No. 711,386. Patented Oct. 14, 1902.

# L. DAFT & A. WILLIAMS.

## MEANS FOR SIGNALING TO OR COMMUNICATING WITH SHIPS.

(Application filed June 29, 1901.)

(No Model.)

Fig. 1.

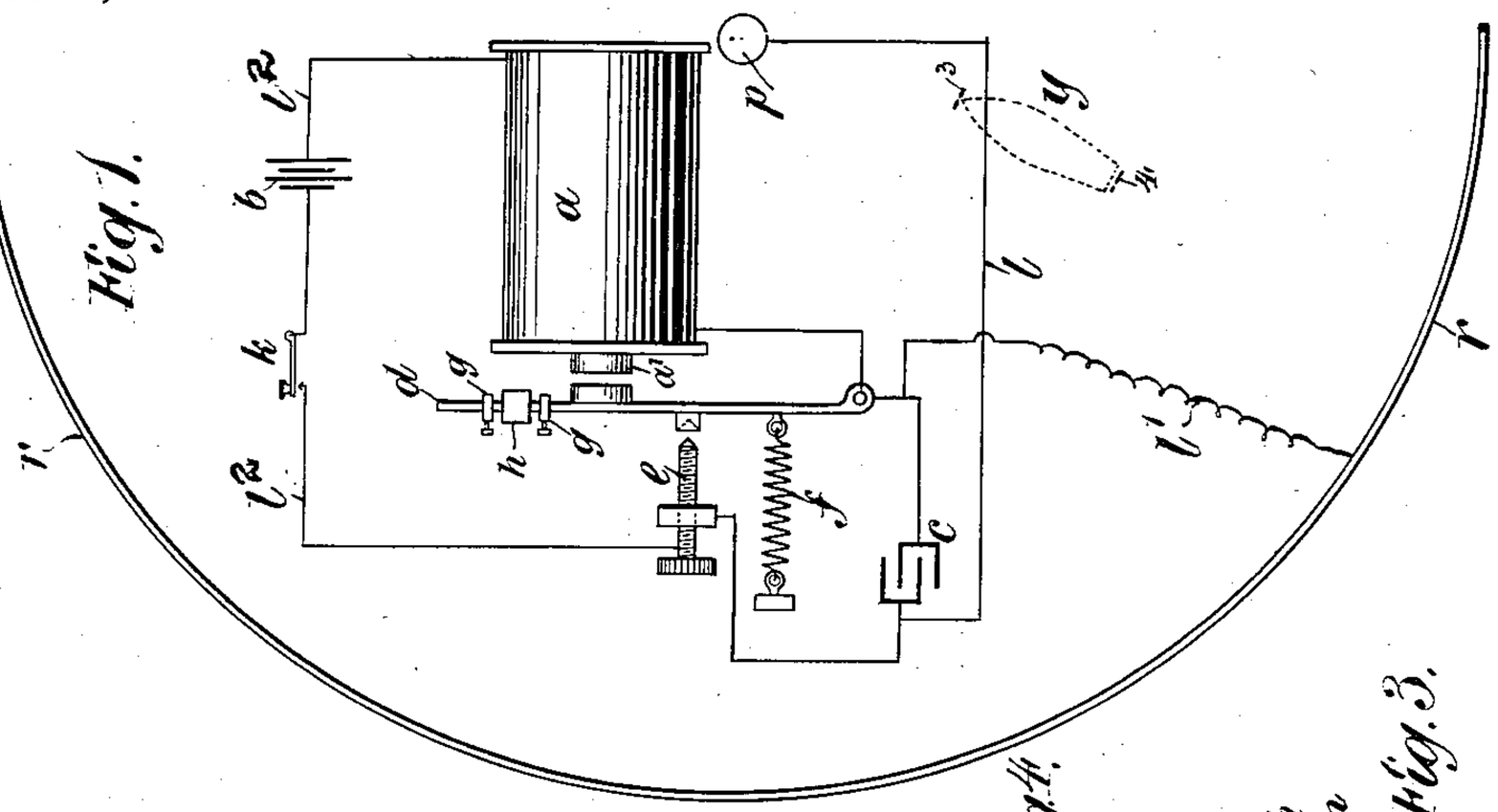


Fig. 2.

