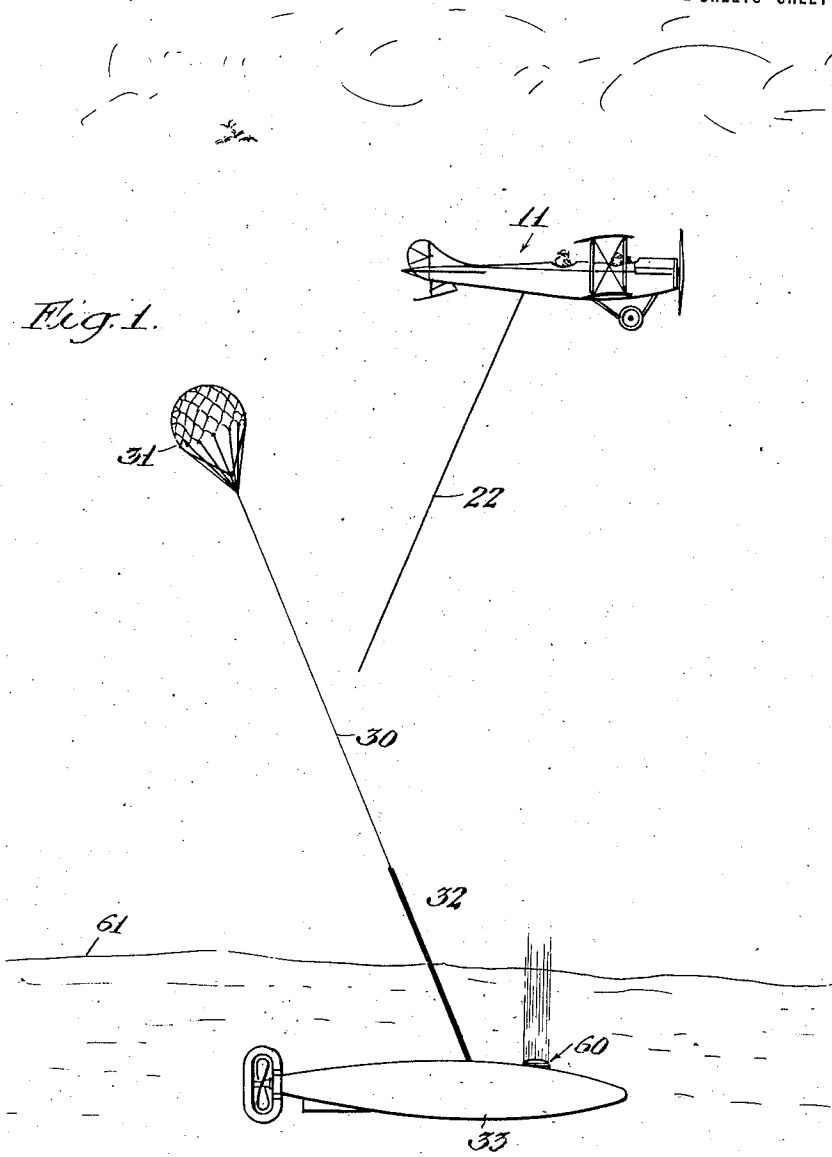


E. C. HANSON.
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APPLICATION FILED JUNE 4, 1918.

1,320,142.

Patented Oct. 28, 1919.
2 SHEETS—SHEET 1.



