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SYSTEM OF RADIODIRECTIVE CONTROL.

1,319,068.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, JOHN HAYS HAMMOND, JR., a citizen of the United States, residing at Gloucester, in the State of Massachusetts, have invented certain new and useful Improvements in Systems of Radiodirective Control, of which the following is a specification.

My invention relates to the control of moving bodies by means of radiant energy, and relates more particularly to systems for controlling the movement of dirigible torpedoes from a number of stations, and it may be applied to the protection of harbors and coasts from hostile ships. In my system, one central station may be equipped with radio telegraph apparatus for sending out electric waves to operate suitable apparatus on torpedoes or other movable bodies, and the apparatus at said central station may be under the control of a number of other stations, suitably situated to observe and direct the torpedoes or other movable bodies.

Referring to the accompanying drawings:—

Figure 1 shows a chart or plan of a harbor, with torpedo-control stations, ships and torpedoes.

Fig. 2 shows a diagrammatic form, several auxiliary control stations and a central station on my system of radio directive control.

In Fig. 1, a central station O is equipped with radio telegraph apparatus and is placed in a position protected from the gun fire of the enemy. A number of operators may be placed at different advantageous positions along the shore at stations 1, 2, 3 and 4. These different operators will have either wire connection with station O or ether wave connection with station O, or any other form of electric connection with station O. As shown in Fig. 1, stations 1, 2, 3 and 4 are connected with central station O, by means of the common wire N N N, with ground return at E, E¹, E², E³ and E⁴. T is a torpedo supply station. As will be seen in the plan, station 1 would not be able to operate torpedoes against a ship in the position S¹ by reason of the headland H intervening. Nor would station 2 be able to operate torpedoes against a ship in the position S for the same reason. Therefore, it would be suitable to place an operating base on each side of the headland H. Moreover,

operating station 4 would be able to direct torpedo T² against ship S², whereas the operators at 1, 2 and 3 could not do so by reason of the island I intervening. It is not necessary that there should be a torpedo base having dirigible torpedoes at each of these controlling stations, for it may be understood that one torpedo can be handed on from one station to another. However, if a number of torpedoes be employed either simultaneously or consecutively, it is essential that each of these said torpedoes shall respond to and be controlled by an electrical impulse or electric waves having specific characteristics. Now, in order that each operator may control independently his own torpedo, it is essential, as has been above stated, that he shall use for the control of the said torpedo an electrical impulse of specific characteristics. Therefore, at the central station O there should be a plurality of sets of apparatus, each capable of sending out electrical impulses or electric waves having specific characteristics, and all under the control of any of the auxiliary operating stations. For instance, at station O there may be a number of alternators having different frequencies, and energizing, respectively, oscillatory circuits also having different frequencies of a higher order. In this way electric waves of various lengths, in groups or with periodic amplitude variations of different frequencies, can be transmitted from the central station, and each torpedo will be responsive to a specific wave length and a specific group frequency. All the sets of apparatus at station O can be operatively controlled from each of the stations 1, 2, 3 and 4, and in order that these latter stations may operate simultaneously without interference, I have invented a method for accomplishing this result, as shown in Fig. 2.

In Fig. 2, 1, 2 and 3 represent different auxiliary operating stations. At the other end of the line N is situated a central wireless station O and means for controlling circuits containing a number of different alternators. At station 1, is shown a form of apparatus which I have devised for the purpose of obtaining a specific number of electrical impulses or waves to be transmitted over the line. In order to obtain the best results in multiplex telegraphy with current waves of different frequencies, the currents should be sinusoidal, and to secure

this effect I have designed the following apparatus: W^1 is a wheel rotating at a specific speed. Eccentrically connected with this wheel is a pistonlike mechanical movement
 5 P^1 which effects a periodic compression of the diaphragm of microphone M^1 . The compression of the microphonic contact will vary with the position of the wheel W^1 , and the number of complete cycles of micro-
 10 phonic action will depend upon the number of revolutions of the wheel, and in this manner, sinusoidal current waves can be sent out over the line N . F^1 represents a frequency meter for showing the frequency of the cur-
 15 rent waves sent out from station 1, and E^1 is a ground connection. The speed of W^1 can be varied so as to send current waves of any desired frequency over the line N . At stations 2 and 3, similar apparatus to that
 20 just described is shown at W^2 and W^3 , P^2 and P^3 , M^2 and M^3 , F^2 and F^3 , and E^2 and E^3 , respectively.

