No. 833,034. PATENTED OCT. 9, 1906.

L. DE FOREST.

AEROPHORE.

APPLICATION FILED DEC. 8, 1905.

2 SHEETS—SHEET 1.

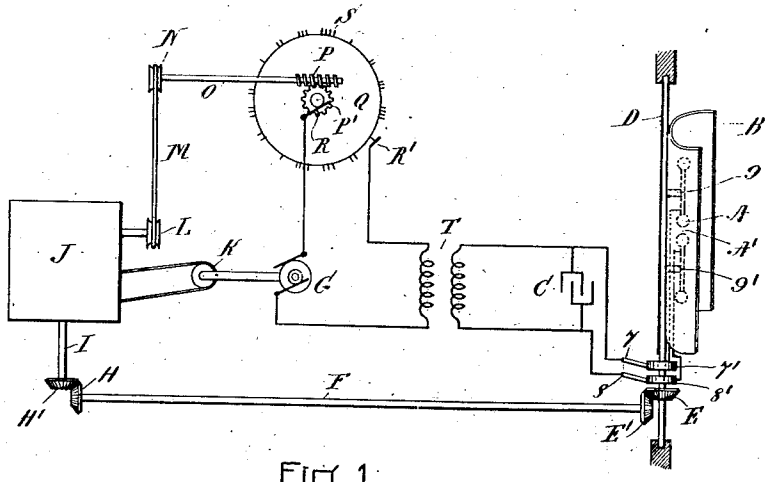

Fig. 1.

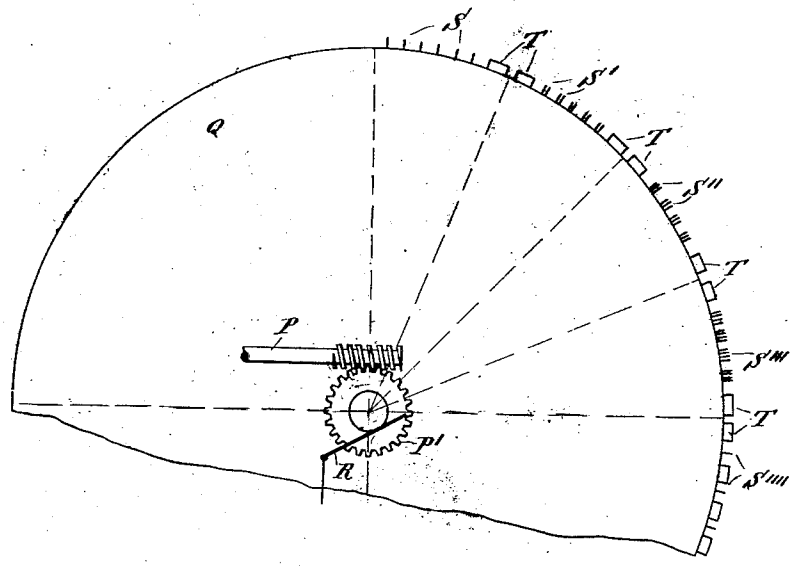

Fig. 2.

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2 SHEETS—SHEET 2

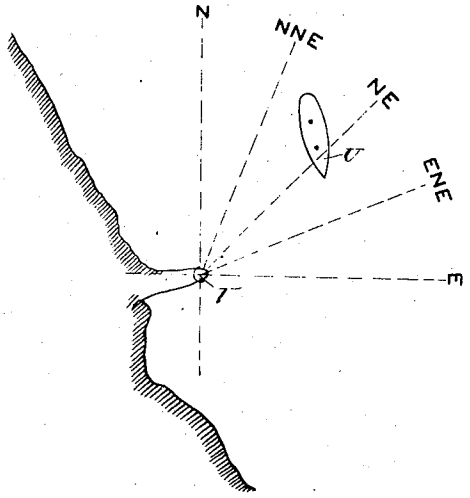

Fig. 3.

