No. 660,155. Patented Oct. 23, 1900.

B. A. FISKE.

APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS OR VEHICLES.

(Application filed Sept. 7, 1898.)

(No Model.)

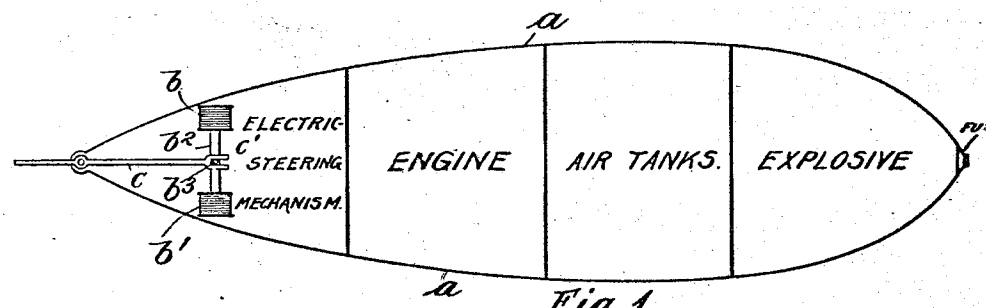

Fig. 1.

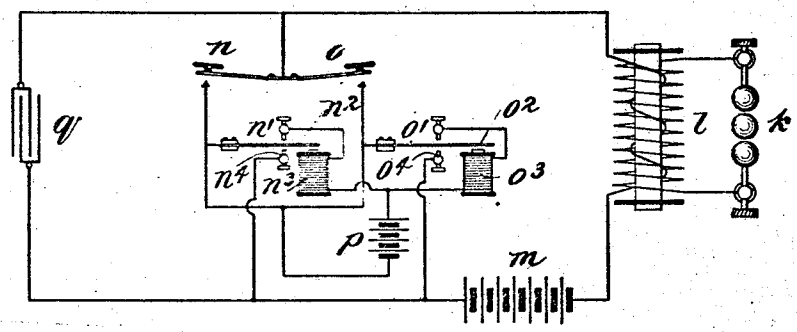

Fig. 2.

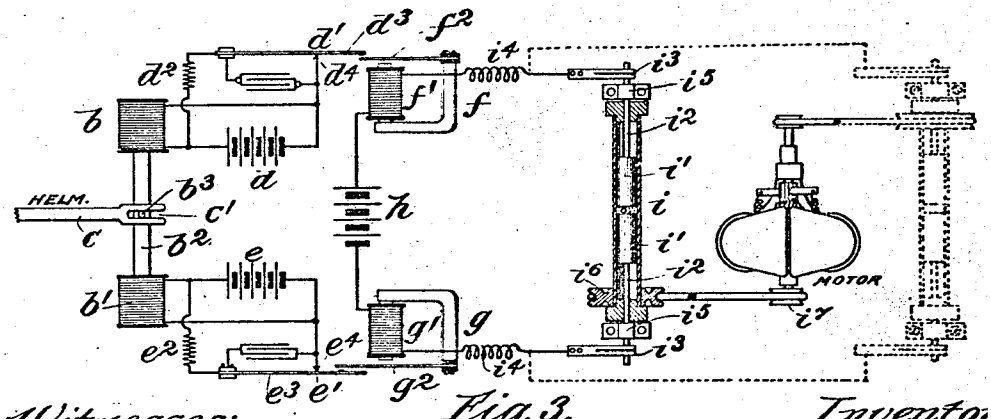

Fig. 3.

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UNITED STATES PATENT OFFICE.

BRADLEY ALLAN FISKE, OF THE UNITED STATES NAVY, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

APPARATUS FOR CONTROLLING MECHANISM OF MOVING VESSELS OR VEHICLES.

SPECIFICATION forming part of Letters Patent No. 660,155, dated October 23, 1900.

Application filed September 7, 1898. Serial No. 690,433. (No model.)

To all whom it may concern:

Be it known that I, BRADLEY ALLAN FISKE, a lieutenant in the United States Navy, have invented a certain new and useful Improvement in Apparatus for Controlling Mechanism of Moving Vessels or Vehicles, (Case No. 2,) of which the following is a full, clear, concise, and exact description.

