(No Model.) 2 Sheets—Sheet 1.

# F. P. BENJAMIN.

## SIGNALING SYSTEM.

No. 461,809. Patented Oct. 27, 1891.

Fig. 2.

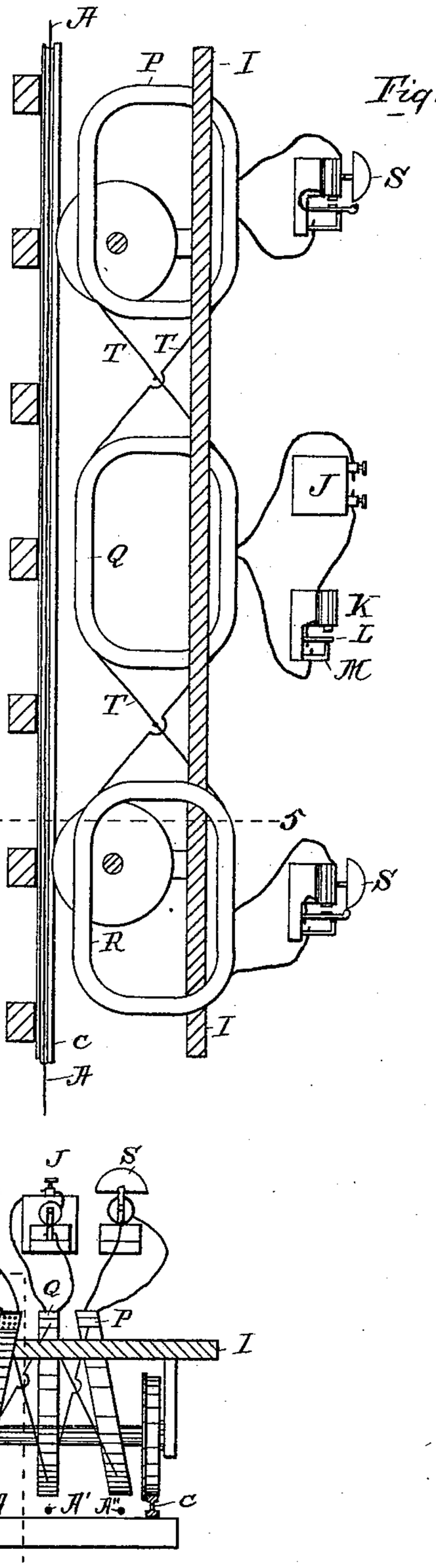


Fig. 1.

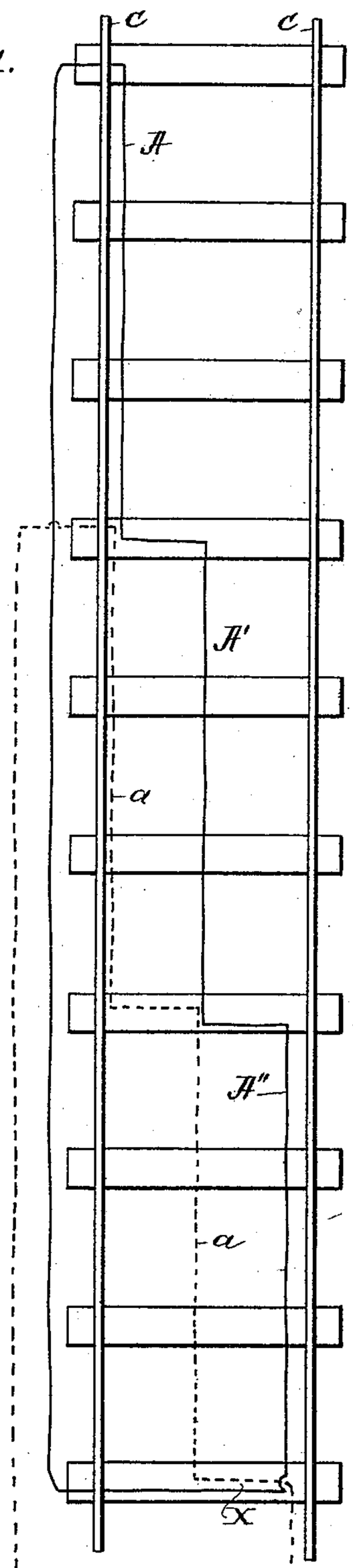


Fig. 3.

