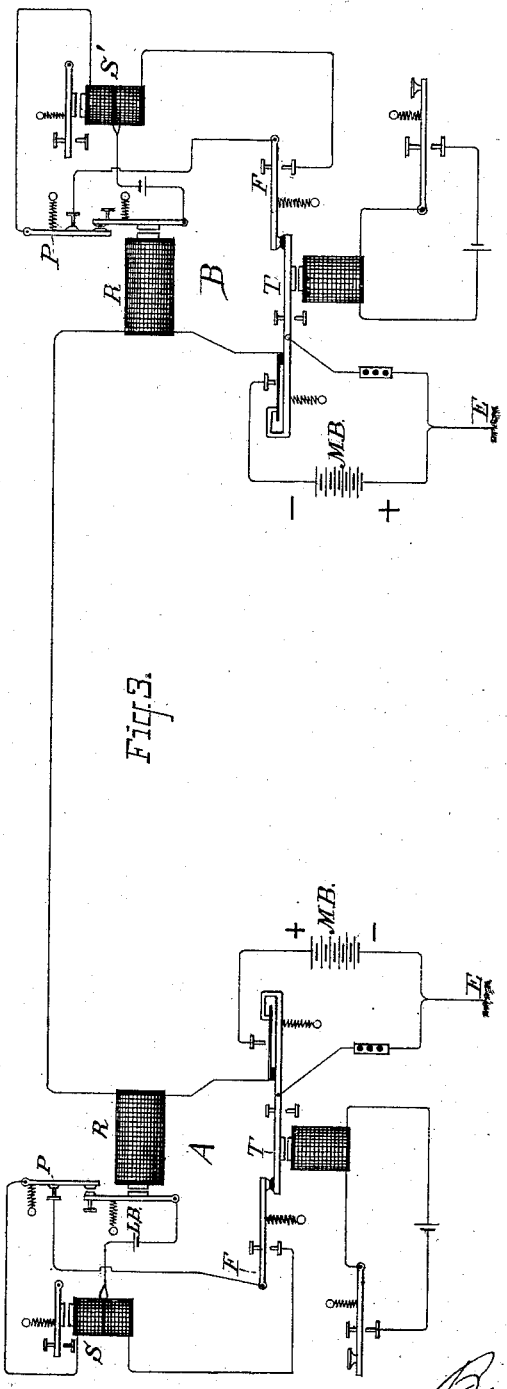

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UNITED STATES PATENT OFFICE.

BENJAMIN THOMPSON, OF BUFFALO, NEW YORK.

DUPLEX TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 261,788, dated July 25, 1882.

Application filed May 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN THOMPSON, a citizen of the United States, and a resident of Buffalo, in the county of Erie and State of New York, have invented a certain new and useful Improvement in Duplex Telegraphs, of which the following is a specification.

The object of my invention is to form a simple and effective duplex telegraph without the use of condensers, equating-rheostats or differential relays.

My invention consists in the combination, with any ordinary relay and transmitter, both located at the same station, of a differentially-wound sounder or receiving-instrument, the circuit of one of whose coils is controlled by the movements of the transmitter in such a way that both coils are simultaneously broken or closed when the transmitter is operated—one coil by the movement of the transmitter and the other in the ordinary manner by the movements of the relay-armature. As an illustration of the principle, let it be supposed that normally both differential coils are broken, and that the sounder-lever be against its back stop. If the transmitter be operated to send a signal to the distant station, the arrangement is such that both coils will be simultaneously closed, one by the movement of the transmitter and the other by the relay-armature lever; but no signal will be given upon the sounder, because one coil will neutralize the action of the other. If under this condition a signal come from the distant station, the relay-armature will fall back, the two line-batteries neutralizing one another, thus breaking one differential coil, whereupon the other will act and draw down the sounder-lever. This general principle admits of various modifications with regard to the normal condition of the local circuits—that is, whether open or closed—and also with respect to the normal polarity of the main-line batteries. Some of these modifications will be hereinafter described. The invention, however, is not limited to those described, as it consists broadly in rendering the sounder of the home station insensible to outgoing signals by the aid of an extra or differentially-wound coil, the circuit of which is controlled by the movements of the transmitter-lever, the other differentially-wound coil being controlled in the ordinary way by the action of the home relay.

In the accompanying drawings, Figure 1 is a diagram of an apparatus constructed and arranged according to my invention, and illustrates the application of the invention to an ordinary duplex telegraph. Fig. 2 is a diagram showing a modification of the devices operating with the transmitter to open and close one coil of the differential sounder or receiving-instrument. Fig. 3 illustrates the manner of applying the invention to a duplex telegraph in which batteries of opposite polarity are used at the two ends of the line.

