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PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

# Improved Means for Signalling the Presence of Explosive Mines, Submarine or other Ships, Icebergs and other Bodies.

I, Luigi Giovanni Valerio Rota, of 55, Eardley Crescent, Earl's Court, S.W. 5, in the County of London, Professor, 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 object of the present invention is to provide improved means for signalling the presence and the direction of floating mines, submarine and other ships, or other magnetic or para-magnetic bodies or icebergs. The apparatus signals the presence of such bodies whether floating or submerged, and as it indicates the direction of such bodies it may also indicate the speed at which they are travelling.

I have discovered that there are certain telluric or earth currents which produce in the earth telluric magnetic vortices. The presence or intensity of these currents is shown when they encounter a magnetic or para-magnetic body however small this may be. Due to this fact it is possible to recognise the presence of a mine, submarine, ship or other magnetic or para-magnetic body, by means of the apparatus forming the subject of the present invention, which indicates these currents.

The invention is illustrated in the accompanying drawings, in which:—

Fig. 1 is a vertical longitudinal section showing some of the parts in elevation.

Fig. 2 is a horizontal section taken through the axis of the apparatus.

Fig. 3 is a transverse section taken on the line 3—3 of Fig. 2.

Fig. 4 is an axial section of the apparatus showing a modification.

The apparatus consists of a wooden cylinder or casing $a$, which may be enclosed in a pointed outer iron casing $a^1$. This latter is only necessary when the apparatus is intended for use in water as it diminishes the resistance and withstands the pressure of the water. The cylinder $a$ is hermetically closed and is supported by the rods $b$, fixed to a vertical shaft $b^1$, supported by a ball bearing $b^2$, carried by the vertical rod $b^3$. This latter may be telescopic and the two parts may be fixed with relation to each other by a set screw, $b^4$, or by other suitable mechanism. The ball bearing $b^2$ allows the apparatus to be rotated upon a vertical axis. The vetrical rod $b^3$ is supported by a ball bearing $c$, carired by the arm $c^1$, fixed to the ship. This bearing $c$ allows the shaft $b^1$ and rod $b^3$ to hang in a vertical position. Any other suspension means may be employed which will allow the indicating apparatus to be retained with its longitudinal axis horizontal, which will allow the apparatus to be oriented about a central vertical axis, and which will allow it to be raised or lowered. The apparatus may be suspended either at the bows or side of a ship.

[*Price* 6*d*.]

Within the casing $a$, and concentric therewith, is mounted a rotating cylinder $d$ made of wood. The cylinder $d$ is carried by radial arms or spokes $d^1$, mounted, by means of ball bearings $d^2$, upon a rod $d^3$, fixed to the casing $a$. The cylinder $d$ may be rotated by any suitable means, such as clockwork, located in the space $a^2$ at the right hand end of the casing $a$. In the drawings a bevel toothed wheel $e$, indicated by broken lines, is attached to the end of the cylinder $d$. This bevel wheel $e$ is driven by the bevel pinion $e^1$, mounted upon the end of a flexible shaft $e^2$, both parts being shown in broken lines. The flexible shaft $e^2$ would be carried up to the deck of the ship and be there driven by suitable mechanism. It will be understood that an electric motor cannot be used in the end $a^2$ of the casing $a$ as it would prevent accurate observations being taken. The cylinder $d$ has a surface velocity of from 4 to 9 meters per second.

On the rotating cylinder $d$ is wound insulated copper or soft iron wire $d^4$ in one or more layers forming a closed circuit. The ends of this circuit are furnished with suitable brushes or contacts $d^5$, and these latter are in contact with the rings $f$, $f^1$, which are connected to a very sensitive galvanometer $f^2$.

