April 23, 1940. C. MELLIER 2,198,551

DEVICE FOR COMPELLING A GYROSCOPE TO REMAIN VERTICAL

Filed April 17, 1939

Fig. 1

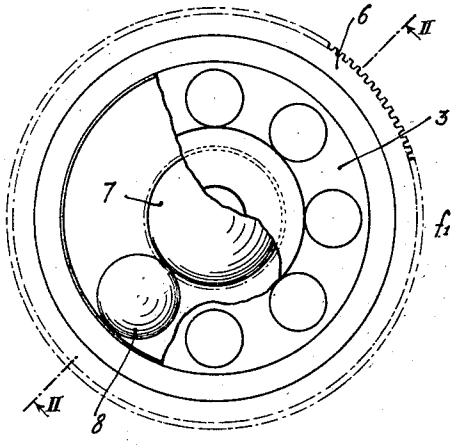


Fig. 4

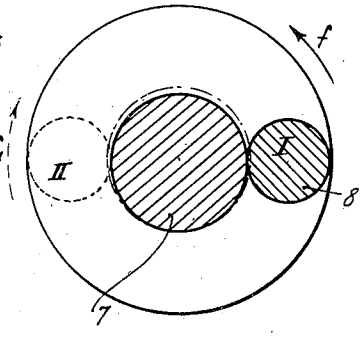


Fig. 2

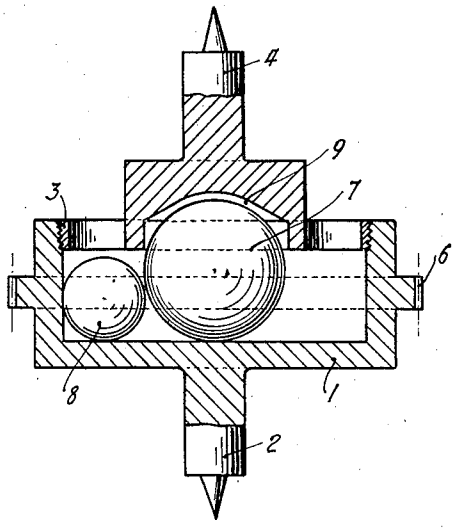
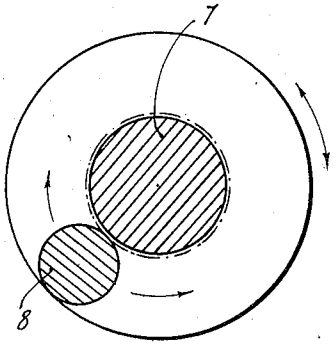


Fig. 3



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DEVICE FOR COMPELLING A GYROSCOPE TO REMAIN VERTICAL

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5 Claims. (Cl. 74—5)

The invention has for its object a device for compelling a gyroscope to remain vertical.

The device according to the invention essentially comprises two balls of different diameters which both rest freely on the bottom of a cup which is coaxial with the axis of the gyroscope and is rotated about said axis at a substantially uniform speed, the larger ball forming an inclination detecting ball, and being kept in the central region of said cup by an annular guard which only allows it to effect a limited radial displacement in all directions and the diameters of the two balls being such that when the detecting ball is exactly in the centre of the cup it defines with the lateral wall of same a circular path along which the other ball can circulate freely whereas when it is in contact with any point of said guard the space between said detecting ball and the lateral wall of the cup is less than that required for the free passage of the peripheral ball.

By way of a non-limitative example, an embodiment of the control device according to the invention has been shown diagrammatically in the accompanying drawing.

In said drawing:

Fig. 1 is a general plan view of the device with the upper wall partly broken away;

Fig. 2 is a vertical section along the line II—II of Fig. 1;

Figs. 3 and 4 are diagrammatical plan views, the balls being shown in section, along a plane passing through the two centres, and said figures respectively show the position of the balls in the case in which the axis of rotation of the device is absolutely vertical and in that in which it is inclined.

