No. 894,318. PATENTED JULY 28, 1908.

L. DE FOREST.

AEROPHORE.

APPLICATION FILED DEC. 22, 1905.

2 SHEETS—SHEET 1.

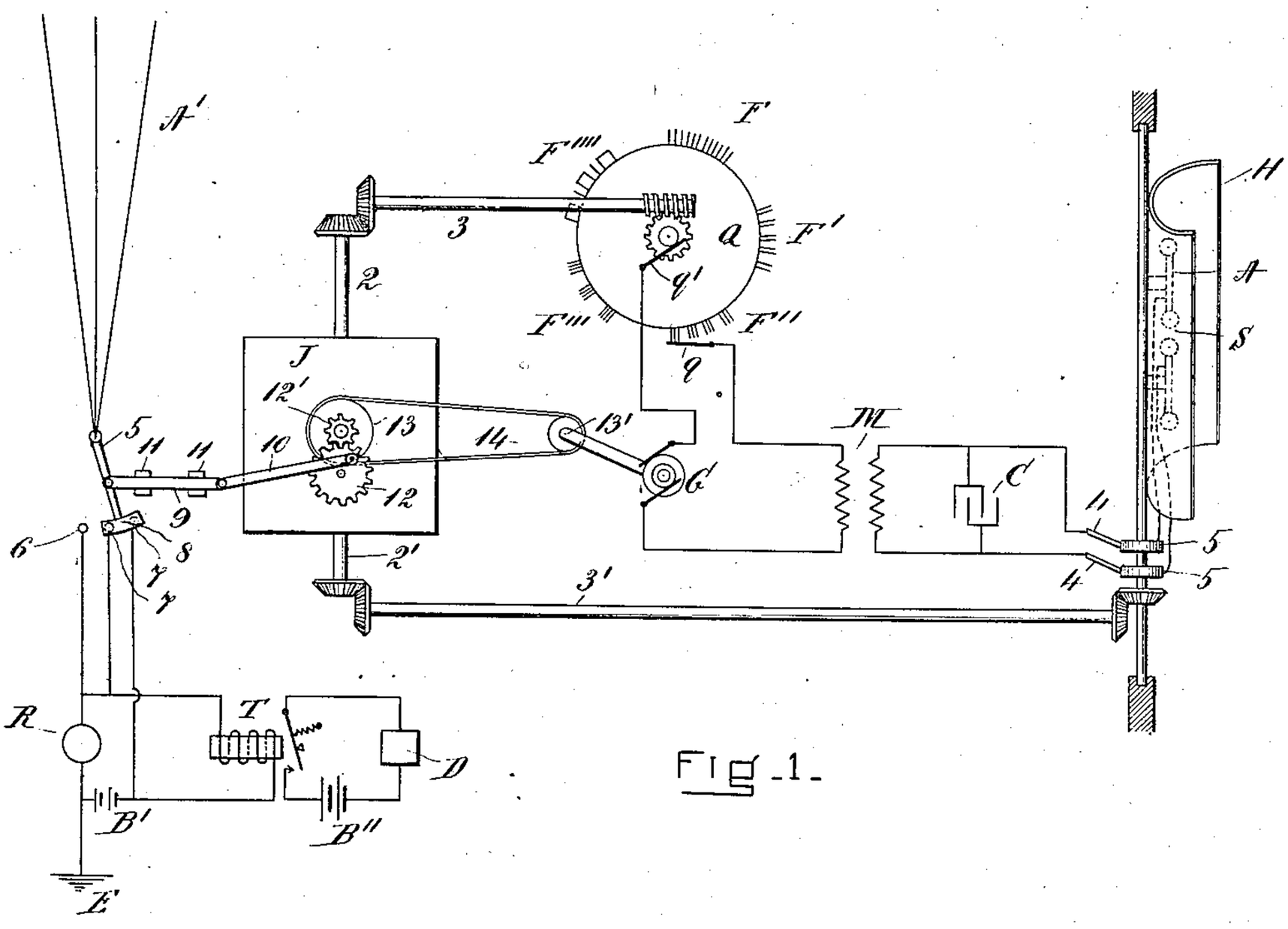

Fig. 1.