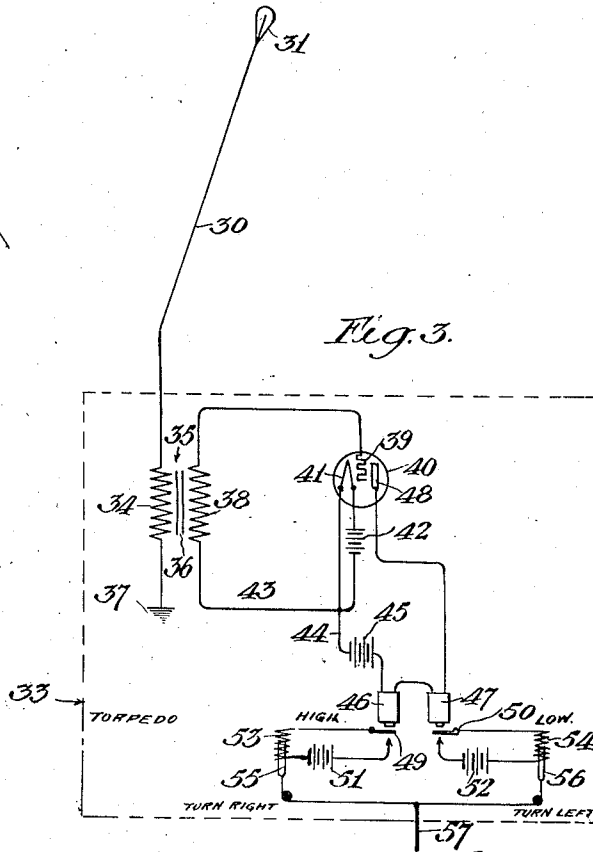
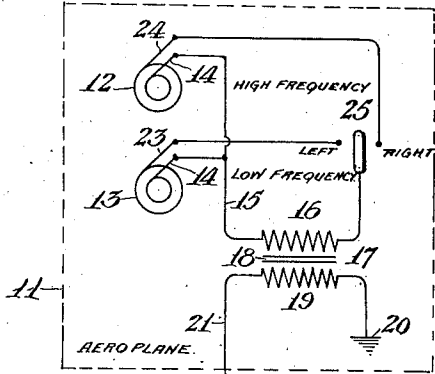
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Fig. 2.



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UNITED STATES PATENT OFFICE.

EARL C. HANSON, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO TITLE INSURANCE AND TRUST COMPANY, A CORPORATION OF CALIFORNIA.

AUDIO-FREQUENCY-CONTROLLED TORPEDO.

1,320,142.

Specification of Letters Patent.

Patented Oct. 28, 1919.

Application filed June 4, 1918. Serial No. 238,110.

To all whom it may concern:

Be it known that I, EARL C. HANSON, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Audio-Frequency-Controlled Torpedo, of which the following is a specification.

My invention relates to the art of naval warfare, and the principal object of the invention is to provide means by which a torpedo or submarine or other self-propelled vessel can be controlled and directed from a distance and more particularly from an aeroplane.

A further object of the invention is to provide means by which a dirigible vessel may be controlled by an aeroplane without the necessity of any physical connection between the aeroplane and the vessel.

Further objects of the invention will be made evident hereinafter.

Referring to the drawings, which are entirely diagrammatic,

Figure 1 shows an aeroplane and torpedo embodying my invention.

Fig. 2 is a diagram of the electrical apparatus on the aeroplane.

Fig. 3 is a diagram of the electrical apparatus on the torpedo.

The aeroplane 11 may be of any type, or a dirigible balloon, kite or ship may in some cases be substituted therefor. This aeroplane is provided with a pair of audio frequency generators; the generator 12 generating a frequency approximately twice that of the generator 13. One of the brushes 14 of each of the generators is connected to a common wire 15, which in turn is connected to the primary 16 of a transformer 17, this transformer having an iron core 18 and a secondary 19, one terminal of the secondary 19 being grounded at 20 on the aeroplane frame, and the other terminal 21 being connected to a hanging wire 22, which may be of considerable length. The other brushes 23 and 24 of the generators 12 and 13 are connected to a switch 25 by means of which either of the brushes 23 or 24 can be connected to the other terminal of the primary 16.

The apparatus installed on the torpedo consists of an antenna 30 which is preferably secured to a glider, but for example is shown secured to a balloon 31, or which may