A battery B supplies current to stations 1, 2 and 3, and the line N connecting them with
 25 the central station O . At station O , there are a plurality of tuned relays, R^1 , R^2 and R^3 , each responsive to current impulses of a definite frequency. Taking one of these
 30 operating sets at station O as an example, when electrical impulses or current waves of the proper frequency, (from any one of the auxiliary operating stations 1, 2 or 3), are
 sent over the line N , the tuned relay R^1 will respond, the vibratory reed or armature r^1
 35 will break contact and the circuit including the battery B^1 and the relay R^1 , which is normally closed, will be opened. The armature r^1 will then no longer be attracted, but will
 40 fall away by the action of gravity, (or by means of a spring or by other means), and will close the circuit containing the battery
 B^1 and the solenoid D^1 . The solenoid will therefore attract its core d^1 , which latter
 will then close the circuit containing the alter-
 45 nator G^1 and the primary coil of step-up transformer J^1 . The secondary windings of J^1 supply high-potential currents to con-
 denser C^1 , which, when charged to the sparking
 50 voltage at spark gap K^1 , discharges through K^1 and inductance coil L^1 , and induces os-
 cillatory currents in the untuned antenna A by means of the coupling coil L^4 . In this
 manner, there are radiated from the an-
 55 tenna A , which is grounded at E^3 , electric waves of a specific length, depending upon
 the periodicity of the oscillatory circuit L^1 , C^1 , and of a specific group frequency, de-
 pending upon the frequency of the alterna-
 60 tor G^1 , the three alternators G^1 , G^2 , G^3 hav-
 ing different frequencies respectively. A torpedo, having suitable apparatus respon-
 sive to such waves, will therefore be under
 the control of this set of apparatus at central
 65 station O , and hence under the control of
 any of the auxiliary stations 1, 2 or 3, which

can put this central station apparatus in operation.

Relays R^2 and R^3 are tuned to different frequencies from R^1 and from each other, and each puts in operation a set of apparatus
 70 similar to that under the control of R^1 , each set including an alternator of a specific frequency, and an oscillatory circuit of a higher order of frequency, as will be evident from
 the drawings, and need not be more par-
 75 ticularly described here. It may be repeated, however, that any one of the sets of apparatus at the central station O may be put
 in operation from any one of the auxiliary
 80 stations 1, 2 or 3, and thus different torpedoes or other moving bodies may be controlled and directed either consecutively or
 simultaneously. Also, all the auxiliary stations may operate conjointly or consecutively in the control of one torpedo.
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It is evident that the number of auxiliary control stations and the number of sets of apparatus at the central station need not be
 confined to three, but may be any number that is convenient and suitable, and the sets
 90 of radio transmission apparatus need not be all placed in one central station, but may be divided up among two or more central
 stations. In the present embodiment of my invention, the auxiliary control stations are
 95 shown as connected with the central station by a wire with ground return, but they may also be connected by a complete metallic circuit, or through the ether by means of suit-
 able radio telegraph apparatus. Selectivity
 100 in the electric wave characteristics may also be secured through periodic variations in amplitude, instead of by group frequencies, by means of suitable apparatus such as
 shown and described in other applications of
 105 mine.

It is also obvious that various other changes and modifications may be made in the particular apparatus and arrangements
 herein shown and described, without depart-
 110 ing from the spirit of my invention, or the scope of the following claims.