In this embodiment, the device comprises a cup 1, the bottom of which carries a central vertical pivot 2 and in the upper part of which is screwed a plate 3 carrying a second central vertical pivot 4. This unit is mounted between two plates, not shown, which are carried by the gyroscope perpendicular to the axis of its rotor, the pivots 2 and 4 being held by said plates coaxially with the axis of the gyroscope. On the outside, the cup 1 is surrounded by a toothed ring 6 adapted to be engaged by a driving gear which is actuated in any manner but preferably in the manner described in the French patent Serial No. 850,087 filed on the 16th of August, 1938, in the name of: "Société Industrielle de Mécanique et de Matériel d'Equipement." On the inner bottom of said cup which is preferably plane and perfectly polished rest two balls 7 and 8 of different diameters. The larger ball 7 is kept in the central region of the cup by its upper part which is engaged with a slight clearance in a cavity 9 of the plate 3 which thus forms an annular guard that only allows of slight radial displacements of the central ball 7. The ball 8 is located in the annular space limited by the central ball and the lateral wall of the cup 1. The dimensions are such that when the central ball 7 is exactly in the centre of the cup 1 (Figs. 1 to 3), the peripheral ball 8 is free to circulate in said annular space without touching the ball 7, but when the ball 7 is in contact with the edge of the cavity 9 (Fig. 4), the space between said ball 7 and the lateral wall of the cup 1 is less than that required for the free passage of the peripheral ball 8.

The operation is as follows:

When the axis of rotation of the cup 1 is absolutely vertical and said cup is rotated at a uniform speed, the ball 8 participates in the rotary movement of the cup 1 and rotates about the central ball 7 which remains exactly in the centre of the cup. If the axis of rotation becomes slightly inclined the central ball 7 immediately falls in the direction of this inclination (Fig. 4) and the peripheral ball 8 can then no longer be carried along in the direction of the movement beyond a certain position of equilibrium in front of the plane of inclination of the axis. By suitably proportioning the diameters, it is possible to make this position of equilibrium fall 90° in front of the plane of inclination of the axis. The force of gravity on the eccentrically located ball 8 produces a restoring couple and the axis of the gyroscope rotor is thus returned to its vertical position. The position of equilibrium of the ball 8 corresponding to the production of the restoring couple is at I in Fig. 4 when the cup 1 rotates in the direction of f and at II when the cup rotates in the direction of f_1.

Of course the invention is in no way limited to the constructional details illustrated or described, which have only been given by way of example.

What I claim is:

1. In the combination of a gyroscope with means carried thereby and arranged to compel said gyroscope rotor to remain vertical, said means including a cup shaped member coaxial with the gyroscope and supported to be rotatable about its axis, means carried by the gyroscope for rotating said cup-member at a substantially uniform speed, two balls free to roll on the bottom of said cup and having different diameters such

that when the larger ball is in the middle of said cup member, there is provided around it within said member an annular passageway along which the smaller ball can run freely, guard means carried by said cup member around the larger ball to keep it in the central region of said cup whereas allowing small radial displacements of said larger ball in any direction from the middle position to at least such an extent that when said central ball is in contact with said guard means said passageway is thereby locally restricted to such an extent that the smaller ball cannot any longer run through said restricted part of the passageway.

2. In the combination as in claim 1, said cup shaped member having a bottom the inner face of which is smooth and plane and a cylindrical lateral wall the inner face of which is smooth.

3. In the combination as in claim 1, the diameters of said balls being experimentally determined so that an inclination of the gyroscope rotor axis in any direction the smaller ball will be locked against the cup-shaped member by the central ball in a position located at 90° forwardly of the vertical plane containing said inclined axis.

4. In the combination as in claim 1, said cup shaped member externally carrying axial pivots and a ring of gear teeth.

5. In the combination as claimed in claim 1 said cup shaped member having a bottom the inner face of which is smooth and plane.

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