

(No Model.)

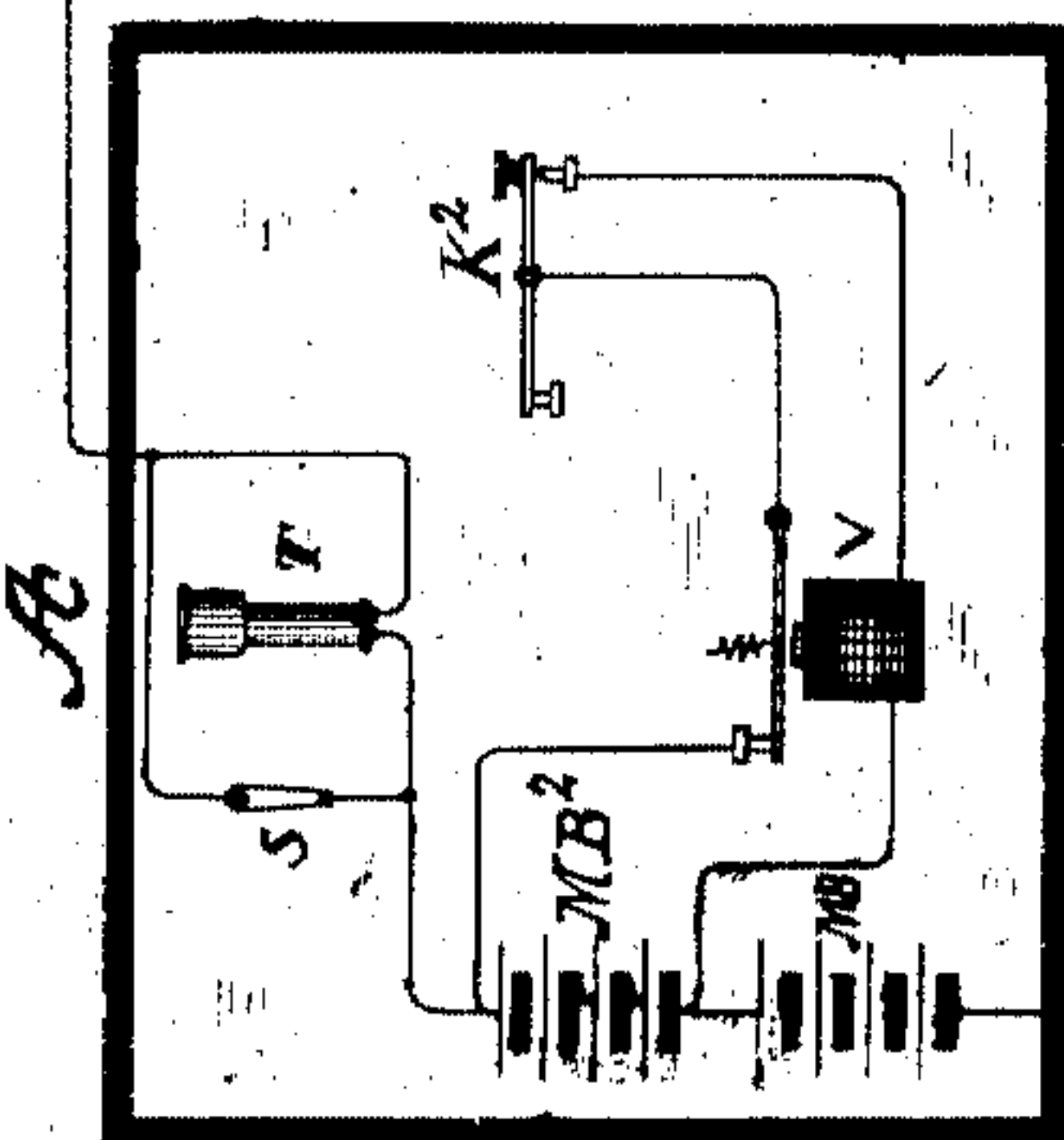
