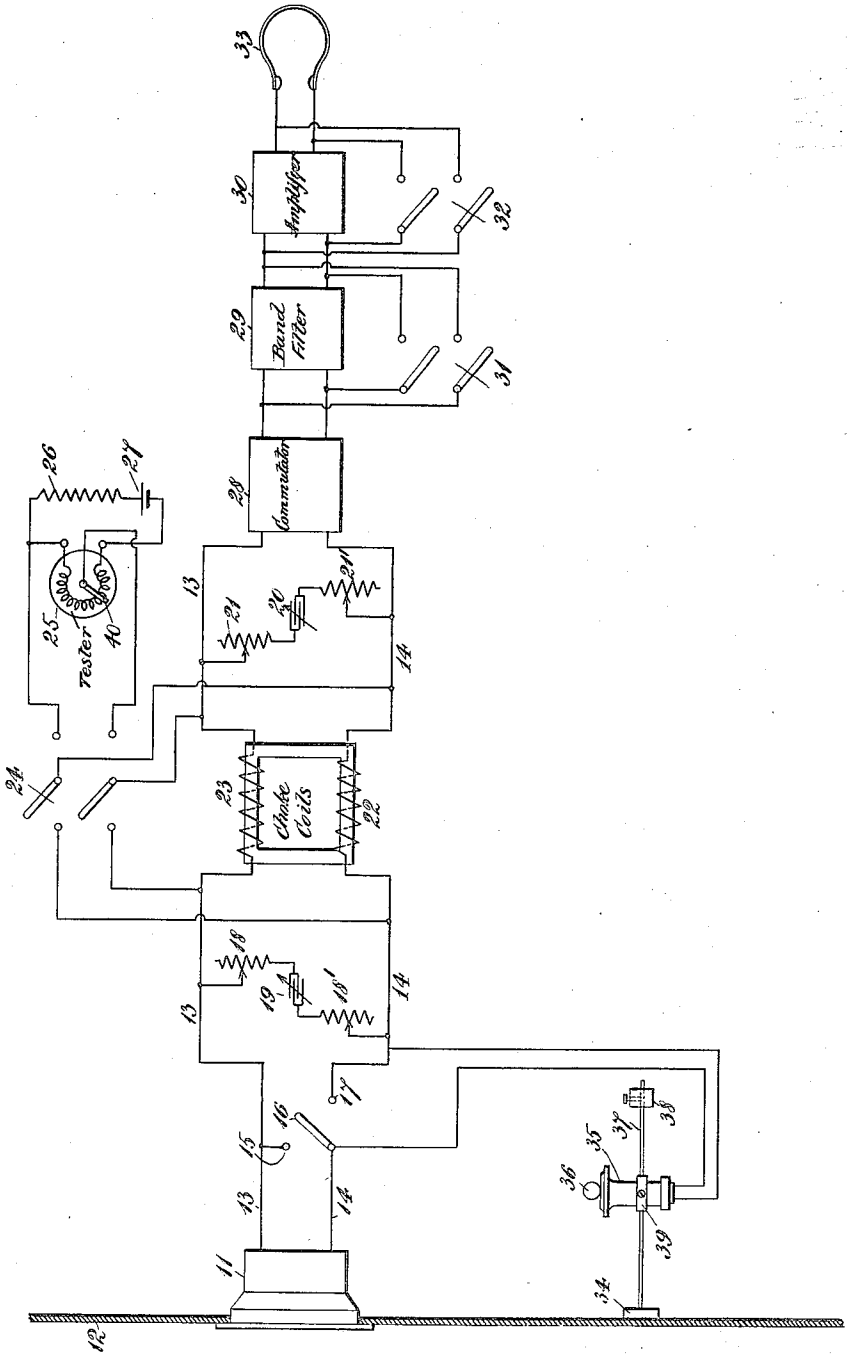
R. A. FESSENDEN.

METHOD AND APPARATUS FOR SUBMARINE SIGNALING.

APPLICATION FILED JULY 20, 1917.

1,415,539. Patented May 9, 1922.



INVENTOR=
Reginald A. Fessenden
By
HIS ATTORNEYS=

UNITED STATES PATENT OFFICE.

REGINALD A. FESSENDEN, OF BROOKLINE, MASSACHUSETTS, ASSIGNOR TO SUBMARINE SIGNAL COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE.

METHOD AND APPARATUS FOR SUBMARINE SIGNALING.

1,415,539. Specification of Letters Patent. Patented May 9, 1922.

Application filed July 20, 1917. Serial No. 181,857.

To all whom it may concern:

Be it known that I, REGINALD A. FESSENDEN, of Brookline, in the county of Norfolk and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Methods and Apparatus for Submarine Signaling, of which the following is a specification.