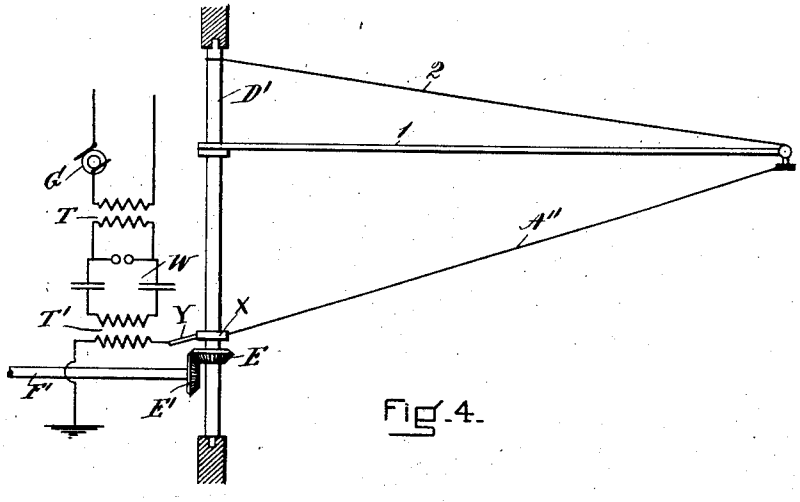

Fig. 4.

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UNITED STATES PATENT OFFICE.

LEE DE FOREST, OF NEW YORK, N. Y.

AEROPHORE.

No. 833,034. Specification of Letters Patent. Patented Oct. 9, 1906.

Application filed December 8, 1905. Serial No. 290,876.

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 a system of signaling by electromagnetic waves.

The object of my invention is to provide a system whereby a ship or other moving body which is provided with receiving apparatus may be able to locate its position with respect to a stationary body which is provided with transmitting apparatus.

The drawings which accompany and form a part of this specification illustrate two embodiments of my invention, although it is to be understood that I do not limit myself to such particular embodiments, inasmuch as many modifications will be made therein without departing from the spirit of my invention.

In the drawings, Figure 1 illustrates diagrammatically one form of my aerophore. Fig. 2 shows a detail of construction. Fig. 3 is a diagram representing a portion of a seacoast having the aerophore located on a cape and a ship within the influence of the waves transmitted by said aerophore, and Fig. 4 represents a modification of my invention.

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 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 disclosed in Fig. 1 of my Letters Patent No. 749,131, dated January 5, 1904—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.

Referring now to Fig. 1, J represents a prime mover—for example, a gas-engine—operatively connected with the generator G by means of a belt passing around the sheave K. Q is a signaling-wheel, hereinafter more fully described, driven by the worm P and worm-gear P'. The shaft O, which is provided with said worm P, is driven by the belt M, which passes around the pulley N on the shaft O and the driving-pulley L, which is operatively connected with the prime mover J. A brush R makes electrical connection with the axle of the wheel Q, and hence with said wheel, and the brush R' makes electrical connection with the contacts S, with which said wheel Q is provided. T is a step-up transformer whose primary is included in the generator-circuit and whose secondary is connected to the spark-gap A' of the oscillator or antenna A through the brushes 7 8 and the rings 7' 8'. A condenser C may be connected in shunt to the spark-gap A' in the usual well-known manner. B is a reflector of parabolic or other suitable shape which carries by means of the insulators 9 9' the oscillator A and which is mounted on the rod D, which is rotated by the prime mover J by means of the shaft I, bevel-gears H' and H, shaft F, and bevel-gears E' and E.

It is to be understood, of course, that although I have shown and described certain specific mechanisms for rotating the wheel Q and reflector B such mechanisms are herein shown and described merely for the purpose of more clearly and fully illustrating my invention and that any suitable mechanism or train of mechanisms may be employed for the purpose of rotating the wheel Q and reflector B in such manner that there is always a definite and predetermined relation between the two.

