(No Model.)

L. J. PHELPS.

RAILWAY TELEGRAPHY.

No. 355,468. Patented Jan. 4, 1887.

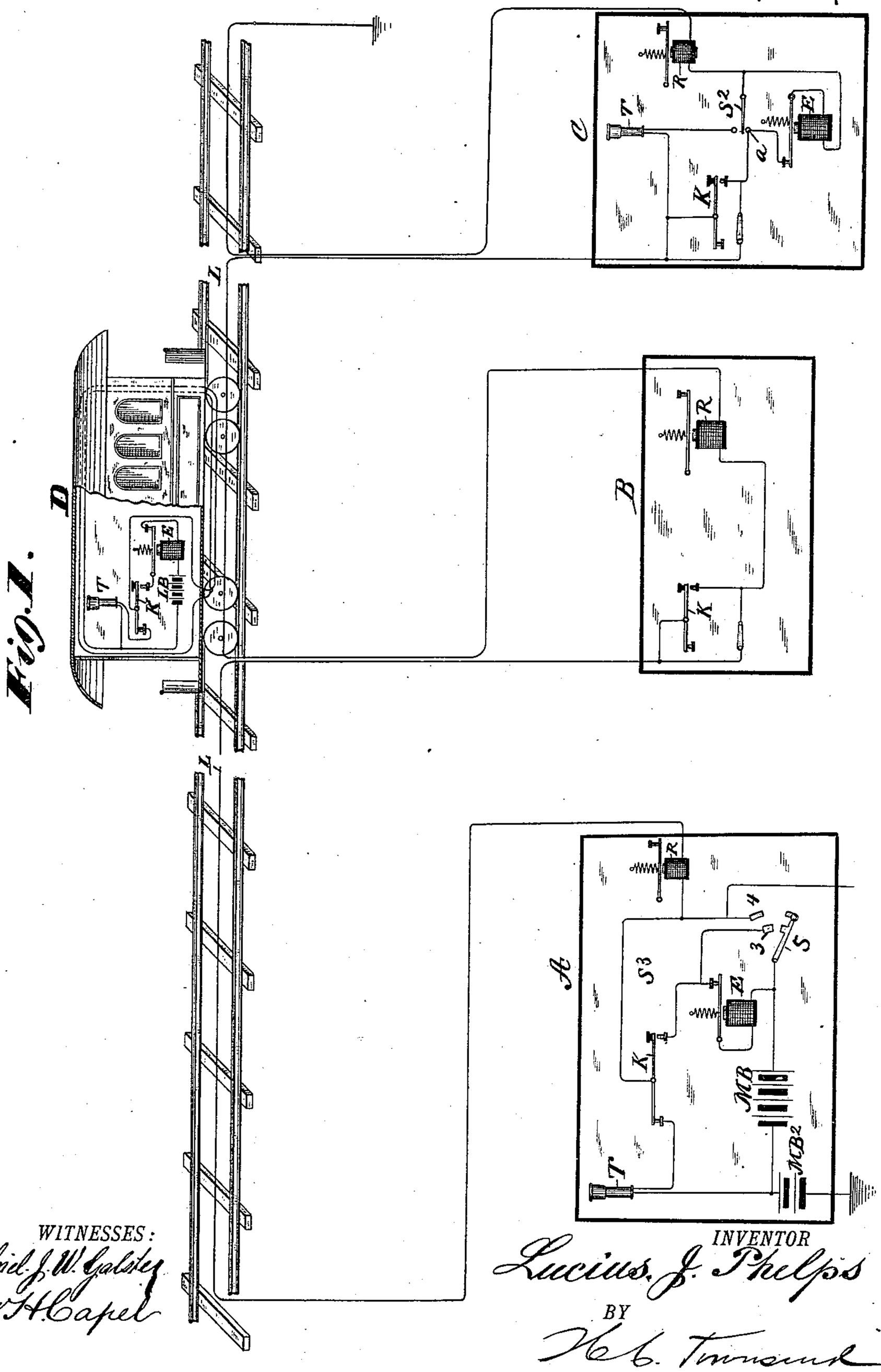

Fig. 1.

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RAILWAY TELEGRAPHY.

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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 Railway Telegraphy, of which the following is a specification.

My invention relates to apparatus whereby an ordinary telegraph line or circuit may be readily utilized for two purposes, to wit: for the purpose of maintaining communication with a railway-train in motion or at rest by the principle of electric induction and for its ordinary purpose of telegraphing between a terminal station and ordinary way stations or offices or between any stations.

