

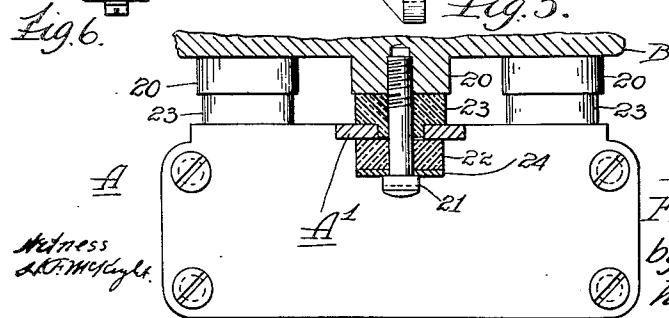
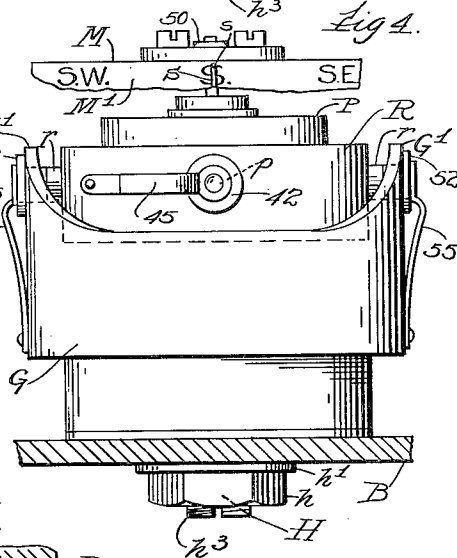
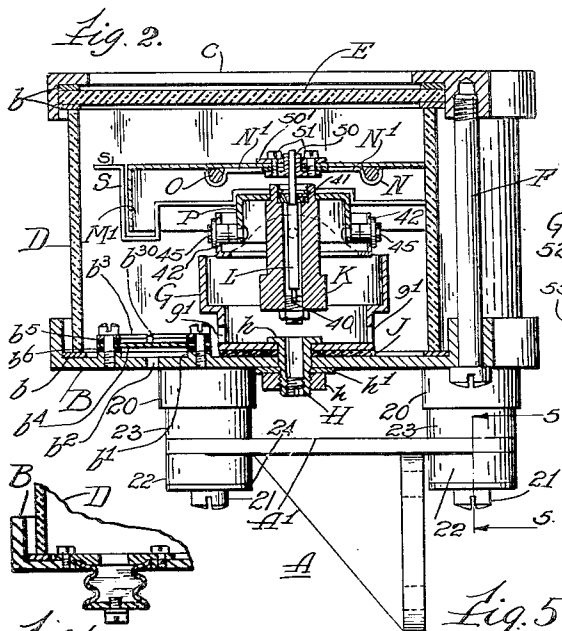
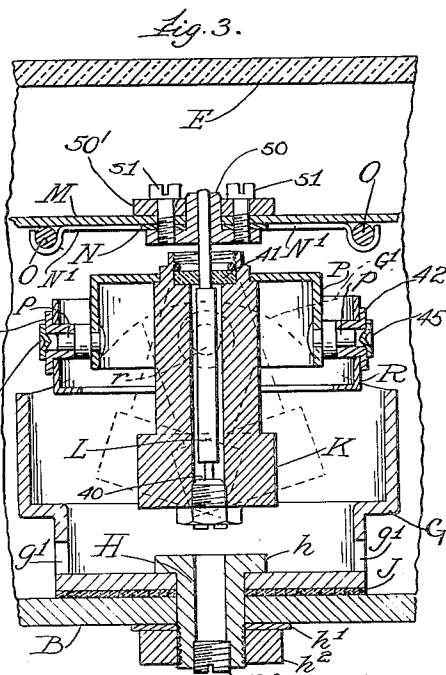
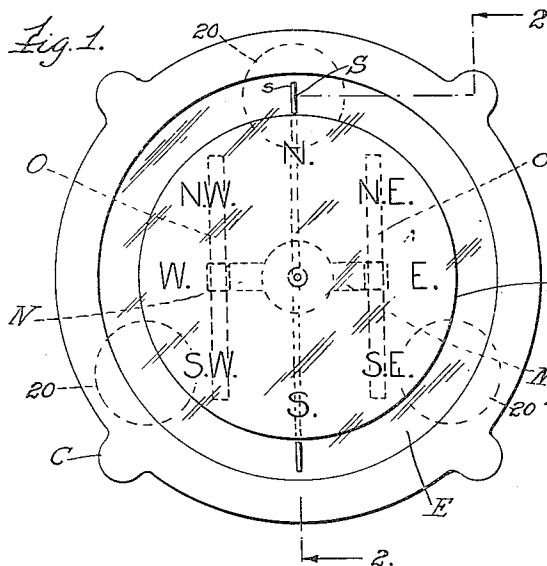
Oct. 17, 1933.

