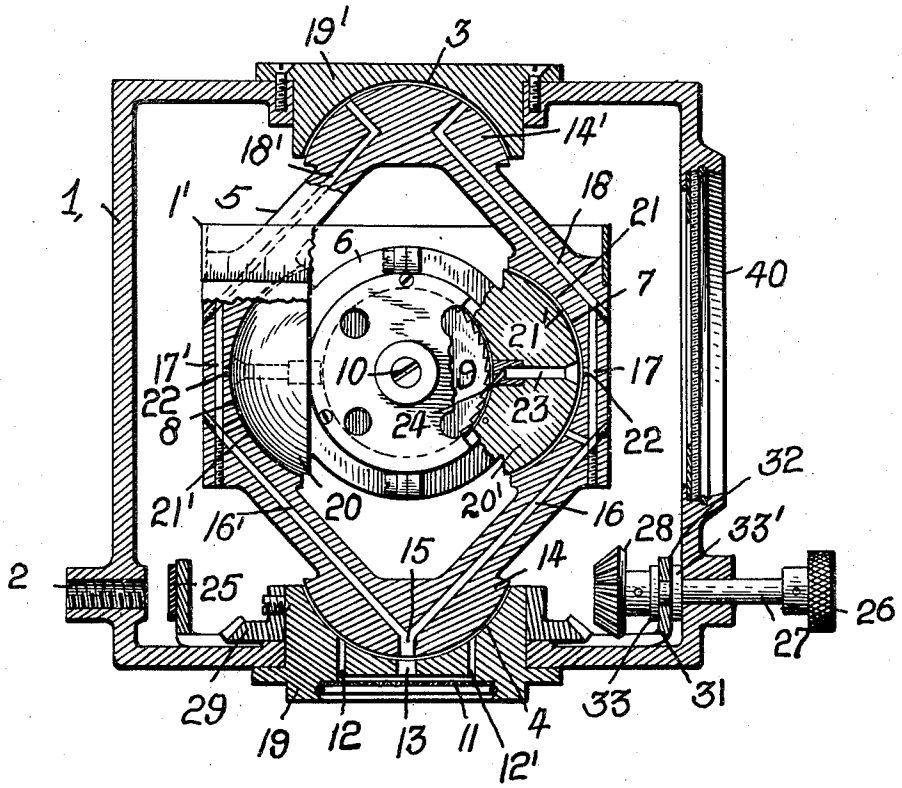
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RESETTING MEANS FOR AIR BORNE GYROSCOPES

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RESETTING MEANS FOR AIR BORNE GYROSCOPES

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This invention relates to gyroscopic directional and similar devices of the air borne type in which ordinary oil or ball bearings are replaced by bearings supported entirely by air films. Such gyroscopes are either used alone or operated in conjunction with a magnetic compass as a gyromagnetic compass unit, as well understood in the art of aircraft navigational instruments.

In directional gyroscopes which have three degrees of freedom, it is occasionally necessary to reset the same to bring the compass card thereon into the desired course or into synchronism with the magnetic compass. For resetting the ordinary type of gyroscope, considerable mechanism is required because the gyroscope must be locked about its horizontal axis, but by my present invention I have devised an extremely simple device for resetting air borne type directional gyroscopes.

Referring to the drawing, the single figure shows a vertical section of an air borne directional gyroscope with my resetting means applied thereto.

The directional gyroscope is shown as enclosed in a casing 1 having a front window 40 for reading the card 1' and from which air is exhausted through a pipe coupling 2 by means of a pump (not shown). The gyroscope is supported within said casing for freedom about its vertical axis by means of upper and lower spherical air bearings 3 and 4 which support and guide the vertical ring 5 about the vertical axis. The rotor bearing casing 6, in turn, is supported for oscillation about a horizontal axis within said vertical ring on spherical air bearings 7 and 8. Such air bearings are now well known in the art, as shown in the prior application of Leslie F. Carter, Serial No. 734,619, filed July 11, 1934, and comprise large complementary, close fitting, curved, dry metallic surfaces between which air is caused to normally flow, whereby the supported member is floated in the supporting member. The rotor 9, in turn, is journalled in said casing for spinning about normally horizontal axis 10 on any suitable type of anti-friction bearing, preferably other than the air borne type.

Air is shown as supplied to the instrument for lubricating or floating the bearings and spinning the rotor through a bottom screened opening 11. The air passes upwardly through apertures 12, 12' and 13 within a bearing block or cup 19, shaped to closely fit the spherical button 14 on the bottom of the vertical ring. A portion of said air escapes between the button and cup to thereby float the vertical ring. The greater portion of said air passes upwardly, however, through an opening 15 in line with the opening 13, whence it branches into channels 16 and 16' connecting with similar channels 17 and 17' and 18 and 18' which finally emerge through the top button 14' to supply air for lubricating or floating the same within the complementary shaped cup member 19'. A portion of the air from each system of channels is also led horizontally to float the rotor bearing casing buttons 20 and 20' in the spherical seats 21 and 21' set or formed in the vertical ring, the air being shown as entering the same through small transverse bores 22. It will be understood ring 5 is actually made in two or more separable parts for assembly purposes, although not shown so. A portion of this air also passes through a central aperture 23 in each button to supply air to the spinning nozzles 24 for spinning the rotor.

