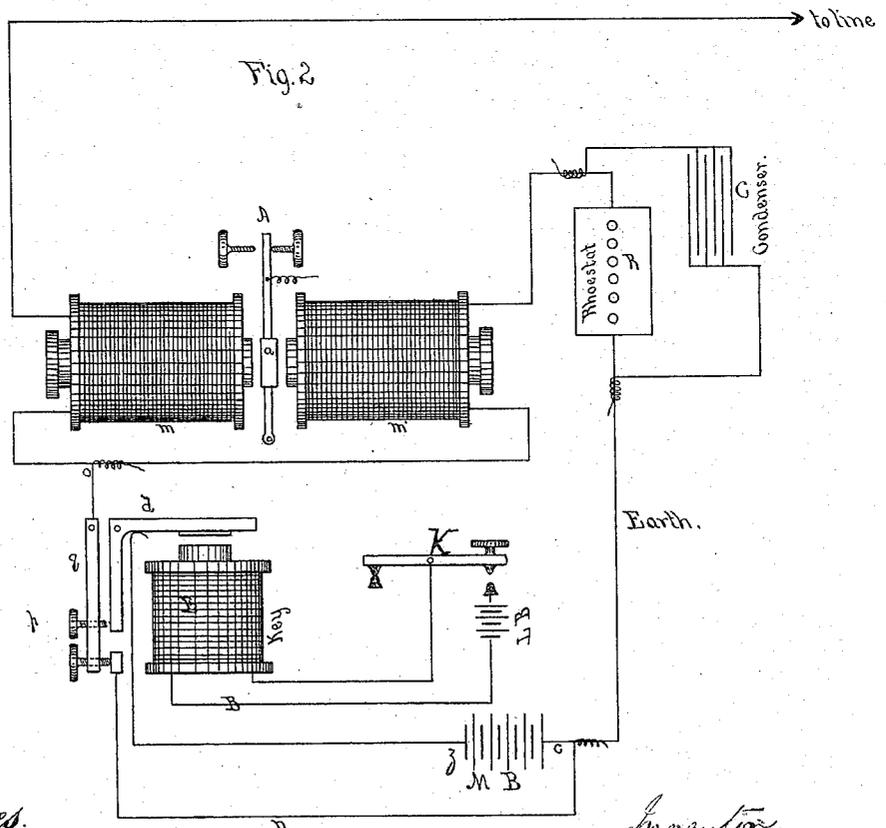
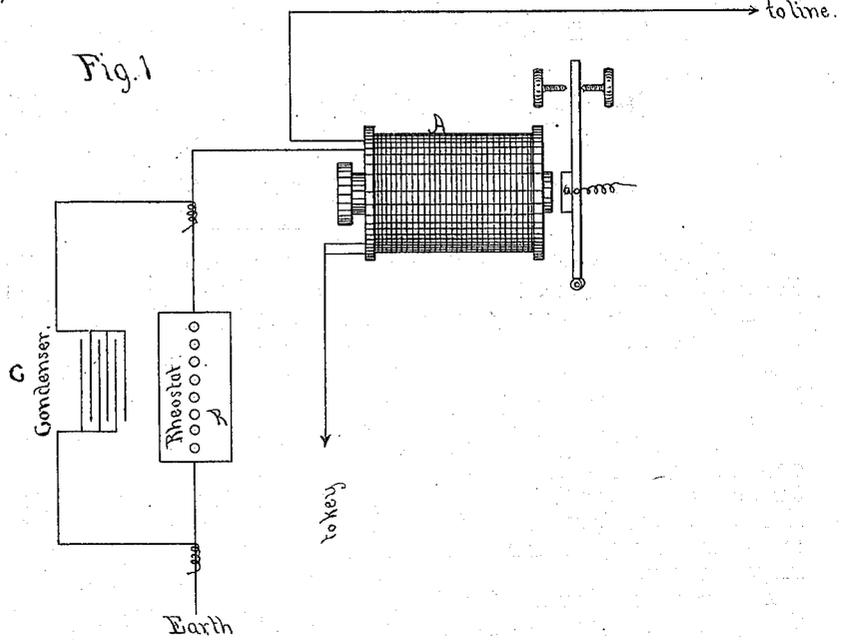


JOSEPH B. STEARNS.  
Duplex Telegraph Apparatus.

No. 126,847.

Patented May 14, 1872.



Witnesses.  
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# UNITED STATES PATENT OFFICE.

JOSEPH B. STEARNS, OF BOSTON, MASSACHUSETTS.

## IMPROVEMENT IN DUPLEX TELEGRAPH APPARATUS.

Specification forming part of Letters Patent No. 126,847, dated May 14, 1872.

Specification describing an Improvement in Telegraph Apparatus, invented by Jos. B. STEARNS, of Boston, in the county of Suffolk and State of Massachusetts.

