Jan. 8, 1952 H. ERIKSSON 2,581,846

GYROSTATIC STABILIZER

Filed Jan. 21, 1947

Fig.1

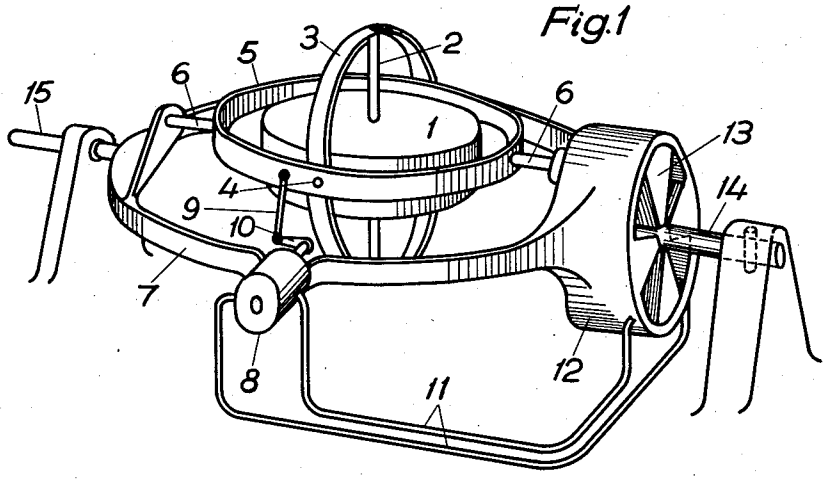


Fig.2

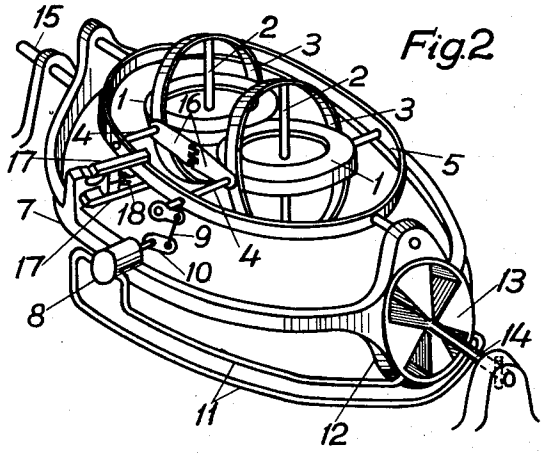
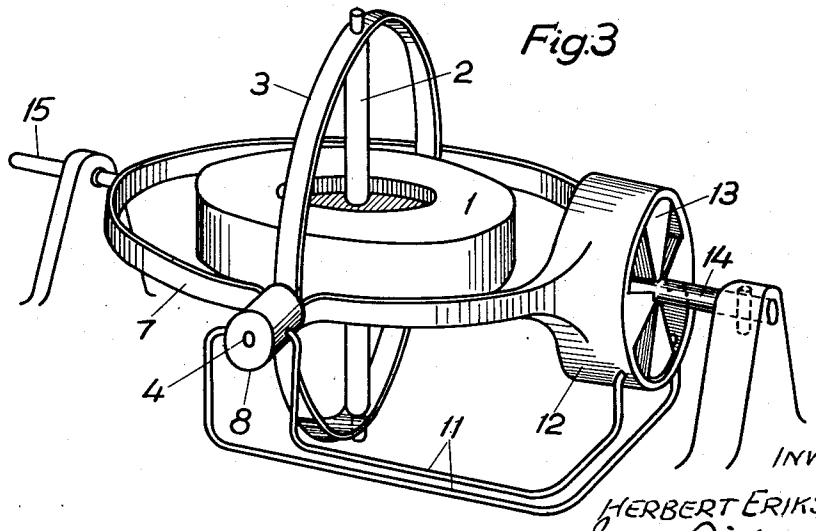


Fig.3



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GYROSTATIC STABILIZER

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3 Claims. (Cl. 74—5.22)

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The present invention refers to a gyrostatic stabilizer of the kind comprising one or more rapidly rotating bodies (gyroscopes) which are journalled in a frame or the like on which they exert a torque when its position is altered, and a servo-motor which is started at an angular displacement of the frame with respect to its surroundings and which adjusts a heavier structure which may support the object, for instance an instrument or a gun, the position of which shall be made independent of certain movements of its surroundings for instance of the rolling of a ship on which it is mounted. In the hitherto known constructions of such apparatus, it has been necessary to provide the servo-motor with a rather complicated compensating mechanism, which has interrupted its adjusting motion when the heavier structure had been brought into the desired position. According to the present invention, the compensation is effected in a much more simple way of mounting the operating device of the servo-motor in such way on the heavier structure that the adjusting movement of the said structure effects the compensation.

Three forms of the invention are diagrammatically illustrated in perspective views in Figs. 1–3 of the accompanying drawing.

In all the forms illustrated, the gyro-stabilizer is intended to compensate only the movements around a horizontal axis, for instance the longitudinal axis of a ship (rolling), while the movements around a horizontal axis at right angles thereto (pitching) are not compensated. A compensation of such movements may of course be effected in an entirely analogous way. Said last-mentioned axis is supposed to be substantially parallel to the plane of the drawing.

