

R. A. FESSENDEN.
DYNAMO ELECTRIC MACHINERY.
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1,213,610.

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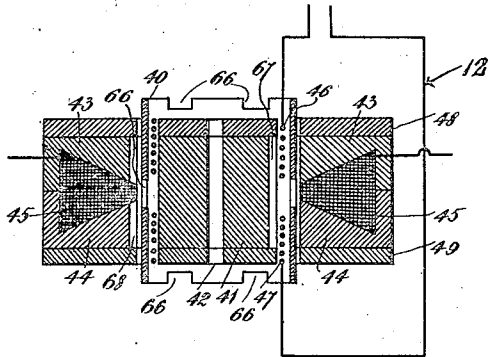


Fig. 1.

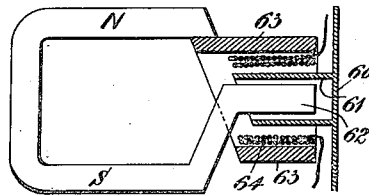


Fig. 2.

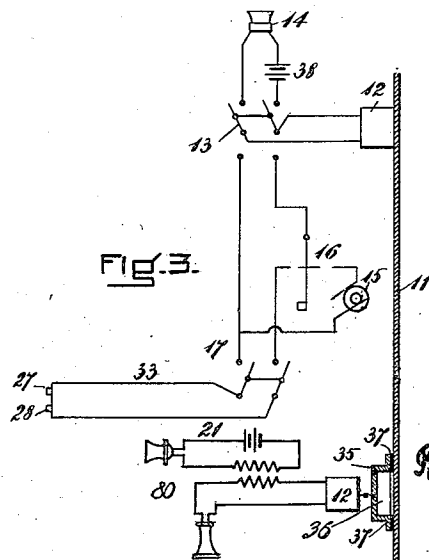


Fig. 3.

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UNITED STATES PATENT OFFICE.

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DYNAMO-ELECTRIC MACHINERY.

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Specification of Letters Patent.

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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 certain new and useful Improvements in Dynamo-Electric Machinery, of which the following is a specification.

The invention herein described relates to electrodynamic apparatus and methods and to the generation, the utilization, the transmission and the receipt of electric energy and more particularly to the production and detection of compressional waves, and still more particularly to submarine signaling.

It has for its object increased efficiency in these lines.

This application is a division of the application filed by me which matured into Letters Patent No. 1,167,366, issued January 4, 1916, which was a division of my application Serial No. 744,793, filed January 29, 1913.

The invention will be understood more particularly by reference to the drawings in which it is shown in its preferred embodiment.

In the drawings Figure 1 is a diagrammatic cross section of apparatus embodying my invention; Fig. 2 being an elevation partly in section of a modification thereof. Fig. 3 shows diagrammatically the application of the invention to the transmission and receipt of submarine signals.

A suitable form of apparatus for carrying out this invention is shown in Fig. 1. Here 40 is a copper tube say approximately eight inches in diameter and eight inches long (the length being preferably equal to or less than the diameter). 45—45 is the magnetizing coil of the magnetic circuit, 43—43 being the north pole and 44—44 being the south pole. The magnetic flux flows from 43—43 through the top air gap to the armature or core 41, thence through the bottom air gap 44—44 and back through the outside ring to 43—43. The tube 40 lies in the two air gaps and such part of it as is not over the windings 46, 47, is preferably slotted as at 66 or otherwise made of high resistance. The windings 46, 47 are preferably wound on the core 41 though they may be wound on the inside of the poles 43—43, 44—44.

The core 41 and the poles are preferably

slotted vertically and radially as at 67 and 68, respectively. The core 41 is preferably made of iron and the poles are preferably made of soft steel or wrought iron, tube 40 being attached in any suitable manner to the object to be set in motion or attached to the piston of an engine as shown in Fig. 3. As shown these two windings 46, 47 are two coils of a single winding, though two windings may be used in which case there would be additional terminals.

In operating, for example, the device shown in Fig. 1 an alternating current dynamo and telegraph key are connected to the terminals of the windings 46, 47, and a direct current dynamo with rheostat is connected to the terminals of the magnetizing coils 45. On passing an alternating current through 46, 47, the tube 40 acts as a short circuited secondary and has induced in it the same number of ampere turns as 46, 47, and consequently being in an air gap in which a magnetic flux exists it is driven up and down with great force. For example, if the alternating current has a frequency of 1,000 and the air gap contains as it may about 15,000 lines per square centimeter the force with which the tube is driven up and down will be over 4,000 pounds. The stroke may be of any desired length. If the sides of a ship or the piston rod of a locomotive be attached to the ends of the tube it will be set in motion.