My invention relates to an improvement in apparatus for controlling from a distance the mechanism of moving vessels or vehicles; and its object is to obviate the necessity of physical connection by other than the natural media in space between the moving object and the distant station from which it is to be controlled.

My invention is especially applicable to automobile torpedoes or other water-craft, and the motor devices or mechanism controlled by my improved method and apparatus may be applied or adapted to the doing of any desired work in connection with the moving body. For instance, my invention is of especial value when use is made of it to control the steering mechanism of the vessel and makes it possible to control the movements of a torpedo with great certainty from ashore, from the deck of a ship, or the like without being hampered by certain practical difficulties which have heretofore stood in the way of successfully accomplishing such a result.

The principal reason why automobile torpedoes are not more extensively used in naval warfare is that with the apparatus heretofore available it has been extremely difficult while launching the torpedo to aim it with sufficient precision to strike the enemy's ship. It is usual at this time to launch or fire torpedoes from pneumatic tubes mounted upon carriages. These torpedo-tubes are placed in the ship either above or below the water-line. If they are below, the difficulty of accurate aiming is materially increased, while if they are above the water-line the loaded torpedo is exposed to the enemy's fire while the torpedo-tube and carriage are being manipulated. For this reason nearly all modern ships are constructed with their torpedo-tubes below the water-line.

It has heretofore been proposed to connect the torpedo with the ship by means of an electric cable which is carried by the torpedo and unreeled as the latter continues on its course. This plan, however, has been found to be objectionable on account of the great length and weight of cable which is required for such a purpose, and numerous other practical difficulties have stood in the way of its successful operation. In accordance with my invention at the point from which the mechanism upon the moving object is to be controlled means are provided for producing waves, impulses, or radiations—such, for instance, as the phenomena known as "Hertzian" waves, and which may be described for convenience as vibrations or disturbances of the universal ether—and upon the moving object motor mechanism for performing certain work upon the moving vessel—such, for instance, as the work of operating the steering-gear—is associated with a local circuit upon the vessel, which circuit controls the said motor mechanism and is adjusted or rendered sensitive to the waves, radiations, or etheric disturbances emanating from the distant station, whereby the said local controlling-circuit may be rendered active or inactive and the operation of the said motor mechanism and the devices operated or controlled thereby may be effected from a distance without physical connection.

Amplifying the above statement somewhat and referring directly to the special object in view—that is, the control of an automobile torpedo—an electrical radiator may be located on shore or upon the ship from which the torpedo is launched, such radiator being capable of transmitting electrical waves of such peculiar and distinctive character or interrupted at such intervals of time as to constitute distinctive signals. The rudder of the torpedo may be connected with electromagnetic-motor mechanism for changing its position, whereby the torpedo may be steered, and this electromagnetic motor or steering mechanism may be associated with a local circuit or circuits and a source of current, such circuit being sensitive to or including a device which is sensitive to the wave-signals sent out by the transmitting-station, means being provided whereby said circuit may select or respond to distinctive signals, and thus

control different movements of the steering apparatus.