In Fig. 1 the gyroscope 1 rotates around a vertical axis 2 journalled in a vertical frame 3. The latter is pivoted by means of a pair of horizontal transverse journals 4 in a frame 5 which in its turn is pivoted by means of longitudinal journals 6.

The movements now described are utilized for influencing the controlling member of a servomotor which moves a heavier structure so as to prevent its partaking in the tilting in the transverse direction, for instance the rolling of a ship. According to the present invention, the controlling member of the servomotor is carried by the said heavier structure 7 in such manner that a compensation of the servomotor is automatically obtained as soon as the said heavier structure has occupied its desired position, for instance parallel to the frame 5, so that the controlling

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member is then restored to its inactive position. The controlling member, for instance a rotatable slide inside the cylinder 8, is moved from the frame 5 for instance by means of a link rod 9 and an arm 10 in such manner that the passage through the cylinder is opened as soon as the parallelism between the frame 5 and the structure 7 is disturbed but is closed again as soon as the said parallelism has been restored.

Conduits 11 lead from the control cylinder 8 to the servomotor which consists of a cylinder 12 with pistons 13 rotatable therein. One bottom of the cylinder is removed in the figure to show the pistons. The latter are mounted on a shaft 14 which is stationary with respect to the surrounding body, for instance a ship, while the cylinder is rotatable together with the structure 7 which is also rotatable together with a journal 15.

In the construction illustrated, the journals 6 of the frame 6 are directly mounted in the heavier structure 7. This is generally the most simple way of mounting, but the frame 5 may also be mounted in another structure while a compensation is still obtained as soon as the frame 5 and the structure 7 are in their normal mutual position.

Fig. 2 differs from Fig. 1 essentially in two respects. First, two vertical frames 3 are mounted in the frame 5, each frame 3 having a gyroscope 1 rotating about a vertical axis 2. The gyroscopes 1 are intended to rotate in opposite directions, and are therefore also inclined in opposite directions around their transverse axis when the frame 5 is tilted around its longitudinal axis. Their transverse journals 4 are connected by means of toothed arcs 16 so as to cooperate when inclined.

Further, in Fig. 2, the frame 5 is connected to the heavier frame or structure 7 by an elastic device consisting of bars 17 hinged to the structure 7 and held together by a spring 18, said bars embracing the frame 5. The structure 7 therefore is forced to partake in the movements of the frame 5 by a force limited by the initial tension of the spring 18, but a certain relative movement between the frames 5 and 7 occurs as soon as the force therebetween exceeds the initial tension of the spring 18. When such a movement or a tilting of the frames 3 occurs, the compensating servomotor is brought into action as in Fig. 1, a link rod 9 and an arm 10 acting to rotate a slide inside the cylinder 8 to admit fluid to the servo-motor 12, 13 through the conduits 11.

In Fig. 3, the transverse journals 4 of the vertical frame 3 are directly mounted in the heavier

frame or structure 7, and the light frame is therefore omitted. One of the said journals 4 then directly actuates the rotatable slide in the cylinder 8 for admitting fluid to the servomotor 12, 13. The movements of the admitting slide is therefore directly caused by the tilting movement of the gyroscope around its transverse axis caused by a tilting of the frame 7 around its longitudinal axis. The apparatus will in this manner be more sensitive to such a tilting movement than the apparatus according to Fig. 1, but it is not suitable for stabilizing structures of so large moments of inertia as the apparatus of Fig. 1. The properties of the form shown in Fig. 2 are in this respect intermediary between Figs. 1 and 3.

I claim as my invention:

1. A gyrostatic stabilizer comprising a gimbal frame tiltable about an axis, a gyroscope rotatingly mounted therein, a light frame carrying said gimbal frame and tiltable about an axis perpendicular to the axis of said gimbal frame, a heavy structure tiltable about an axis parallel to the axis of said light frame, a servo-motor carried by said heavy structure and serving to tilt said structure, and means for operating said servo-motor under the influence of the tilting motion of said gimbal frame.

2. A gyrostatic stabilizer comprising a gimbal frame tiltable about an axis, a gyroscope rotatingly mounted therein, a light frame carrying said gimbal frame and tiltable about an axis perpendicular to the axis of said gimbal frame, a heavy structure tiltable about an axis parallel to the axis of said light frame, a servo-motor carried by said heavy structure, means for operating said servo-motor under the influence of the tilting motion of said gimbal frame, a fixed support, said servo-motor comprising a cylinder secured to said heavy structure, and pistons angularly displaceable therein and secured to said fixed support.

3. A gyrostatic stabilizer comprising a gimbal frame tiltable about an axis, a gyroscope rotatingly mounted therein, a heavy structure tiltable about an axis perpendicular to that of said gimbal frame, a servo-motor carried by said heavy structure, and means comprising a closed hydraulic system for operating said servo-motor under the influence of the tilting motion of said gimbal frame.

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