My invention relates to submarine signaling, and more particularly to secret methods and apparatus for submarine signaling and for detecting submarines, and still more particularly to methods and apparatus for comparing the strength of disturbing noises and eliminating, compensating and neutralizing said disturbing noises from the receiving apparatus.

The figure forming a part of this specification shows diagrammatically the best form and arrangement of apparatus now known to me for carrying out my invention.

The object of my invention is to obtain increased efficiency in submarine signaling and to provide a means for signaling secretly and to eliminate or compensate for the disturbing noises in the receiver while listening for submarines.

In the figure, 11 is a submarine receiving apparatus, such for example, as the oscillator shown in United States Patent No. 1,167,366 granted to Submarine Signal Company January 4, 1916, on applicant's application. This oscillator as shown is fixed in the side of the ship 12 and from it leads 13 and 14 run to the switch 16 and thence through the choke coils 22 and 23 to a commutating device 28, such for example, as a commutator of the type referred to in United States Patent No. 1,108,895, issued September 1, 1914, granted to Submarine Signal Company on applicant's application, whereby low frequency impulses received on the oscillator and generating low frequency electrical impulses in the circuit 13 and 14, are commutated into pulses of a frequency of about 850.

The leads from the commutator are connected to a band filter 29 preferably of the type well known in the telephone art as the standard "Bell telephone filter" and constructed to let through desired frequencies in the neighborhood, for example of 850 cycles per second, while opposing a high resistance to frequencies higher and lower than the desired frequency, whatever it may be.

The leads from the band filter 29 are connected to an amplifier 30, of any of the well known types, preferably of the De Forest audion type or the Fessenden magnetic type disclosed in applicant's U. S. Patent No. 706,747, dated August 12, 1902, and leads from the amplifier 30 are connected to the receiver or other indicator 33. This device is shown as a head piece receiver.

The switch 24 permits the choke coils 22 and 23 to be short-circuited, and switches 31 and 32 permit the band filter and the amplifier, respectively, to be short-circuited.

18, 18′, 21, 21′ are resistances and 19 and 20 are capacities bridged across the conductors 13 and 14, and these in conjunction with the choke coils 23, 22 tend to prevent any high frequency generated in the oscillator 11 from reaching the commutator 28.

If the switch 24 be thrown to the right a tester for testing the condition of the commutator 28 is connected to the line 13—14. This tester consists of a small, circular, variable resistance 25, of about 10 ohms, a resistance 26, of about 1000 ohms, a dry cell 27, and a switch arm 40, which connects with the variable resistance and is connected through the switch 24 with the line 13.

When the switch 24 is thus thrown to the right, the resistance 25 is connected across to the circuit 13—14 and a small potential, varying from 0 when the resistance 25 is 0, up to about 1/70 of a volt, when all the resistance of 25 is in, is imposed on the commutator 28, and if the commutator is in good condition a musical note of a frequency of say 850 will be heard in the receiver 33, the intensity of which will depend upon the amount of resistance in the adjustable resistance 25.

35 is a telephone receiver having a small weight 36 attached to its diaphragm. The receiver 35 is used as a transmitter and is held by the adjustable clamp 39 to the flexible rod 37.

The rod 37 is attached to the support 34, which is clamped to the side of the ship 12, and a movable weight 38 is also attached to slide along the rod 37.

When the blade of the switch 16 is connected to the contact 17 the receiver 35 is short-circuited, and the only noises heard

in receiver 33 will be those generated by the oscillator 11.

By throwing the switch blade 16 onto the contact 15, the oscillator 11 is short-circuited, and the only noise heard in receiver 33 will be the noise generated by the telephone receiver 35. By alternately throwing the switch blade on the contacts 15 and 17 the sound made by the oscillator 11 may be compared with the sound made by the telephone receiver 35. The sound made by the telephone receiver 35 may be made to have approximately the same intensity as that of the oscillator 11, by sliding 35 in and out along the rod 37, or sliding the weight 38 in and out along the rod 37 when it is known that there is no submarine in the neighborhood. Having made such adjustment, if, on listening into the oscillator 11, the operator is not certain whether or not he is hearing any strange noise, he can, by throwing the switch blade onto the contact 15, compare the noise heard on the oscillator 11 with that made by the receiver 35, and if the noises are no longer clear or simple he will know that he is listening to some new sound which was not in the neighborhood originally. When used in this way the telephone receiver 35 is called a comparator.

The telephone receiver 35 may also be used as a compensator to compensate for or neutralize all undesirable noises produced in the oscillator 11 by the vibration of the ship itself.

As is pointed out in United States Patent No. 1,108,895, issued September 1, 1914, and as has been shown by experiment, when the commutator is used high pitch noises do not get through to receiver 33, but only the low pitch noises produced by the vibration of the submarine.