be secured to a kite. The lower portion of the antenna 30 is insulated, as shown at 32, and passes into the interior of the torpedo. 33, being connected therein to the primary 34 of a transformer 35 having an iron core 36, the other terminal of the primary 34 being connected to ground 37, which is, in this case, the hull of the torpedo. The secondary 38 of the transformer 35 is connected at one terminal to the grid 39 of a vacuum bulb repeater 40. This vacuum bulb repeater has a filament 41 energized by a battery 42, the other terminal of the secondary 38 being connected through a wire 43 with the filament 41. The filament 41 is also connected through a wire 44 with a battery 45, the other terminal of this battery being connected through a pair of vibrating relays 46 and 47 with the plate 48 of the vacuum bulb repeater 40. The vibrating relays 46 and 47 are provided with vibrating reeds 49 and 50 which are tuned for audio frequencies and which connect batteries 51 and 52 through operating magnets 53 and 54. The operating magnets act upon cores 55 and 56 connected to the rudder 57 of the torpedo. The torpedo 33 is provided with a search light 60 which is so set that it shines in a practically vertical direction so as to be visible to the aeroplane 11 which moves approximately above it, being more or less invisible to objects on the surface 61 of the ocean in which the torpedo moves.

The method of the operation of the invention above described is as follows:

The torpedo 33 being started by any convenient means pulls the balloon 31 along and maintaining the antenna 30 at a considerable distance in the air, this antenna being insulated at 32 so that it makes no contact with the water. The aeroplane 11 flies over the torpedo 33, the pilot making observations from time to time of the torpedo's progress by watching the search light 60 at night, or by watching the balloon 31 in the daytime.

Whenever the pilot of the aeroplane wishes to change the direction of the torpedo's progress he flies the aeroplane into the neighborhood of the torpedo so that the trailing wire 22 is somewhere in the neighborhood of the antenna 30. If the wire 22 and the antenna 30 are each several hundred feet long, it is not necessary that the

aeroplane approach closer than several hundred feet. Whenever the pilot wishes to change the direction of the torpedo he moves the switch 25 to connect either the high frequency generator 12 or the low frequency generator 13 to the transformer 17, thus impressing a high frequency or a low frequency potential on the trailing wire 22. The electro-static charges caused by this potential set up an electro-static field which includes the antenna 30 causing faint currents to flow through the antenna and the primary 34 to the ground 37. This in turn generates currents on the secondary 38, which are amplified by the vacuum bulb repeater 40, so that relatively heavier currents flow through the vibrating relays 46 and 47. The reeds 49 and 50 are so tuned that they each respond to a particular frequency, this frequency being that of the generators 12 and 13 respectively. If, for example, the generator 12 is connected to the transformer 17, the reed 49 will start to vibrate closing the circuit through the operating coil 53 and moving the rudder in one direction. If, on the other hand, the low frequency generator 13 is connected to the transformer 17, the reed 50 will vibrate and the rudder will be turned in the opposite direction. It is thus possible for the pilot on the aeroplane by approaching the neighborhood of the antenna 30 to turn the torpedo at will so that he can guide it through a tortuous channel to any desired objective. Obviously captive or dirigible balloons might be used in the place of aeroplane 11, although with some sacrifice of efficiency.

While I have spoken of the torpedo 33 it is to be understood that any sort of self-propelled vessel may be substituted therefor, and this vessel may run either submerged or on the surface.

In the operation of my invention I use audio frequencies exclusively, that is to say,

frequencies below 10,000 cycles per second. By so doing I am able to use iron core transformers at both the sending and receiving ends, and I am able by the use of these iron core transformers to entirely eliminate any radio frequency waves which may be present in the neighborhood, as the radio frequency waves are entirely eliminated by the iron core transformers. Transmission of audio frequency waves over long distances is difficult. I have, however, demonstrated that it is entirely practical to operate over short distances, using the apparatus above described, and I have found that such apparatus is not only low in first cost and easy to maintain, but that it is also very reliable and quite efficient for the purpose set forth in this specification.

What I claim is:—

An apparatus for directing and controlling the movement of a self-propelled torpedo or the like, comprising an antenna secured to the torpedo and insulated from the water surrounding said torpedo; means for supporting said antenna so that it projects a suitable distance out of the water in which the torpedo moves; audio frequency responsive means located inside the torpedo and electrically connected to said antenna, an iron core transformer so connected in the circuit of said audio frequency responsive means as to eliminate all radio frequency waves; control means actuated by said audio frequency responsive means and arranged to control the movement of the torpedo; and manually controlled radiating means mechanically independent of said torpedo for impressing audio frequency waves on the space surrounding said antenna.

In testimony whereof, I have hereunto set my hand at Washington, District of Columbia, this 4th day of June, 1918.

EARL C. HANSON.