

E. KLAHN.

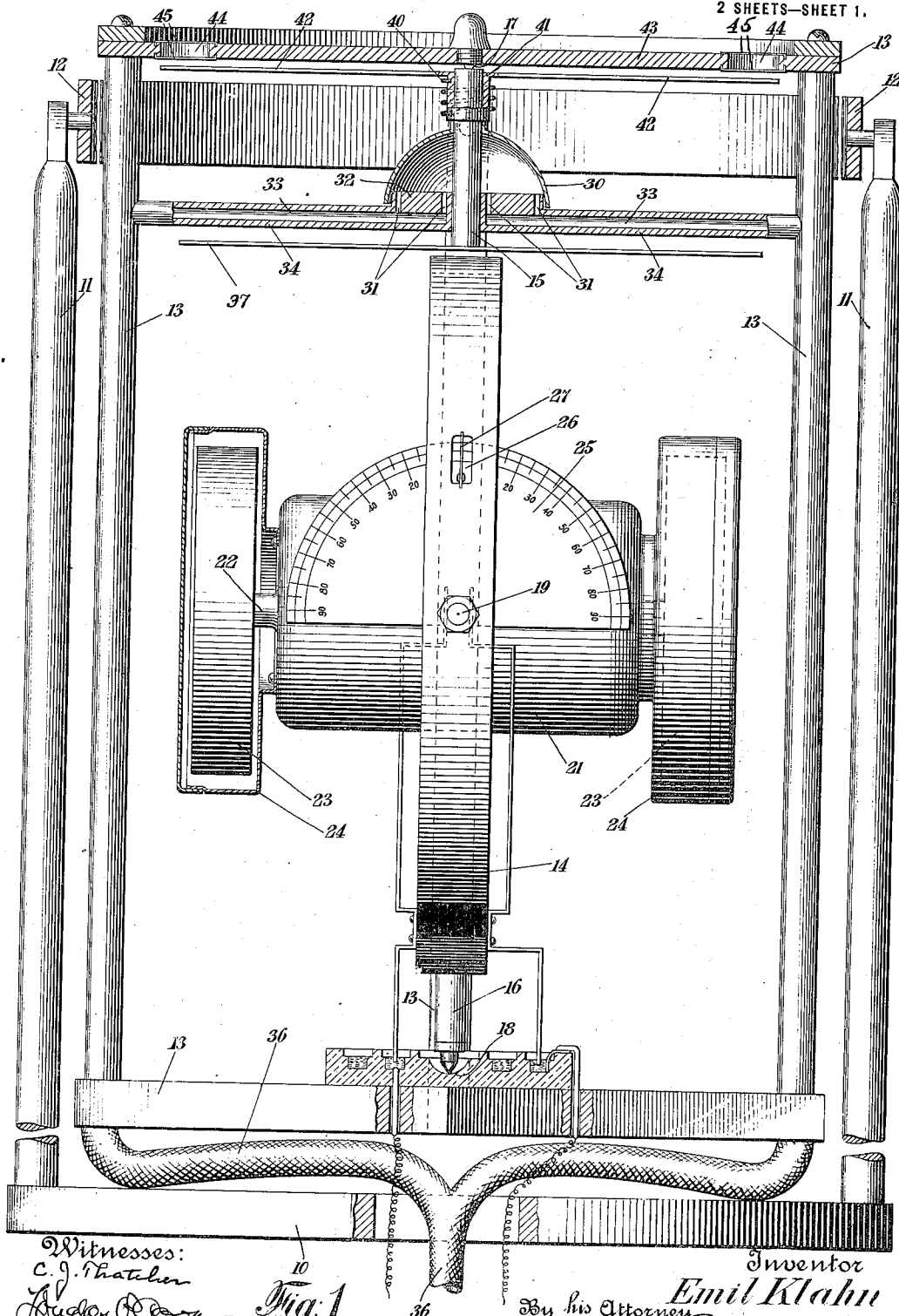
NON-MAGNETIC COMPASS.

APPLICATION FILED MAY 12, 1913. RENEWED OCT. 22, 1917.

1,250,592.

Patented Dec. 18, 1917.