I claim as my invention:—

1. In a system of radio control, a main controlling station provided with means for
 115 transmitting a plurality of electric waves, having different characteristics, and a plurality of local stations, each being provided with means to cause the main controlling
 station to produce any of said waves of pre-
 120 determined characteristics.

2. In a system of radio control, a controlling station comprising wave transmission
 apparatus adapted to emit a plurality of
 125 waves having different characteristics, and means for automatically controlling said
 apparatus to produce any of said waves hav-
 ing predetermined characteristics, and a
 plurality of local stations, each comprising
 variable wave transmitting apparatus and
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adapted to actuate the controlling mechanism at the central station.

3. A system of radio control, comprising a main station and a plurality of local stations, the main station comprising a plurality of independent means for transmitting groups of waves, each group having a predetermined group frequency and composed of waves having a predetermined length, each of said transmitting means being under the control of an independent control device, and the local stations each comprising variable wave transmitting mechanism adapted to actuate any predetermined control device at the main station.

4. The method for transmission of electroradiant energy which consists in producing a current in a circuit, varying the current at any one of several local stations on said circuit, selectively operating by means of such current variations any of several electroradiant energy transmitters for emitting a plurality of series of waves having different characteristics respectively.

5. A system of teledynamic control, comprising a main station and a plurality of auxiliary stations, the main station comprising a plurality of independent means for transmitting waves having a plurality of predetermined characteristics, each of said transmitting means being under the control of an independent control device, and the auxiliary stations comprising transmitting apparatus including a variable speed wave transmitter adapted to actuate any of the control devices at the main station.

6. In a system of teledynamic control, a main station and a plurality of auxiliary stations, said main station comprising means for transmitting a plurality of electric wave trains, each wave train having a plurality of characteristics, and each of said auxiliary stations comprising apparatus, including a variable-speed sinusoidal wave transmitter, adapted to cause the emission of any desired wave train from the main station, and a frequency-indicating device connected with said variable-speed wave transmitter.

7. In a system for the transmission of energy, the combination with means for transmitting a plurality of series of waves, of an electric circuit, means for producing periodic variations in an electric current in said circuit and for varying the frequency of said variations, and means selectively controlled by varying the frequency of said variations for causing said first-mentioned

means to transmit any one of said series of waves.

8. In a system for the transmission of energy, the combination with means for transmitting a plurality of waves having different wave frequencies respectively, of an electric circuit, means for producing periodic variations in an electric current in said circuit and for varying the frequency of said variations, and means selectively controlled by varying the frequency of said variations for causing said first-mentioned means to transmit any one of said series of waves.

9. In a system for transmitting energy, the combination with means for transmitting a plurality of series of waves, of an electric circuit, means for producing electrical oscillations having a variable frequency in said circuit, and means selectively controlled by varying said frequency for causing said first-mentioned means to transmit any one of said series of waves.

10. In a system for the transmission of radiant energy, the combination with an open aerial circuit, of means for causing said circuit to emit a plurality of series of groups of electro-radiant waves having different wave frequencies and different group frequencies respectively, an electric circuit, means for periodically modifying at a variable frequency and at any one of a plurality of stations on said circuit an electric current in said circuit, and means controlled by a variation in said frequency at any one of said stations for causing said open circuit to emit any one of said series of groups of radiant oscillations selectively.

11. The method for the transmission of radiant energy, which consists in producing an electric current in a circuit, periodically varying said current at any one of a plurality of stations on said circuit, and at any one of a plurality of predetermined frequencies at each station, and selectively causing the transmission of any one of a plurality of series of groups of waves having different wave frequencies and different group frequencies respectively as the result of such variation of said current.

This specification signed and witnessed this 22nd day of May, A. D. 1912.

JOHN HAYS HAMMOND, JR.

Witnesses:

MABEL J. COOPER;
OLIVE B. KING.