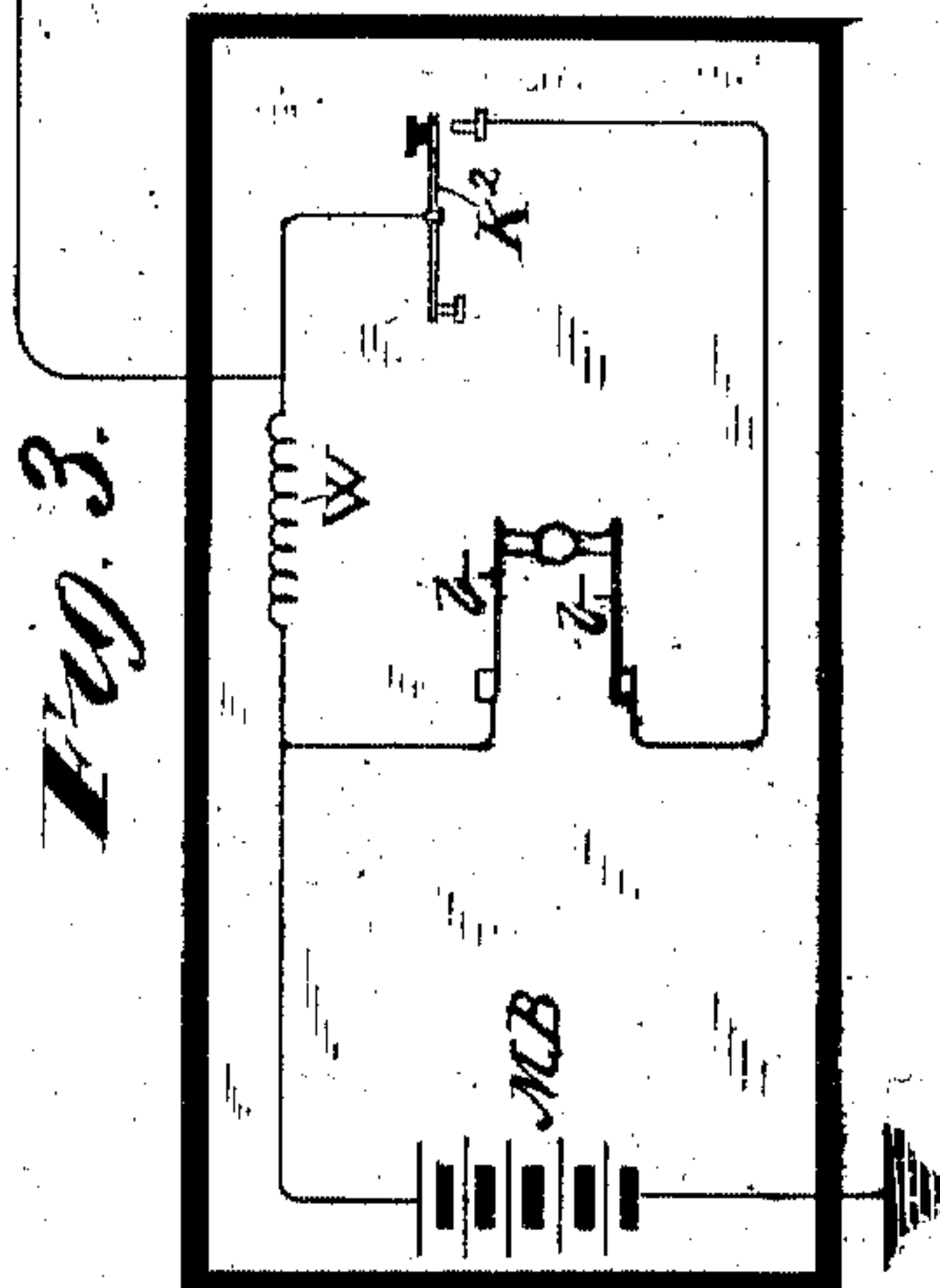