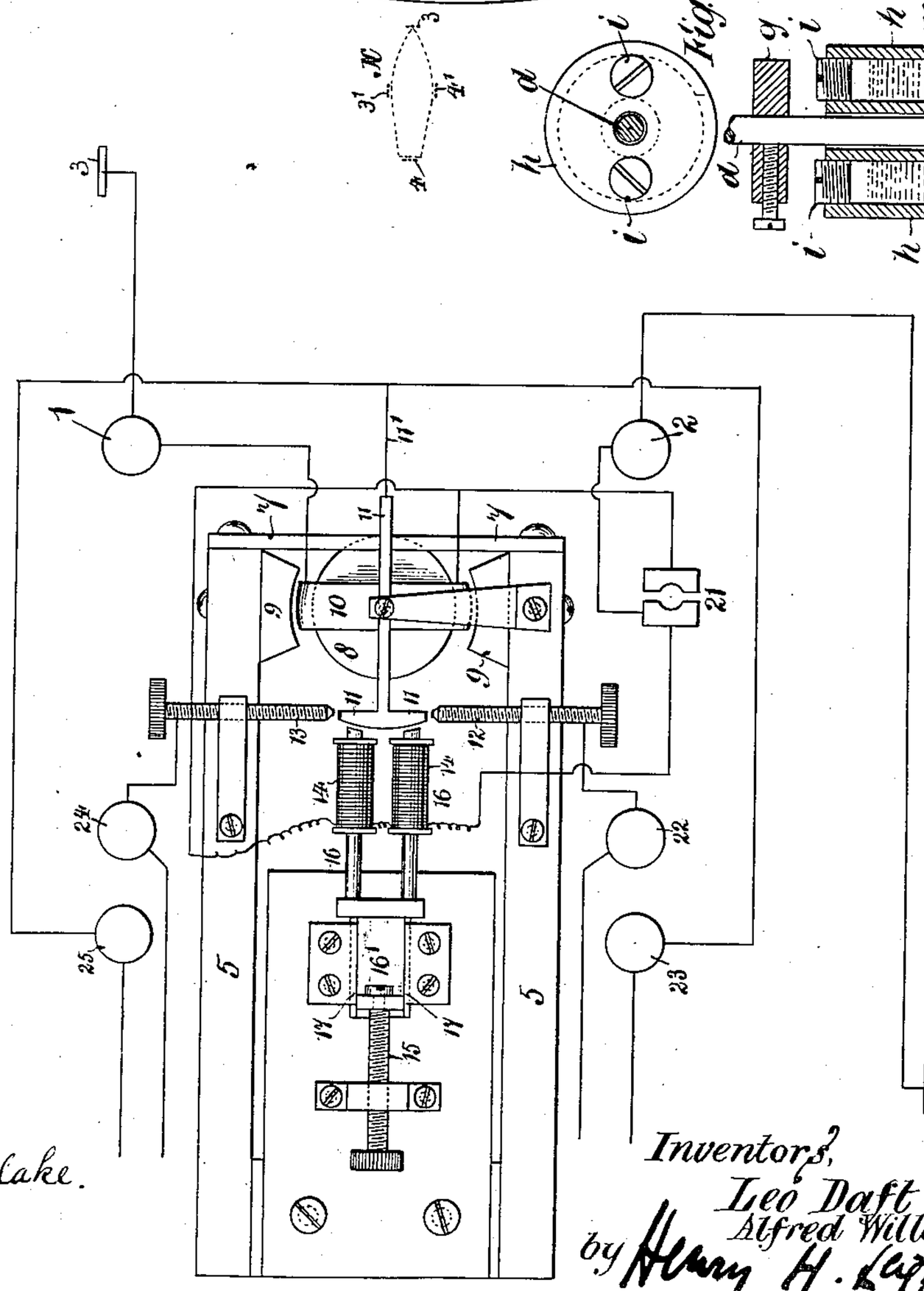


Fig. 3.

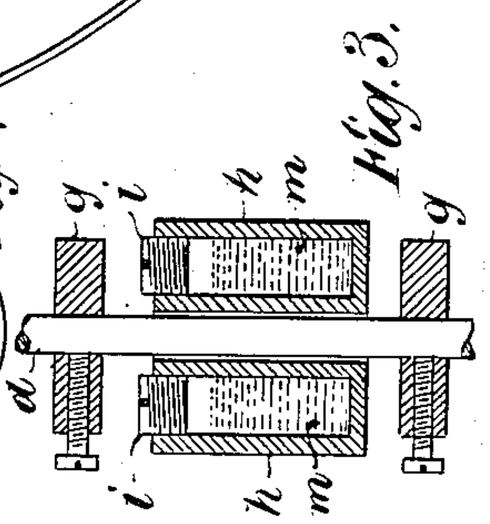


Fig. 4.