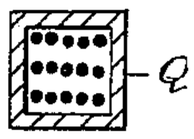


Fig. 4.

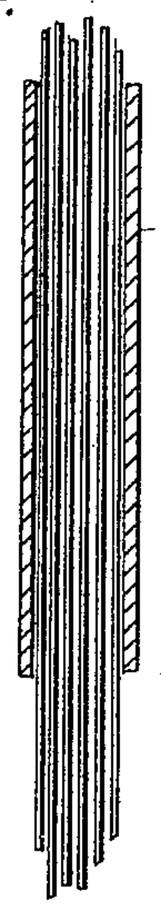


Fig. 5




Witnesses:

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Frank P Benjamin

(No Model.) 2 Sheets—Sheet 2.

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## SIGNALING SYSTEM.

No. 461,809. Patented Oct. 27, 1891.

Fig. 8.

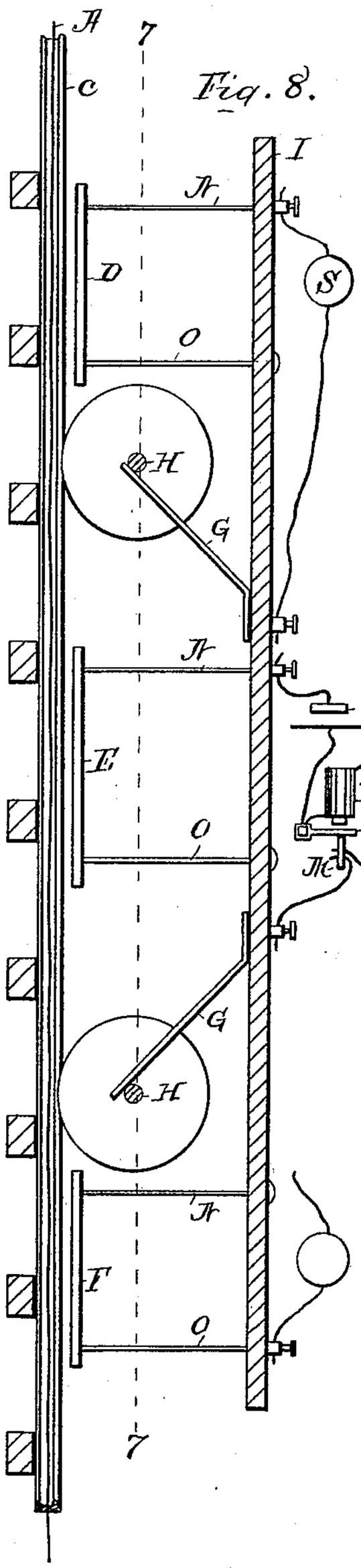



Fig. 7.