This invention is an improvement upon apparatus for transmitting two signals at the same time from opposite ends of the same line-wire, its object being to prevent the effect upon the relay at the sending station of the return current due to the static induction of the line; and it consists in the connection with the apparatus of a condenser of any of the well-known forms.

The accompanying drawing, forming part of this specification, is a representation of my invention, Figure 1 showing a condenser, arranged with one form of double-transmitting apparatus; and Fig. 2 showing a condenser arranged with another form of the same.

In the drawing, A is the receiving instrument; K, the key; C, the condenser; R, the resistance; and M B the main battery.

For the purpose of more clearly explaining my invention I will proceed to describe the construction and operation of an apparatus for double transmission, selecting for that purpose the apparatus patented by me June 2, 1868, and numbered 78,548, which apparatus is represented in Fig. 2 of the drawing.

The conditions necessary for success in the double transmission of signals are, first: Having each relay at either station always in the circuit on the line; second, preventing the transmission of currents from either station from affecting the relay at that station; and, third, maintaining the resistance of the line always the same. These conditions are fulfilled in the following manner in the apparatus represented in Fig. 2 of the drawing, and before referred to: The relay or receiving instrument A consists of two electro-magnets,  $m m'$ , opposed to each other, and having a common armature. From the main battery M B the current passes to the armature-key  $d$ ; thence, through back-stop  $b$ , to the point  $o$ , where it divides, one portion passing through the electro-magnet  $m$  of the relay or receiving instrument to the line; the other portion through the electro-magnet  $m'$  of the relay or receiving instrument to a rheostat or resistance-coil, R, having the same or nearly the same resistance as the line, and thence to the earth. The elec-

tro-magnets  $m m'$  being thus equally excited by currents of the same strength, and being opposed, neutralize each other's effect upon the armature, and it, consequently, remains immovable, and no indication is given at the home station that a current is transmitted from that station. When, however, a current is transmitted from the distant station, it passes through the magnet  $m$  of the relay or receiving instrument at the home station, and thence to the earth, but not through the magnet  $m'$  of the relay, on account of the resistance-coil situated between the relay and the earth, and, consequently, the balance between the electro-magnets of the relay is disturbed, and the armature thereof is attracted toward the stronger magnet  $m$ . Thus the relay or receiving instrument at the home or receiving-station responds only to the currents or signals transmitted from the distant or sending station, and not to the currents transmitted from the station where it is situated; and, consequently, the two stations can send, simultaneously, the respective relays at each station, though always in the circuit, responding only to the currents from the other station.

In operating this apparatus, I prefer to use, instead of the common finger-key, a key which is operated by an electro-magnet excited by a local battery, and controlled by a common finger-key lever, as shown in Fig. 2, in which K is the common key-lever; L B, the local battery; E, the electro-magnet;  $a$ , the lever;  $p$ , the contact-stop, connected to earth by a wire,  $u$ . When the key is closed, the current passes from the main battery M B, from  $z d p o m$  line,  $z d p o m' R$  earth. When the key is open the line is connected to earth through  $n$ .

In Fig. 1 of the drawing I have represented another form of double-transmitting apparatus, also patented by me June 2, 1863, and numbered 78,547, in which the neutralization of the effect of the divided currents is accomplished by providing the relay with two coils, wound in opposite directions on the same magnet, as described in the aforesaid patent. In this form of apparatus, also, a rheostat or resistance is used, having the same or nearly the same resistance as the line.

I will now explain the nature of my improvement. It is a well-known phenomena in working the electric telegraph that a long line-wire,

when well insulated, secures, when connected with a battery, what is known as a static charge, which is similar to that of the well-known Leyden jar; and when the line-wire is disconnected with the battery and put to earth, the discharge of this accumulated electricity causes a return current in an opposite direction to the current from the battery. This current has been found upon long lines a serious obstacle to the successful operation of double-transmitting apparatus of the character described, for when the battery at the sending station is disconnected in writing, and the line put to earth, the relay at the sending station, which, as I have before explained, should be perfectly quiet, is affected by this return current, which passes through the opposing magnets or coils of the relay, and disturbs their balance, therefore producing a momentary attraction of the armature, and a consequent confusion of the signals. To obviate this difficulty is the object of my invention, which consists in placing in branch circuit passing through one of the coils or one of the magnets of the relay to the resistance and thence to earth, a condenser of any of the well known forms in use, which receives a static charge at the same

time as the line when the latter is connected to the battery, and when the line is disconnected, sends a return current, which neutralizes the effect of that coming from the line, and thus prevents the relay from being affected. This condenser is shown at C, in Figs. 1 and 2 of the drawing.

I have shown the connection of a condenser with two forms of double-transmitting apparatus. I do not limit myself to its use with these alone, as there are other forms of double-transmitting apparatus in which a condenser can be used with the same effect and for the same purpose as that described.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

In telegraph apparatus for double-transmission, the combination with the relay at each station of a condenser, for the purpose of neutralizing the effect of the return current due to the static induction of the line, as set forth.

J. B. STEARNS.

Witnesses:

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