(No Model.) 2 Sheets—Sheet 1.

L. J. PHELPS.

RAILWAY CAR TELEGRAPH.

No. 312,506. Patented Feb. 17, 1885.

Fig. 1.

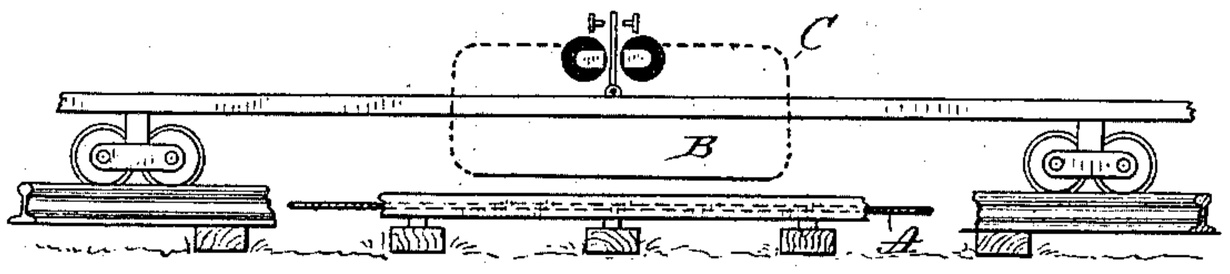


Fig. 3.

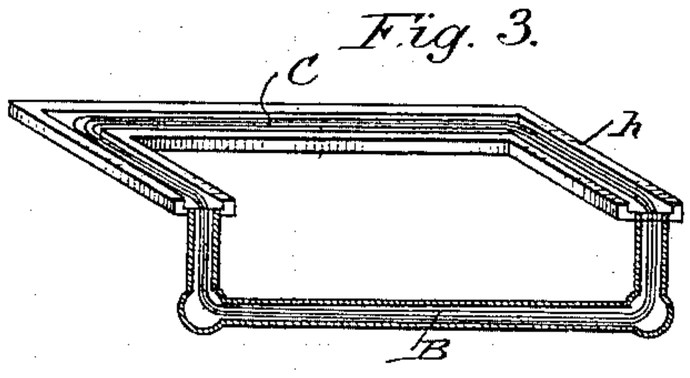
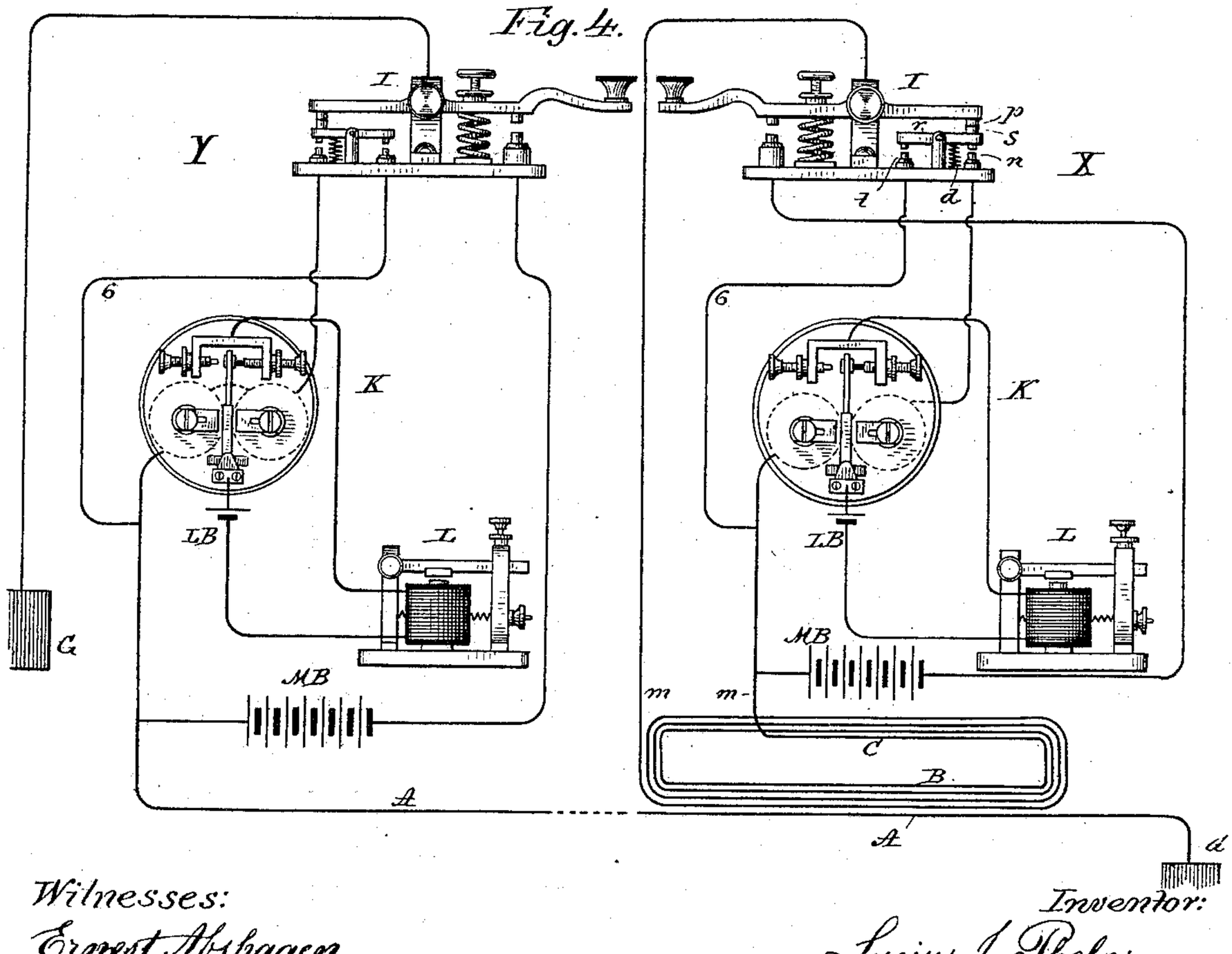


