W. HAHNEMANN.

SENDING DEVICE FOR SUBAQUEOUS CURRENT LINE TELEGRAPHY.

APPLICATION FILED JAN. 29, 1915. RENEWED JULY 12, 1919.

1,331,640. Patented Feb. 24, 1920.

Fig. 1.

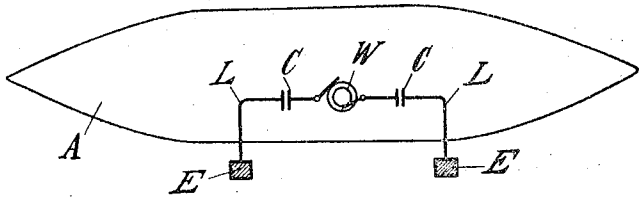


Fig. 2.

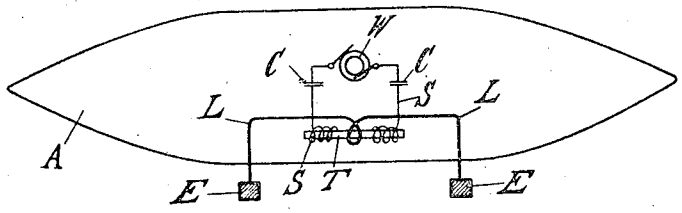
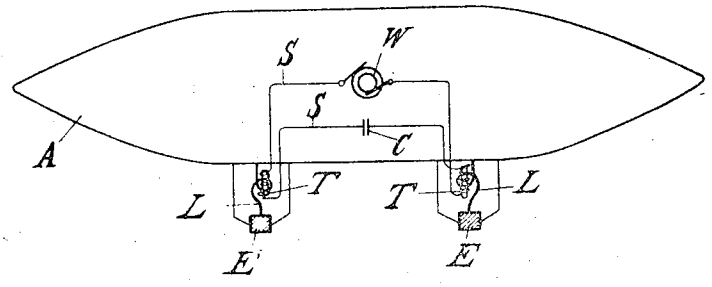


Fig. 3.



Witnesses.

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SENDING DEVICE FOR SUBAQUEOUS-CURRENT-LINE TELEGRAPHY.

1,331,640. Specification of Letters Patent. **Patented Feb. 24, 1920.**

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To all whom it may concern:

Be it known that I, WALTER HAHNEMANN, subject of the German Emperor, and residing at Kitzeberg, near Kiel, State of Prussia, Germany, have invented certain new and useful Improvements in Sending Devices for Subaqueous-Current-Line Telegraphy, of which the following is a specification.

This invention relates to a sending device for sub-aqueous current line telegraph stations. It relates more particularly to stations on ships with iron hulls from which current lines are propagated by the sending device through the water. With sending devices of this kind the spreading out of the current lines is considerably impaired by the metallic hull of the ship which forms what may be termed a short circuit on account of its low resistance. In order to render this short circuiting effect as small as possible the expedient has been adopted for sending out alternating currents of a comparatively high frequency from the electrodes into the surrounding water instead of continuous current.

But it will generally be found that the short-circuiting effect of the ship's hull can not be adequately met by merely using a sender energy of high frequency. Even with comparatively high frequencies the resistance of the ship's body will still be small compared to the internal resistance of the electrical devices in the ship, *i. e.*, the resistance of the circuit comprising the electrodes, leads and the source of current.

The present invention consists in devising means for improving the sending equipment by reducing the afore-mentioned internal resistance. This is accomplished by the application of suitable electric tuning or balancing means, and by reducing the resistance of the conducting parts so that the resistance of the entire circuit of the sending equipment in the ship compares favorably with the resistance of the short circuit formed by the ship's hull. The external resistance is represented substantially by the resistance of the ship's hull. The maximum efficiency of transmission is attained when the potential between the electrodes is highest. The reduction of the internal resistance to approximate the external resistance, represented by that of the ship's hull, establishes a maximum difference in potential between the electrodes and thereby a maximum efficiency of transmission. Specifically stated, these measures consist in neutralizing as far as possible the self-induction of the sender generator and of the leads between the generator and the electrode plates by a suitable arrangement of condensers so as to reduce the resistance of the electrical equipment in the ship to alternating currents. In addition to this the resultant ohmic resistance of the entire circuit in the ship is reduced either by increasing the cross section of the leads and conductors in the generator to the greatest possible extent or by using electric transformers.

Figure 1 illustrates an equipment in which condensers are employed. Figs. 2 and 3 show equipments in which transformers are used.

In Fig. 1 electrodes E are fixed in any desirable manner by suitable insulating mountings to ship's hull A and are connected to a generator W by leads L of very large cross section that include condensers C.

In Fig. 2 the leads L of large cross section that extend to the electrodes E form the secondary winding of a transformer T the primary windings S of which are coupled by condensers C to the generator W.

Another mode of applying the invention consists in arranging transformers between the electrodes and the hull of the ship the secondary windings of which are formed by means of cable leads between the hull and the electrodes, while the primary windings are connected to the source of current. Thereby longer leads of large cross section are saved. An arrangement of this kind is illustrated in Fig. 3. The electrodes E and the metallic ship's hull A are electrically connected by the cable leads L of large cross section. The cables form the secondary windings of transformers T, the primary windings S of which are connected at their one end to a condenser C and at their other end to a generator W.

I claim:—

1. A system of submarine telegraphy or telephony in which current lines originating at a transmitting station on a ship with a metallic hull are utilized to operate a distant receiving station, said system having an internal or sending circuit comprising an alternating current generator, spaced submerged sending electrodes carried by the ship and electrically connected to said gen-

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erator, balancing means for reducing the resistance of the electrical equipment to alternating current and leads of large cross section and low ohmic resistance, the resistance of the whole internal or sending circuit being so small as to be comparable with the resistance of the external circuit; for the purpose specified.

2. A system of submarine telegraphy or telephony in which current lines originating at a transmitting station on a ship with metallic hull are utilized to operate a distant receiving station, said system having an internal or sending circuit comprising an alternating current generator, spaced submerged sending electrodes carried by the ship and electrically connected to said generator, balancing means for reducing the resistance of the electrical equipment to alternating current, and leads of large cross section and low ohmic resistance, the resistance of the whole internal or sending circuit being so small as to be comparable with the resistance of the external circuit formed by the water and the ship's hull; for the purpose specified.

3. A system of submarine telegraphy or telephony in which current lines originating at a transmitting station on a ship with metallic hull are utilized to operate a distant receiving station, said system having an internal or sending circuit comprising an alternating current generator, a transformer with its primary circuit electrically connected to the said generator, balancing means in the primary circuit for reducing the resistance of the electrical equipment to alternating current and a secondary circuit of low ohmic resistance connected to spaced submerged sending electrodes carried by the ship, the resistance of the whole internal circuit being so small as to be comparable with the resistance of the external circuit formed by the water and the ship's hull; for the purpose specified.

4. A system of submarine telegraphy or telephony in which current lines originating at a transmitting station on a ship with metallic hull are utilized to operate a distant receiving station, said system having an internal or sending circuit comprising an alternating current generator, a transformer having a primary circuit provided with balancing means to reduce the resistance of the electrical equipment to alternating current, secondary windings of low ohmic resistance and spaced submerged sending electrodes connected by said secondary windings to the ship's hull, the resistance of the whole internal circuit being so small as to be comparable with the resistance of the external circuit passing through the water, for the purpose specified.

In testimony whereof I affix my signature in presence of two witnesses.

WALTER HAHNEMANN.

Witnesses:
JULIUS RÖPKE,
WILLY RÖSCHER.