Fig. 2 shows another form embodying the same invention where the device is used for a telephone receiver. Here 60 is the telephone diaphragm made of any suitable material, 61 is the tube, NS is the magnet, 62 being the armature or core and 63—63 the pole circular in form 64—64 being the winding. This winding is a single winding attached to the telephone line from which it is desired to receive telephonic messages. The tube while preferably made of copper may be of aluminum and is preferably attached to the diaphragm as shown. On currents from a microphone passing through 64—64 the tube 61 vibrates. In this construction only one air gap is used. In the construction shown in Fig. 1 an electromagnet is employed, with air gaps and coils 46 and 47 wound in opposite directions, since the coils act differently as regards any fluctuations of the magnetized coil 45, silence is obtained ex-

cept for the receiving of signals. This is not necessary in the construction shown in Fig. 2 where a permanent magnet is used.

A convenient way of using a device of this character for submarine signaling is shown in Fig. 4, where 11 represents the skin of the ship. In place of this may be used a diaphragm inserted in a hole cut in the side of the ship, or a diaphragm attached to the side of the ship, preferably to the inside, the space between the diaphragm and the side of the ship being filled with water or other liquid, as oil, which may be under pressure. Or, instead of liquid, compressed gas may be used, as air or carbonic acid. In Fig. 3, 35 is such a diaphragm, attached to the inside of the skin 11 of the ship, 36 being the liquid, and 37—37 a packing ring, preferably of rubber. The diaphragm may be so constructed that when struck it vibrates for some time, like a tuning fork, or it may be dead beat.

The apparatus 12, mounted on the skin of the ship 11 is that shown in Fig. 1. When it is used and the switch 13 is thrown down, and the key 16 depressed (moved to the right) current from the alternating current dynamo or source of intermittent current 15 flows into 12 and causes the tube 40 of Fig. 1 to vibrate with great force, which may be, for example, in an apparatus of given size, over 4,000 pounds stress. This tube being attached to the skin of the ship directly or indirectly as in the case where it is mounted on the diaphragm 35, or attached to a rod or spring, produces compressional waves in the water outside of the ship's skin, analogous to sound waves in air, which waves are transmitted and received at the receiving station. The frequency of the waves so transmitted may be any desired, ranging from 5 per second to several thousand per second. In practice the frequency is preferably determined by the frequency of the source 15.

The key 16 may be used for telegraphing, as in the case of the ordinary telegraph.

When the switch 13 is thrown up, the device 12 is put in circuit with the battery 38 and the controlling device 14, which may be a carbon telephone transmitter or where large currents are used a transmitter and relay. Telephonic transmission through the water is accomplished by talking into the transmitter 14. When the switch 13 is thrown down and the switch 17 up, and the

key 16 is up (moved to the left) the device 12 is connected to the receiving circuit shown. In this position, when compressional waves strike against the side of the ship 11, coming from some other station, the waves cause the skin of the ship to move, carrying with it the tube 40 (Fig. 2), and the motion of 40 causes currents to be generated in the winding 46, 47, (Fig. 1) which currents actuate the receivers 27, 28. The current entering at the right hand side of the switch 17 and conductor 21 passes through the receivers 27 and 28 which are in series, and back through 33.

The apparatus may be used for both talking and listening as with the ordinary telephone receiver and transmitter. Such an arrangement is shown in Fig. 3 where the ordinary transmitter and receiver circuit is shown at 80 the apparatus 12 being used both for sending and receiving sound waves.

It is obvious that mechanism embodying my invention may be utilized in submarine signaling as well as signaling in the air.

What I claim as my invention is:—

1. Apparatus for signaling by impulses comprising an oscillating dynamo, a source of electric power, a receiving apparatus, and means for energizing the magnetic circuit of the dynamo to maintain a non-fluctuating flux therein both while sending and receiving signals.

2. Apparatus for signaling by periodic and speech-producing impulses comprising an oscillating dynamo, a receiving apparatus, and means for maintaining a non-fluctuating magnetic flux in the magnetic circuit of said dynamo both while sending and while receiving signals, said means comprising a source of continuous current.

3. Apparatus for signaling by periodic and speech-producing impulses comprising an oscillating dynamo arranged so as to generate and be acted upon by compressional impulses of a liquid, and means for maintaining a non-fluctuating magnetic flux in the magnetic circuit during operation.

4. Apparatus for signaling by periodic and speech-producing impulses comprising an oscillating dynamo, a receiving apparatus, and means for maintaining the oscillating dynamo in a uniformly responsive condition for receptance during the act of transmission.

REGINALD A. FESSENDEN.