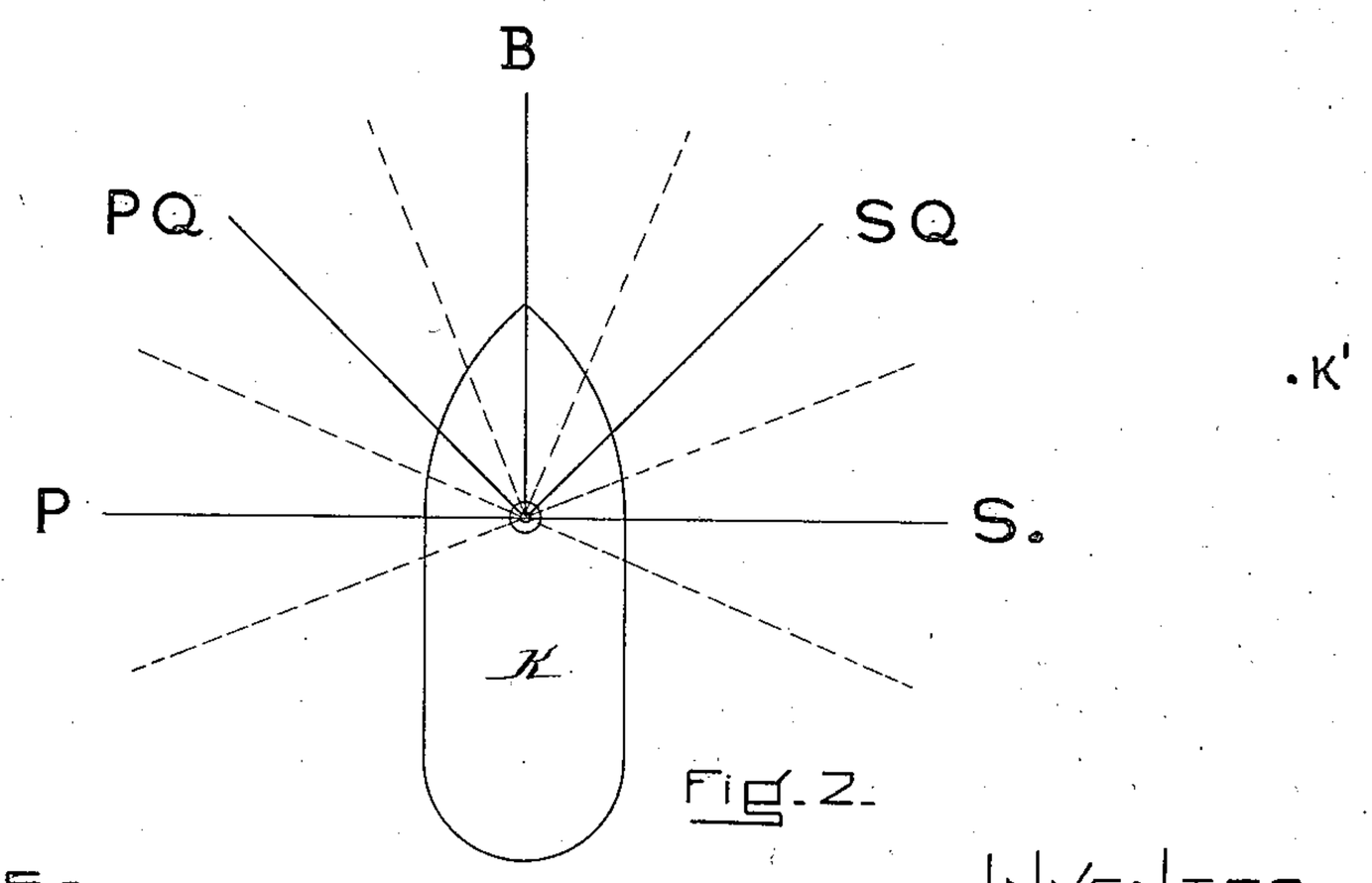

Fig. 2.