Partly located within the cylinder $d$ is a fixed frame $g$ which may be of any suitable form. In the drawings it is shown as rectangular but it may be cylindrical or polygonal. This frame $g$ is concentric with the cylinder $d$ and carries coils of soft iron wire $g^1$ as shown or thin plates forming a closed circuit. In side the frame $g$ and parallel to a plane of a convolution of the wires $g$ or plates, is located a magnetic declination needle $g^2$ as the wires or plates are caused to point to the north. Above the needle $g^2$, in the construction shown, is fixed a mirror $h$, and at the extreme left hand end of the cylinder $a$ is another mirror $h^1$.

Within the inspection chamber $a^3$ is an electric lamp $a^4$ (Fig. 1) for illuminating the galvanometer $f^2$ and the magnetic needle $g^2$. An inspection tube $i$, indicated in broken lines in Figs 1 and 3, passes up to the deck of the ship and enables the galvanometer $f^2$ to be seen by direct vision and the magnetic needle $g^2$ to be seen by double reflection by means of the mirrors $h$, $h^1$. Prisms may be employed instead of the mirrors $h$, $h^1$, and the tube $i$ may be fitted with lenses to enable the observations to be more readily made.

When the apparatus is used upon a ship having an iron hull it will probably be necessary to employ compensating or correcting magnets, which are not shown upon the ship or within the apparatus as will be understood.

The apparatus will generally be fixed at about 3 to 5 meters from the hull of the ship, but the greater the distance the better, especially when it is carried by a battle-ship.

The apparatus may be used with the cylinder $d$ rotating or stationary, and it is lowered into the water or onto the surface. Whatever may be its position the signalling action will always take place, but to render this action more sensitive it is well to use the apparatus in the following manner. If the apparatus is used with a stationary cylinder $d$, it should be retained with its longitudinal axis at right angles, as far as possible, to the magnetic meridian. If the apparatus is used with the cylinder $d$ rotating, it should be kept on the magnetic meridian, or making with the magnetic meridian an angle of 30° to 35° to the right or east thereof.

The extensions $j$ are provide at each end of the casing $a$ to enable the apparatus to be turned and retained in the desired direction by mechanical connections.

I may in some cases employ two apparatuses, one having a magnetic declination needle as above described, and the other having, within the fixed frame $g$, a magnetic declination needle and also a magnetic dipping needle. One apparatus is used with a rotating cylinder, and the other is used with a stationary cylinder $d$. Each apparatus is retained in the direction which is most suitable, as above explained, so that one apparatus is at right angles to

the other apparatus. It is known that terrestrial magnetism induces currents in moving conductors so that the quantity of flux received by each apparatus will vary.

The apparatus will be sensitive to telluric currents when a paramagnetic body is encountered, such as a mine, a submarine, or a ship, and the larger bodies will be detected at considerable distances reckoned in miles. Experience will determine the type of body by the intensity of the current. When the presence of a body has been signalled by the apparatus, it is advisable to stop the ship upon which the apparatus is carried, and it will then be possible by watching the magnetic needle and galvanometer to ascertain whether the body is fixed or in motion, and if in motion, whether it is approaching or receding from the apparatus and what is its depth. By being able to follow the direction of the object and knowing whether it is approaching or receding one is able to calculate the course of the object. According as the apparatus is increased in size, so it will be able to detect mines at a greater distance.

I have discovered that icebergs when carried by currents have a very high electric potential. In order to render the apparatus suitable for detecting an electrically charged body as well as a para-magnetic body, the apparatus above described and shown in Figs. 1, 2 and 3, may be modified as shown in Fig. 4. The outer casing $a^1$ is dispensed with. The cylinder $d$, covered with wire $d^4$, is mounted upon spokes $d^1$, carried by ball bearings $d^2$, rotating upon a rod $d^3$. All the other parts, not shown, are similar to those shown in Figs. 1, 2 and 3. The cylinder $d$ is closed at one end by a discs $d^{10}$, which projects beyond the casing $a$ and fits against this latter. To the disc $d^{10}$ is fixed a copper cylinder $k$, which covers about half of the casing $a$. This copper cylinder $k$ may be further supported by means of small rollers $k^1$ carried by the casing $a$. Within the casing $a$ is fixed another copper cylinder $k^2$, having the same length as the copper cylinder $k$. The two coppers cylinders $k$, $k^2$. are connected to a suitable apparatus, such as an electroscope or torsion balance, located in the inspection chamber $a^3$, to reveal the most delicate electric charges and to measure their intensity and variations.

