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GYROSCOPIC DEVICES
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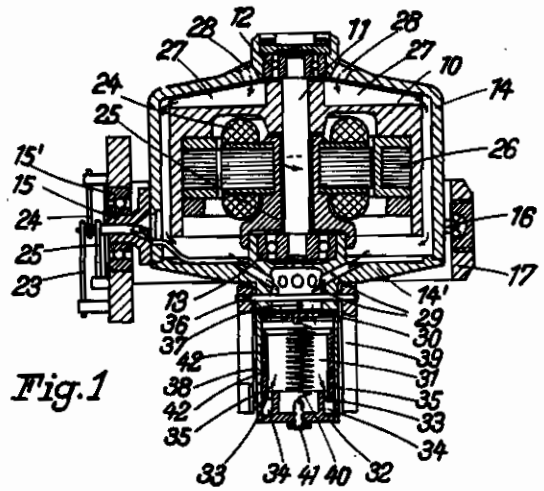

Fig. 1

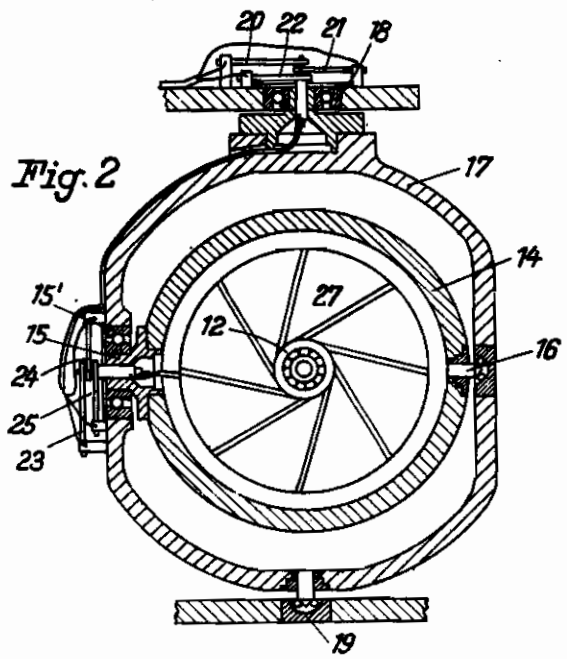

Fig. 2

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ALIEN PROPERTY CUSTODIAN

GYROSCOPIC DEVICES

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This invention relates to gyroscopic devices adapted for use in aircraft, the rotor of which is electrically driven and which generates compressed air, which, for example, may be used for keeping the spin axis of a horizon gyro vertical.

For vertical gyros with air-driven rotors, it is known to use pairs of pendulums suspended on the rotor housing and swinging in front of control jets, whereby the air stream serving for the erection of the gyro may be alternately opened and closed. The use of such a pneumatic control device is difficult with gyros having electric drive for the rotor, because the stream of control air generated by the rotor depends in its action upon the amount of air furnished, and this again depends upon the altitude at which the craft is flying.

According to the present invention, a regulating device is provided for the control air, which serves the purpose of keeping the control effect constant at different altitudes. For this purpose the product of air jet pressure and useful air jet cross section is kept constant.

The use of the invention in connection with a gyro-vertical will be further described by means of the drawings. However, the invention if suitably modified, may also be used with azimuth gyros, which in known manner are made to follow the position of a magnetic system by means of a pneumatic control device.

Fig. 1 is a longitudinal section of the gyro-vertical.

Fig. 2 is a horizontal section of the device through the gimbal ring and the gyro rotor housing in the plane of the gimbal bearings, showing the gyro rotor.

The gyro rotor 10 is supported in bearings 12 and 13 for spinning about a vertical axis 11. These bearings are mounted in the housing 14 surrounding the rotor. This housing may oscillate around the horizontal axis on trunnions 15 and 16, journalled in the gimbal frame 17, which in turn is carried by fixed bearings 18 and 19.

Three-phase alternating current is used to drive the gyro rotor, the current being conducted to the stator winding 24' by means of springs 20—22 and 23—25, respectively, and through the gimbal bearings 18 and 15'. The stator 24' is carried by the member 25' mounted in the lower part 14' of the gyro rotor housing. The rotor 10, which surrounds the stator, has a short-circuited winding 26 in which eddy currents are induced by the rotating field of the winding 24', whereby the rotor is revolved.

On top of the rotor is mounted a blower-like member 27, with fins, which receives air through a number of openings 28 through which the air may be sucked into the housing. The air flows in the direction shown by the small arrows, around the gyro rotor into the lower part of the housing and from there through passages 29 and the holes in a disc 30, into a projection 31 attached to the gyro rotor housing.

In this housing projection, a piston 32 is movable in an axial direction. The air flows through the passages 33 from the piston into a ring-shaped space 34, whence it emerges into the atmosphere through the control ports 35. In known manner, four control ports have been provided, two of which (not visible in the drawing) are located in a plane perpendicular to the plane of the paper. The two opposing ports 35 are alternately covered by pendulum valves 38 and 39, which are fastened to a shaft 36. The other two pendulums (not visible in the drawing) are supported on an axis 37, perpendicular to the axis 36, so that the pendulums swing in a plane parallel to the paper. If the gyro rotor axis deviates from the true vertical, the four air jets will be influenced to different amounts so that a reaction torque is generated which precesses the gyro directly back into the vertical, as well known in art.

According to the present invention, the air jets are all controlled by the piston 32. A spring 40, which is fastened on one end to the fixed disc 30 and on the other end to a screw 41, which may be adjusted with respect to the piston, tries to move the piston upwardly, and thereby to open the ports 35 entirely. This motion is counteracted by the air pressure against the piston, the amount of which is dependent upon the outer atmosphere. The greater the density of the surrounding air, the greater is the amount of air moved and the higher, therefore, the pressure acting upon the piston. The spring 40 is so adjusted that the effective opening or cross section of the control ports is enlarged in proportion to the decrease in pressure. Obviously the reaction torque acting upon the gyro is equal to the product of pressure times cross section.

In order to obtain the least amount of friction in the motion of the piston, the same is provided with ring-shaped notches 42. In lieu thereof, a suitably formed lining provided with the notches may be fitted into the housing projection 31. In this case, the piston may be kept smooth without notches and may be produced with extremely thin walls, which is of great advantage with respect to weight. It is necessary that the weight

of the piston be negligible as compared with the weight of the gyro, so that small changes of position of the piston do not appreciably change the position of the center of gravity.

Instead of varying the effective cross section of the control ports in accordance with the change of pressure of the air provided by the blower, the arrangement may be such that with constant cross section, the jet pressure of the control air is kept constant. The simplest way of doing this is by leading the control air through a throttling valve, the cross section of which is controlled by means of a pressure regulator controlled by the jet pressure and the atmospheric pressure.

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

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