Witnesses.
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# UNITED STATES PATENT OFFICE.

LEO DAFT AND ALFRED WILLIAMS, OF WIMBLEDON, ENGLAND

## MEANS FOR SIGNALING TO OR COMMUNICATING WITH SHIPS.

SPECIFICATION forming part of Letters Patent No. 711,386, dated October 14, 1902.

Application filed June 28, 1901. Serial No. 66,561. (No model.)

*To all whom it may concern:*

Be it known that we, LEO DAFT and ALFRED WILLIAMS, of 50 Hartfield road, Wimbledon, in the county of Surrey, England, (whose post-office addresses are the same,) have invented certain new and useful Improved Means for Signaling to or Communicating with Ships; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention has reference to improved electrical means for conveying signals to ships at sea, and is specially designed to warn such vessels when approaching shore both of the proximity of a rock or headland or the like danger and also of the direction in which it lies.

Our invention consists, essentially, of means for transmitting the signals from the island or headland and of apparatus situated on board the vessel which is to be warned of its proximity thereto consisting of certain receiving or detecting apparatus, by means of which the signals are received and made perceptible.

In order to transmit the signal from the shore to the vessel, we employ a ring or part of a ring of metal, (such as a stranded cable,) which is immersed in the water at a convenient distance from the shore and preferably connected by means of insulated conductors (which resemble in construction the shore ends of submarine cables) at various points with one terminal of a source of high-tension electricity, such as an induction-coil. The other terminal of the induction-coil is connected to earth at a point situated, preferably, somewhere near the center of the island or headland, the earth connection being made to a suitable buried plate, a mass of buried carbon, or by the like equivalent and known means. A Morse key or equivalent appliance, which may be worked either by hand or automatically at certain fixed intervals by machinery, is introduced in the circuit of the induction-coil for giving the signals. Any existing form of induction-coil may be employed in our system in the manner described and will give more or less satisfactory results; but the best effects are obtained with a special form of induction-coil, which we shall describe in detail below.

The means which we employ on board the vessel for receiving and indicating the signals transmitted from the land consist of two or more plates arranged, preferably, as far as possible from one another on the vessel below the water-line—say at the bow and stern. These plates are connected, preferably by insulated conductors, with the terminals of a delicate relay. This relay is arranged in such a manner as to close a second or local electric circuit, which operates bells or visual signals, or both, when the relay is itself set in action. This occurs, assuming the relay to be connected to plates situated on the vessel, as above described, whenever the vessel is approaching the island or headland provided with the appliances above described and when the induction-coil situated thereon and with the connections mentioned is operated by the key. If the vessel is not approaching the island or headland, but is passing at right angles to it, or thereabout, so that the plates on the bow and stern are approximately equidistant from the submerged ring connected with the induction-coil on the shore, then the relay will not operate even when the coil on shore has been employed to transmit the signal. In order to enable persons situated on the vessel to be made aware of the neighborhood of the island or headland—say, for instance, in a fog—even when they are not approaching it, we may arrange two other plates preferably similarly connected to another relay arranged to work different signals from those worked by the relay previously mentioned, these plates being situated below the water-line on opposite sides of the vessel. The signals received by the relay connected with these plates will then be indicated and then only when the bow and stern of the vessel are approximately equidistant from the submerged ring. Any form of sufficiently delicate relay may be employed, connected, as above described, on board the vessel; but we prefer to employ a special form of relay which we have devised and which is constructed electrically in a manner similar to that of the d'Arsonval galvanometer.

In order that our invention may be the more fully and readily understood, we hereby

refer to the accompanying sheet of drawir gs, which we make part of this specification, and in which—

Figure 1 shows diagrammatically the arrangement of our induction-coil connected to a central point on the island or promontory and to the ring or part of the ring submerged around it. Fig. 2 is a plan of the improved form of relay which we prefer to employ. Fig. 3 shows in sectional detail part of a special form of contact-breaker which we have found when employed with our induction-coil gives increasedly satisfactory results. Fig. 4 is a plan of Fig. 3.