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. Apparatus for signalling the presence of mines, submarine or other ships, or other para-magnetic bodies, comprising in combination a casing, a cylinder covered with a closed circuit of wire the ends of which are connected to a galvanometer, a fixed frame covered by a closed circuit of wire or thin plates, a magnetic declination needle, within said frame, and means for inspecting the galvanometer and magnetic needle, substantially as set forth.

2. Apparatus as claimed in Claim 1, having means for rotating the said cylinder, substantially as set forth.

3. Apparatus as claimed in Claims 1 and 2, in which the said cylinder is mounted upon spokes carried by bearings on a fixed rod and is provided with a bevel gear wheel which is driven by means of a bevel pinion on the end of a flexible shaft, substantially as shown and described.

4. Apparatus as claimed in Claim 1, which is suspended by means enabling its longitudinal axis to remain horizontal and enabling the apparatus to be turned upon a vertical axis, substantially as set forth.

5. Apparatus as claimed in Claim 4, comprising a vertical rod suspended by a ball bearing enabling the apparatus to be rotated upon a vertical axis, the said ball bearing being carried by a vertical extensible rod, which latter is supported by a second ball bearing, substantially as shown and described.

6. Apparatus as claimed in Claim 1, having a magnetic dipping needle, substantially as set forth.

7. Apparatus as claimed in Claim 1 adapted also to signal the presence of electrically charged bodies, in which the casing is covered within and without

for about half its length with copper cylinders connected to a suitable apparatus, such as an electroscope or torsion balance, to measure the intensity and variations of electric charges, substantially as set forth.

8. Apparatus as claimed in Claim 7, in which the outer copper cylinder is adapted to be rotated with the inner cylinder carrying the closed circuit of wire, substantially as shown and described.

Dated this 28th day of May, 1918.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