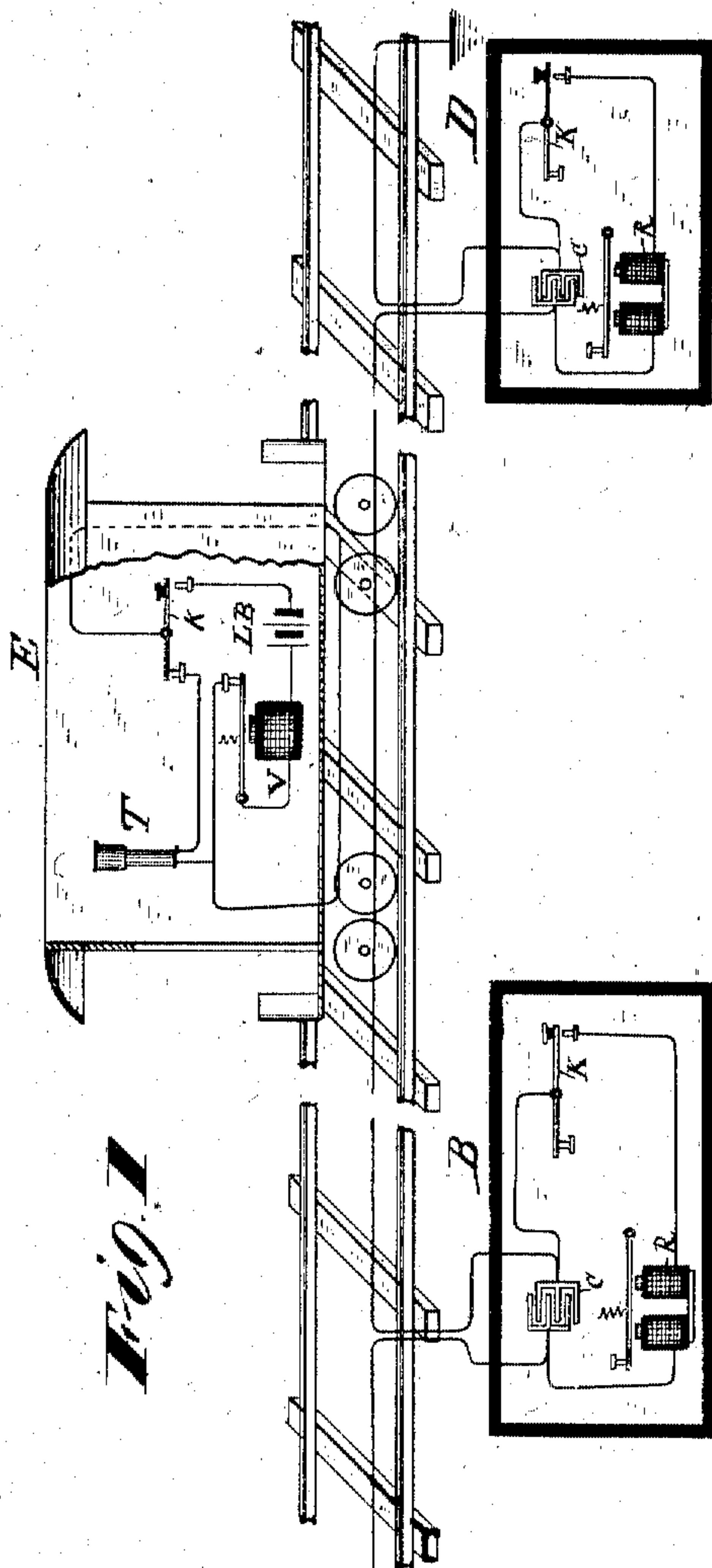
2 Sheets—Sheet 1.

