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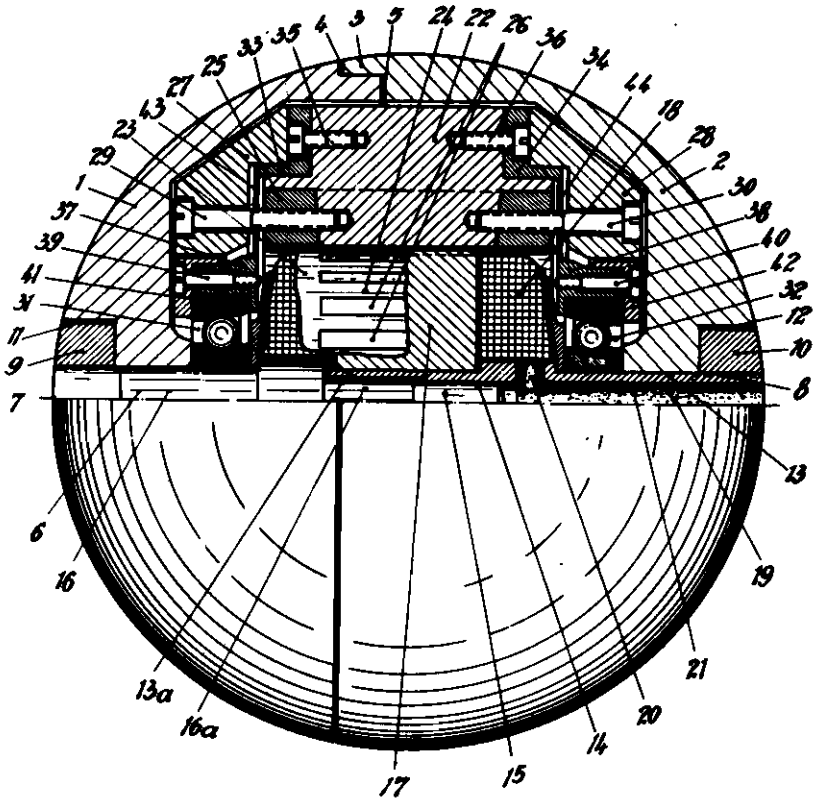

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ALIEN PROPERTY CUSTODIAN

GYROSCOPES

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The invention relates to gyroscopes, such as are employed in airplanes for navigation and control purposes. It is essential that such gyroscopes occupy as small a space as possible. The gyros employed, for instance, in azimuth gyros and horizon gyros are, as a rule, suspended in gimbals. The gyro itself is in most cases arranged in a closed casing which forms the inner gimbal ring and the casing is pivotally mounted in an outer gimbal ring.

The gyro casing may consist of a sectional spherical casing. According to the invention the spherical casing of the gyro is designed in such a manner that the parts of the spherical casing made preferably of two spherical parts may be assembled with the aid of a bracing member extending diametrically through the casing and that the bracing member serves at the same time as an axis of rotation for the gyro flywheel mass designed in the form of an outer rotor.

In the accompanying drawing is shown an embodiment of such a gyroscope in diagrammatic form.

The casing of the gyroscope is designed in the form of a spherical casing and consists of two parts 1 and 2 substantially of the same size. The spherical part 2 is provided with a flange 3 which cooperates with a circular shoulder 4 of the part 1. The joint 5 between the two spherical parts does not extend exactly in the central plane perpendicular to the axis of rotation, but is displaced with respect to this plane by a small amount. In this manner it is possible to provide at any point of the spherical part pins which lie in the said central plane or to provide corresponding flanges for such pins. Under circumstances the flange 3 may have a fitting face on the shoulder 4.

The two spherical parts may be assembled with the aid of a bracing member extending diagrammatically through the casing and the bracing member serves at the same time as an axis of rotation for the gyro flywheel mass designed in the form of an outer rotor. Consequently, the axis of rotation is fixedly mounted in bearings. Both ends of the bracing member are provided with threaded portions 7 and 8 which serve to brace the two spherical parts. Each of these two threaded ends cooperates with a nut 9 and 10 respectively. These nuts serve as tightening nuts and are arranged in corresponding recesses 11 and 12 provided in the two spherical parts and cooperate with the axis 6 to brace the two spherical parts 1 and 2 which therefore form a completely closed casing for the gyro, the nuts being flush with the spherical surface of the casing.

The gyro axis 6 forming the bracing member for the two spherical parts is made of two parts. The one part 13 of the axis of rotation is provided with a threaded portion 14 which cooperates with a corresponding threaded portion 15 of the other part 16 of the axis of rotation. Consequently, the part 13 is designed in the form of a screwed joint (screwed cap), the part 13*a* of which surrounding the part 16*a*. Between the parts 13*a* and 16*a* is provided a fitting face by means of which the axis of rotation is centered as well as the two spherical parts with respect to the axis, since the two spherical parts with the fitting face are arranged on the corresponding parts of the axis of rotation. The stator field winding of an electric gyro drive is secured to the part 13 of the stationary axis of rotation 6. The stator laminations are denoted by the numeral 17 and the stator winding by the numeral 18. To supply current to the stator winding, the part 13 of the axis of rotation is provided with an axial bore 19 and a radial bore 20 which are lined with insulating material 21 so that the current may be supplied to the inside of the gyro casing in a simple manner.