My invention contemplates the employment of an apparatus for communicating with the railway-train by what I term "vibration-signals"—that is to say, signals whose elementary portions consist each of a series of electrical pulsations, vibrations, or waves of any desired kind and of any desired rapidity, preferably, however, of such rapidity as to produce the sensation of a musical tone. In accordance with this system the characters of the Morse alphabet would be represented by musical tones or sounds corresponding in their duration to the dots and dashes or elementary portions of the Morse characters. The electric vibrations might be either intermittent, undulatory, or pulsatory, and may be either direct or alternating—that is to say, all of the same polarity or successively of opposite polarity. I prefer, however, to use direct current-vibrations, and have herein described an apparatus adapted to produce currents of such kind for use in the train-telegraphing. The special object sought in employing vibrations of such character is to make the ordinary apparatus in the line-circuit at any station—such, for instance, as Morse relays—respond more readily to the vibration-signals, not by themselves vibrating, but by moving between their stops in the same way that they move when used in receiving signals sent by an ordinary Morse key controlling the circuit of a battery or source of continuous current connected directly to the circuit in the ordinary way.

I have herein shown my invention as carried out in connection with a line-circuit, the way and terminal stations on which are equipped with ordinary Morse keys and Morse relays or receivers.

One of the objects of my invention is to enable the operators at the way-stations of the Morse circuit to read on their Morse receivers the messages sent by vibration signals to the train.

A further object of my invention is to permit the way-stations on the Morse circuit to communicate with each other in the ordinary way when such Morse circuit is not employed for the train-service.

A further object of my invention is to permit the operators at way-stations to communicate with the train.

Other objects and results incident to my invention will appear from the subjoined description, taken in connection with the accompanying drawings.

The novel combinations and arrangements of apparatus will be more particularly specified in the claims.

Referring to the drawings, A indicates the terminal stations—such, for instance, as a train-dispatcher's office; and B C indicate, respectively, two way-stations on a Morse circuit composed of a line-wire, L, which wire is carried beside, between, or over the tracks of the railway in proper position to be in such proximity to induction apparatus on a railway-vehicle that vibration-signals produced on said circuit will by induction set up corresponding vibrations on a vehicle circuit or wire, and will operate suitable apparatus thereon:

D indicates a vehicle—such, for instance, as a railway-car—carrying a coil of wire arranged, for instance, after the manner described in my prior patent, No. 312,506, and having its terminals connected with apparatus for transmitting and receiving vibration-signals. The apparatus on the vehicle for this purpose is herein shown as consisting of an ordinary telephone-receiver, T, a Morse key or other transmitter, K, a battery or other generator of electricity, L B, and a means for throwing the current of said battery into electric waves or vibrations.

For the sake of simplicity I have illustrated

the vibrator as consisting of an electro-magnet, E, through whose coils the current from the battery passes, and whose back contact-stop for its armature-lever is also included in the circuit, so that when current is admitted through the magnet and armature the armature will vibrate and throw the battery-current into rapid vibration. These devices are connected into the car-circuit in obvious manner.

The key K, when depressed, admits the vibratory current to the car-circuit, and the electrical vibrations on such circuit induce vibrations on the line L, which are received upon suitable apparatus.

For receiving signals on the car a telephone is preferably employed, said telephone being placed in circuit in any of the ways ordinarily employed with telegraph apparatus.

The devices and circuits on the car D are typical only of means for receiving the signals by induction from the line and for transmitting messages by induction to the line. Any other arrangements might be used for the purpose—such, for instance, as those indicated in my Patent No. 334,187.

At the station A, M B indicates a generator of electricity—such, for instance, as a galvanic battery—which may be placed on the circuit of the line L, either through a vibrator for throwing the current into vibrations, pulsations, or undulations, or may be connected directly to said line-circuit, the vibrator being at such time shunted or cut out of circuit. In this instance, also, I have shown for the sake of simplicity a vibrator consisting of an electro-magnet vibrator similar to that shown on the vehicle, and connected into the circuit with the battery and the front contact of the key K at the station. The key itself is connected to the line-circuit through an ordinary Morse relay, R, as shown, and the back contact of the key is connected to ground through a telephone-receiver, T, such as is ordinarily employed on speaking-telephone circuits.