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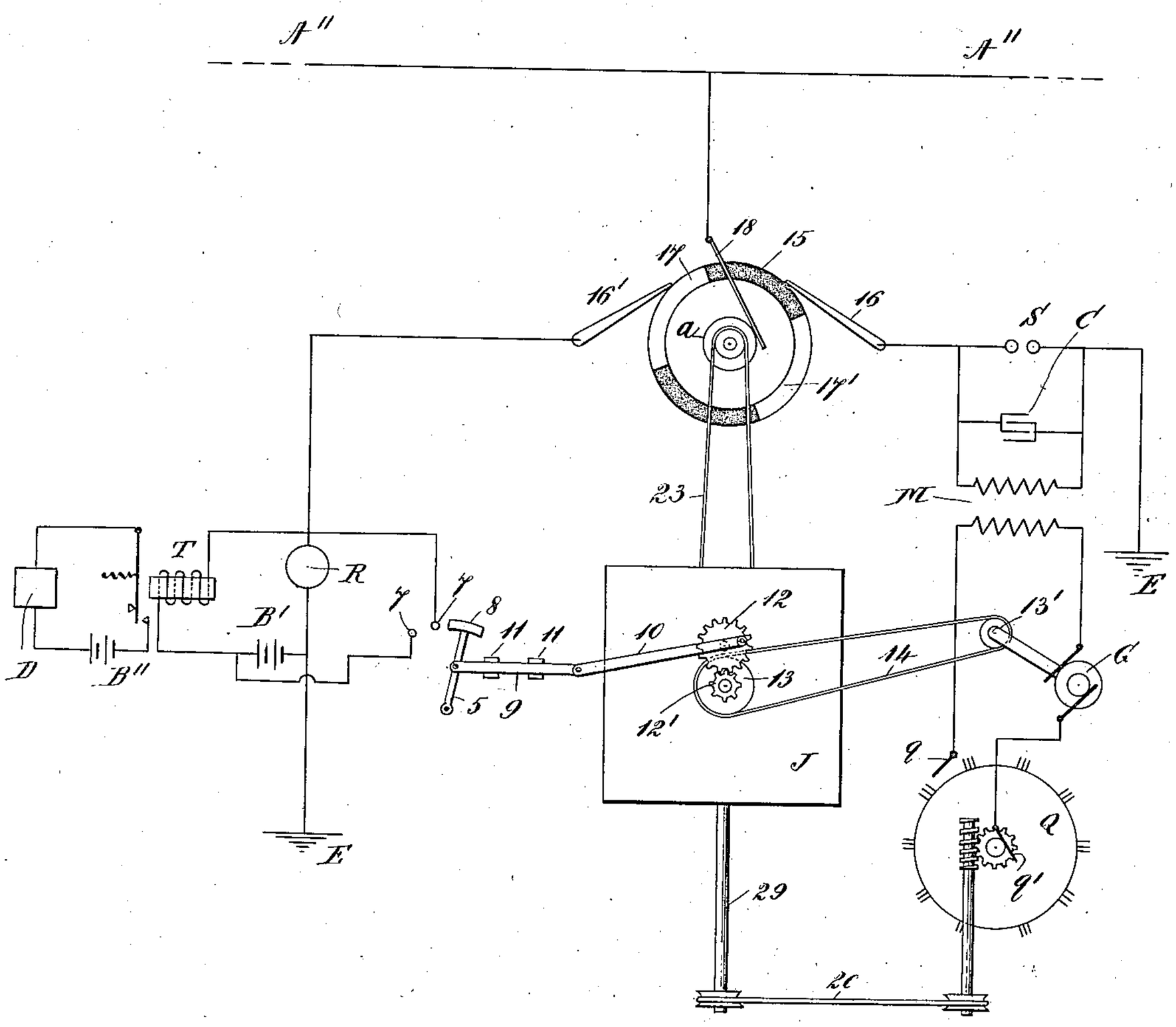

Fig. 3.

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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO DE FOREST RADIO TELEPHONE CO., A CORPORATION OF NEW YORK.

AEROPHORE.

No. 894,318. Specification of Letters Patent. Patented July 28, 1908.

Application filed December 22, 1905. Serial No. 292,921.

To all whom it may concern:

Be it known that I, LEE DE FOREST, 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 a new and useful Improvement in Aerophores, of which the following is a specification.

My invention relates to systems of signaling by electromagnetic waves.

The object of my invention is to provide a system whereby two moving bodies, each provided with transmitting and receiving systems, may mutually communicate warning or direction-indicating signals.

Two systems embodying the principles of my invention are illustrated diagrammatically in the drawings which accompany and form a part of this specification and in which

Figure 1 represents one form of aerophore adapted to be employed on ships, Fig. 2 is a diagram representing how one ship may communicate a direction-indicating signal to another ship, and Fig. 3 represents one form of aerophore adapted to be employed on railway locomotives or other vehicles.

My invention depends upon the fact now well known that by various devices, such for example as a parabolic or other suitably shaped reflector, or an inclined or horizontal antenna, it is possible to concentrate the transmission of electromagnetic waves in one general direction. It is to be understood, however, that, although I have herein shown only two of such radiation concentrating devices, there are many other devices and systems of circuits which are available for this purpose, such for example as the system heretofore disclosed by me in prior Letters Patent, and that I do not herein limit myself to any particular kind of radiation concentrating device but consider any suitable device within the scope of my invention.

