L. F. A. ARSON.

CORRECTING THE DEVIATION OF THE MARINER'S COMPASS.

No. 103,701. Patented May 31, 1870.

FIG. 1.

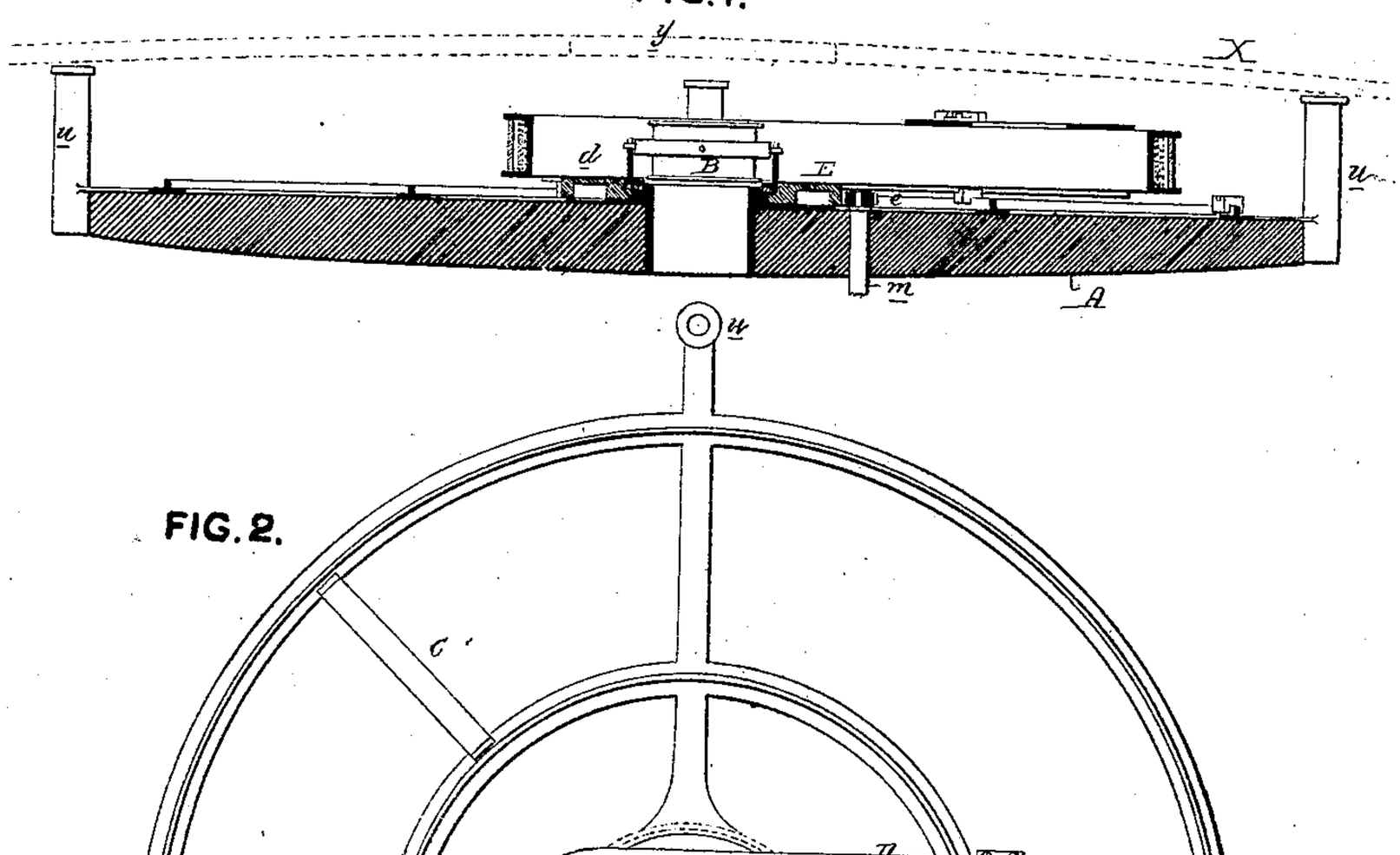


FIG. 2.

FIG. 3.