It is desirable that the apparatus on the torpedo should be capable of receiving and selecting a number of different signals which may be set up at the transmitting-station, so that different movements of the steering mechanism may be produced. For this purpose the responsive device may consist of a circuit including a source of current, such circuit being sensitive to or including a device, such as a coherer, which is sensitive to electrical waves, and a number of signal-receiving instruments may be associated with the circuit which includes the coherer, each of said signal-receiving instruments being adapted to respond only when a distinctive signal peculiar to itself is impressed upon the receiving-circuit which includes the receiving-instruments and the coherer. To illustrate, suppose that the circuit upon the torpedo includes two signal-receiving instruments, each of which is adapted to respond to a pulsating or intermittent current of electricity of a given periodicity—that is, suppose that one of the instruments will respond to an electric current which is varied or interrupted at a given rate—say t times per second—and let the other signal-receiving instrument be adapted to respond to a current which is varied or interrupted at a different rate—say t' times per second. Let each of these signal-receiving instruments be so associated that when one of them is thrown into action the steering mechanism will be influenced in a particular way and when the other is thrown into action the steering mechanism will be influenced in another and different way. Now it is evident that if the radiator at the transmitting-station be caused to send out electrical waves intermittently at the rate of t times per second, the coherer when properly adjusted, by absorbing these intermittent waves or vibrations, will intermittently, at the rate of t times per second, decrease the resistance of the local circuit which includes the signal-receiving devices, thereby producing in such local circuit a pulsating current with a corresponding frequency. One of the two signal-receiving instruments, therefore, will respond and influence the electromagnetic steering mechanism in the predetermined way, but the other receiving instrument will remain inactive. Likewise it will be evident that the latter instrument may be actuated by causing the radiator at the transmitting-station to send out electrical waves intermittently at the rate of t' times per second. It will be seen that by providing two such receiving instruments adapted one to control electromagnetic mechanism for putting the helm of the torpedo to starboard and the other to control similar mechanism for putting the helm to port, if signals or electrical impulses having a periodicity or pitch corresponding to that of the receiving instruments on board the torpedo are sent out from the transmitting-station by means of the Hertzian waves the torpedo may be steered at will from the transmitting-station by sending out signals to actuate either one or the other of the receiving instruments.

The movements of the torpedo through the water can usually be followed by the eye by watching the air-bubbles that rise to the surface of the water, or the torpedo may be provided with apparatus for generating calcium-phosphid gas, which rises to the surface of the water and burns. These means are well-known. Without going into detail it may be stated that the torpedo may be kept at a uniform depth—say about ten feet under water—by mechanism which is controlled by a hydrostatic piston. This is old in the art and needs no further description.

I will describe the details of my invention more particularly by reference to the accompanying drawings, in which—

Figure 1 is a diagrammatic illustration of a torpedo embodying my invention, this view being intended only to show the relative positions which are occupied by the explosive, the air-tanks, the engine, or other propelling means, and the electrical steering apparatus which forms the subject of this application. Fig. 2 is a diagram showing the transmitting-station for sending out Hertzian waves of the required character. Fig. 3 shows in diagram the responsive apparatus provided on the torpedo for receiving signals sent out by the transmitting-station, and thereby actuating the electrical steering mechanism.

The same letters of reference are used to designate similar parts wherever they are shown.

In the stern of the torpedo a are provided two solenoids b b', having a core b^2 common to both of them. This core carries a pin b^3, which engages a slot c', provided in the end of the helm c. The helm is associated with the rudder in the usual manner. It will therefore be seen that if the solenoid b is energized and draws in the core the helm will be put to port, and that if, on the other hand, the solenoid b' is energized and the core b^2 attracted thereby the helm will be put to starboard. Now it will be understood that if means are provided for energizing either the solenoid b or the solenoid b' at will the torpedo may be steered in the direction desired. To effect this, the solenoid b is included in a local circuit with a battery or source of current d. Similarly the solenoid b' is included in a local circuit with a battery e. The solenoid b, however, is normally short-circuited at d' through the resistance d^2, and likewise the solenoid b' is normally short-circuited at e' through the resistance e^2. The means for short-circuiting the solenoid b consist of a reed or spring d^3, normally resting upon the contact d^4, while the means for short-circuiting the solenoid b' similarly consist in a reed or spring e^3, normally resting upon a contact e^4. Immediately under the reed d^3 is mounted the reed f^2 of

the receiving instrument f, such reed f^2 being placed in inductive relation to the magnet f' of said receiving instrument. The reed f^2 has a characteristic pitch or rate of vibration and is adapted to be thrown into vibration only when electrical impulses of the same characteristic periodicity are impressed upon the circuit which includes its electromagnet f'. When, however, the reed f^2 is thus thrown into vibration, it strikes the end of the spring or reed d^3, whose rate of vibration is relatively much slower, and raises the spring d^3 from its contact d^4, thereby breaking the circuit of the battery d at that point. The current of the battery thereupon will flow only through the solenoid b, which will of course be energized. The circuit will remain broken at d' as long as the reed f^2 continues to vibrate.