As a locking means for locking the gyroscope preliminary to resetting or shutting down, I have shown a manually operated shut-off valve 25 adapted to close the outlet 2 at will. When said valve is closed, the rotor bearing casing becomes immediately locked about its horizontal as well as about its vertical axis because with the air removed the large bearing surfaces, as they are not lubricated other than by air, are in frictional contact with each other. I have shown a common knob 26 both for shutting off the air pump and for resetting the gyroscope. As shown, said knob is mounted on a shaft 27 both slidably and rotatably mounted in casing 1. At the inner end of said shaft is a bevel gear 28 adapted to be be brought into mesh with a bevel gear annulus 29 secured to the cup member 19, the latter being rotatably mounted within the casing 1. There is also shown a U-shaped member 31 connecting the valve 25 and the push rod 27. As shown, the extension of the rod 27 passes through a hole in the right hand upturned portion 32 of said member so that said portion is non-slidably held between collars 33 and 33' on said shaft 27. It will readily be apparent that by pushing the handle 26 in, the source of differential air pressure, will be shut off, thereby frictionally locking the gyroscope about both its vertical and horizontal axes, and that by rotating the knob 26 the gyroscope may be set about its vertical axis to any desired position. The bearing 10 is preferably of the ball bearing type so that the rotor remains spinning even though the gyroscope is locked about another axis.

Since the entire weight of the gyroscope is on the lower bearing, it will ordinarily be found sufficient to turn the lower bearing only. As above

stated, this type of setting device is especially adapted for the resetting of directional gyroscopes of the gyro-magnetic type. One advantage of this type of setting device is such directional gyroscopes is that the locking means about the horizontal axis of the rotor bearing frame does not centralize the frame with respect to the vertical ring. With the ordinary type of resetting device, the frame is brought to a position with the gyro spin axis perpendicular to the normally vertical ring, but in case the vertical ring is inclined due to the inclined position of the aircraft at that time, the spin axis of the gyro will also be brought to an inclined position by the former type of setting device. In my invention, however, the rotor bearing frame is locked in whatever position with respect to the vertical ring it may be at the time the air is cut off, so that when released again it will remain in that position.

From the foregoing description it will be readily apparent that I have devised an extremely simple caging and resetting device. In the usual type of directional gyroscope, a system of gears and levers has to be employed to cage or lock the gyroscope about its horizontal axis to prevent precession when resetting and it is also necessary to actually engage the vertical ring. In my system the caging function is accomplished simply for shutting off the air supply, and the resetting simply by turning the lower vertical bearing.

As many changes could be made in the above construction any many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim and desire to protect by Letters Patent is as follows:

1. In an air borne gyroscope having large complementary, dry bearing surfaces between the supported and supporting parts and means for normally supplying air flow between said surfaces to provide freedom about an axis of said gyroscope, a resetting means for the same comprising means for shutting off the air supply, causing frictional binding of the bearings, and means for rotating the supporting part of at least one of said bearings while the air supply is off.

2. A resetting means for directional gyroscopes of the air borne type having a rotor bearing casing, a vertical ring and outer casing, large complementary dry bearing surfaces mounting said casing within said ring and mounting said ring within said outer casing for freedom about horizontal and vertical axes, means for supplying air flow between said surfaces to provide air flow bearings, means for shutting off the supply of air to said bearings, and means for rotating the part of at least the lower vertical bearing in said casing, while the air supply is shut off.

3. A resetting means for directional gyroscopes of the air borne type having a rotor bearing casing, a vertical ring and outer casing, large complementary dry bearing surfaces mounting said casing within said ring and mounting said ring within said outer casing for freedom about horizontal and vertical axes, means for supplying air flow between said surfaces to provide air flow bearings, means for shutting off the air supply to said bearings, means for rotating the lower vertical bearing in said casing, and a common knob for operating both of said last named means.

4. In a directional gyroscope, a rotor bearing casing, a rotatably mounted vertical ring, large complementary dry surfaces for supporting said casing for oscillation about a horizontal axis within said ring, means whereby air under pressure is supplied thereto for floating said casing about said axis, means for locking the casing about said axis preparatory to resetting by shutting off the air supply, means for temporarily cutting off the air supply, and means for resetting said vertical ring and casing in azimuth while said casing is so locked about said horizontal axis.

5. A directional gyroscope as claimed in claim 4, also having large complementary dry surface bearings supporting said ring for turning about a vertical axis whereby the vertical ring is also locked in azimuth, and means for resetting the position of said vertical ring by utilizing the friction of the dry surfaces of the lower bearing of said vertical ring while the rotor bearing casing of the gyroscope is so locked.

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