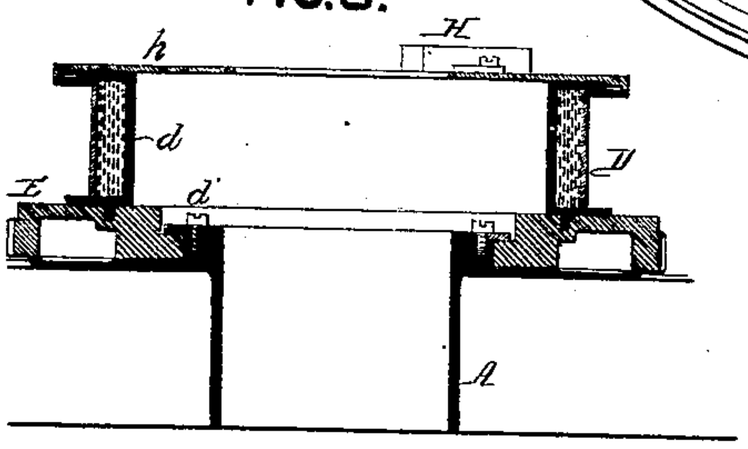


FIG. 4.

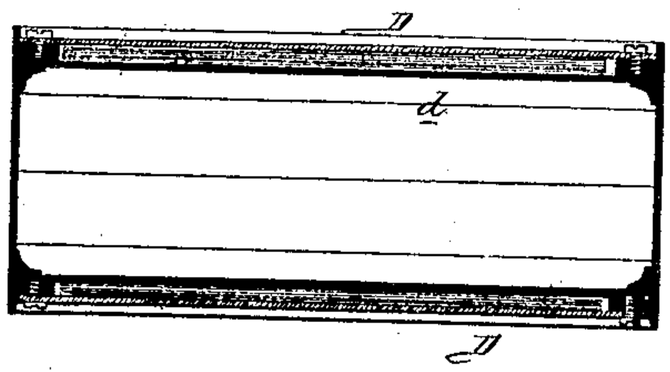


FIG. 5.

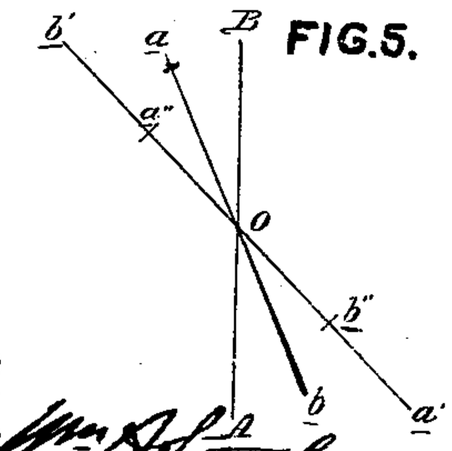
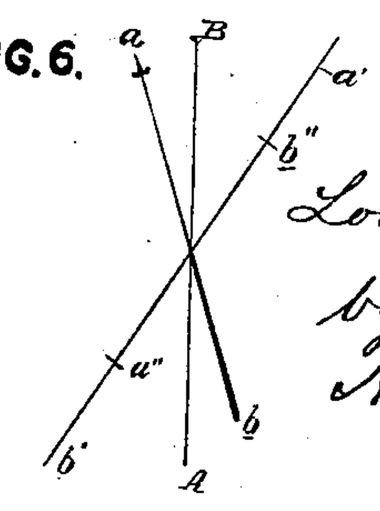


FIG. 6.



WITNESSES

Wm. A. Steel

John Parker

Louis F. A. Arson

by his Attys

Howson & Howson

United States Patent Office.

LOUIS FRANÇOIS ALEXANDRE ARSON, OF PARIS, FRANCE.

Letters Patent No. 103,701, *dated May* 31, 1870.

IMPROVEMENT IN CORRECTING THE DEVIATION OF THE MARINERS' COMPASS.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, LOUIS FRANÇOIS ALEXANDRE ARSON, of Paris, France, have invented an Improved Mode of Correcting Compass Deviations on Iron Vessels, of which the following is a specification.

Nature and Object of the Invention.

My invention consists of certain apparatus and devices of the character fully described hereafter, whereby the various forces which cause a compass, when arranged on an iron or iron-plated vessel, to deviate from a position due north and south are counteracted, and the reliability of the instrument maintained.

Description of the Accompanying Drawing.

Figure 1 is a longitudinal section of one form of apparatus, which may be used in carrying out my invention;

Figure 2, a plan view;

Figure 3, a sectional view, drawn to an enlarged scale;

Figure 4, a modification; and

Figures 5 and 6, diagrams illustrating the mode of correcting deviations of a compass.

General Description.

Compasses of iron vessels are exposed to disturbing influences, of which the principal are—

First, the presence of soft iron, which acts with equal intensity upon both poles of the needle.