The receiver T is that on which the vibration-signals used in telegraphing from the train are received, and, as will be observed, said receiver is in the normal circuit to earth when the apparatus is not in use at station A. In the normal circuit is also included a battery or section of battery, M B^2, which is always in operative connection with the line, and which serves to charge the same, so that, as will be presently described, any interruption of the line-circuit at a distant station will operate to cause a loud sound in the telephone-receiver, thus "calling" the operator at the station A.

S indicates an electric switch of any suitable construction, having the two contact-points 3 4. Contact 3 is connected to the front stop of key K, and contact 4 is connected directly to line, as indicated, so as to include in the circuit of the line the receiver R.

The switch S, being connected to the main battery M B, may be moved to make contact with stop 3, so as to shunt the vibrator and at the same time connect the battery to the front stop of key K, in which case key K may be employed for sending ordinary Morse signals in the ordinary way by making and breaking the circuit of the battery M B. When the switch S is turned still farther, so as to make contact with the button 4, battery M B will flow directly to line through the receiver R, and a circuit is thus established for said battery over the line and through the instruments at the way-stations independently of the condition or position of the key K and its attachments.

At way-stations B, I have shown an ordinary Morse key, K, and the usual shunting-switch for the same, said key being introduced directly into the Morse circuit of line L. Also included in said circuit is the relay R, upon which the operator at station B receives signals sent by the key and battery in the ordinary way either from station A or from station C.

At station C, I have shown also an ordinary Morse key and shunting-switch and a receiver, R. In addition to these devices is a telephone-receiver, T, that may be employed for the purpose of reading signals sent from the railway train or vehicle to the office A, and which may be introduced into circuit for this purpose by means of a switch, S^2, operating in obvious manner. At the station C is also placed a vibrator, by whose action the continuous flow of current from the battery M B at station A may be thrown into pulsations or vibrations such that they may serve to transmit messages to the car D by the vibration-signaling system. The vibrator at C is here typified by an electro-magnet vibrator, which may be shunted from circuit by throwing the switch S^2 to make contact with the button *a*. When the vibrator is thus shunted the key K and its attachments are included in the Morse circuit L. In such position of the switch the circuit through station C is the same as through way-station B. If the switch be turned to the position shown in the drawings—that is, between its two contact points—any current flowing through the circuit L will have to pass through the vibrator and through the relay R.

The relays R are to be properly constructed or adjusted so that, when vibration-signals are sent from the station A, the relay-armatures will remain against their front contacts during the continuance of any series of vibrations representing a dot or dash of, say, the Morse alphabet, while on the interruption of said series of vibrations the armature will be thrown against its back stop in the ordinary way. This adjustment may be effected by adjusting the retractors for the armatures to exert small retracting force and by making the armatures quite heavy. It is obvious that in order to secure such result it is desirable that the natural rate of vibration of the armature shall be different from the rate of the electrical vibrations or pulsations on the main circuit.

The apparatus is employed in the following manner: In the normal condition of the appa-

ratus the devices at station A are in the position shown at station B. The switch of the key is closed so that the circuit through the station is that of an ordinary Morse circuit. At station C the switch of the key is also closed and the switch S^2 is on its stop *a*, so that the telephone T and the vibrator are out of action, and the circuit at station C is practically the same as that of any ordinary Morse circuit. At station A it will be observed that there is no circuit for battery M B. If, however, the key K be depressed, intermittent currents will be sent through its front stop from battery M B over the line L, and such intermittent currents or electrical vibrations will, by induction, act upon the telephone-receiver T on the car D, which receiver is normally in circuit on the car. By closing and opening the key K the message may be sent to the car by vibration-signals, and the same message may be read by the operators at stations B and C on their receivers R, which, as before explained, are adjusted to respond in the same way to the vibration-signals that they would respond if the battery M B were in direct connection with the line L and were controlled by the key at station A in the ordinary way. When the key K is against its back-stop, the operator on the car D may send a message by operating his key, such message being transferred by induction from the car to the line-circuit L, and being received on the telephone T at station A.

If the operator at, for instance, station B desires to communicate with the operator at station C, or with the operator at A, in the same way that he would do if his station was on an ordinary Morse circuit, he opens the circuit and operates his key K, thus making and breaking the circuit over the line L of the battery M B^2, which is the "call" battery of the system at the station A, and which produces sufficent sounds in the telephone T to call the operator. The operator at A, in obedience to the direction of operator at B, thereupon throws the switch S so as to make connection with point 4, thus placing the battery M B on the circuit L, so that when the operator at B moves his key the receivers R at the various stations on the circuit will respond and act after the manner of ordinary Morse relays. The operator at C can call the station A in the same way, if he desire to have battery M B connected directly to the line L. When the battery is so connected he can, by operating his key K, send a message to any way or terminal station on the Morse circuit thus formed over the line L.