A receiving instrument g, consisting of the magnet g' and reed g^2, is disposed in front of the reed e^3 and is similarly adapted to open the circuit of the battery e at the point e'. The reed g^2 has a characteristic pitch or rate of vibration which is different from the pitch of the reed f^2 and will be thrown into vibration only when electrical impulses of a periodicity corresponding to its characteristic pitch are impressed upon the circuit including the magnet g'. The receiving instruments f and g are included in series in a local circuit with the battery or source of current h, the continuity of this circuit being controlled by a coherer i, which is adapted to respond to Hertzian waves set up by a radiator k at the transmitting-station.

The form of coherer which is shown in the drawings is well known, but for the sake of clearness will be briefly described. A glass tube is fitted with two silver pole-pieces i' i', attached to rods i^2 i^2, which project out through the ends of the tube and are engaged by copper strips or brushes i^3 i^3, forming the terminals of the circuit which includes the battery h and the receiving instruments f and g. Choking coils i^4 i^4 are provided in the circuit, one between the receiving instrument f and the brush i^3 and another between the receiving instrument g and the other brush i^3. The rods i^2 i^2 are mounted in bearings i^5 i^5 to permit the rotation of the glass tube.

Between the pole-pieces i' i' is provided a small quantity of powder, which may consist of a mixture of silver and nickel filings with a slight trace of mercury. Normally when the powder is in a disordered condition the resistance of the path through the coherer is extremely high, approximately twenty thousand ohms; but when its absorption of electric waves set up by the radiator is intense the particles of powder cohere, and the resistance of this path drops to something like five ohms, thereby practically closing the circuit. The powder remains cohered unless the tube is mechanically agitated, and to decohere the powder I preferably rotate the tube on its axis in the bearings i^5 i^5. This may be done by a belt passing from the pulley i^6 to the pulley i^7 of a small motor, which is kept constantly running.

The transmitting-station is illustrated in Fig. 2. The Hertzian radiator k consists, as usual, of three solid brass balls in alinement, the outer balls being connected to the terminals of the secondary winding of an induction-coil l. The primary winding of the induction-coil is included in circuit with a battery m, keys n and o, and vibrating make-and-break pieces n' and o'. The make-and-break piece n' consists of a reed n^2, whose characteristic pitch or rate of vibration is the same as that of the reed f^2 of the receiving-instrument f—say t times per second. Similarly the reed o^2 of the make-and-break piece o' has a characteristic pitch or rate of vibration corresponding to that of the reed g^2 of the receiving instrument g—say t' times per second. The reeds n^2 and o^2 are kept in constant vibration by means of magnets n^3 o^3, which are included in circuit with a local battery p and, being in constant vibration, alternately make and break contact with their respective contact-anvils n^4 o^4, which are connected with one terminal of the battery m. A condenser q is connected in multiple with the contacts of the vibrating make-and-break pieces and the keys n and o to suppress the sparks which would otherwise manifest themselves. When the key n is depressed, therefore, it will be understood that the radiator k will be caused to send out Hertzian waves whose frequency may be millions per second; but the operation of the radiator is intermittently interrupted by the make-and-break piece n' t times per second, which we have assumed to be the characteristic pitch or rate of vibration of the reed f^2 associated with the receiving instrument f upon the torpedo. The powder of the coherer i then will be influenced by the Hertzian waves, which are intermittently set up, as described, and will alternately cohere and decohere as many times in a second as the production of Hertzian waves from the radiator k is interrupted. This action of course results in intermittently reducing the coherer, battery h, and the two receiving instruments f and g. Since we have assumed the rate of interruption at the radiator to be t times per second, it is manifest that a pulsating current whose frequency is t will be produced in such local circuit. Therefore the reed f^2, whose characteristic pitch or rate of vibration we have assumed to be t, is thrown into vibration; but the reed e^2, which vibrates at t' times per second, will remain quiet. The reed f^2 being thrown into vibration will act in the manner heretofore described and open at the point d' the short circuit which includes the battery d, thus causing the current from said battery to be directed through the solenoid b, energizing the latter and putting the helm to port. In like manner if the key o is depressed intermittent impulses having a periodicity corresponding to the rate of vibration of the reed g^2 will be