In Figs. 1 and 3, J represents a prime mover of any suitable type which, by any convenient means, such as the belt 14 passing around the pulleys 13, 13′, may drive the generator G. M represents a transformer interposed between said generator and the spark-gap S, and C is a condenser which may be connected across the terminals of said spark-gap. In Fig. 1, the prime mover J rotates the signal wheel Q by means of the shafts 2, 3 and any appropriate gearing, and intermittently rotates the reflector H by means of similar shafts 2′, 3′ and gearing, although any suitable means may be employed to communicate motion from the motor J to the wheel Q and reflector H. The secondary of the transformer M is connected to the antenna A by means of the brushes 4, 4, and rings 5, 5. Geared to a pinion 12′ which is operatively connected to the motor J, is a wheel 12 which operates the crank arm 10 connected to the switch 5 by means of the rod 9 which reciprocates in the guideways 11, 11, and so communicates an intermittent movement to said switch. When the generator circuit is closed through any of the contacts F, F′, etc., of the signal wheel Q, the switch 5 is in such position that its contact 8 coöperates with the contacts 7, 7, thereby connecting a shunt circuit around the responder R and at the same time breaking the connection of the receiving antenna A′ with said responder R at the point 6, so as to protect said responder from the effects of the transmitted waves.

The mechanism which operates the reflector is connected and arranged in any suitable manner to rotate said reflector through an arc of, say, 225 degrees, and back again. The mechanism whereby such intermittent rotation may be effected forms no part of my invention and hence is not illustrated in detail. The signal wheel is rotated continuously and its signaling contacts are so arranged with respect to the position of the reflector H that when the reflector is directed so as to concentrate the radiated waves in a particular predetermined direction, a distinctive signal is produced. Thus, for example, when the reflector is directed to the starboard, a signal consisting of a series of dots is emitted; when it is directed to the starboard-quarter, a series of two-dot signals is emitted; when the reflector points to the bow, the signal consists of a series of three dots; when it points to the port-quarter, the signal consists of four dots; and when it is directed to the port, a signal dot-dash signal is produced.

The circumference of the signal wheel Q is divided as shown into ten parts, although it may be divided into any other number of parts, and a certain number of said parts, herein shown as five, are provided with the signaling contacts F F′, etc., while the remaining parts are left blank. When the reflector H is directed as above indicated, the circuit of the generator is closed through the

brush q, one set of the contacts F, the wheel Q and the brush q', and when the circuit of said generator is broken by a set of the contacts F breaking connection with the brush q, the switch 5 is in such position that the shunt around the responder R is broken at the contacts 7, 7 and the antenna A′ is connected to earth E by way of said responder at the point 6. In such position of the apparatus, any signal which may be emitted by an aerophore on another ship may be received by the responder R and thereby energize the magnet T, connected in series with said responder and the battery B′. This magnet T may be a telephone magnet, or as shown, it may be the magnet of a relay which, when energized, will close the circuit of the signal-indicating device D and the battery B″. The signal-indicating device D may be a bell or an incandescent lamp or any other device which will give an audible or visible signal. The pilot of a vessel receiving such signal by referring to a table or chart can determine the position of his ship with respect to the ship from which the signal was transmitted. For example, in the diagram shown in Fig. 2, the ship K′ which is on the starboard side of the ship K would receive the standard signal indicating "starboard," which, as above set forth, might be a series of single dots, but would not receive the signals indicating starboard quarter, bow, etc.; while if a vessel were ahead of the ship K its pilot would receive the standard signal indicating "bow," but would not receive the others.