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1,930,775

MAGNETIC COMPASS

Filed March 31, 1930



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UNITED STATES PATENT OFFICE

1,930,775

MAGNETIC COMPASS

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Application March 31, 1930. Serial No. 440,274

4 Claims. (Cl. 33—223)

The purpose of this invention is to provide an improvement in magnetic compasses adapted particularly for aerial vehicles. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawing:

Figure 1 is a top plan view of an instrument embodying this invention.

Figure 2 is a section at the line, 2—2, on Figure 1.

Figure 3 is a detail section upon an enlarged scale of a portion of Figure 2.

Figure 4 is a partly sectional view showing in side elevation the pendulous universally pivoted carrier for the compass for the magnetic needle and compass card, the bottom of the casing being shown in section.

Figure 5 is a detail section at the line, 5—5, on Figure 2.

Figure 6 is a detail section showing a modification of the corresponding structure of Figure 2.

In the drawing the compass represented is shown having its casing mounted fixedly upon a fixed bracket, A, said casing comprising a bottom plate, B, and a top annular plate or clamping flange, C, bound together by four bolts, F, of which one may be seen in Figure 2, clamping between them a transparent body, D, and at the upper end of said body a transparent face plate, E, with suitable packing gaskets, *b*, at the opposite ends of said transparent body, D, and at opposite sides of the transparent face plate, E, for making the enclosed chamber liquid tight. For mounting the casing on the bracket the bottom plate, B, has three short foot bosses, 20, 20, by which the casing is secured to the horizontal flange, A¹, of the bracket by means of bolts, 21, insulating and cushioning washers, 22 and 23, being interposed at opposite sides of the web, A¹, between said web, and the head of the bolt and the bottom of the foot bosses, 20, respectively, suitable metal washer, 24, being interposed between the head of the bolt and the insulating washer, 22.

Within the casing there is mounted rigidly upon the bottom plate, B, an upwardly open cup-shaped supporting member, G, for supporting pendulously as hereinafter described, the magnetic needle and compass card, said member, G, being secured to the plate, B, by means of a hollow bolt, H, having its head, *h*, stopped upon the upper side of the bottom of the cup member and a gasket, *h*¹, interposed at the under side of the bottom between the same and a clamping nut, *h*², an extended gasket, J, being interposed between the bottom of the

cup and the upper surface of the bottom plate, B, and the aperture through the hollow bolt being closed at the lower end by a screwed-in plug *h*³. Said cup member, G, has toward the bottom, apertures, *g*¹, *g*¹, for communication from the cup cavity to the cavity of the casing outside the cup. The purpose of the casing construction as thus far described is to adapt it to be occupied with liquid for certain purposes hereinafter set forth, the hollow bolt at the bottom serving upon withdrawing the plug, *h*³, for filling and draining the casing chamber.