sent through the primary of the induction-coil by means of the vibrating make-and-break piece o', and these intermittent impulses will affect the coherer on the torpedo-boat to cause intermittent impulses of the same periodicity to be supplied to the circuit which includes the receiving instruments f and g. Since these impulses have the same periodicity as the rate of vibration of the reed g^2, the latter will be thrown into vibration and current from the battery e thereby directed through the solenoid b' and the helm put to starboard. It will thus be seen that by depressing either the key n or the key o the torpedo may be steered in one direction or the other, as desired. An especial advantage of this arrangement is that the torpedo may be launched on the opposite side of the ship from the point which it is desired to attack and from which fire may be directed upon the ship, so that there is no danger of the torpedo being struck by an enemy's shot and exploded while being launched.

In Fig. 3 I have illustrated, diagrammatically, in dotted lines a supplemental coherer which may be included in multiple with the coherer i. This may be desirable in some cases to increase the sensitiveness of the signal-receiving apparatus, acting as a guard against failure of the apparatus to operate if for any reason the coherer i should not work properly—that is to say, one of the coherers may respond a little more readily than the other to Hertzian waves of a given wave length or from a given distance and the two may therefore be included in multiple with the circuit to be controlled, so that if one does not respond as quickly as it should the circuit may yet be controlled by the other. Such a supplemental coherer will not, however, in all cases be necessary or desirable, since ordinarily one coherer alone will be sufficient for the purpose.

I have illustrated and particularly described my invention as embodied in an apparatus for steering automobile torpedoes; but it is evident that it may be found useful for other allied purposes, and while I consider it needless here to enter into vague and imaginative speculations as to the extent of its application or its possible value to mankind I do not wish to be understood as limiting myself to the particular apparatus illustrated.

I therefore claim—

1. The combination with a source of electrical waves or disturbances, of a moving vessel or vehicle and mechanism thereon for steering or operating the same, and controlling apparatus adapted to be actuated by the influence of the said waves or disturbances at a distance from the source, as set forth.

2. The combination with a source of electrical waves or disturbances, of a moving vessel or vehicle, mechanism thereon for steering or operating the same, a circuit and means therein for controlling said mechanism, and means for rendering said circuit active or inactive through the influence of the said waves or disturbances exerted at a distance from the source, as set forth.

3. The combination with a source of electrical waves or disturbances and means for starting or stopping the same, of a vessel or vehicle, steering mechanism carried thereby, a circuit containing or connected with means for controlling the operation of said mechanism and adjusted or rendered sensitive to the waves or disturbances of the source, as set forth.

4. The combination with a source of electrical waves or disturbances and means for starting or stopping the operation of the same, of a vessel or vehicle, mechanism carried thereby for steering or operating the vessel, local circuits controlling said mechanism, a circuit sensitive to the waves or disturbances of the source, and means therein adapted to control the said local circuits, as and for the purposes set forth.

5. The combination with an automobile vessel or vehicle, of electromagnetic motor mechanism for controlling the operating mechanism of the vessel, a responsive device adapted to be actuated by etheric waves or disturbances, means controlled by said responsive device, for actuating said motor mechanism, a distant source of etheric waves or disturbances adapted to send out wave-signals of a distinctive character, and means for controlling said source, whereby the mechanism of the vessel or vehicle may be controlled from the source of said waves or disturbances, substantially as set forth.

6. The combination with a moving vessel or vehicle, of electromagnetic motor mechanism, as b b', for controlling the operating mechanism of the vessel, an electric circuit adjusted or rendered responsive to etheric waves or disturbances, a source of current in the circuit and means actuated by the flow of current in the circuit for controlling the said motor mechanism, and means for propagating etheric waves or disturbances of a character to which said circuit is responsive, whereby the electromagnetic motor mechanism and consequently the operating mechanism of the vessel may be controlled, substantially as set forth.

7. The combination with a moving vessel or vehicle, of electromagnetic motor devices b b' for controlling the operating mechanism of the vessel, a circuit adjusted or rendered sensitive to electrical waves or vibrations, a source of current in the circuit, signal-receiving instruments f g controlling the said electromagnetic motor devices, each of said instruments being adapted to select and respond to electric signals of distinctive character received by the circuit, and means at a distant point for transmitting such signals by electrical waves or vibrations, whereby the opera-

tion of said electromagnetic motor devices may be effected from such distant point, as described.

