W. THOMSON.

MARINERS' COMPASS.

No. 186,638. Patented Jan. 23, 1877.

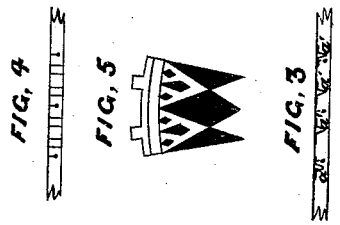

FIG. 4 FIG. 5 FIG. 3

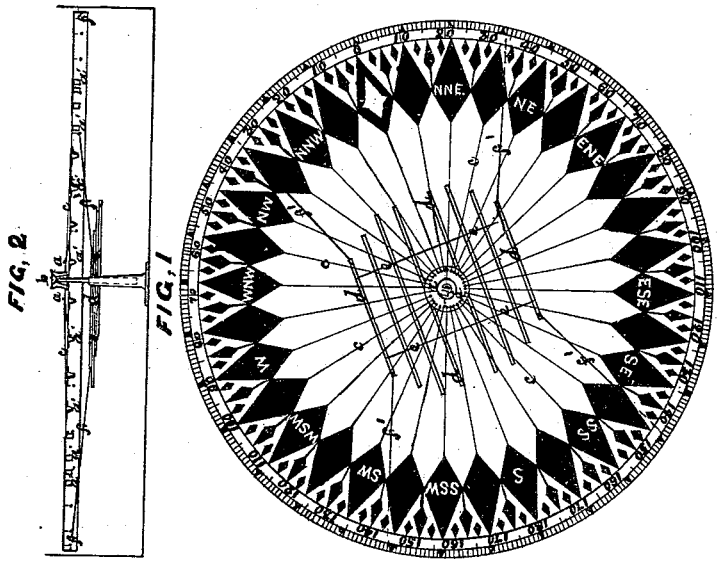

FIG. 2 FIG. 1

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SIR WILLIAM THOMSON, KT., OF GLASGOW, NORTH BRITAIN.

IMPROVEMENT IN MARINERS' COMPASSES.

Specification forming part of Letters Patent No. **186,638**, dated January 23, 1877; application filed December 8, 1876.

To all whom it may concern:

Be it known that I, Sir WILLIAM THOMSON, Knight, of Glasgow College, Doctor of Laws and Professor of Natural Philosophy in the University and College of Glasgow, in the county of Lanark, North Britain, have invented Improvements in the Mariner's Compass, of which the following is a specification:

This invention, which relates to improvements in the mariner's compass, has for its object, first, to obtain with smaller needles than in compasses hitherto in practical use as long a period of free oscillation as is suitable for working well at sea; and, second, to obtain smallness of frictional error.

Steadiness of the compass at sea in stormy weather has hitherto been obtained by making the compass-card and needles large and heavy, and sometimes also by adding weights to the compass-card. The addition of weights is detrimental, by increasing the frictional error, and tending thereby to make the compass follow the motion of the ship when she moves in azimuth. In a mathematical paper, communicated in 1874 to the British Association for the Advancement of Science, and published in the Philosophical Magazine for November, 1874, I showed that largeness of period of free oscillation is favorable for steadiness. It follows from these considerations that it is desirable to obtain as large a moment of inertia as possible with as light compass-card and frame as may be.

My improved compass-card is illustrated on the sheet of drawings hereunto appended, on which Figure 1 shows the card with its magnetic needles in plan. Fig. 2 is a transverse section of the same, with the pivot on which it is suspended. Fig. 3 shows, in section, the manner of connecting the segments of the compass-card together at their inner ends by means of strips a' of gummed paper, while Figs. 4 and 5 illustrate, in plan and in side elevation, the manner of attaching the compass-card to the rim.

The compass-card consists of a light aluminium boss, a, with a central cap, b, of sapphire, ruby, or other sufficiently-hard material for the compass to rest on, and a rim of aluminium from about four to twelve inches, or more, in diameter, according to the size of the compass.

The compass-card is, by preference, constructed with an even number of holes in the rim, (to save circumlocution I shall call the number thirty-two, being the number I prefer for my largest size of compass-card,) and the central boss has the same number of holes in its circumference. The rim and boss are connected together by means of thirty-two fine threads or wires, c, which form, as it were, thirty-two spokes. Those thread or wire spokes c are knotted, so as to retain them in the holes both of the boss and the rim, after which they are cemented thereto by shellac or other adhesive substance. The compass-card is partly supported by the threads or wires directly and partly by the rim f, as shown at Figs. 1 and 2. Two or more small magnets, d, of which eight are employed in the compass shown at Figs. 1 and 2, having their corresponding ends tied together by threads or wires e, of equal lengths, so that the magnets may be as nearly parallel as possible, are attached to the rim by means of four threads or wires, f', as shown; or they may be attached thereto by three or other number of such threads or wires.

The following method is used for giving an equal tension to each of the threads or wires between the boss and the rim: When connecting the boss and rim together, and so as to get the boss to a truly-central position, the boss is fixed horizontally over the center of a fixed ring, hereinafter referred to. Each of the thirty-two threads or wires is passed outward through a hole in the rim f, where one end is retained by a knot on the inside of the rim; then upward and over the rim inward to a corresponding hole in the boss. The thread or wire passes through this hole upward, and then horizontally outward over the stout fixed ring above mentioned, and downward, with a weight attached to it to stretch it with proper force. The rim is then worked about until it is made truly circular and concentric with the sapphire cap. The threads or wires are then cemented to the boss, after which they are

drawn through the holes in the boss a second time, and again cemented, and their loose ends cut away.

I thus obtain a compass which, while being extremely light, and yet having a large radius of gyration, has very small frictional error, with small enough magnetic movement to give a very long period of free vibration. For example, one of my compasses of ten inches over all diameter, having eight needles of from three inches to one and three-fourths inch long, weighs one hundred and seventy-eight grains, and at Glasgow, North Britain, has a period of free vibration thirty-eight seconds, and extreme static frictional error on either side of the true position of less than one-quarter degree.

Having thus described my invention, the following is what I claim as new therein and desire to secure by Letters Patent:

The compass-card composed of an aluminium rim, *f*, and boss *a*, connected together by fine threads or wires, to which and to the rim the compass-card is secured, in combination with the small needles or magnets *d*, substantially as and for the purposes set forth.

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

WILLIAM THOMSON. [L. S.]

Witnesses:

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