It will now be clear that the operation of the prime mover J causes the alternating current in the generator-circuit to be interrupted by the contacts S and the brush R' in accordance with the spacing of said contacts S, that said current so interrupted is transformed into high-potential current by the transformer, and that said high-potential current impressed upon the oscillator A causes the latter to emit electromagnetic waves broken up into signal elements which also correspond to the spacing of the contacts S. The waves so emitted are concentrated in one general direction by the reflector B and sent out into space in a direction determined by the position of the reflector, and inasmuch as the reflector is rotated continuously said direction is continuously shifted. Thus, for example, in Fig. 3, in which V represents the aerophore and U a ship within the influence of the waves transmitted by said aerophore, the receiving appa-

ratus on the ship will not respond to waves sent out when the reflector is directed toward north or north northeast or east northeast or east, but will respond when the reflector is directed northeast. If the waves which affect the receiving apparatus on the ship in the position shown in Fig. 3 were characterized by a certain arbitrary or code signal—such, for example, as three dots—the pilot by consulting a chart would know that he was northeast at a certain aerophore, but would not know what aerophore. If shortly afterward he should receive a radically different signal—as, for example, two dashes—he could by consulting a chart ascertain the location of the point from which the direction-signal had been transmitted. For the purpose of transmitting direction-indicating signals I divide the wheel Q into a certain number of sectors (herein shown as sixteen) corresponding to sixteen points of the compass and provide each sector with contacts S S′ S″ S‴ S⁗, &c., adapted to produce in the particular form herein shown a series of single dots when the reflector is directed north, a series of two dots when the reflector is directed north northeast, a series of three dots when the reflector is directed northeast, a series of four dots when the reflector is directed east northeast, and a series of dots and dashes when the reflector is directed east. The other sectors into which the wheel Q is divided are provided with similar contacts adapted to break up the radiation into code-signals, each distinctive or characteristic of a given compass-point. The wheel Q is also provided with frequently-recurring contacts T, (herein shown as contacts adapted to produce two long dashes,) in order to indicate to the ship carrying the receiving apparatus the location of that particular aerophore from which the direction-signals are being transmitted. Thus, for example, the contacts T on one wheel would be, as shown, two dashes, on another wheel three dashes, on a third wheel dash, dot, dash, &c., and these aerophore-locating signals would be tabulated on charts with which the ships employing receiving apparatus for receiving signals from the aerophores would be furnished.

The modification shown in Fig. 4 depends upon the principle enunciated by Braun in the *Physikalische Zeitschrift*, April 1, 1903, page 361, that inasmuch as the field of force between an inclined antenna and the earth is more intense in the direction of inclination than in other directions the radiation of electromagnatic waves from said antenna likewise is more intense in the direction of inclination. In Fig. 4 the circuit of the alternator G includes the brushes R R′ (shown in Fig. 1) and the primary of the transformer T, whose secondary energizes the oscillating circuit W, which is provided with a spark-gap, two condensers, and the primary of the oscillation-transformer T′, whose secondary is included in the antenna A″. It will be understood, of course, that the oscillation-circuit W is herein shown merely to illustrate one of the numerous ways in which oscillations may be developed in the antenna. The mast D′ is rotated through the bevel-gears E E′, shaft F′, and prime mover J in the manner shown in Fig. 1 or by any other suitable means, and thereby produces the rotation of the antenna which is supported by the boom 1 and cable 2. Y is a brush contacting the ring X, which is conductively connected with the antenna. The operation is the same as in Fig. 1—that is to say, the direction of transmission and the character of the transmission are continually varied in a definite and predetermined manner by the operation of the prime mover on the signal-wheel Q and inclined antenna A″.

I claim—

1. An aerophore comprising means for emitting a predetermined electromagnetic wave-signal in a predetermined direction and means for emitting a signal identifying the location of the aerophore.

2. An aerophore comprising means for emitting predetermined electromagnetic wave-signals in predetermined directions and means for emitting frequently-recurring signals identifying the location of the aerophore.

3. An aerophore comprising means for emitting electromagnetic wave code-signals changing with their direction of transmission and means for emitting signals identifying the location of said aerophore.

4. An aerophore comprising means for emitting predetermined electromagnetic wave-signals and means for emitting signals identifying the location of the aerophore.

5. In a wireless-telegraph transmitting system, means for transmitting electromagnetic wave-signals indicating the direction of their transmission and means for transmitting other electromagnetic wave-signals identifying the location of the transmitting system.

In testimony whereof I have hereunto subscribed my name this 1st day of December, 1905.

LEE DE FOREST.

Witnesses:
M. E. GRIMES,
PHILIP FARNSWORTH.