2 SHEETS—SHEET 1.



Witnesses:
C. J. Thatcher
August 1917

Fig. 1

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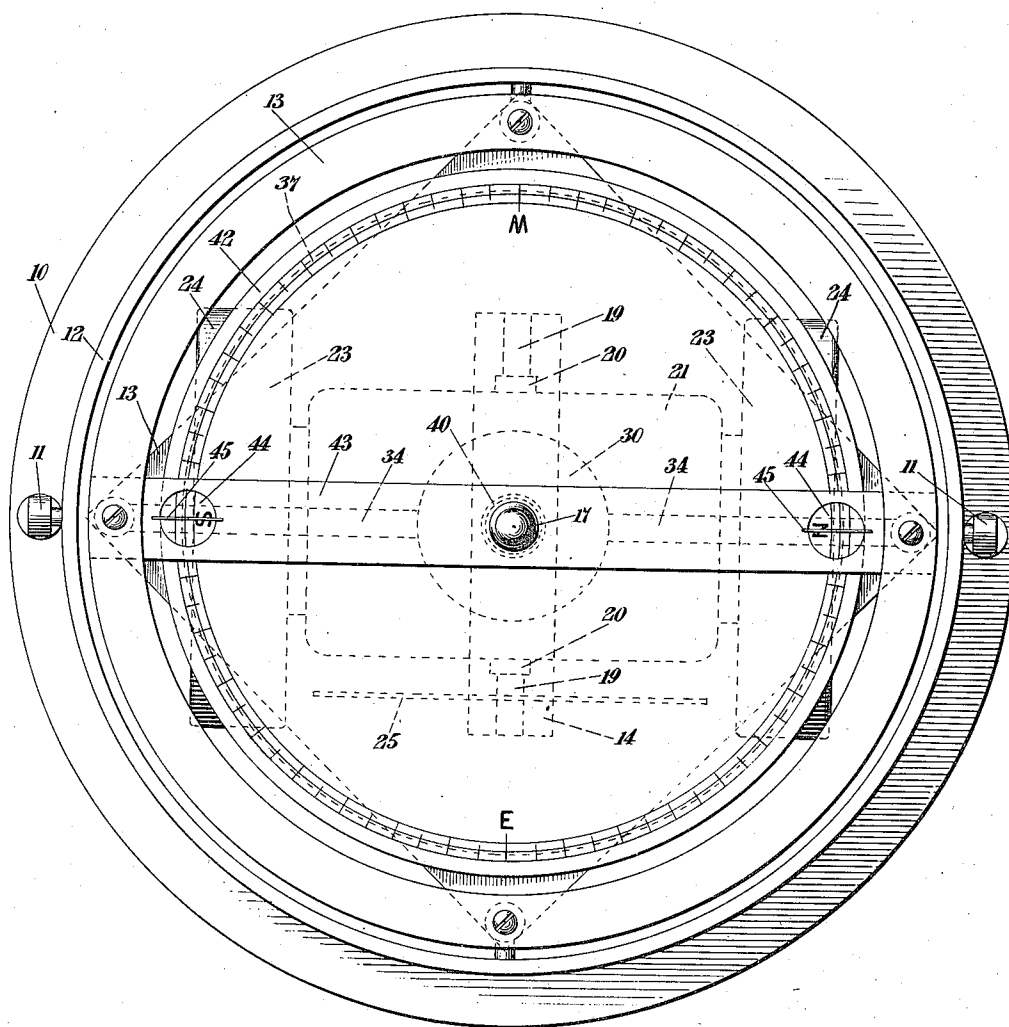
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2 SHEETS—SHEET 2.

Fig. 2



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UNITED STATES PATENT OFFICE.

EMIL KLAHN, OF MORRIS PLAINS, NEW JERSEY.

NON-MAGNETIC COMPASS.

1,250,592.

Specification of Letters Patent.

Patented Dec. 18, 1917.

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To all whom it may concern:

Be it known that I, EMIL KLAHN, a citizen of the United States, and a resident of Morris Plains, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Non-Magnetic Compasses, of which the following is a specification.

The invention relates to gyroscopic apparatus, for example such as may be employed in connection with non-magnetic compasses, and more particularly to suspension means therefor and whereby the frictional resistance to turning about one or more of its axes may be substantially eliminated—in the case of non-magnetic compasses, particularly that upon the vertical axle of the gyroscopic member employed.

This is effected by providing a sustaining column of air under suitable pressure to support the entire gyroscope, so that friction upon its corresponding axle is eliminated. By thus eliminating the frictional resistance to turning about the vertical axle, for example, rotary influences will be transmitted substantially only through the horizontal axle owing to its frictional resistance.

In the embodiment herein illustrated as one application of the invention, viz:—a non-magnetic compass, Figure 1 is a front elevation, partly in section; and Fig. 2 is a plan thereof.

Similar characters of reference designate corresponding parts throughout the several views.

Referring to the drawings, 10 designates a suitable base for the apparatus, which base may be carried by a ship or other course changing body. Suitable columns 11 extend upwardly from the base and support a gimbal ring 12, which, in turn, is pivotally connected to the frame 13 of the apparatus proper, the mounting of frame 13 in the gimbal ring being according to the usual practice and intended to maintain the said frame 13 at all times in the plumb line.

The frame 13 retains a frame 14 rotatably mounted therein as by means of upper and lower vertical shafts 15, 16 forming the axle of precession of the gyroscope and rigidly connected with the frame 14. Shafts 15 and 16 are held in respective bearings 17 and 18 of the frame 13, the upper bearing 17 being merely to locate the shaft 15, while the lower bearing 18 is a supporting bearing

for the gyroscopic member as a whole. This member is pivotally mounted within the frame 14 in the line of its center of gravity, as by trunnions 19 in bearings 20, and at right angles to the said axle of precession. It comprises a suitable motor 21, herein shown as an electric motor to which electrical connection is made in well-known manner as shown, said motor rotating an axle 22 at right angles to the said trunnions, the axle being hereinafter referred to as the axle of rotation of the rotating mass and driving preferably two rotatable masses 23 at its respective ends. The masses 23 are shown inclosed in suitable casings 24 to avoid any disturbing action due to air currents produced by their rotation. Upon one of the trunnions 19 is mounted a semi-circular dial 25, graduated in degrees latitude from zero to ninety, and adapted to cooperate with a sight opening 26 in the frame 14 having two superposed parallel threads 27 for affording a more convenient and accurate reading of said dial.