Fig. 4.



Wilnesses:
Ernest Abshagen
Thos. Toomey.

Inventor:
Lucius J. Phelps.
By his Attorney: H. C. Townsend

(No Model.)

2 Sheets—Sheet 2.

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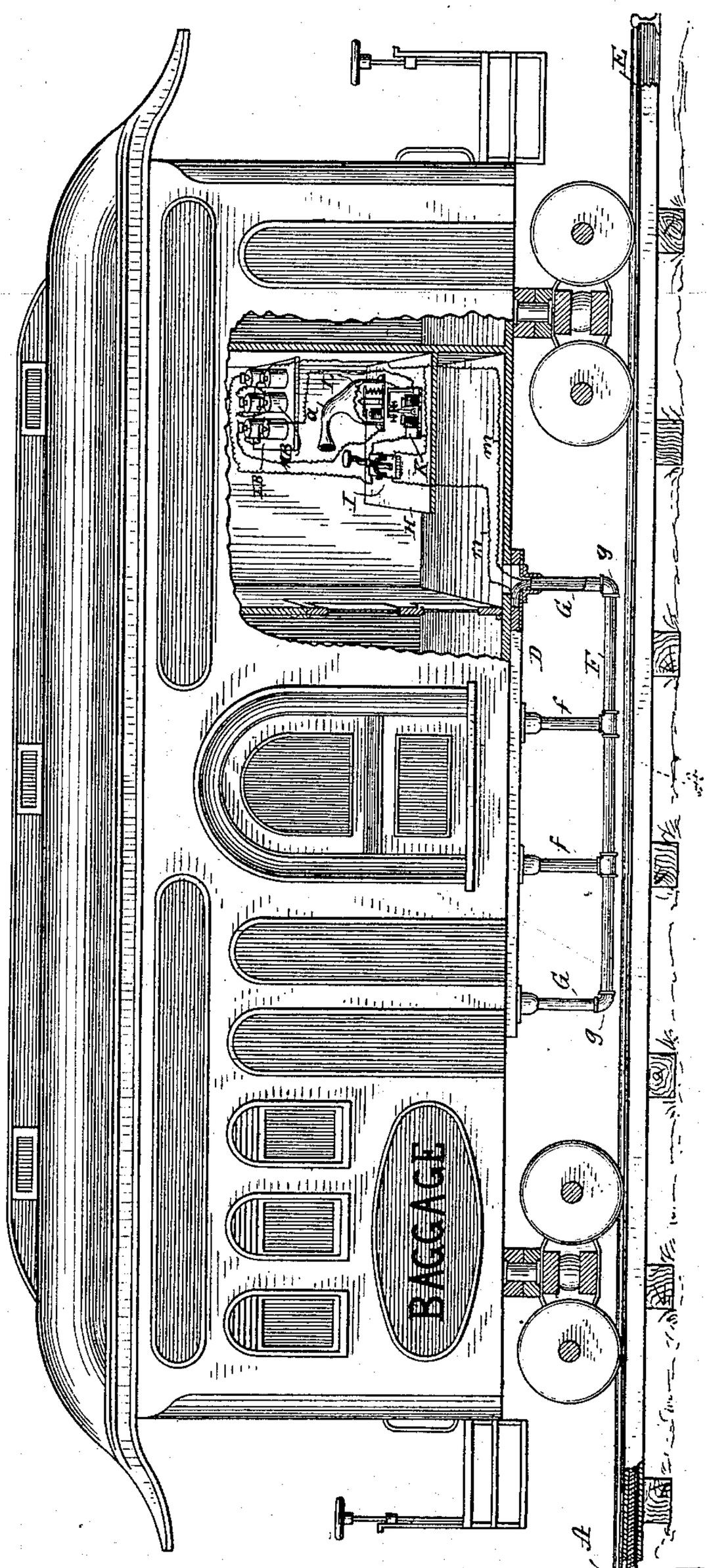

Fig. 2.

Witnesses:
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By his Attorney: H. C. Townsend

UNITED STATES PATENT OFFICE.

LUCIUS J. PHELPS, OF NEW YORK, N. Y., ASSIGNOR TO THE RAILWAY TELEGRAPH COMPANY, OF NEW YORK.

RAILWAY-CAR TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 312,506, dated February 17, 1885.

Application filed November 18, 1884. (No model.) Patented in England December 20, 1884, No. 16,735; in France December 20, 1884, No. 153,448, and in Belgium December 22, 1884, No. 49,394.

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 Communicating to and from Railway-Vehicles by Electricity, of which the following is a specification.

In a prior application for patent filed by me March 13, 1884, No. 124,009, I have described a method of communicating to and from a moving vehicle by induction transfer, one element of the induction apparatus being a conductor extending along the way or path over which the vehicle travels, and the other being upon the vehicle and carried in closed circuit and in suitable continuous inductive proximity to the line-conductor.

My present invention constitutes an improved means of carrying out the invention described in my prior application, and, like the apparatus described in my prior case, permits communication to take place without the employment of a rubbing or traveling contact.

My present invention consists, first, in placing upon the moving vehicle a conductor, which is parallel or substantially parallel to the line-conductor, and has its ends or terminals connected in closed circuit through a receiving or transmitting apparatus, according as signals are being received or transmitted.

My invention consists, further, in forming said conductor of two or more strands, making up a portion of a coil, and having their return portions located out of inductive proximity to the line-conductor, so as to prevent conflict of action from the induction of the line upon both portions of the coil.