For mounting the magnetic needle and compass card pendulously so that the needle and compass card may maintain horizontal position throughout all changes of inclination of the vehicle in its aerial travel, there is provided a suitably long step bearing member, K, constituting a pendulous weight and having at its lower end a step bearing, 40, for the spindle, L, which has near its upper end a second bearing, 41, and which has secured to it at its upper end above said step bearing a fitting, 50, onto which there are clamped by bolts, 51, 51, the compass card, M, and a magnet-needle-securing member, N, 80 the latter having oppositely extending arms, N¹, N¹, formed at their extremities for seating and holding clamped against the under side of the compass card, M, two parallel magnetic needles, O, O, shown circular in cross section, constituting the magnet element. The step bearing member, K, is carried by securement at its upper end to an inner gimbal ring, P, which is pivoted by its opposite gudgeons, *p*, *p*, at diametrically opposite points in an outer gimbal ring, R, which in turn is pivoted by its gudgeons, *r*, at opposite ends of a diameter in a vertical plane at right angles to the plane of the gudgeons, *p*, *p*, in upwardly projecting lugs, G¹, G¹, of the support, G, said lugs projecting above the remainder of the upper edge of the cup so as to position the said gimbal ring, R, high enough to permit it to clear the upper edge of the cup member, G, in the tilting movement which it may derive in the changing level of the vehicle and the fixed supporting bracket, A.

The detail construction indicated is designed to facilitate assembling of the parts as follows: The jewel, 41, is placed over the upper end of the spindle, L, and the bushing, 50, is then pressed onto the spindle to its required position. Strap, N, is placed in position on the bushing, 50; the magnets, O, O, are placed in the seating cavities of the strap, N, and the compass card, M, is applied over the magnet mount or strap, N, with the

washer, 50', above it on the bushing, 50, and to complete the assembly they are securely clamped by screws, 51.

The inner gimbal ring, P, is adapted to be assembled pivotally in the outer gimbal ring, R, by the provision of flanged bearing bushings, 42, 42, fitted to suitable apertures in the outer ring, R, as seen in Figure 3, the inner gimbal ring being introduced into the outer gimbal ring with its pivots, p, in alignment with the apertures in the outer ring, and the bushing bearings being then inserted from the outer side of the outer ring, and retaining springs, 45, 45, are secured at their lower ends to the outer side of the ring, R, and at their upper ends formed for engaging the outer ends of the bushings as seen in Figure 3. This construction permits ready assembling and disassembling of the parts, the retaining springs, 45, being adapted to swing sideways a sufficient distance for admitting and withdrawing the bushings as described.

The outer gimbal ring is similarly arranged for assembling in the support, G, by means of bearing bushings, 52, 52, retained in place by springs, 55, 55, secured to the outer side of the support, G.

The compass card, M, has direction readings upon its upper face exposed for reading through the transparent face plate, E, of the instrument. The index member cooperating with the compass card for reading the indication of the compass is afforded by a rod or bar, S, mounted fixedly on the upper gimbal ring, and thereby on the step bearing member, K, and extending diametrically across under the compass card and up-turned at the ends outside the circumference of the compass card so as to have at each upper end an outwardly turned index terminal, s, which is positioned substantially in the plane of the compass card and exposed immediately outside the circumference of the latter so that its registration with the direction readings of the compass card may be accurately noted without mistake due to parallax. This index member, S, it will be understood, is mounted fixedly, as stated, with respect to the step bearing member in which the needle and compass card are pivoted, as is necessary in order that the reading of the compass card by reference to the index terminal of said rod shall indicate correctly the direction in which the vehicle is headed for movement of travel,—in the direction of the longitudinal dimension or direct fore-and-aft line of the vehicle which is commonly indicated by a mark on the compass box called the "lubber line". And accordingly this index member, S, may be hereinafter referred to as the lubber line rod.

As mentioned above, the casing is adapted and designed to be filled with liquid for the purpose of damping the oscillation of the needle and compass card; and for amplifying the damping effect, the compass card is formed with a downwardly projecting peripheral flange M¹, which has on its outer surface direction readings corresponding to those on the face of the compass card. And it will be noticed that the lubber line indicator in its extent from its mounting at the step bearing member, K, to the point where it is folded upwardly, necessarily extends under the lower edge of the flange, M¹, so that its upward extent for reaching the plane of the compass card at which it carries the index terminal, s, stands closely adjacent to the outer face of the flange, M¹, and at that part serves as an index co-operating with

the direction readings of the flange for reading the direction indication afforded by the compass, such reading being rendered possible by the transparent enclosing wall, D.

