July 13, 1943. R. M. HEINTZ 2,324,157

AIR JET GYRO DRIFT CONTROL

Filed Feb. 5, 1942

Fig. 1.

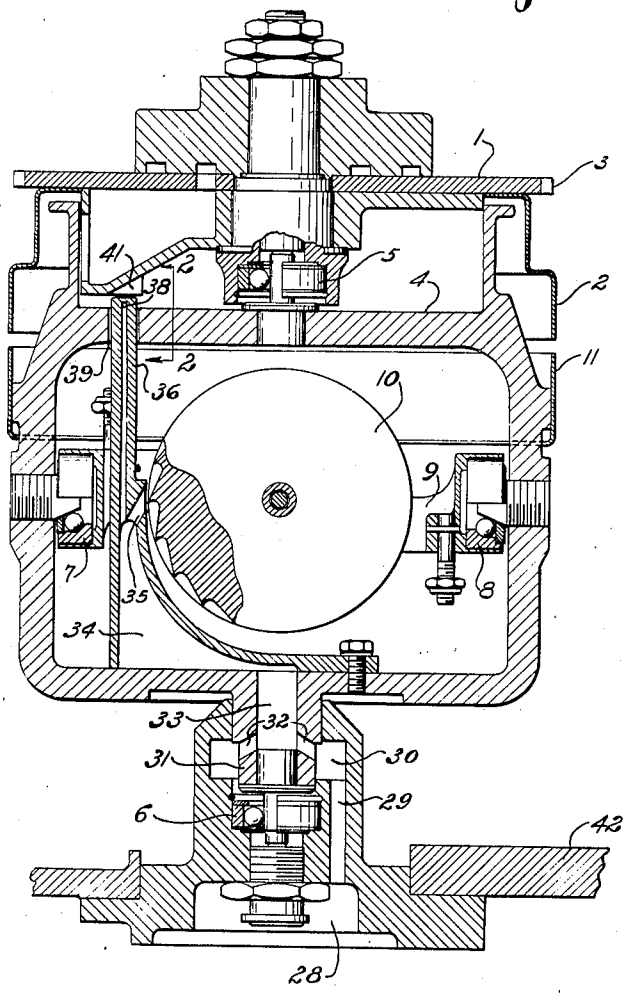
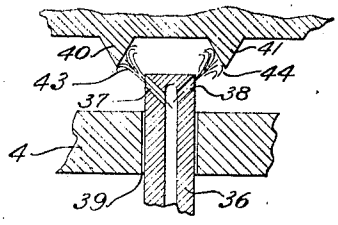


Fig. 2.



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AIR JET GYRO DRIFT CONTROL

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2 Claims. (Cl. 33—204)

This invention relates to improvements in directional gyroscopes and has particular reference to means for preventing the drift of the gyroscope away from a set course or azimuth position.

While a gyroscope will theoretically maintain any fixed orientation in space after being set in such position it is found in practice that there is invariably a tendency to slowly creep or drift away from the set position. The factors contributing to produce this undesirable effect may all be summed up as resulting from physical limitations and imperfections which cannot be eliminated regardless of the skill and precision employed in the manufacture of the instrument.

It is an object of the present invention to provide means for preventing this drift, to thereby maintain the gyroscope in its true orientation without the necessity for very frequent readjustment or resetting.

A specific object of the invention is to provide an air jet control to prevent drift of the directional element of a gyroscope on a vehicle while travelling on a predetermined course.

In connection with the following description reference will be made to the attached drawing forming a part of this specification, in which:

Figure 1 is a vertical sectional view through a directional gyroscope embodying the novel features of the present invention, and

Figure 2 is an enlarged fragmentary view taken on the line 2—2 of Fig. 1.

The gyroscope to which the invention is applied includes in general the usual components of a conventional directional gyroscope. A rotatable circular frame 1 carries a scale or card 2 oriented by means of the gear teeth 3. A gimbal ring 4 is supported in vertical bearings 5 and 6, and supports in bearings 7 and 8 a rotor frame 9 carrying an air driven rotor 10. The gimbal frame 4 carries the conventional compass card 11 arranged for rotation adjacent the relatively fixed scale or card 2 on the circular frame 1.

In the illustrated embodiment the air supply for driving the rotor is admitted through a chamber 28 and passage 29 to an annular chamber 30 surrounding the lower shaft or trunnion 31 of the gimbal frame 4. Lateral passages 32 and an axial passage 33 convey the air to a hollow member 34 provided with a nozzle 35 for delivering a jet or jets of air into the buckets of the rotor 10 according to conventional practice.