My invention consists, also, in a system of signaling or communicating by induction transfer to and from a moving vehicle, in which the receiving-instrument upon the vehicle or connected to the line-conductor consists of a polarized relay whose armature is unbiased, so that it may retain the position in which it is placed by a current of one polarity until a succeeding current of the opposite polarity affects it, in combination with a suitable transmitter and source of electricity controlled by said transmitter, whereby, through a simple make and break or reversal of the current from said source by the transmitter each of the characters making up a signal may be transmitted through the simple reversal of current produced by the inductive action between the line-conductor and the apparatus on the car, on the occurrence of the make and break or reversal of current in the line, or the car-circuit, as the case may be.

My invention consists, further, in a novel means of preventing disturbance in the adjustment of the relay, through the action of the extra current developed during the operation of the transmitter at the same station with the relay, and consists in momentarily forming a shunt around said relay, as will be hereinafter more fully described.

My invention consists, further, in certain details of construction and combination of devices, more particularly hereinafter described, and specified in the claims.

In the accompanying drawings, Figure 1 is a diagram illustrating the principle of my invention. Fig. 2 is a side elevation of a railway-car equipped with apparatus in accordance with my invention. Fig. 3 is a perspective view of the coil detached from the car, the tubing or casing for the coil being shown partially in section. Fig. 4 is a diagram of the circuits and connections.

Referring to Fig. 1, let A indicate a conductor of electricity extending along a line of way over which a vehicle of any kind may travel, and B a conductor carried by a vehicle and stretched or supported in substantial parallelism with the line-conductor and in suitable inductive proximity thereto. If the ends of the conductor B be joined in closed circuit by a return-conductor, as C, it is obvious that on the well-known principle of current-induction a break, reversal, or other change of electric condition in the line A will produce by induction a current in the conductor B on closed circuit, which current will travel on said circuit and will affect any instrument therein. At the time current begins to flow

in A, current will flow in B in one direction, and when current ceases to flow in A current will flow in B in the opposite direction. If, therefore, a make-and-break transmitter be connected to circuit A, its signals may be readily received on a polarized relay in circuit with B if said relay have an unbiased lever, so that at the beginning of a signal the lever will move in one direction and will retain its position until the current in the opposite direction produced by the break of the line-circuit flows. If the conductor B is moving, the same action can take place without interruption, because the inductive relation of B and A remains unchanged. The same action, evidently, may be produced in reverse way by opening and closing the circuit of B if the latter be in circuit with any source of electricity. The same action may obviously be produced by the well-known expedient of reversing the current on A or on B, according as it is desired to produce effects in the receiving apparatus connected to one or the other. If it be desired to re-enforce the effects, two or more strands or conductors like B may be employed, connected in continuous circuit like a coil of wire, the strands B then forming, in effect, one portion or side of a coil, and the return portions C the other side of a coil, which is in effect flattened or straight on its side B.

Having described the general principle and simplest embodiment of my invention, I will proceed to describe its application to a railway in more specific terms.

Referring to Fig. 2, D is the bottom of a railway-car moving on a line of rails, E.

At F is indicated a hollow pipe or conduit, say thirty feet in length, and formed, if desired, of ordinary gas-pipe. At its ends said pipe is connected with the hollow depending pipes G, which, in conjunction with the standards or rods *f*, support said pipe F beneath the car-bottom at a distance of four inches, more or less, from the box or other pipe containing the line-conductor A. The pipes G may also be ordinary cast-iron pipes, and, with the arms or rods *f f*, are firmly secured to the car-bottom by any suitable means. Curved elbow couplings or joints are provided at *g g*, and openings are provided at the upper ends of the tubes or pipes G, preferably in their sides. Through the pipes G F are carried a number of strands of insulated wire, formed, preferably, into a continuous coil, which is carried out through the ends of the pipe G and along the car-bottom to one side, as indicated in Fig. 3, at which portion it is properly secured in place, and is preferably inclosed in a wooden or other boxing, *h*.

The purpose in carrying the portion C of the coil to one side or out of plane with the conductor A and portion B is to remove it as far as possible from the inductive influence of the conductor. The same end is of course also secured to greater or less degree by placing the return portion C of the coil at as great a distance as practicable above the conductor.