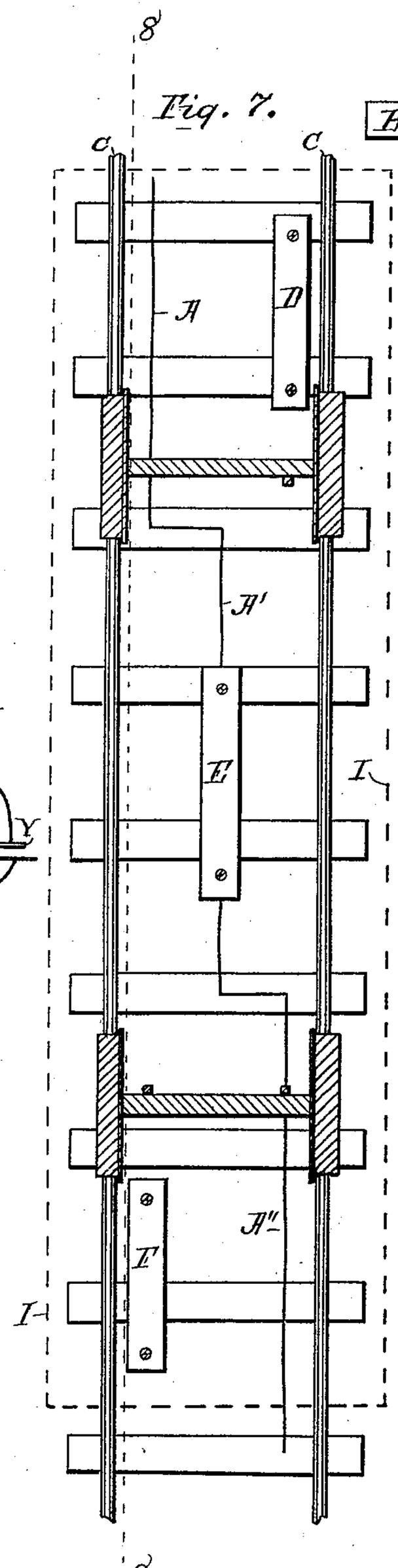
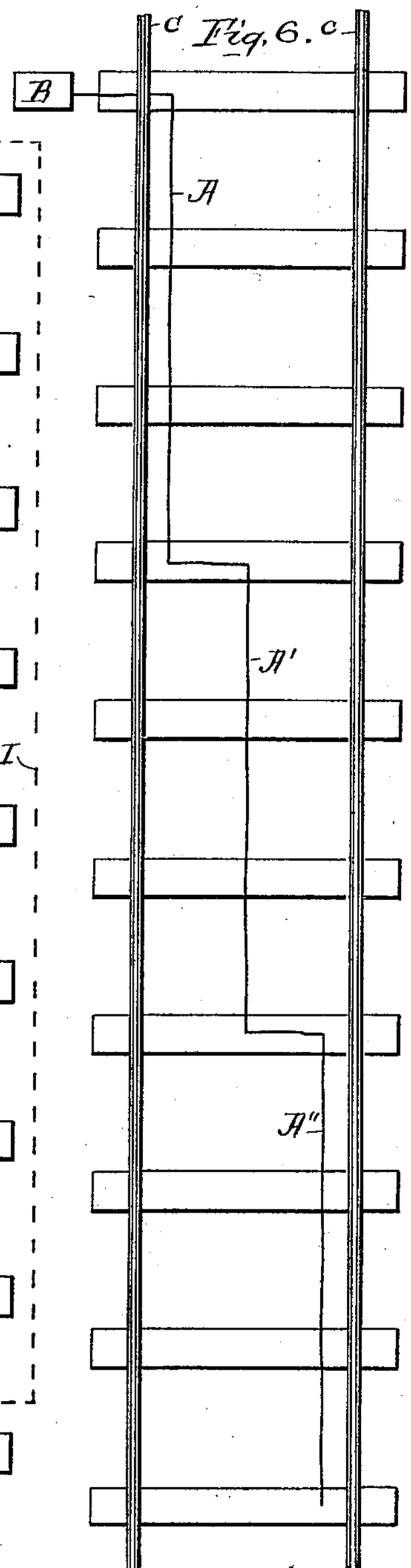



Fig. 6.




Witnesses:

Chas. B. Burl

Robert Bell

Inventor:

Frank P. Benjamin

# UNITED STATES PATENT OFFICE.

FRANK P. BENJAMIN, OF NEW YORK, N. Y.

## SIGNALING SYSTEM.

SPECIFICATION forming part of Letters Patent No. 461,809, dated October 27, 1891.