Second, the fixed magnetic influence, attractive and repulsive, which certain parts of the vessel possess, giving them all the character of magnets.

Third, the action of soft iron, when affected by the free magnetic fluid, which imparts to the metal instantaneously a magnetic character.

Action of Soft Iron.

The first influence compensates itself when exercised by a continuous closed body, and when the needle is surrounded equally by the disturbing element, as when it is placed in the central plan of a vessel.

Action of Magnetized Iron.

Certain parts of the shell of the vessel formed of soft iron are magnetized, and exercise a fixed magnetic action which can be counterbalanced by fixed magnets suitably placed.

Whenever soft iron is hammer-hardened, it takes the form of a fixed magnet, and is similar to magnetized tempered steel. It is known that powerful magnets can be made from soft iron, hammer-hardened, as, for instance, by twisting iron wire while in a proper magnetic position.

Now, the rivets, which connect the plates hardened by the hammer, constitute so many fixed magnets, which, collectively, exercise a very energetic action, and this will account for the fixed magnetic action in the same direction, which affects all vessels constructed in the same yard.

The magnets thus produced are not very durable, and the causes which produce the change are probably positively known. Their direction and intensity vary at different periods, so that to counteract their action, it is necessary to employ means which may be regulated in accordance with the varying state of the influence which is to be overcome.

To obtain this result, I suspend an ordinary but very sensitive mariner's compass in the center of an apparatus or compensator, which I will now describe.

A circular frame or plate, A, suitably braced, is suspended by arms *u* beneath the deck of a vessel, an opening, *y*, in the latter being directly above the compass, which is hung in supports secured at the center of the frame A, the apparatus being thus out of the way of accident to which it would be exposed if upon the deck.

Fixed Compensator.

On the frame A are two concentric annular ribs or rails, between which slide two boxes containing magnets *c' c'*, of tempered and strongly magnetized bars of steel. These magnets should be as light as possible, and, when properly arranged, counteract the effect of the fixed magnetic parts of the ship, and when two magnets are used may be so placed that this magnetic action will be compensated by itself.

Adjustable Compensator.

Around the compass B turns a disk, E, with teeth on the edge of which engage the teeth of a pinion, *e*, on a crank-shaft or spindle, *m*, and in the disk E are guides, adapted to ribs on an oblong frame, D, which, with its appurtenances, constitutes the adjustable compensator, and which, by turning the shaft *m*, may be caused to move round the geometrical axis of the compass.

The compensator consists essentially of a body of soft iron, which, in the present instance, is obtained by winding on the exterior of the frame D a band or ribbon of thin sheet metal *d*.

Position for Mounting.

When the compass is placed amidships, the compensator D should be adjusted so as to turn round its magnetic center, otherwise the point round which it turns should bear the same relation to the compensator that the latter does in its position to the vessel. If, for instance, the compass is one-fourth of the ship's length from either end, the compensator D is arranged

so as to revolve round a point one-fourth of its length from one end.

The magnetic power of the compensator should be such as to cause the compass to deviate as much as the ship itself. This power is easily determined by an observation.

What has been said of the compensator presumes that the soft iron possesses no fixed polarity. Unfortunately this condition is difficult if not impossible to be realized, inasmuch as all mechanical labor applied to iron results in the development of fixed magnetism, so that the difficulty of making an apparatus not liable to this objection will be readily understood.

The fixed magnetism possessed by the compensator after its construction, develops itself at the same time as and changes the effect of the free magnetic influence, and since the difficulty alluded to refers to a degree of the fixed magnetism, and as the cause is foreign to the free magnetism, it suffices if it is compensated by an equally fixed and suitably proportioned influence.

When this is done, the free magnetic influence will alone remain, and can attain its proper effect without being disturbed by any foreign influence.

The means applied for correcting the influence of the fixed magnetism exercised by the iron shell is applicable here under like conditions, and consists in the use of fixed magnets H H′, lying near the body, which is the seat of the disturbing action, and turning with it. It is evident that this coupteracting influence must be regulated in proportion to the influence which is to be counteracted.

The said fixed magnets are arranged in advance upon a plate, *h*, turning round the geometric axis of the compass, the plate sliding on the frame D so as to be adjustable in a direction to and from the compass.

In fig. 4 is shown a compensator in which the frame D is rectangular, and the thin metal band is replaced by a series of plates or blades of tinned iron, arranged parallel to each other on opposite sides of the frame.

It is evident that when the compensator D is so adjusted as to cause a deviation of the needle in one direction, equal to the deviation in the opposite direction caused by the vessel, the compass thus influenced by equal and contrary actions will not be disturbed.