To provide for expansion and contraction of the liquid with which the chamber is filled for co-operating with the compass card to damp the oscillation of the card and the magnetic element, O, O, the bottom plate, B, has at one side of the position of the member, G, a slight annular boss, b¹, encompassing an air vent aperture, b², and there is clamped onto this boss a flexible diaphragm, b⁴, interposed between impervious gaskets, b⁵ and b⁶, respectively, above and below the diaphragm; the clamping ring, b³, is split or slotted at b³⁰, and the upper gasket, b⁵, is similarly split to release any air which might otherwise be trapped over the diaphragm, b⁴. The aperture, b², admits atmospheric pressure to the chamber below the diaphragm, and the liquid fills the chamber above the diaphragm. The diaphragm is flexibly resilient and adapted to extend substantially without deflection from the plane in which it is mounted by the weight of the liquid in the chamber as the latter is normally filled. Upon expansion of the liquid due to rise in temperature, the diaphragm yields into the lower chamber which is accordingly dimensioned for taking care of the expansion of the liquid due to the maximum anticipated rise of temperature above that at which the chamber was filled. And upon the lowering of the temperature, causing shrinkage of the liquid, atmospheric pressure on the diaphragm, causes it to be deflected into the upper chamber, absorbing the shrinkage and preventing the creation of empty space in the casing. Figure 6 illustrates the substitution of a small bellows of the "slyphon" type in place of the diaphragm for response to expansion or contraction of the liquid.

I claim:—

1. A magnetic compass comprising a fixed mount and a magnet element carrier pendulously universally pivoted on said fixed mount; a magnet element having a spindle carried by the carrier; a compass card fixed for rotation with the magnet element, and a lubber line indicator mounted fixedly on the carrier for movement therewith in the pendulous swinging oscillation of the latter, the fixed mount comprising a sealed chamber filled with liquid; the carrier being universally pivoted pendulously within said chamber; whereby the compass card co-operates with the liquid for damping the oscillation of the magnet element.

2. A magnetic compass comprising a fixed mount and a magnet element carrier pendulously universally pivoted on said fixed mount; a magnet element having a spindle carried by the carrier; a compass card fixed for rotation with the magnet element, and a lubber line indicator mounted fixedly on the carrier for movement therewith in the pendulous swinging oscillation of the latter, the fixed mount comprising a sealed chamber filled with liquid; the carrier being universally pivoted pendulously within said chamber; the compass card having a flange projecting transversely of the plane of said card at the side opposite the compass readings for affording increased surface for liquid contact for damping the oscillation and the lubber line indicator being carried by securement to the spindle bearing and extended out under and outwardly past said flange and upwardly immediately outside the flange to the plane of the compass card, whereby the indicator may be read on the flange without error due to parallax.

3. A magnetic compass comprising a fixed mount and a magnet element carrier pendulously universally pivoted on said fixed mount; a magnet element having a spindle carried by the carrier; a
 5 compass card fixed for rotation with the magnet element, and a lubber line indicator mounted fixedly on the carrier for movement therewith in the pendulous swinging oscillation of the latter, the compass card having a flange projecting
 10 transversely of the plane of the card at the side opposite the face having the compass readings, the lubber line indicator being carried by securement to the spindle bearing and extended out under and outwardly past said flange and up-
 15 wardly immediately adjacent the flange to the plane of the card, the fixed mount comprising a transparent enclosing wall encompassing the pendulous universally pivoted carrier and all parts carried thereby, the compass card flange having

direction readings on its outer surface, whereby the compass indication may be read both from the side and the face of the instrument.

4. In a magnetic compass having a magnet element and a spindle on which it is mounted, said
 80 magnet element comprising a pair of magnets and a compass card; a clamping bar for holding the magnets to the compass card in position parallel to each other, the compass card having a central aperture, and the clamp having an aperture
 85 adapted to register with the compass card aperture when holding the magnets in their said parallel positions; a flanged bushing; a washer fitted to the bushing, and bolts for clamping the clamping bar to the compass card between the washer
 90 and the flange of the bushing, the bushing being centrally apertured for forced fit on the spindle.

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