Application filed February 9, 1889. Serial No. 299,307. (No model.)

*To all whom it may concern:*

Be it known that I, FRANK P. BENJAMIN, a citizen of the United States, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Signaling Systems, of which the following is a description of the forms in which I prefer to embody my said invention, said description being in such full, clear, and exact terms as will enable any one skilled in the art to which my invention appertains to practice the same, reference being had to the accompanying drawings, making a part of the specification, and to the letters of reference marked thereon.

The object of my present invention is to enable a car in motion or at rest to signal other trains on the same track.

In the accompanying drawings, Figure 1 illustrates a plan view of a track with the signaling-lines laid thereon. Fig. 2 illustrates a vertical section through the moving vehicle and the track, showing the devices for signaling and for receiving signals. Fig. 3 is a cross-section of one of the signaling or receiving coils carried on the moving vehicle. Fig. 4 is a longitudinal section through the same. Fig. 5 is a vertical section taken on the line 5 5, Fig. 2. Figs. 6, 7, and 8 illustrate the application of my invention to a system operated by the principle of static induction, in which Fig. 6 illustrates a plan view of the track; Fig. 7, a longitudinal section through the moving vehicle on the line 7 7, Fig. 8; and Fig. 8 a vertical section through said vehicle on line 8 8.

The following is a description of the accompanying drawings, wherein are illustrated two of the forms in which my invention may be employed.

In the concluding claims I will indicate, specifically, the novel features of the invention and the features which are covered by these Letters Patent.

Referring to Fig. 1, C C are rails or tracks. A A′ A″ is a closed circuit laid along the track, consisting, essentially, of two parts, one—the part A′—for receiving the signaling energy and another—A and A″—for inducing a current into the receiving coil or coils. This circuit is shown in full lines and as a complete metallic circuit, although the circuit might be made complete by grounding the wires. *a a a* is another circuit of similar character, (shown in dotted lines,) but not complete.

Referring to Fig. 2, I I is the platform of one or more moving vehicles, carrying the coils P, Q, and R. Each of these coils consists of a number of wires wound round and round. (Shown in cross-section at Fig. 3 and in longitudinal section at Fig. 4.) The construction of these induction-coils is now so well known that a further description thereof is deemed unnecessary. Q is the coil by means of which the signals are transmitted to the line. It is provided with a battery J and a make-and-break or other suitable device for causing an intermittent or vibratory current to traverse the coil. P and R are signal-receiving coils, and are provided each with a device S for receiving the signals or for indicating when the current is caused to traverse the coils. When these coils are placed near enough together on the moving train to affect each other injuriously by induction, it is desirable to employ some means for counteracting said effects. I have shown the coils inclined, as in Fig. 5, with the wire T T wrapped round them in opposite directions for this purpose, this being one of the known means for accomplishing the object sought. Thus, assuming that portion of the coil Q which is nearest to the coil P induces a current in the coil P which it is desired to neutralize, a strand T T of the wire on the coil Q may be so wound on the coil P as to carry a current around the same in the opposite direction to that in which said induced current is flowing and may just equal the strength of the induced current, thereby effectually neutralizing the same. The coils P and R are parallel to the conductors on the sides of the track, and the coil Q is parallel to the conductor in the center of the track.

The operation of the device above described is as follows: Let the train stand over the section marked A′, Fig. 1. The intermittent or vibratory current traversing the coil Q will induce in the circuit A A′ A″ a similar current. This current will signal any other vehicle on the same local circuit through either

the coil P or R, into which by induction the current flowing over the line is introduced, and by means of the device S for receiving such signals. When the local circuits are arranged on both sides of the track, as shown in Fig. 1, intelligence will be communicated as to whether the train is behind or before the signaling-vehicle. As this is particularly pointed out in my application bearing Serial No. 363,717, patented March 12, 1889, No. 399,474, a further description of this operation is deemed unnecessary here.