In the figures, *a* is the induction-coil, which when constructed in the manner which, as above mentioned, we have found to give the most satisfactory results consists of a single winding of thin sheet-copper of the same width as the length of the coil, the different layers of the sheet-copper being separated from one another by a continuous sheet of thin insulating material, such as paraffined paper. Dimensions which we have found to give good results are for the strip of copper six inches in width and one hundred feet in length. The coil as thus constructed has only a single or primary winding. It is provided with a core of iron wires *a'* about two inches in diameter. The ends of the winding of the coil are connected to the battery *b* through the contact-breaker, consisting of the vibrating arm *d*, controlled by the spring *f* and the contact-screw *e* in the ordinary manner. The contact-breaker is shunted by a condenser *c*, the capacity of which should be large—namely, some two or three times as great as that of an ordinary induction-coil for giving a three-inch spark.

*r* is the ring, which is composed of stranded conductor, which is submerged at a moderate distance—say one hundred yards—from the shore either completely or partly around the island or headland. One end of the winding of the coil *a* (where an ordinary coil is used the terminal of the secondary coil) is connected by the lead *l* to the earth-plate or other contacts *p*, situated near the middle of the island or headland. The other end of the induction-coil winding is connected to the ring *r* by insulated conductors constructed like the shore ends of cables, of which several, preferably equidistantly, are employed, but of which only one is shown in Fig. 1—namely, *l'*. A Morse or other similar key *k* is inserted in the connection $l^2$, by which the coil *a* is connected to the battery *b*. This key, which may be operated automatically—say by clockwork mechanism or by hand—enables the signals which result from the operation of the coil connected in the manner described to be given.

Toward the end of the vibrating arm of the contact-breaker, which preferably takes the form of a rod, is mounted a special appliance, the use of which we have found to improve the results obtained. It is shown in detail in Figs. 3 and 4 and consists of a cylindrical receptacle *h*, mounted between the stop-rings *g g*, comprising an annular space inclosed by two stoppers *i i*, the space being partially filled by metallic mercury *m*. When the contact-breaker is vibrating, the mercury oscillating in the containing vessel *h* causes the vibrating arm *d* of the contact-breaker to give a sort of double blow, which very much improves the effectiveness of the induction-coil.

*x* and *y* show diagrammatically two different positions of vessels approaching the shore, which is provided with the above-described signaling apparatus, *x* showing the vessel outside the ring, but heading straight for it, and *y* showing it inside the ring and closely approaching the land.

The type of relay which we prefer to employ on board the vessel for detecting the signals transmitted from the shore is shown diagrammatically in Fig. 2. It consists, essentially, of the rectangular permanent steel magnet 5, the ends of which are cross-connected by the bar 7. This bar-magnet is provided with curved pole-pieces 9 9, between which is mounted a cylindrical mass of soft iron 8, secured to the cross-bar 7, which has the effect of making a comparatively small magnetic gap between the cylinder 8 and the pole-pieces 9 9. Pivotally mounted about the cylindrical mass 8 is a coil of insulated wire 10, which corresponds to the moving coil in a d'Arsonval galvanometer. This coil carries the branched contact-arm 11, which is adapted to make electric contacts with the contact-screws 12 and 13, which, as well as the contact-arm, are provided with suitable platinum contacts for that purpose. The ends of the moving coil 10 are connected to the main terminals of the relay 1 and 2 directly and through the plug block or bush 21, respectively. The control of the relay is effected by means of the small horseshoe permanent magnet 16, which is mounted on a slide 16', which can be moved backward or forward by the adjusting-screw 15, the slide 16' moving in guides 17. The contact-arm 11, being of soft iron, is held in the normal position shown in the drawings by the attraction of the permanent magnet 16, the value of the couple tending to restore it to this position when displaced, varying according to the distance of the permanent magnet 16 and diminishing as that distance increases. It will be observed that the magnet 16 is provided with a winding 14, mounted on it. This is so arranged that when a current traverses this winding it tends to weaken the permanent magnetism, and this winding may be arranged either in parallel or series with the moving coil 10. In Fig. 2 it is shown in series connected through the plug-bush 21, the object of this arrangement being to enable the coil 14 to be short-circuited, and so thrown out of action altogether, by inserting a metal plug into the bush 21.