If the operator at station A desires to communicate with stations B and C as he would over an ordinary Morse circuit, he turns the switch S to make contact with the point 3 only, thereby short-circuiting the vibrator, and at the same time connecting the battery M B to the front stop of the key K.

The apparatus at station B of the Morse circuit is only capable of receiving the vibration-signals sent to the train. The operator at that station cannot signal to the train and cannot ordinarily read the messages sent from the train, owing to the fact that the vibrations on the line received by induction from the car D are usually comparatively weak and require a telephone or similar sensitive instrument in order that they may be readily received.

The operator at station C may communicate to the train by means of vibration-signals, and he does this by throwing into vibration the battery M B at the station A. When he desires to communicate with the train directly, he gives notice to the operator at station A, who turns the switch S so as to connect the battery M B directly to line L. The operator at C thereupon turns his switch S^2 into the position shown, so as to break the shunt around his vibrator. Under this condition of the apparatus, whenever he closes his key the circuit of battery M B over line L is through the vibrator at C, and such vibrator breaks up the current into the intermittent currents, producing a series of vibrations, which by induction are transferred to the vehicle and received in the telephone T in obvious manner.

By operating the key K a message may be sent from station C to the vehicle over the line L by the vibration-signaling method. This same message may obviously be read at station A on the Morse receiver R at that station.

When the operator at station C throws his telephone T into circuit, he may read the message sent from the car.

The vibration-signals sent by key K at station A are, however, ordinarily too strong to permit the telephone T at station C to be used as a receiver with comfort, and it is therefore desirable to receive them at station C upon the relay R, as already explained.

In calling station A, the operator at C may do so by the action of his vibrator upon the current from battery M B^2, thus producing a musical tone in the receiver T, which would be more plainly heard than a series of ticks such as would be produced when the vibrator is not in action. To call by means of the vibrator, he simply throws his switch into the position shown, and after opening his key manipulates such key in the ordinary way, the vibrator during each period of closure operating to throw the current of the call-battery M B^2 into vibration.

I do not limit myself to any particular construction of switch apparatus for throwing the vibrators into and out of operative connection and for connecting the battery directly to line, inasmuch as the same effects may be produced by numberless variations in the connections and by various modifications of switch devices, as is well understood in the art.

What I claim as my invention is—

1. The combination, substantially as described, in a railway inductive signaling apparatus, with a telegraph-wire and its instruments, as way and terminal stations, of a railway-vehicle having railway signaling, transmitting, and receiving instruments operating to receive and transmit messages by induction

to and from said telegraph-wire, a station on said line-wire, and at said station a battery, M B, connected directly to the line, means for throwing the current of said battery into vibrations on the line, and a key controlling the passage of the vibratory battery-current over the line-circuit for sending messages to the vehicle, as and for the purpose described.

2. The combination, with a Morse telegraph-wire and the instruments thereof at one or more stations on the wire, of a vehicle having railway signaling, transmitting, and receiving instruments operating to transmit and receive vibration-signals to and from the wire by induction and at a station having its instruments in the direct circuit of the wire, a battery and vibrator connected directly to line, and a key for sending messages to the vehicle over the wire by the vibrating currents of the battery circulating over said wire, as and for the purpose described.

3. The combination, with the line L, of a vehicle having railway signaling apparatus operating to transmit signals to and from the line by vibration-signals transferred to and from the vehicle by induction, a station having a vibrator and battery, a key controlling the direct circuit of the line through said vibrator and battery, and switch apparatus for throwing the vibrator out of action and connecting the battery directly to line, so that its current will flow over the line-circuit, as and for the purpose described.

4. The combination, with a telegraph-line, L, of a vehicle having railway signaling, transmitting, and receiving instruments operating to transmit and receive signals inductively by vibration-impulses transferred to and from the line-wire, a station on the line-wire, a generator of electricity at the station, means for producing on the line electrical vibrations consisting of currents flowing from said generator directly over the line-circuit, transmitting and receiving instruments at said station for the induction railway-signals, and way-stations provided with receiving-instruments R, included in the direct normal-line circuit and responsive to the message sent by the vibration-signals, as and for the purpose described.