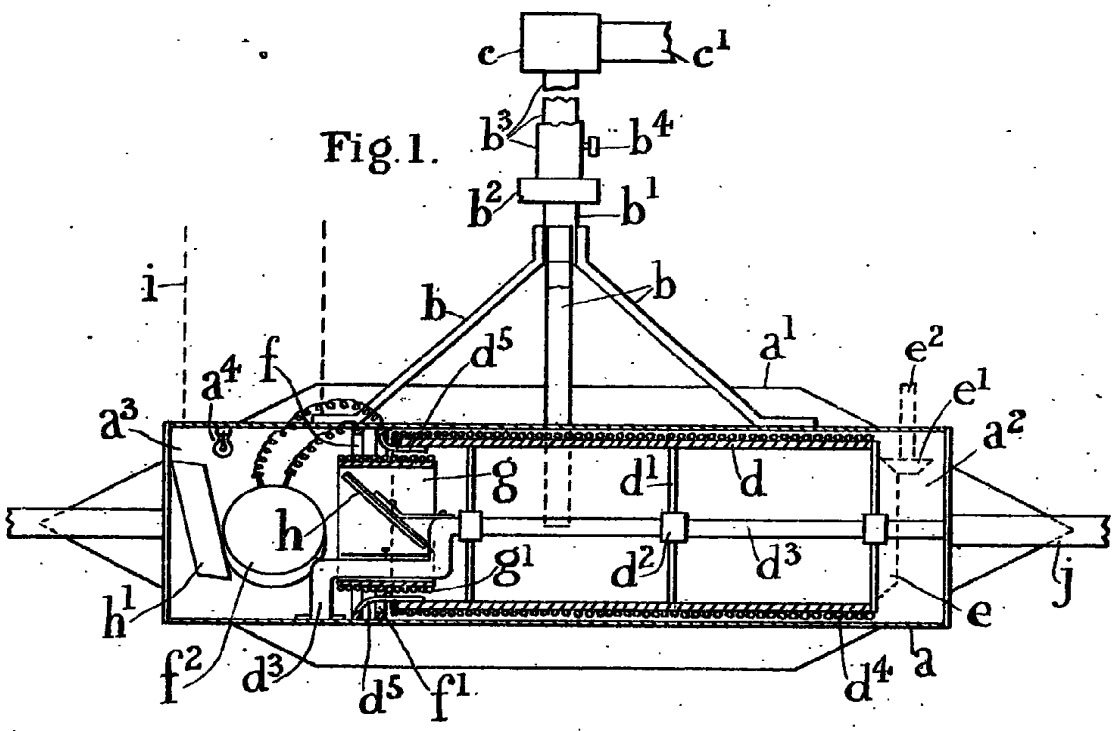



Fig. 2.

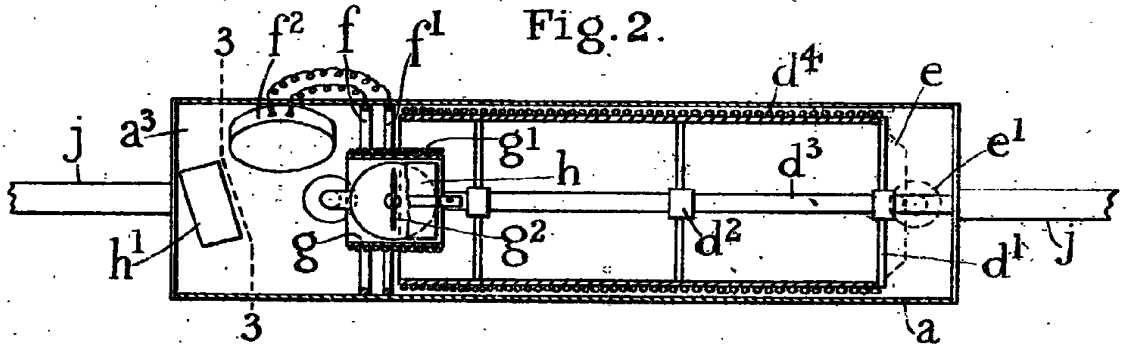



Fig. 4.

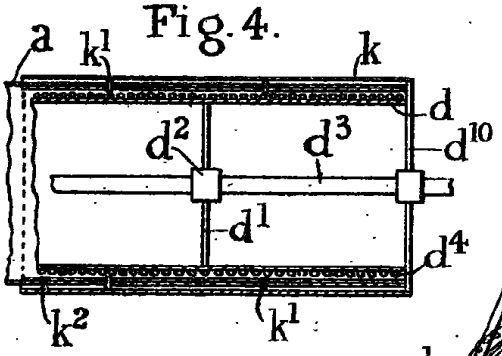
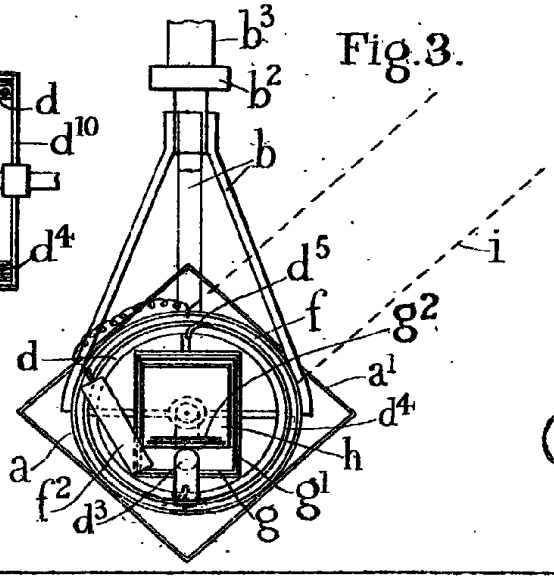



Fig. 3.



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