Instead of carrying two coils for receiving signals on the train, one coil only may be employed, in which case the form of the local circuit would be correspondingly modified. For example, assuming that the train was proceeding from the bottom toward the top of the drawings, Fig. 1, and had a receiving-coil on the left side, but none on the right, the extension A″ might be omitted, or if it had a receiving-coil on the right side, but none on the left, the extension A might be omitted. When there are a plurality of local circuits employed and they are lapped, to insure a signal always being set behind or ahead or both behind and ahead, the train induction from one to the other may be neutralized by bringing the circuits close together, as at X, Fig. 1, for a suitable distance, when the currents flow in opposite directions. The system may be extended indefinitely.

Referring to Figs. 6, 7, and 8, which illustrate the application of my invention to a line worked by static induction, A illustrates the local circuit connected to the earth at one end only. Instead of the signaling and receiving coils heretofore described, plates D, E, and F are employed, which are also connected to the earth at one end through the spring G G, car-axles H H, and rails C C. The operation of this plan is substantially like that above described, except that static induction is relied upon, according to principles well known in the arts, to convey the necessary intelligence from car to car.

In my above-mentioned application (to which reference is here made) I have claimed a certain system of railroad-signaling, and I have also claimed the form and also the relation of the local circuit here shown. The most characteristic difference between the system claimed in said application and that which it is desired to cover in this is that there the signaling energy is external to the moving vehicle and is introduced into the line by make-and-break devices, while here the source of the signaling energy is carried on the train and is introduced into the line by induction without the aid of such make-and-break devices.

Of course the position of the circuit on the track and the signaling and receiving coils may be varied, and it will be understood that my invention is not limited to the precise devices and combinations of devices shown, as many modifications may obviously be made without departing from either the spirit or scope of my present invention.

What I claim, and desire to secure by Letters Patent, is—

1. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a plurality of separate and independent local circuits arranged on both sides of the track, a vehicle carrying a plurality of conductors respectively parallel to and in inductive relation to different portions of said local circuit, and also carrying a signaling-circuit connected with a suitable source of electric energy, parallel to a separate portion of said local circuit, substantially as described.

2. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a vehicle having a plurality of conductors, each including instruments for receiving signals and also including a signaling-conductor connected with a suitable source of electric energy, and a plurality of local circuits arranged on both sides of said track, parallel to and in inductive relation to said vehicle-conductors, respectively, substantially as described.

3. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a vehicle carrying a conductor with instruments for receiving signals and also carrying a signaling-conductor connected with a suitable source of electric energy, a local circuit arranged along the line, one part of which is parallel to and in inductive relation to said vehicle-conductor carrying receiving-instruments and another part of which is in inductive relation to said signaling-conductor, substantially as described.

4. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a vehicle carrying a conductor with signaling-instruments and also carrying a signaling-conductor connected with a suitable source of electric energy, a plurality of separate and independent local circuits arranged along the line, different portions of which are in inductive relation to said conductors, respectively, said local circuits being overlapped, substantially as described.

5. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a vehicle having a conductor with instruments for receiving signals and also having a signaling-conductor connected with a suitable source of electric energy, a plurality of local

circuits arranged along the line, parts of which are parallel to and in inductive relation to said signal-receiving conductor and other parts of which are in inductive relation to said signaling-conductor, said local circuits being overlapped, substantially as described.

6. In a system of railroad-signals in which communication between vehicles is established by means of the inductive effects of a current of electricity, the combination of a vehicle carrying a signaling-conductor connected with a suitable source of electric energy and also carrying a conductor provided with instruments for receiving signals, a circuit laid along the track, one part of which is in inductive relation to said signal-receiving conductor and another part of which is in inductive relation to said signaling-conductor, substantially as described.

FRANK P. BENJAMIN.

Witnesses:
J. EDGAR BULL,
CHAS. C. BULL.