For the purposes of my invention I find that No. 8 copper wire is suitable for the line-conductor, and that very good results may be obtained by the employment of, say, twenty turns of No. 10 insulated copper wire in the conductor upon the car.

The two ends of the coil of wire upon the car are indicated at *m m*. They are carried beneath the car-flooring or in other suitable manner to an operator's table, (indicated at H,) upon which are placed suitable transmitting and receiving apparatus, consisting, in the present instance, of a Morse key, I, a polarized relay, K, and a sounder, L, the relay, key, and a suitable battery or generator being connected to the terminals *m m*, as shown in the diagram Fig. 4, while the sounder is controlled by the relay in the usual way.

The batteries or sections of battery or other generator may be placed in a suitable cupboard near the car-roof, as indicated, and connections taken to the apparatus on the operator's table in the usual way.

The connections of the apparatus upon the car and of the apparatus used at a train-dispatcher's office or other fixed station are illustrated diagrammatically in Fig. 4.

At X is shown apparatus supposed to be upon the car, and at Y apparatus placed at a fixed station, such, for instance, as a train-dispatcher's office.

M B at X indicate a galvanic battery, storage-battery, or other source of continuous or straight electric current placed in the circuit from one terminal, *m*, of the vehicle, conductor, or coil to the other terminal, through the front contact of the Morse key I, so that by depressing the key a current will flow in the coil, and by induction set up a current in one direction on the line A, while by opening the key at the termination of the dot or dash a current will be induced on the line in an opposite direction.

The polarized relay indicated at K is by preference of the well-known form known as the "Siemens" or "Siemens-Halske" relay, and it controls in the usual and well-known manner indicated the circuit of the sounder L and local battery L B. The coils of the relay are in a circuit from *m* to *m* through contacts closed when the key is at rest or on its back contact. The connection from the relay is to a stop, *n*, between which and the contact *p* on the key is interposed the double contact *s* on a lever, *r*, the office of which latter is by its stop *t* to close a shunt, 6, around the coils of the relay. The lever *r* is provided with a spring, *d*, which draws it against the contact *t*, when the key I is closed; but the retractor for the key is of sufficient strength to overcome the spring *d*, when the key is relieved of pressure by the hand of the operator. When, therefore, the key is at rest, there is circuit from the terminals *m m* through the key, the

contacts and stops *p s n*, and the coils of the relay, so that the latter may be operated by the reversed currents induced on the conductors B by making and breaking of the line-circuit A through suitable apparatus at a station, Y, or by the induced currents upon A set up through the operation of the key upon another vehicle traveling over the same conductor A. The shunt-circuit 6 around the relay is then broken at *t*. When the key I is closed, the circuit of the relay is broken at two places by the separation of the contacts *p s* and of *n s*. When, after the closing of the circuit of the battery M B, the key is opened, a spark occurs, produced by extra current, which, with keys of the ordinary kind, would be liable to pass through the back contact of the key to the relay and derange the adjustment of the latter. By providing, however, the shunt 6 and circuit-controller therefor, a path for such extra current is provided around the relay, its path being through the points *p s*, (which come together the moment that the front contact of the key is opened,) lever *r*, and contact *t*. The relay is therefore unaffected. As the key settles back to its position of rest, however, the contact at *t* is broken, and the circuit of the relay is again established through the contact *n*.

The apparatus at the fixed station Y is similar to that upon the car, and the key, relay, and battery are connected to the circuit formed of the conductor A and an earth or return conductor in the same way that the similar apparatus upon the car is connected to the circuit of the conductor B.

From what has been already said the operation will be obvious and need not be described further in detail. The conductor B moves in continuous inductive proximity or relation to the line-conductor A, and currents in either may be induced by the flow and cessation or decrease of current in the other. The relays are normally in circuit and rest normally against their insulated stops. The depression of a key—as, for instance, that at Y—causes a current to flow upon line A, which induces a current in one direction on the conductor B, and causes the relay to close the circuit of the sounder. The opening of the key by breaking the flow of current in A causes an induced current to flow in B in the opposite direction, so as to throw the relay-armature back to its normal position, thus breaking the circuit of the sounder. I sometimes find it advisable to furnish the latter with a sound collector or resonator, (indicated at *a*, Fig. 2,) which is made to surround the whole sounder or its stops only and to convey the sounds to the ear of the operator.