5. The combination, in a railway-telegraph, of a telegraph-line, L, a railway-vehicle having transmitting and receiving instruments operating to transmit and receive signals produced by a series of electrical vibrations or pulsations acting inductively to or from the line, a station having transmitting and receiving instruments for such vibration railway-signals, and one or more stations, B, placed in the direct-line circuit and provided with Morse receiving-relays responsive to the vibration railway-signals sent from the fixed station to the train, as and for the purpose described.

6. The combination, with the Morse circuit L, of a railway-vehicle having transmitting and receiving instruments operating to transmit and receive messages by vibration-impulses transferred inductively to and from the line, a station having transmitting and receiving instruments for the induction railway-signals, a battery at said station, means for connecting said battery to line directly or through the contacts of a vibrator in the direct-line circuit, and at another station on the line a vibrator, means for throwing the same into the direct-line circuit, and a transmitter controlling the circuit, as and for the purpose described.

7. The combination, with a telegraph-line, L, of a vehicle having transmitting and receiving apparatus operating to transmit and receive signals by electrical vibrations or impulses transferred inductively to and from the line, a station, A, provided with a generator of electricity having direct connection to line, a vibrator and a key, and a station, C, on the line, provided also with a vibrator having direct connection to line for throwing the current from the generator to the first-named station into vibration, as and for the purpose described.

8. The combination, with the line L, having one or more telegraph way-stations, of a vehicle having transmitting and receiving instruments operating to transmit and receive signals by vibrations or impulses transferred to and from the line by induction, a station connected to the line L and provided with a battery and vibrator having direct connections to line for producing vibrations on the circuit, a telephone in the normal-line circuit at the station, and a call-battery in the normal-line circuit with the telephone.

9. The combination, with the line-circuit L, of a vehicle having transmitting and receiving instruments for transmitting and receiving Morse signals by a series of vibrations or impulses transferred inductively to and from the line, a way-station, C, in the direct-line circuit, and at said station a vibrator, a Morse key, a receiving-relay, and switch apparatus for throwing the vibrator-contacts into and out of the direct-line circuit.

10. The combination, with the line L and a vehicle having an induction-circuit thereon carried in part in proximity to the line of railway signaling, transmitting, and receiving apparatus connected with such induction-circuit, of means at a station on the circuit for sending messages by vibration-signals to the train and a way-station on the direct circuit of line L, having a receiving-instrument, R, on the direct-line circuit for receiving the heavy vibration-signals sent on to the direct line, and a telephone, T, for receiving the signals induced on the line from the vehicle.

11. The combination, with the Morse telegraph-circuit L, of a station, A, having apparatus for sending messages by vibration-signals on said circuit, a railway-car station having an instrument for receiving said signals by induction, a way station, C, placed on the Morse circuit and having Morse transmitting and receiving apparatus of the ordinary kind,

a vibrator at said station, and a switch for throwing the contacts of said vibrator into and out of the direct-line circuit.

12. The combination, with a Morse telegraph-circuit, L, of a station, D, having instruments for receiving signals and transmitting signals over said circuit by induction, a way-station in the direct-line circuit having ordinary Morse transmitting and receiving apparatus, a vibrator at a station, A, a battery, a switch for throwing the vibrator out of direct connection with the line and connecting the battery directly to the line-circuit, a telephone-receiver at such station normally in circuit and serving as a call-receiver, and a battery, as M B^2, on the normal circuit to permit the way-station to call the station A on the telephone.

13. The combination, with a telegraph-line, L, having Morse way-stations in direct circuit thereon, a station, as D, having instruments for receiving and transmitting signals by induction to and from said circuit, a battery at a station, as A, a switch for connecting the battery directly to line when the way-stations are to telegraph to one another or to station A, a vibrator for throwing the battery-current into vibration over the line-circuit when the station A is to communicate with the induction-station, and a switch for throwing said vibrator out of circuit to permit the station A to use the battery M B on the circuit, in the manner described.

14. The combination, with the telegraph-line L, having way and terminal offices equipped with ordinary Morse apparatus, of a station, D, railway signaling, transmitting, and receiving instruments connected to devices in inductive proximity to said line, as described, a battery, M B, a vibrator having contacts in the line-circuit for throwing the battery-current into vibrations over the circuit, and a switch for connecting the battery to the circuit independently of the vibrator.

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.