Referring to Fig. 1, A and B represent the two distant stations of a duplex-telegraph line fitted with a similar apparatus. It will be sufficient to describe the apparatus with reference to one station—as, for instance, A—that at the other station being similar and similarly marked.

R represents a relay of any ordinary construction. T is a transmitter operated in the ordinary way by a local electro-magnet and key, as indicated, and provided with the ordinary continuity-preserving contacts at D, by means of which the main battery M B is connected to and disconnected from line. A rheostat, connected in the usual way, in the ground-wire, which is connected to transmitter-lever, and adjusted to equal resistance of the main battery, is shown at *r*.

S represents a sounder, wound differentially in a well-known way, with two sets of coils, so that when a current flows simultaneously in them they will neutralize each other's effects, and the armature-lever will not be attracted. One end of one of the coils is connected to the front contact-stop for the armature-lever of relay R. The corresponding end of the other coil is connected to the contact-stop of a supplemental circuit-closer, F, operated by the transmitter-lever T.

L B indicate the local battery, connected on one side to the armature-lever of the relay and to the circuit-closer F and on the other to the two coils of the differentially-wound sounder.

In the normal condition of the apparatus the parts are in the position shown. Both coils of the differential sounder are broken, one at the

front contact of relay R, whose armature-lever is held against its back stop by its retractor, and the other at the contact-points of the supplemental circuit-closer F, which is held out of connection with its contact-stop by the transmitter-lever T, the latter, in the position shown, being against its back contact-stop and unattracted by its operating electro-magnet. The contact-spring at D being against the hook of the lever and out of contact with the stop connected to battery M B, the line-circuit is to earth through the resistance *r*, as shown.

The apparatus at station B is the same as at A, and the main battery at that station has the same pole to line, so that if both of the transmitters are operated so as to simultaneously connect the batteries to line they will neutralize one another. When the key at station A is depressed so as to operate transmitter T and put the main battery to line the transmitter simultaneously operates the circuit-closer F, allowing its lever to make contact with its stop and close the local circuit through one of the differential coils simultaneously with the closing of the circuit for the other coil by the armature-lever of the relay at A, which is of course affected by the outgoing current and draws forward its lever. The circuit through both coils being simultaneously closed, the sounder at A is not affected. At B the current flows through the relay R and closes the circuit through one only of the differential coils, which (the other coil being broken at circuit-closer F) causes a signal upon the sounder. In a similar way, if transmitter T at A be at rest, a current from main battery at B, circulating through the relay of A, the transmitter-lever, and resistance *r* to earth, will operate the sounder S at A. If battery at B is put to line for the purpose of giving a signal at A during the time that the transmitter T at the latter station is in position for sending a signal, both batteries, being to line, will neutralize one another, and the armature-lever of R at station A will fall back, thus breaking one of the local circuits completed when the battery at A was put to line, leaving the other, which is completed through the circuit-closer F, intact. The current flowing through the differential coil connected to F, being then unopposed in its action, will draw down the sounder-lever and give the signal. At station B the signal from A will not be mutilated, because, although the armature-lever may fall against its back contact, breaking the local coil by which the lever of the sounder is held down, the circuit through the other coil will be simultaneously completed by the action of the supplemental circuit-closer F at station B.

In order to insure a uniform action of the transmitter in making and breaking the local differential circuit, I sometimes employ the device shown in Fig. 2. In this device the local differential circuit is broken through the intervention of a circuit-closer controlled by an electro-magnet, H, the circuit of which in turn is made and broken by the supplemental circuit-closer F, operated by the transmitter. The operation of the apparatus fitted with this appliance does not differ in its general characteristics from that just described, as can be readily seen.