I do not limit myself to any particular kind of relay, nor when a polarized relay is employed to any particular form of the latter. The form and construction of the key or transmitter as well as the location of the conductors A B may also be indefinitely varied without departing from the essential characteristics of the invention claimed. For instance, as described in my prior application, the conductor might be suspended upon poles or posts, and the conductor B might be carried on the frame of the car.

The conductor B, in one or more strands parallel to the conductor A, is obviously applicable to securing the desired inductive transfer from the line to the car for any method of signaling or communicating, and is a substitute for a traveling circuit-closer for whatever purposes the latter may or might be used.

What I claim as my invention is—

1. The combination, substantially as described, of a line-conductor, a vehicle movable in a direction parallel with the same, and a conductor upon the vehicle substantially parallel with and in inductive proximity to the line-conductor, the ends of said vehicle-conductor being joined in closed electric circuit.

2. The combination, in a system of electric transmission or transfer to and from a moving vehicle, of a line-conductor, one or more strands of conductor placed upon the vehicle, and arranged substantially parallel with but in close inductive proximity to the line-conductor, and return connections of said strands removed as far as practicable from close inductive proximity to the line.

3. The combination, with a line-conductor extending along a track, of a coil of wire, as B C, carried upon a vehicle moving over said track, and having its portion B parallel or substantially parallel with the line-conductor.

4. The combination, with a line-conductor extending along a railway, of a coil of wire suspended beneath a car or vehicle, and having one portion, as B, parallel or substantially parallel to the line-conductor.

5. The combination, substantially as described, of the line-conductor, the vehicle-conductor, and the containing pipe or conduit suspended beneath the car and connecting with depending pipes or conduits, as G G, as and for the purpose described.

6. The combination, with the line-conductor, of the vehicle-conductor, having its return portions carried to one side out of plane with the line-conductor.

7. In a system of electric induction transmission or transfer to and from a moving vehicle, the combination of a line-conductor, a vehicle-conductor, and a polarized relay in closed circuit in the vehicle-conductor.

8. The combination, substantially as described, of a line-conductor, a vehicle-conductor, a transmitting apparatus for sending currents through the closed circuit of the vehicle-conductor, and a polarized relay connected with the line-conductor.

9. The combination, with the line-conductor, of a closed circuit-conductor upon the vehicle, a generator and circuit-breaker upon

the vehicle, and a polarized relay connected to the line-conductor.

10. The combination, in a system of transmission by induction to and from a moving vehicle, of a transmitter, a relay and contact-points controlled by the transmitter for momentarily closing a shunt around the relay when the circuit closed by the transmitter is broken.

11. The combination, in a system of transmission to and from a moving vehicle, of a transmitter for opening and closing the circuit from a suitable source of electricity, a polarized relay in a back contact-circuit for the transmitter, a shunt or branch around the relay, and a circuit-controller therefor, governed by the transmitter, and serving to close a circuit around the relay at the instant of breaking off the generator-circuit.

12. The combination, in a system of railway-telegraphing by induction, of a polarized relay or transmitter, and a supplemental circuit-closer and breaker having three points of closure, one controlling a shunt around the relay, and the other a circuit through the relay and transmitter, as and for the purpose described.

13. The combination, in a system of railway-telegraphing, substantially such as described, of a polarized relay, a Morse key, a supplemental circuit-closer playing between two contacts, one of which is on the key, and a third contact for said lever forming a portion of a shunt around the polarized relay.

Signed at New York, in the county of New York and State of New York, this 21st day of October, A. D. 1884.

LUCIUS J. PHELPS.

Witnesses:
THOS. TOOMEY,
WM. H. BLAIN.