L. J. PHELPS.

DUPLEXING RAILWAY TELEGRAPHS.

No. 351,525.

Patented Oct. 26, 1886.



WITNESSES:

*Gabriel W. Galster*  
*Wm. H. Capel*

INVENTOR

*Lucius J. Phelps*

BY

*H. C. Townsend*  
ATTORNEY

(No Model.)

2 Sheets—Sheet 2.

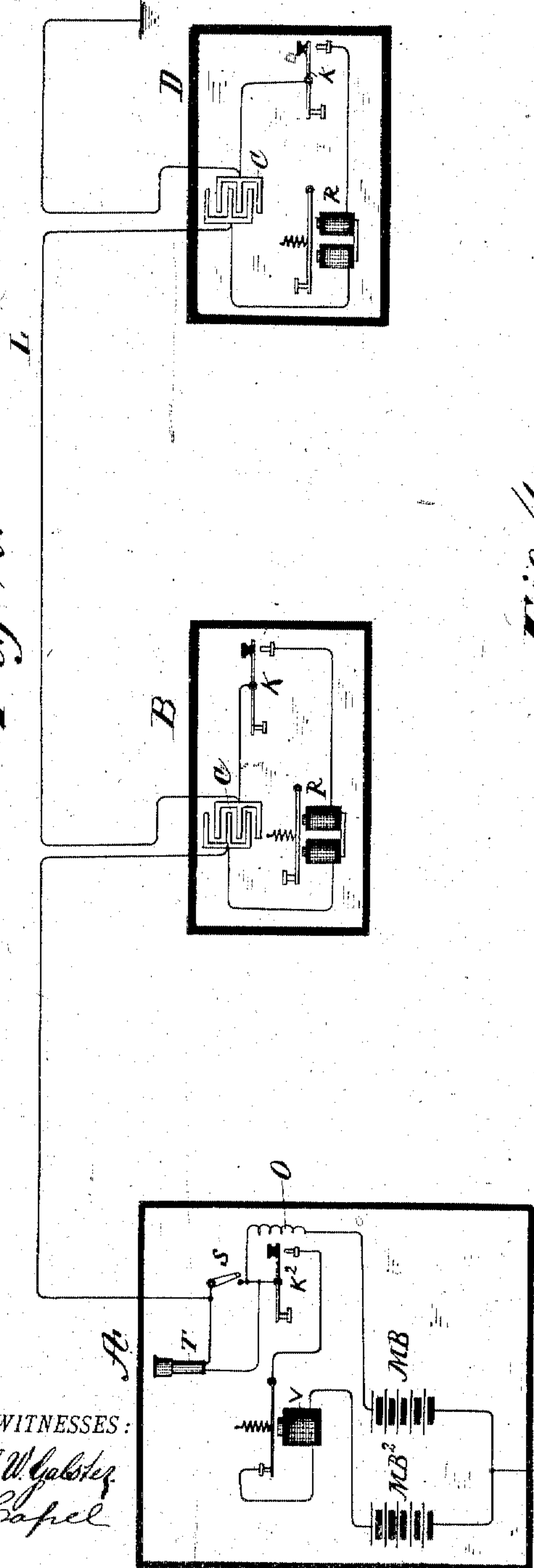
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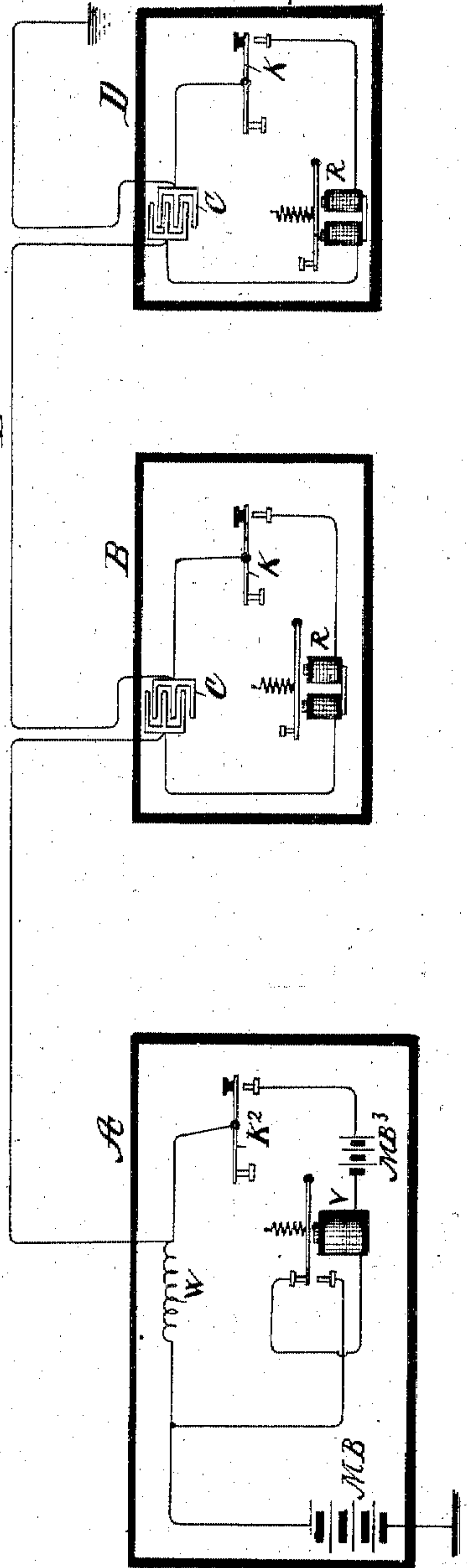
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Fig. 2.