When the coils on the permanent magnet 14 are arranged in series with the moving coil 10, their resistance should be made considerably less—say about a quarter of the resistance of the coil 10. By means of this device for either using or throwing out of action the coils 14 by means of a plug inserted into the bush 21 we are able to give the relay two degrees of sensitiveness without altering the adjustment of the permanent magnet 16, the action being that when the same current that traverses the moving coil 10 also passes through the coil 14, thereby weakening the magnetism of the magnet 16, the control is weakened at the instant that the deflecting force comes into action, and thereby the sensitiveness is greatly increased. We have found that excellent results are obtained with this relay by using a movable coil with the resistance of five hundred ohms and winding the permanent controlling-magnets with windings having a resistance of about one hundred ohms. In addition to the arrangement above described the controlling-magnet may be wound with coils divided into a number of sections, which may be connected to a multiple commutator, so as to enable all or any of the sections to be employed, thereby varying the sensitiveness of the control still further. When used upon the vessel for recording signals, the main terminals of the relay 1 and 2 are connected to two plates 3 and 4, situated below the water-line at the bow and stern of the vessel. Two subsidiary terminals on the relay 23 and 25 are connected to the contact-arm 11 by a flexible filament of phosphor-bronze 11′ or by other suitable means. The two terminals 22 and 24 are connected to the contact-screws 12 and 13, respectively. Signaling appliances, such as bells, are connected in the circuits of the terminals 23 and 22 and 24 and 25 to suitable batteries or other sources of current, so that when the contact-arm 11 makes contact with the contact-screw 13 a set of signals connected with the terminals 24 and 25 will be set in action, while when the contact-arm makes contact with the contact-screw 12 those signals connected with the terminals 22 and 23 will be set in operation.

Two relays, such as that shown and described in reference to Fig. 2, are mounted on the vessel, one being connected to plates 3 and 4 at the bow and stern, respectively, and the other being connected to plates 3′ and 4′ on either side of the hull. If now a vessel is approaching the land some distance outside the submerged ring and is in the position shown in dotted lines at $x$, if the coil on the shore, connected as described and shown, is being operated by the key $k$ a certain potential difference is found to be established between the bow and the stern plates 3 and 4, and the coil 10 will be accordingly deflected—say so as to bring the contact-arm 11 into contact with the screw 13—which will cause the signals connected with the terminals 24 and 25 to be set in operation. If the vessel is turned around and proceeds in diametrically the opposite direction, the contact-arm 11 will be deflected to make contact with the screw 12, causing the signals connected with 22 and 23 to be set in action. In the position shown at $x$ there will be no potential difference between the plates 3′ and 4′, and the second relay connected to those plates will not operate. If, however, the vessel is in a position at right angles to that shown at $x$, then this relay will operate; but the first relay connected to the plates 3 and 4 will cease to act. By this means the vessel is warned not only of the neighborhood of the headland, but also of the direction in which it lies. If the position of the vessel is that shown in dotted lines at $y$—namely, inclined to the radial line joining $p$ and the ring $r$—no matter whether the vessel be inside or outside the ring, then both relays will operate simultaneously.

We claim—

For marine electric signaling, a combination of four combinations, the first combination consisting of an earthed plate, a distant wide-spread conductor sunk in the sea, a source of electricity and an induction-coil; the second combination consisting of a vibrating contact-breaker and a receptacle partially filled with mercury, adjustably fitted to the same, these two combinations together being adapted to generate and transmit electric impulses to considerable distances through the earth and water; the third combination consists of two plates carried by a ship exposed to the contact of the sea-water in positions as remote as possible from one another, the two plates being in electrical connection and having the fourth combination interposed in series between them; the fourth combination being a device for detecting minute electric impulses and consisting of a pivoted coil 10 suspended in a magnetic field and rigidly connected to a soft-iron arm 11 controlled by an adjustable permanent magnet 16 which is so wound in series with the pivoted coil 10 that the passage of an electric impulse momentarily weakens its controlling influence, substantially as described.

In witness whereof we have hereunto set our hands in the presence of two witnesses.

LEO DAFT.
ALFRED WILLIAMS.

Witnesses:
WARWICK HY. WILLIAMS,
WALTER J. SKERTEN.