In order that the apparatus may be put in this condition, the compensator is provided with a card similar to that of the compass, and it is only necessary to impart to it a deviation in a contrary direction to that of the ship.

Regulation of the Fixed Compensator.

The fixed compensator is the first apparatus to be regulated, and the compensation which may be effected should be obtained before mounting the movable compensator.

The same physical laws are in play in these two operations, and what follows is as applicable to one as to the other.

The proposed apparatus is such as to facilitate these arrangements.

The needle may be deviated from its normal position through the influence of the fixed magnetism of the shell, and this deviation may be due to two circumstances, which it is necessary to distinguish in order to effect an exact compensation. These fixed actions of the shell result in two equal and contrary influences, acting together upon the needle in the character of a magnetic couple.

Suppose that these forces should be in the direction $b^1\ o\ a^1$, fig. 5, they will combine with the earth's influence, and cause the compass to take an intermediate position, *a b*.

The correction will simply consist in the employment and proper orientation of a magnet, $a^2\ b^2$, so placed as to exert an influence equal and contrary to that exercised by the other forces.

The other cause which can produce precisely the same effect is, that resulting from a fixed magnetism, acting on the direction $a^1\ b^1$, fig. 6. The correction in this instance results from the adjusting of the fixed compensator in the position $a^2\ b^2$; but it will be seen that this differs essentially from the before described correction by orientation.

The choice between the two methods of action will not be difficult to make after having made the first compensation. This being done, the ship is oriented full north, for example. The ship will then be turned ninety degrees, and if the direction of the correction was properly chosen it will remain, but if it was the reverse of what it should have been, the deviation will increase, and the correction must then be made in accordance with such deviation.

Law of Deviations,

The apparatus described is upon the principle of developing a counteracting influence, equal but in a direction contrary to that which it is necessary to neutralize, and this end is obtained by an apparatus similar to that which produces the perturbation. It therefore follows that the law in accordance with which the disturbance is caused and corrected should be understood.

The expression of these deviations is well characterized. If the method of tracing curves on a rectangular axis is employed, the expression is always interesting by its regularity, but it has not all the character which can be given it by tracing around a circumference serving as its base.

The ordinates, then, are radii, extending beyond the circle for distances proportionate to the deviations. When the ship turns westward, deviations are produced to the east, and the maximum is manifested at points, the position of which depend upon the position of the compass within the ship.

If the compass is amidships, or rather at the magnetic center, the deviation is expressed by four similar curves, touching the base circle at the four cardinal points.

If the compass is situated between the needle and the stern of the vessel, the curve loses its regularity, but is still composed of symmetrical parts, in relation to the rectangular axis passing through the four cardinal points.

These characters are not only interesting, but also afford a means by which a ship can trace the source of its deviations, so that the latter can be rectified.

Permanence of the Action of the Compensator.

The compensator, suitably arranged and regulated at a given time under any latitude, will satisfy the same conditions at any time and under any latitude. In the first place, time can effect no change except in the fixed magnetism of the ship, and since this can be continually corrected by adjusting the fixed magnets, the compensating apparatus will always exert the same proportionate influence to that of the soft iron of the vessel.

Next, it is evident that since the action of the soft iron of the vessel is counteracted by soft iron in the compensator, they will both be equally affected by the same influence, and the equilibrium will not be disturbed.

Compensator for the Dip-Needle.

The dip-needle is subject, like the preceding, to disturbing influence. If correction is found necessary it may be effected with the same certainty and like simplicity by a special apparatus, based upon the same principles as that described.

Such needles are sensible only to disturbing influences acting in the plane of inclination, and an attentive examination of the consequences therefrom shows that this condition of the needle considerably limits the influence exercised.

Between different latitudes there may be very appreciable differences of influences, requiring a corrector. In this case, the apparatus above described is applicable by change of position, but without modification of principle.

Claims.

1. The combination, with a magnetic needle, of an adjustable oblong frame, carrying bars or plates of soft iron, arranged as described.

2. The combination, with the said frame, of soft iron bars H H′, adjustable, as set forth.

3. The permanent magnets C C, adjustable in a circle around the compass, as specified.

4. The compass B, in combination with the revolving disk E, and the frame or compensator D, sliding in said disk and enclosing the compass, as specified.

5. The combination of the compass B, disk E, sliding compensator D, magnets H H′, and adjustable magnets C, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ARSON.

Witnesses:
F. ALCOTT,
E. RICHARD.