For railroad trains, and vehicles which travel in a fixed direction, it is not necessary to shift the direction of the signals, but it is desirable to connect the antenna carried by such train alternately and at rapidly recurring intervals to the transmitting and receiving apparatus, so that the signals may alternately be sent and received to and from other trains which are ahead or behind the train in question. In order to concentrate the radiation of waves in the general direction of the track on which a train is traveling, I may employ the horizontal or slightly inclined antennæ A″, A″ which may be secured to the roof of the train or locomotive and which extend preferably in the direction of the track. The brush 18 contacts with ring a which may be connected in any suitable manner with the conducting segments 17, 17′ of the commutator 15. As shown, for example, the ring a is made integral with the metallic parts of the commutator 15, so that thereby said brush 18 normally is connected with the segments 17, 17. The commutator 15 is rotated by the motor J, by means of the belt 23, and thus affords a means of connection between the antenna and the brushes 16, 16′ which lead to the transmitting and receiving apparatus, respectively. The signaling wheel Q, which is rotated by the motor J by means of the shaft 19 and 21 and the belt 20, coöperates with the brush q to vary the current of the generator Q in any predetermined manner. For example, trains running on a certain one of a series of parallel tracks would emit a series of signals, each consisting of three dots, while trains running on other of said tracks would emit a series of one-dot, or two-dot signals. By the same mechanism as described in connection with Fig. 1, or by any other suitable mechanism, the switch 5 closes a shunt circuit around the responder R when the brush 16 is on one of the conducting segments 17 or 17′, when the brush q closes the generator circuit through the wheel Q, and when the brush 16′ is on the insulating portion of the commutator 15, thereby protecting the responder R; while when the brush 16′ is on one of the said conducting segments 17, 17′, when the brush q opens the generator circuit by breaking contact with the wheel Q′ and when the brush 16 is on the insulating portion of the commutator 15, as shown in Fig. 3, said shunt circuit is opened and any oscillations created in the antenna A″, A″ by signal-waves sent out from another train can operate the responder and the signal-indicating device D.

It is to be understood that I do not limit myself to the particular arrangement of apparatus or the particular systems of circuits herein disclosed, inasmuch as many changes may be made therein by those skilled in the art without departing from the spirit of my invention.

I claim:

1. An aerophore comprising automatic means for transmitting predetermined electromagnetic-wave signals in predetermined directions, and means for receiving electromagnetic wave signals during the intervals of time in which signals are not being transmitted.

2. An aerophore comprising means for transmitting electromagnetic wave signals changing with direction, and means for receiving electromagnetic wave signals during the intervals of time in which signals are not being transmitted.

3. In a wireless signaling system, a transmitting system including means for transmitting predetermined signals in a predetermined direction, a receiving system including an oscillation responder, automatic means for protecting said responder during the operation of said transmitting system and a prime mover controlling both the aforesaid means.

4. In a wireless signaling system, a transmitting system including means for transmitting predetermined signals in a predetermined direction, a receiving system including an oscillation responder, automatic means for connecting a shunt circuit around

said responder during the operation of said transmitting system and a prime mover controlling both the aforesaid means.

5. In a wireless signaling system, a transmitting system including means for transmitting signals changing with direction, a receiving system including an oscillation responder, and means for protecting said responder during the operation of said transmitting system.

6. In a wireless signaling system, a transmitting system including means for transmitting signals changing with direction, a receiving system including an oscillation responder, and means for connecting a shunt circuit around said responder during the operation of said transmitting system.

7. An aerophore, comprising means for alternately transmitting and receiving electromagnetic-wave direction-indicating signals changing with their direction of transmission.

8. An electromagnetic-wave signaling system comprising means for intermittently transmitting electromagnetic waves varying with their direction of transmission, means for modifying said waves in accordance with their direction of transmission and means for receiving waves from other systems.

9. An electromagnetic-wave signaling system comprising means whereby two moving bodies may mutually communicate electromagnetic-wave signals varying according to the direction of their transmission.

10. An electromagnetic-wave signaling system comprising means whereby two moving bodies may mutually communicate direction indicating signals changing with their direction of transmission.

11. In an aerophore, an electromagnetic wave radiator, a source of electric current associated therewith, means for concentrating the electromagnetic waves radiated by said radiator in a definite general direction, a device for modifying said current in accordance with the signal to be transmitted, a receiving system including an oscillation detector, a prime mover, mechanism connecting said prime mover with the means for concentrating the waves and with the device for modifying the current, said mechanism being so constructed and arranged that the transmitted signals vary in accordance with the position of the wave concentrating means, and other mechanism connecting said prime mover and said receiving system, said latter mechanism being so related to the former mechanism that said receiving system is rendered inoperative during the operation of the aforesaid radiator.

12. An aerophore comprising means for transmitting electromagnetic wave signals changing with their direction of transmission, means for receiving electromagnetic wave signals, and mechanism so related to both the aforesaid means that one is rendered inoperative during the operation of the other.

13. In an aerophore, an electromagnetic wave transmitter, a prime mover, means controlled by said prime mover for transmitting electromagnetic wave signals changing with their direction of transmission, a receiving system including an oscillation detector, and means controlled by said prime mover for protecting said detector during the operation of said transmitter.

In testimony whereof, I have hereunto subscribed my name this 18th day of Dec., 1905.

LEE DE FOREST.

Witnesses:
M. M. MacRae,
Philip Farnsworth.