8. The combination with an automobile torpedo, of a rudder therefor, electromagnetic steering mechanism adapted to control the position of said rudder, a plurality of selective signal-receiving devices adapted each to respond to electrical impulses of distinctive character, said signal-receiving devices serving to control said electromagnetic steering mechanism, an electric circuit including said signal-receiving devices, a responsive device located in said circuit and adapted to receive Hertzian-wave signals and to set up electrical signals corresponding thereto in the circuit which includes said signal-receiving devices, a radiator at a transmitting-station for sending out Hertzian waves, and means for causing said radiator to transmit signals of any distinctive character to which any of said signal-receiving devices is adapted to respond, substantially as and for the purpose set forth.

9. The combination with an automobile torpedo, of electrically-operated steering mechanism therefor, a plurality of electromagnetic signal-receivers controlling corresponding parts of said steering mechanism, an electric circuit including said signal-receivers with a source of electric current, each of said signal-receivers being adapted to respond to electrical impulses of a characteristic periodicity, a responsive device controlling said circuit and adapted to receive intermittent Hertzian-wave signals, a radiator at a distant station for transmitting Hertzian waves, and means for causing said radiator to transmit intermittent Hertzian waves in impulses of a periodicity corresponding to the periodicity to which any one of said signal-receivers is adapted to respond, whereby said responsive device is caused to set up electrical impulses of the same periodicity in the circuit which includes the several signal-receivers, substantially as and for the purpose set forth.

10. The combination with an automobile vessel or vehicle, of a rudder therefor, electromagnetic steering mechanism for controlling the position of said rudder, a responsive device adapted to be actuated by electrical waves or disturbances, means controlled by said responsive device for actuating said electromagnetic steering mechanism, a distant source of electrical waves or disturbances adapted to send out wave-signals of a distinctive character, and means for controlling said source, whereby the course of the vessel or vehicle may be directed from the source of said waves or disturbances, substantially as described.

11. The combination with an automobile torpedo, of a rudder therefor, electromagnetic steering mechanism for controlling the position of said rudder, a circuit associated with said steering mechanism and including a source of electric current, a responsive device adapted to be actuated by waves, radiations or etheric disturbances for controlling the electrical condition of said circuit, a distant source of radiations, waves or disturbances, and means for stopping and starting the same, substantially as described.

12. The combination with an automobile vessel or vehicle, of steering mechanism therefor, a plurality of circuit-controlling devices and circuits associating the same each with a particular part of said steering mechanism whereby the operation of such part may be controlled, means, adapted to be actuated by electrical waves or disturbances for throwing into action either of said circuit-controlling devices, each of such circuit-controlling devices being adapted to respond only to signals of a distinctive character, and a source of electrical waves or disturbances of a character to actuate either of said circuit-controlling devices, whereby different operations of said steering mechanism may be controlled from said source, substantially as described.

13. The combination with an electric circuit adjusted or rendered responsive to electrical waves, radiations or disturbances, of a plurality of signal-receiving instruments in the circuit, each adapted to select and respond to signals of a peculiar and distinctive character, electromagnetic motor devices controlled by said instruments, and a radiator which may be located at a distant point for propagating the waves or radiations and so for transmitting signals to which either of said instruments will respond, whereby the electromagnetic motor devices can be controlled from the distant point, substantially as set forth.

14. The combination with an automobile vessel or vehicle, of electromotor devices for controlling the operating mechanism thereof, a plurality of signal-receiving instruments controlling said electromotor devices, means, actuated by electrical waves or radiations, for throwing into action either of said signal-receiving instruments, and a radiator at a distant point for transmitting waves or radiations of suitable character for operating either of said signal-receiving instruments, substantially as set forth.

In witness whereof I hereunto subscribe my name this 16th day of July, A. D. 1898.

BRADLEY ALLAN FISKE.

Witnesses:
N. M. DYER,
F. H. HOLMES.