WITNESSES:  
*Gabriel J. W. Gabster*  
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Fig. 4.



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*Lucius J. Phelps*  
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ATTORNEY



# UNITED STATES PATENT OFFICE.

LUCIUS J. PHELPS, OF NEW YORK, N. Y.

## DUPLEXING RAILWAY-TELEGRAPHS.

SPECIFICATION forming part of Letters Patent No. 351,525, dated October 26, 1886.

Application filed July 3, 1886. Serial No. 207,009. (No model.)

*To all whom it may concern:*

Be it known that I, LUCIUS J. PHELPS, a citizen of the United States, and a resident of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Duplexing Railway-Telegraphs, of which the following is a specification.

The object of my invention is to provide a means whereby telegraphic communication may be maintained with a moving vehicle—such, for instance, as a railway car, whether in motion or at rest—over an ordinary telegraph-line equipped with the usual telegraphic apparatus—such, for instance, as Morse apparatus—without interference with or from the simultaneous use of the Morse apparatus on the line.

My invention is designed more particularly to provide a means whereby the telegraphic communication with the train may be maintained by the use of any system of vibration-signals, while at the same time permitting said line to be used for ordinary telegraph purposes.

By "vibration-signals" I mean signals whose elementary portions—such, for instance, as the dots and dashes of the Morse alphabet—each consists of a series of electrical pulsations, waves, or vibrations, whether alternating—that is, of alternately opposite polarity—or whether all of the same polarity. The vibrations may recur with sufficient rapidity to produce the sensation of a musical tone, and this is the preferred plan of operation. It would, however, be within the invention to cause the vibrations or undulations to recur with a speed insufficient to produce a musical tone. In any case, however, they should be sufficiently rapid to give a series of vibrations, undulations, or pulsations for each closure of the transmitting-key or other device employed as the transmitter or controller, whereby the arbitrary signals may be produced or governed.

The novel combinations forming my present invention will be described, in connection with the accompanying drawings, and will then be more specifically recited in the claims.

In the drawings, Figure 1 is a diagram of apparatus combined in accordance with my invention. Fig. 2 illustrates a modification in

the manner of producing the pulsations on the charged line by means of a battery and vibrator. Fig. 3 illustrates another construction of vibrator adapted to produce the electrical vibrations on the circuit by controlling an artificial resistance in the line-circuit.

Referring to Fig. 1, L indicates an ordinary Morse or other telegraph line or circuit carried on posts or otherwise supported parallel to a line of railway, so as to be in suitable inductive proximity to a telegraph apparatus mounted on a vehicle that is indicated at E. Such apparatus is to be combined with devices whereby the electrical pulsations on the line may be inductively transferred to the vehicle, to be there received on a suitable instrument. A device suitable for this purpose is described in my prior Patent No. 312,506, though in the place of the principle of current induction I may employ the principle of static induction shown in my Patent No. 334,187.

In the present instance the vehicle E is shown with a conductor, arranged as described in the first of my patents mentioned, and connected with a receiver, T, consisting, preferably, of an ordinary telephone-receiver or other instrument sensitive to weak electric currents. The transmitter on the vehicle may consist of an ordinary Morse key, K, adapted to control the passage of pulsations or vibrations from a battery, L B, through the conductor that is parallel to the line L. The vibrator for setting up the pulsations or vibrations may be of any desired kind. That shown consists of an ordinary electro-magnetic vibrator, consisting of an electro-magnet whose coils are included in the circuit of the local battery and whose armature-lever and back contact-stop for the latter are also included in the circuit, so that when the armature is attracted the current of the battery is interrupted, but is immediately completed again through the consequent decrease of power in the magnet and the resultant falling away of the armature. Any other kind of vibrator might be used—such, for instance, as a clock-work vibrator consisting of circuit-closing points driven by clock-work, as indicated in Fig. 3.