The axial cross-section of the inner space of the casing is adapted to the axial cross-section of the gyro rotor in the manner that the gyro rotor moves with the smallest possible clearance within the casing. The gyro rotor is made in the present embodiment of three parts. The rotor laminations constitute the central part 22 of the electric drive which consists of a three-phase squirrel-cage rotor. The rotor copper is denoted by the numeral 23 and has corresponding armature bars 24 as well as short-circuiting rings 25 connecting the same. The teeth of the rotor are denoted by the numeral 26. The two lateral parts 27 and 28 arranged symmetrically with respect to the central part are firmly secured to the central part by means of screws 29 and 30. To increase the gyro couple the lateral parts may consist of a material of high specific gravity, for instance of a highly refractory metal.

The gyro rotor is rotatably mounted on the stationary axis of rotation with the aid of ball bearings 31 and 32. To support the gyro rotor, particular supporting members 33, 34 are provided which are secured in the embodiment shown to the central part of the rotor by means of the screws 35 and 36. The latter may, however, be dispensed with and the tightening of the supporting member 33 and 34 may be effected by means

of the parts 27 and 28 which in turn are secured to the central part by means of the screws 29 and 30. These supporting members are designed in the form of disks and the inner edge thereof is provided with a hub-shaped flange 37 and 38 respectively which are firmly secured to the bearing rings 41 and 42 resigned in the form of magneto-type ball bearings by means of the screws 39 and 40. Between the fastening flange arranged on the outer edge and the hub-shaped flange arranged on the inner edge is provided a diaphragm resilient intermediate part 43 and 44 respectively. With the aid of the above-mentioned supporting members the gyro rotor may be mounted in a particularly advantageous manner to compensate for the expansions of the gyro rotor due to heat. When the gyro is assembled these supporting members are placed under tension, taken up by the magneto-type bearing of the two bearing rings 41 and 42. The tension is brought about by the fact that the diaphragm-like intermediate part is made resilient. The tension is calculated on the base of a non-revolving gyro and so chosen that it disappears upon the occurrence of thermal expansions of the gyro in operation, i. e., if the gyro rotor revolves at the operating speed. Fluctuations of heat with the gyro in operation are relatively insignificant as compared to the expansion when passing from the state of rest to the state of operation. By mounting the gyroscope in the manner mentioned above the bearing friction is not influenced or only to a slight extent as a result of the expansions due to heat and on the other hand particular auxiliary means are avoided as are employed in the known arrangements in which these means are in part very complicated and in part do not bring about the desired effect. A further advantage presented by the symmetrical arrangement of the supporting member in relation to the central part of the gyro rotor consists in the fact that with respect to the central plane the expansions of the central portion exert the same action in the supporting members at both sides. In this manner the position of the center of gravity of the gyroscope is practically uninfluenced by the expansions due to heat. In the diaphragm-like intermediate members are provided corresponding bores for the screws 29 and 30 so that the said parts do not come into contact with these screws.

The joint 5 as well as the joints between the nuts 9 and 10 and the corresponding recesses 11 and 12 in both parts of the casing may be sealed by means of a suitable packing so that the casing is completely air-tight. In this manner the penetration of moisture, dirt and the like is prevented.

The rotor copper bars may be amply dimensioned so that no undue heating up of the three-phase drive is to be expected. It is therefore not necessary to provide particular air passages or the like through which the interior of the casing is brought into communication with the outside atmosphere.

The gyro rotor is made of three parts having the cross-section shown in the drawing. It is also possible according to the invention to give the gyroscope any axial cross-section and to design the axial cross-section of the inner space of the casing in a corresponding manner. The three parts of the gyro rotor are secured by means of screws or in any other suitable manner. For instance, a connection with the aid of a screw thread may be provided for the two lateral parts, one portion of the thread being arranged on the central part and the other portion of the thread on the corresponding lateral part. The connection of the disk-shaped supporting members of the gyro rotor with one part of the ball bearing may be effected in any suitable manner instead of with the aid of screws. Furthermore, the supporting members made of one piece as shown in the embodiment may also be made of several pieces. Thus, for instance, the diaphragm-like central part may consist of a disk-shaped part which is then secured to a particular outer ring and an inner ring. To secure the two spherical parts screws may be provided, for instance, in the flange 3 and shoulder 4 which may be employed to prevent the two spherical parts from rotating with respect to each other. The gyro casing may consist of any suitable material. A ferro-magnetic material is preferably employed for the casing for shielding the inner magnetic field. The two ends of the axis of rotation of the gyro are made flush with the surface of the spherical parts. It is also possible to provide corresponding devices, for instance, devices in the form of screw lockings in order to prevent the nuts serving to secure the axis of rotation of the gyro from becoming loose. In this case these devices may be arranged in such a manner as to lie inside the outer spherical surface of the gyro casing. Therefore the shape of the gyro casing is such that when the axis of rotation of the gyro is mounted and both spherical parts are secured together no projecting parts are present.

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