The present invention involves the use of an auxiliary nozzle carried by the gimbal frame 4 for directing air jets against relatively stationary vanes in such a manner as to resiliently maintain the auxiliary nozzle and gimbal frame in a fixed position with respect to said vanes, which position is established and maintained by the application of a relatively small force sufficient to resist the tendency to drift. For accomplishing this additional function the hollow member 34 is provided with an extension tube 36 terminating in a pair of divergent, upwardly directed nozzles 37 and 38. In the present construction the gimbal frame 4 is provided with an opening at 39 for the passage of the tubular extension 36. The rotatable frame 1 carries a pair of vanes 40 and 41 just above the nozzles 37 and 38 and appropriately spaced to intercept air jets 43 and 44 from said nozzles when the extension 36 is centered between the vanes. The vanes 40 and 41 are positioned on the rotatable frame 1 so that they will be equally spaced from the respective nozzles 37 and 38, as shown in Fig. 2, when the cards 2 and 11 are in zero-zero alignment.

When an air pressure differential has been established in the system, air jets will issue from the nozzles 35, 37 and 38. The jet from the nozzle 35 drives the rotor 10, and the jets 43 and 44 from the nozzles 37 and 38 impinge upon the vanes 40 and 41. When the circular frame 1 is set to "on course" position, or in zero-zero relation with the card 11, the reactions of the air jets 43 and 44 upon the extension 36 tend to resist movement of the nozzles 37 and 38 with respect to the vanes 40 and 41 and thereby exert light forces to prevent drift of the directional components of the gyroscope with respect to the frame 1 and the card 2. The design of the nozzles 37 and 38 and their arrangement with respect to the vanes 40 and 41 is such, however, that the forces exerted by these elements are relatively slight with respect to the gyroscopic forces produced in the instrument so that the producing of normal directional indications is not interfered with. The card 11 is therefore free for rotation by the directional forces of the gyroscope but at the same time it is lightly and resiliently constrained with sufficient force to prevent its drifting away from its set position when the vehicle and the frame 1 are on course.

Ordinarily, navigation by a gyroscopic compass or the like involves the maintaining of a set course for considerable periods of time. During these periods the drift control of the present invention will be effective to prevent drift of the gyroscope. The time required for change of course or other turns is relatively short and the

amount of drift occurring during such a turn would ordinarily be negligible.

It is of course understood that the air flow through the various passages and nozzles just described is produced by maintaining a pressure difference between the source of air supply communicating with the chamber 28 and the interior of a sealed casing or box 42 surrounding the instrument. For the purpose of the present invention it is immaterial whether this pressure difference be established by opening the chamber 28 to the atmosphere and exhausting the box 42, or by pumping air under pressure into the chamber 28 so as to pass out through the nozzles 35, 37 and 38.

It is to be understood that only a single preferred embodiment of the invention has been described herein for purposes of illustration but that the invention is capable of many modifications. Changes in the construction and arrangement of parts may be made which do not depart from the spirit and scope of the appended claims.

I claim:

1. In a directional gyroscope for aircraft, a frame member rotatable on a normally vertical axis, said frame member carrying an azimuth reference scale and being adapted to be turned to a selected fixed position with respect to said aircraft, a directional element comprising a vertical gimbal ring rotatable about said axis, an azimuth scale on said directional element adjacent said reference scale, a rotor bearing frame pivotally carried in said gimbal ring, upwardly directed air jet nozzle means carried by said gimbal ring, and vane means on said frame member adapted to cooperate with said nozzle means to resiliently maintain said gimbal ring in a predetermined orientation with respect to said frame member when air is flowing through said nozzle means, to prevent drifting of said directional element.

2. In a directional gyroscope for aircraft, a frame member rotatable on a normally vertical axis, said frame member carrying an azimuth reference scale and being adapted to be turned to a selected fixed position with respect to said aircraft, a directional element comprising a vertical gimbal ring rotatable about said axis, an azimuth scale on said directional element adjacent said reference scale, a rotor bearing frame pivotally carried in said gimbal ring, a unitary hollow member carried in said gimbal ring, a rotor driving nozzle on said hollow member, a pair of divergent nozzles on said hollow member adjacent said frame member, and a pair of vanes on said frame member arranged to intercept air jets from said divergent nozzles to resiliently maintain said gimbal ring in a predetermined orientation with respect to said frame member when air is flowing through said nozzles, to prevent drifting of said directional element.

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