

PATENT SPECIFICATION



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COMPLETE SPECIFICATION.

Improvements in Navigation by Means of an Alternating Current Cable Located in the Water.

I, HUGO LICHTER, of 24, Kleiststrasse, Kiel, Germany, Physicist, of German nationality, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to the navigation of vessels by means of a cable carrying alternating current and located in the water. The invention aims at simplifying and improving this method which, in itself, is known. The invention provides a simple and reliable method by means of which it is possible to recognise with certainty on which side of the cable laid, for example, in a channel, the vessel is located.

It is known that a cable laid in water and supplied, for example, with alternating current of a predetermined frequency, sets up magnetic and electric lines of force. The magnetic field of force of the cable then consists of lines of force which are in the form of concentric circles surrounding the cable. At a particular instant these lines of force are directed upwards on the left hand side and downwards on the right hand side, while the electric lines of force due to the return current extend in the direction of the cable.

The solution of the problem involved is effected, according to the invention, by allowing currents to be induced in suitable conductors by means of the magnetic and electric fields of the cable and by superimposing the two currents so set up in a conductor provided with an indicating device, so that the position of the vessel on the one or the other side of the cable can be determined directly from the operation of the resulting current on

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the indicating device. The method is preferably carried into practice as follows:—

A coil, which must be arranged substantially parallel to the surface of the water, is brought into the magnetic field of the cable, and the electric field of force is permitted to act upon two electrodes arranged a sufficient distance apart in the direction of the cable. A conductor connecting the two electrodes is arranged in series with the coil and is connected with an indicating instrument, for example, a telephone. In the latter then is set up the resultant effect of the current arising from the two fields. Since, however, the current arising from the magnetic field of the cable upon passing from one side of the cable to the other changes its direction, while the current set up by the electric field has the same direction on both sides, the two currents must, on one side of the cable, reinforce one another and on the other side weaken one another, and correspondingly a stronger or a weaker sound is audible in the telephone. If now the coil or the electrodes are changed in polarity, the strength of the sound also varies accordingly. Thus, by employing fixed coils and electrodes as indicated above, it can be decided from the polarity of the coil, on which side the observer is and thus the solution of the problem involved is effected.

The invention will now be more fully described with reference to the accompanying drawing in which a diagram of connections of one form of the invention is shown.

The cable traversed by alternating current is earthed at one end so that the current passes from the source of supply

through the cable and returns through the water or earth to the source or conversely.

S is the coil in which the current is induced by cutting the lines of force and is heard in the telephone H. E_1 and E_2 are two plate electrodes arranged on the ship spaced a sufficient distance apart. The current which flows in the conductor l_1 connecting the plates E_1 , E_2 by reason of the potential difference between these plates is transferred into the conductor l_2 by means of the transformer T and is further passed into the conductor l_3 through the switch U. The current produced by the magnetic field, on the one hand, and that produced by the difference of potential existing between the electrode plates, on the other hand, are superimposed on one another upon the telephone H. The coil S can be easily reversed in polarity by means of the switch U. The magnetic lines of force which act upon the coil are shown in fine lines; the static lines of force which set up the potential difference between the plate electrodes are indicated by broken lines.

By means of the magnetic field alone it cannot be determined whether one is on the right or left of the cable. For this purpose, the static field, which has its effect on the plates E_1 and E_2 and passes its current through the transformer T and telephone H, comes in. While this current has the same sense on both sides of the cable, the magnetic field reverses its sense in linking with the coil S, and the resulting current is reversed so that, on one side, the currents set up are added while, on the opposite side, they are subtracted so that one can recognise whether one is to the left or to the right of the cable.

The fact of an iron vessel in water being a particularly good conductor for the lines of force of the electric field of the cable (the return current) permits of a variation of the method set out. That is to say, that the vessel itself is a conductor for the return current and for its part also emits magnetic lines of force. If then a coil is brought into the magnetic field of the ship indirectly set up by means of the inductive effect of the electric field of the cable, the induced current arising in the coil has the same direction on both

sides of the cable just in the same way as the current set up directly by the electric field of the cable. Consequently, the current set up directly by the magnetic field of the ship can be combined with the current produced directly by the magnetic field of the cable, and the resulting current may operate as before on a telephone or a like indicating instrument.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A method of navigating by means of an alternating current cable located in the water, distinguished by the feature that the electric and magnetic fields of the cable, each produces a current in a system of conductors and that the resultant thereof operates upon a suitable indicating device (telephone, indicating instrument and the like) on which the position of the vessel on the one or the other side of the cable can be determined directly.

2. A modification of the method according to Claim 1, distinguished by the feature that the direct effect of the electric field of the cable is replaced by the inductive effect of the magnetic field of the vessel set up by the electric field.

3. A modification of the method according to Claim 1, distinguished by the feature that the currents produced in the system of conductors can be connected by means of a reversing switch, at one time assisting one another, at another opposing one another, so that from the position of the said switch the position of the vessel as regards the cable can be inferred.

4. A method of connection for carrying out the method according to Claim 1, distinguished by the feature that a coil, arranged substantially parallel to the surface of the water and excited by the magnetic field of the cable, is connected in series with two electrodes excited by the electric field of the cable, lying in the direction of the cable and connected together by means of a conductor.

Dated this 9th day of July, 1920.

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FIGURE 1