Fig. 3 illustrates the adaptation of my invention to a duplex telegraph in which the battery at one station is placed to line with a polarity the opposite of that with which the battery at the other is connected, so that when the two batteries are simultaneously connected the two will re-enforce one another. Under this arrangement of the batteries, I employ a supplemental lever for the relay-armatures. P represents the supplemental contact-lever, to which the end of the differential coil is taken in the same manner as the end in Fig. 1, which is carried to the front contact-stop of the armature-lever. Supplemental lever P is normally held against a contact-stop electrically connected to the circuit-closer, controlled by the transmitter by means of a spring applied so as to oppose the movement of the relay-armature lever when the latter is attracted by the relay and drawn against the supplemental lever. This spring is adjusted to such a tension that the supplemental lever cannot be drawn out of contact with its stop by the action of one main battery only, but can be disconnected by the action of both batteries combined. The retractor of the relay-armature allows the lever to be drawn forward by a current from either or both of the two distant batteries. One pole of the local battery is connected to the relay-armature lever and the other to the two coils of the differential sounder. When the relay-armature is against its back stop it is out of contact with the supplemental lever; but when drawn forward against said lever it closes the circuit of one differential coil and completes one of two breaks in the circuit for the other coil, the other break being at the circuit-closer and breaker controlled by the transmitter. In the normal position of the parts the circuit of both coils is broken, the local-battery circuit being interrupted at the contact-point of the relay-armature lever. When the transmitter at, for instance, station A is operated the relay-armature lever is drawn into contact with the supplemental lever by the action of the main battery at A, and the circuit-closer F, controlled by the transmitter, simultaneously completes the connection between the end of the lower differential coil on the sounder and the contact-stop for the supplemental lever. The one battery being insufficient to disconnect the supplemental lever from its stop, the circuit of both differential coils is completed, and the sounder-lever is unaffected. The circuit from the lower coil is through the circuit-closer F, contact-stop of supplemental lever P, supplemental lever, and relay-armature lever, to the local battery. The circuit for the upper coil is to supplemental lever P, relay-armature lever, and to the same pole of the local battery. At the distant station the armature-lever makes contact with the supplemental lever,

completing the circuit of one coil only of the sounder—viz., the upper—the circuit of the lower coil being interrupted at the contact-points of the circuit-closer controlled by the transmitter at that station, which is in a position of rest. The sounder at that station is thus caused to give a signal. If, while the transmitter at the home station is closed, thus completing the circuit of both differential coils and also putting main battery to line, the transmitter at the distant station be operated, the sounder at the home station will respond, because, both batteries being to line, the armature-lever will disconnect the supplemental lever from its stop, thus breaking the circuit of the local coil connected to the circuit-closer controlled by the transmitter at the contact-stop of the supplemental lever, leaving, however, the circuit of the other coil through supplemental lever and armature-lever intact, which latter will act and cause a signal to be given. The sounder-lever at the distant station, which, by the operation of the transmitter at the home station, has been drawn against its front stop, will not be affected, because the circuit of the coil connected directly to the supplemental lever will still be closed, and the transmitter at that station will fail to complete the circuit of the other, because by the movement of the supplemental lever under the influence of both batteries the circuit of the coil connected to the transmitter circuit-closer has been broken at the contact-stop of the supplemental lever.

The contacts of the circuit-closing devices in the various parts of all the diagrams are supposed to be adjustable in the ordinary way, in order that the times of making and breaking the local circuits may be adjusted so that the outgoing current shall have no effect upon the sounder.

Other constructions of circuit closing and breaking devices for closing or breaking one of the differential coils by the movements of the transmitter-lever simultaneously with the closing or breaking of the other coil by the action of the relay when affected by the outgoing signal may be obviously employed without departing from the spirit of my invention.

It is also apparent that my invention is not limited to a system in which two messages only are sent in opposite directions, but may be employed in connection with the receivers and transmitters of a system in which four or more messages are sent, part in one and part in an opposite direction.

What I claim as my invention is—

1. The combination, at the same station of a telegraph-line, of a transmitter, a receiving-relay, a differentially-wound receiving-instrument in a local circuit, circuit-connections from one of the differential coils to a circuit-closer controlled by the relay, and circuit-connections from the other coil through a circuit closer or breaker controlled by the transmitter, as and for the purpose described.

2. The combination of a relay, a transmitter, a differentially-wound receiving-instrument in a local circuit, a circuit closer and breaker controlled by the transmitter and electrically connected with one differential coil upon the receiving-instrument, and a contact-point on the relay electrically connected with the other differential coil.

3. The combination of a receiving-relay, a local battery, one pole of which is connected to the armature-lever therefor, a differentially-wound receiving-instrument whose coils are connected at one end to the other pole of the battery, relay contact-points controlling one of the differential coils, a transmitter, and a circuit closer and breaker operated thereby in the circuit of the other differential coil.

4. The combination, substantially as described, upon the same telegraph-line, of two transmitters, two main-line batteries, one for each transmitter, two relays in the main-line circuit, and, in connection with each relay and transmitter at the same station, a differentially-wound receiving-instrument, the circuit of one of whose coils is controlled by the relay, while the circuit of the other is made and broken by the movements of the transmitter.

Signed at Buffalo, in the county of Erie and State of New York, this 25th day of May, A. D. 1882.

BENJAMIN THOMPSON.

Witnesses:
GEO. O. M. BUCKNER,
CHAS. P. FORBUSH.