The line L is equipped at two or more stations, B D, with ordinary Morse keys and relays, (indicated at K R,) which instruments



are included in the line-circuit with a generator of electricity, M B, consisting of the ordinary galvanic battery that serves to charge the keys in the ordinary and well-known way. In a shunt or branch around the Morse keys respectively are placed condensers C C, whose function is to provide a path for the vibration-signals on the line whenever the line-circuit is interrupted at the contacts of the transmitter K. The condensers C also serve to prevent the very sudden rises and falls of tension on the line produced by the operation of the keys K, and therefore act in a manner to reduce the violence of the sounds in the telephone-receivers employed for reading the vibration-signals. At the station A, which is the transmitting-station for the vibration-signals, and which may be, for instance, a train-dispatcher's office, is located the apparatus for transmitting and receiving messages from and to the car by "vibration-signals," so called. To produce these vibration-signals I employ a suitable vibrator, whose contacts serve to control the passage onto the line of a section of battery, or, which is the known equivalent, serve to throw an artificial resistance into and out of the circuit of the battery M B, thus producing changes of tension on the line corresponding in their rate of recurrence to the rate of movement of the vibrator.

In Fig. 1, M B<sup>2</sup> indicate a section of battery which, by the operation of a vibrator, V, may be caused to flow intermittently over the line-circuit in conjunction with the battery M B. The vibrator is in this instance arranged to alternately make and break a shunt for the battery M B<sup>2</sup>, and in the shunt is included a transmitting-key, K<sup>2</sup>, so that when the key is closed the operation of the vibrator will produce the pulsations or vibrations on the circuit by throwing the battery M B<sup>2</sup> into and out of circuit in obvious way. The vibrator illustrated is shown as an electro-magnetic vibrator—that is to say, one that is kept in operation by an electro-magnet operating on an armature-lever whose movements serve to break and make the path including the coils of the magnet.

At the station A the receiver of vibration-signals is indicated at T, and consists, preferably, of an ordinary telephone-receiver. A switch, S, serves to shunt the telephone-receiver at pleasure.

In the operation of the apparatus described for the purpose of communicating between stations B D, the receivers and transmitters at said stations are used in the ordinary way, and the transmitters serve to make and break the circuit of the battery M B M B<sup>2</sup> over said line. When the apparatus at station A is used at the same time for the purpose of communicating with a train, the section of battery M B<sup>2</sup> is thrown into vibration on the circuit, and by induction produces on the car-circuit similar waves or pulsations that operate the telephone-

receiver T on which the messages from station A are read. If, during the occurrence of a series of vibrations, a transmitter, K, at a station, B or D, is open, the pulsations or vibrations produced by the vibrator will find circuit through the condenser around the key that is for the time open. If the key K be closed in the operation of sending a message to another station on the line L, and if, at the same time, the vibrator at station A be in operation, the section of battery M B<sup>2</sup> will be alternately taken off and placed onto the circuit; but the line will always be charged by the section of battery M B.

The operation of the devices in transmitting a message from the vehicle is obvious. The vibrations on the car-circuit are inductively transferred to the line, and find their way to the telephone T at station A, over said line, and through the transmitters K, when closed, or through the condensers C, when the circuit at the transmitters K is open. Instead of arranging the battery and vibrator in the manner illustrated in Fig. 1, I sometimes prefer to arrange it after the manner shown in Fig. 2. In this instance the battery M B, that charges the line for the Morse stations B D, is connected into the line-circuit through resistance O, and the battery M B<sup>2</sup>, that is thrown into vibration, is connected to the line by a separate branch through the vibrator V and the key K<sup>2</sup>. The resistance O serves to equalize the resistance of the two branches containing the batteries M B M B<sup>2</sup>. Whenever the battery M B<sup>2</sup> is put to line by the operation of the vibrator, there is a momentary increased flow of current on the line, which immediately ceases on the interruption of the branch containing the battery M B<sup>2</sup>, so that the current is restored to the normal amount produced by the current of battery M B acting alone.