Applicant has shown elsewhere that since a cylindrical body moving endwise through a fluid is in unstable equilibrium, it must vibrate with all possible degrees of freedom. Applicant has also proven that when such an elongated cylinder as a submarine is so moving at standard under-water speed it must radiate in the neighborhood of 100 H. P. of compressional wave or sound radiation of so low frequency ($1\frac{1}{2}$ to 5 per second) as to be inaudible to the unaided ear.

Now, if the submarine-detecting apparatus shown in this application is installed on submarine B, when submarine B moves through the water, in order to detect another submarine, which we will call submarine A, the hull of submarine B will also vibrate and low frequency vibrations originating in it will be received on the oscillator 11 and heard in the receiver 33.

But as applicant has discovered, there will always be some frame or part of the structure of the submarine B to which 34 can be attached and clamped so that receiver 35, when properly adjusted by the sliding clamp 39 and weight 38, can be made to generate a low frequency throb of pulsations equal in amount and in opposite phase to that generated by oscillator 11. Consequently, if the blade of the switch 16 is left in intermediate position, as shown, so that the oscillator 11 and receiver 35 are in series, no effect will be produced in the receiver 33 by the pulsations of submarine B, and consequently pulsations made by submarine A can be detected.

Even if the pulsations made by submarine A were of substantially the same period as those made by submarine B, nevertheless the pulsations due to submarine A can be detected by the receiver 33, because they will not have the same phase, or will not continue to have the same phase, as those made by submarine B.

It is well known in the art that other generators may be used for compensating in place of the receiver 35 and that the two sources may be made to oppose each other in other ways than by connecting them in series; and that other methods of commutating may be used besides mechanical commutation, and that many types of amplifiers may be used, as for example, the magnetic amplifier or audion amplifier.

Obviously, the oscillator, in place of being installed on the side of the ship, may be placed in the well known manner in the forepeak tank or any tank containing liquid. See for example United States Patent No. 1,067,207 granted to R. L. Williams July 8, 1913. In this case the compensator may also be placed in the same tank, but shielded by a sound screen so as not to receive internal noises.

This method and apparatus may also be used for secret signaling by telegraphing with a submarine signaling source having a frequency of from 1 to 5 per second, and receiving the signals on the apparatus shown.

The position of the band filter and the amplifier may be interchanged.

What I claim as my invention is:—

1. Means for eliminating undesired disturbing compressional impulses from impulses which it is desired to perceive, comprising a vibratory body, a plurality of means adapted to receive said compressional impulses and transform them into electrical impulses, said means being located at points upon said vibratory body which vibrate substantially equally and in opposite phase to each other, whereby said electrical impulses will neutralize each other and hence cut out said undesired impulses, an indicator, and electrical connections between said transforming means and said indicator, whereby any impulses other than said undesired disturbing impulses will be capable of perception at said indicator.

2. That method of detecting on board of a vessel impulses originating from sources outside the vessel which consists in receiving the said impulses upon a plurality of vibrating electric generators located in said vessel at points where the usual vibrations of the vessel are substantially equal in amount and opposite in phase, and connecting said generators in opposition whereby the impulses generated by said generators will neutralize each other, and transforming other impulses so received into electrical impulses and delivering them to an indicator.

3. That method of detecting on board of a vessel impulses originating from sources outside the vessel which consists in receiving the said impulses upon a plurality of vibrating electric generators located in said vessel at points where the usual vibrations of the vessel are substantially equal in amount and opposite in phase, and connecting said generators in opposition whereby they will neutralize each other's effort, and transforming other impulses so received into electrical impulses and delivering them to an indicator.

4. Electrical means for detecting on board a vessel impulses originating from sources outside the vessel, which consists in a receiving means located on board said vessel and a compensating means also located on said vessel at a point where the pulsations at its location will be substantially equal in amplitude and wave form to the usual vibrations of that part of the vessel at which the said receiving means is located but is in opposite phase thereto, and an indicator electrically connected both to said receiving means and said compensating means whereby undesired impulses produced by the vessel will be neutralized by said compensating means and the desired impulses received on said indicator.

5. Means for detecting on board a vessel impulses originating from sources outside the vessel, which consists in a receiving means located on board said vessel and a compensating means also located on said vessel at a point where the pulsations of said vessel are substantially equal in amplitude and wave form to the vibrations of that part of the vessel at which the said receiving means is located but are in opposite phase thereto, and an indicator connected both to said receiving means and said compensating means whereby undesired impulses produced by the vessel in said receiving means will be neutralized by said compensating means and the desired impulses received on said indicator.

REGINALD A. FESSENDEN.