The shaft 15 has secured to it, near its upper end, and is surrounded by an inverted cup shaped member or dome 30 into which air is adapted to be blown through suitable openings 31 arranged in two circular series in a circular plate 32 fitted within the dome. The air is delivered to these openings through ducts 33 of tubes 34 connected with a number of the vertical supporting columns of the frame 13, said columns being hollow and connected through a hose 36 with a suitable source of compressed air (not shown). The air passes out between the periphery of plate 32 and the inner wall of the dome; and to obviate any disturbing action of the exhaust air upon the gyroscope, a plate 37 is interposed, the same being secured to the shaft 15.

Above this dome 30 and about the shaft 15 is mounted a coiled spring 40, one end of which is fixed to the said shaft 15 and the other to a sleeve 41, freely movable about said shaft and carrying a suitably graduated compass card or dial 42. A bar 43 secured to frame 13 extends over this dial and is provided with suitable sight openings 44 having two parallel, vertically disposed threads 45 to afford a more convenient and accurate reading of the graduations of the dial.

To obtain the extremely small bearing friction of shaft 16 in its bearing 18, the

dome 30, etc., has been employed and provides for a pneumatic support independent of the gyroscope bearings and partly overcomes the weight of the apparatus. The degree of this sustaining air pressure is regulated to suit the minimum bearing friction and affords a very convenient and simple way of effecting the same. In fact, it is possible therewith to substantially eliminate the frictional resistance turning of the desired axle which feature is extremely valuable, for example, in non-magnetic compasses, the elimination of the frictional resistance to turning about the vertical axle rendering the compass subject only to the rotary influences which are transmitted thereto through the horizontal or tilting axle.

I claim:—

1. A rotatably mounted gyroscope, and means to provide a suitable bearing therefor; means to support said gyroscope independently of said bearing, and means to supply air under pressure thereto with a free escape therefrom to eliminate substantially the frictional resistance to turning about one of its axes and without disturbing the gyroscope.

2. A rotatably mounted gyroscope, and means to provide a suitable bearing therefor; means to support said gyroscope independently of said bearing, and means to supply air under pressure thereto with a free escape therefrom to eliminate substantially the frictional resistance to turning about its vertical axis and without disturbing the gyroscope.

3. A rotatably mounted gyroscope, and means to provide a suitable bearing therefor; a member movable with said gyroscope, and means to direct air under pressure thereon with a free escape therefrom to support said gyroscope independently of said bearing and without disturbing the gyroscope.

4. A rotatably mounted gyroscope, and means to provide a suitable bearing therefor; a member movable with said gyroscope, means to direct air under pressure thereon to support said gyroscope independently of said bearing; and means to deflect the discharged air.

5. In a gyroscope: a suitable frame; a second frame supported thereby and rotatable about a vertical axis; a spinning member mounted in said second frame; a member

movable with said second frame; and means to direct air thereon with a free escape therefrom to support said second frame independently of the first named frame and without disturbing the gyroscope.

6. In a gyroscope: a suitable frame; a second frame supported thereby and rotatable about a vertical axis; a spinning member mounted in said second frame; an inverted cup-shaped member movable with said second frame; and open at the bottom to the atmosphere and means extending from said first named frame and opening into the inverted cup-shaped member to direct air therein to support the second frame independently of the first frame.

7. In a gyroscope: a suitable frame; a second frame supported thereby and rotatable about a vertical axis; a spinning member mounted in said second frame; an inverted cup-shaped member movable with said second frame; means extending from said first named frame and opening into the inverted cup-shaped member to direct air therein to support the second frame independently of the first frame; and a plate secured to said first frame to deflect the discharged air.

8. A gyroscope comprising a spinning member rotatable about a vertical axis and upon a horizontal or tilting axle, and means to eliminate substantially frictional resistance to turning about the vertical axis, whereby all rotary impulses acting on the gyroscope are transmitted through the said horizontal or tilting axle.

9. A gyroscope comprising a spinning member rotatable about a vertical axis and upon a horizontal or tilting axle, means to suitably support the gyroscope vertically, and means to supply air under pressure thereto to eliminate substantially frictional resistance to turning about the vertical axis, whereby all rotary impulses acting on the gyroscope are transmitted through the said horizontal or tilting axle.

Signed at New York, in the county of New York, and State of New York, this 10th day of May, A. D. 1913.

EMIL KLAHN.

Witnesses:

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LAURA E. SMITH.