By the operation of the battery M B<sup>2</sup>, controlled by the vibrator and the transmitting-key, the vibration-signals are produced and are transferred to the car in obvious manner. During such operation the stations B D can communicate with one another through the action of the keys upon the flow of current produced from battery M B, and at the same time there is no interference from the operation of the keys K with the transmission of the vibration-signals to and from the vehicle over the same line-circuit L.

I have described ways of producing the vibrations on the circuit by means of a section of battery controlled by the vibrator and key; but it is obvious that the changes of current on the circuit could be produced in the well-known equivalent manner by the action of an artificial resistance placed into and out of the line circuit, and operating, when in circuit, to reduce the tension of the current from the charging-battery M B. Such an arrangement is indicated in Fig. 3, where the artificial resistance is indicated at W, and is included in the direct-line circuit L. The vibrator is



placed in the shunt around said resistance, so as to intermittently close and open said shunt, each closure resulting in an increase of the tension of current from battery M B, and each opening of the shunt resulting in a decrease of the current on the circuit through the introduction of the artificial resistance. The effect is obviously to produce the electrical pulsations or vibrations employed in transmitting signals to the vehicle:

The vibrator shown in Fig. 3 is of the clock-work form, and its contacts move continuously in the same direction, being mounted upon a suitable revolving shaft and serving to complete the circuit between two springs, *bb*, in one position of the parts and to interrupt the circuit when removed to another position. The shunt controlled by said vibrator is also controlled by the transmitting-key  $K^2$ , which is employed in transmitting messages by the vibration-signals in obvious way.

In Fig. 4 I have shown another form of vibrator adapted to control the shunt around the artificial resistance. In this instance the vibrator is what is known as an "electro magnetic" vibrator, and consists of an electro-magnet whose coils, armature, and back contact-stop are in a local circuit with a battery, M B<sup>3</sup>, while another stop for said armature-lever serves to complete the shunt around the resistance W in obvious manner.

The transmitter  $K^2$  controls the operation of the vibrator and the production of the electric vibrations on the line by controlling the circuit of the local battery that operates the vibrator.

The operation of the devices will be evident to any one skilled in the art.

What I claim as my invention is—

1. The combination, substantially as described, with an ordinary telegraph-line, L, and a vehicle-carrying apparatus moving in inductive proximity thereto for transmitting and receiving signals by electrical induction, of two or more stations, B D, equipped with ordinary telegraph apparatus in the direct-line circuit L, a section of battery, M B<sup>2</sup>, or its equivalent, as described, connected to said line, a vibrator, and a transmitting-key for controlling the electrical vibrations produced by the operation of the vibrator and the battery or its equivalent, as set forth.

2. The combination, substantially as described, of a line, L, carried parallel to the path of a vehicle, apparatus on the latter for sending and receiving messages by induction to and from the line, a battery, M B, charging the line-circuit, telegraph-transmitting apparatus at two or more stations, B D, connected into the direct-line circuit, condensers shunting said apparatus, a supplemental battery or section of battery, or its equivalent, as described, at a station, A, a vibrator controlling the circuits of the same, and a transmitting-key, K, whereby vibration-signals may be sent to the vehicle over the line L, as and for the purpose described.

Signed at New York, in the county of New York and State of New York, this 2d day of July, A. D. 1886

LUCIUS J. PHELPS.

Witnesses:

WM. H. CAPEL,

WM. HENRY GARDINER.

It is hereby certified that Letters Patent No. 351,525, granted October 26, 1886, upon the application of Lucius J. Phelps, of New York, New York, for an improvement in "Duplexing Railway Telegraphs," was erroneously issued to said Phelps; that the said Letters Patent should have been issued to *The Railway Telegraph Company of New York*, the said Railway Telegraph Company being the assignee of the entire interest in said invention; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 16th day of November, A. D. 1886.

[SEAL.]

D. L. HAWKINS,  
*Acting Secretary of the Interior.*

Countersigned:

R. B. VANCE,  
*Acting Commissioner of Patents.*