

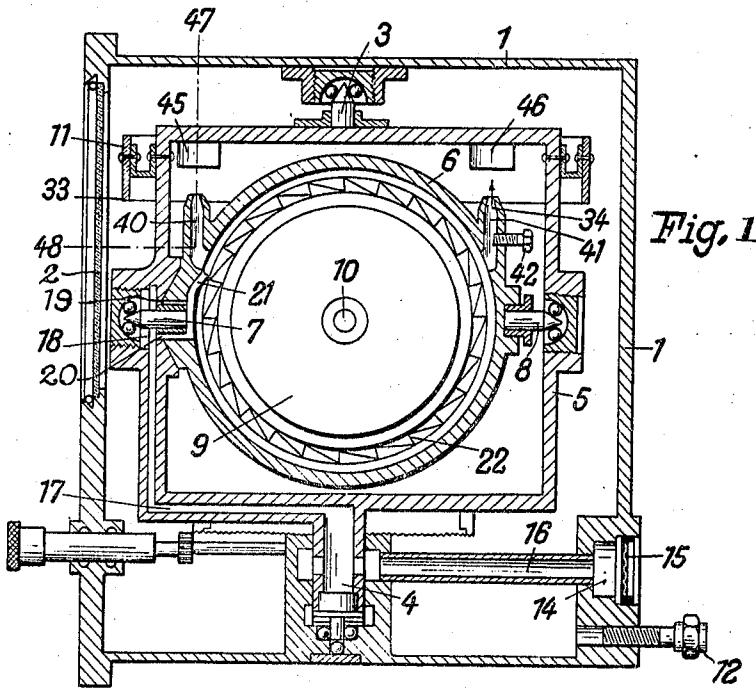
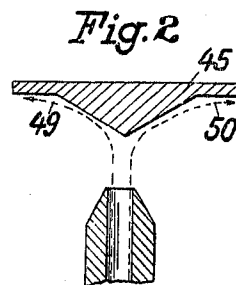
July 8, 1941.

G. Z. VON MANTEUFFEL

2,248,141

DIRECTIONAL GYROSCOPE

Filed Jan. 6, 1936



Inventor:

G. Z. von Manteuffel

UNITED STATES PATENT OFFICE

2,248,141

DIRECTIONAL GYROSCOPE

Gert Zoege von Manteuffel, Berlin-Dahlem, Germany, assignor to Askania-Werke A. G. vormals Centralwerkstatt Dessau und Carl Bamberg-Friedenau, a corporation of Germany

Application January 6, 1936, Serial No. 57,697
In Germany January 15, 1935

3 Claims. (Cl. 74-5)

This invention relates to directional gyroscopes. Such gyroscopes are given three degrees of freedom and are mounted with a substantially horizontal spinning axis and for oscillation about a second horizontal axis at right angles to the spinning axis and for turning about a fixed substantially vertical axis. It is a well known fact that the spinning axis of such gyroscopes has a tendency to become inclined to the horizontal in a relatively short time, thereby diminishing the directive force of the gyroscope.

The principal object of this invention is to provide an indicating device for the gyro rotor which is more reliable and accurate in its working than those heretofore in use.

A further object is to provide means to accurately adjust the force of the air streams through which the erecting torque is exerted.

The above and other objects and advantages of the invention will appear more fully hereinafter from a consideration of the detailed description which follows together with the accompanying drawing wherein embodiments of my invention are illustrated. It is to be expressly understood however, that the drawing is for the purpose of illustration only and is not designed as a definition of the limits of the present invention, reference for this purpose being had to the accompanying claims.

Fig. 1 is a sectional elevation through the instrument.

Fig. 2 is a detail of Fig. 1 in sectional elevation.

My gyroscope is shown as of the air-driven type. It will be apparent however that other means for driving the rotor may be employed such as electricity while the air pressure may be suitably generated by an air impeller or the spinning mass of the rotor in that instance. The gyroscope is shown as enclosed within an air-tight casing 1 having a front window 2. Within the casing is pivoted on vertical axis 3-4 a vertical ring 5 and within said vertical ring is mounted a rotor bearing casing 6 on horizontal trunnions 7-8. The gyro rotor proper 9 is journaled within said casing with its spinning axis 10 horizontal and at right angles to the axis 7-8. A compass card 11 may be mounted on the vertical ring 5 and may appear through the above mentioned window 2 of the casing 1. The window may have a rubber line upon it (not shown).

The gyroscope is shown as equipped with a vacuum drive but a pressure drive may be employed with equal benefit without departing from the spirit of the invention as will be apparent to any person skilled in the art.

For the vacuum drive air is continually withdrawn from the casing 1 by suitable means such as a vacuum pump or a Venturi tube (not shown) through pipe coupling 12. Air at atmospheric pressure is admitted through an aperture 14 in the casing 1 provided with a suitable dust filter 15. The incoming air passes through a pipe 16 to the bottom trunnion 4 shown as hollow, thence through a passage 17 of the vertical ring into space 18 and through channels 19, 20 to nozzle 21. The rotor 9 is shown as provided with buckets or blades 22 against which the air jet from the driving nozzle is directed.

The used air is discharged from the rotor casing 6 through oppositely directed air outlets. Preferably I employ short pipes 40, 41 terminating in nozzles 33, 34 with the purpose of eliminating turbulence of the air as caused by the spinning rotor by forcing the discharged air into an exactly predetermined direction. The discharged air is so directed that no torque about the horizontal axis 7-8 will be exerted in that the extended axes of the nozzles lie in a plane through the horizontal axis 7-8. The supply of air to at least one nozzle may be varied by a throttle valve 42, indicated by a screw extending into the hollow space of pipe. The valve however may take any other form.

The device would be operable with one nozzle. However the use of the differential action of two air outlets the action of which on the gyroscope is opposed to each other offers important advantages. As the torque to reset the gyroscope has to be very small, a nozzle with a correspondingly small bore would have to be used to apply that torque. A small bore implies the danger of clogging with dirt or humidity of the atmospheric air. Furthermore a special air outlet for the rest of the used air would have to be provided together with special means to prevent reaction forces exerted by the air discharged from said outlets. These disadvantages are eliminated by the provision of two air outlets the action of which on the gyroscope is opposed to each other. The bore of the nozzles can thus be made large enough to prevent clogging of the same which may result in a failure of the apparatus. By varying the supply of air to one nozzle the differential action can be easily varied and adjusted according to the requirements.

The vertical frame 5 is provided with deflecting means 45, 46, consisting of two guiding surfaces forming a sharp edge and thus arranged oppositely to nozzles 33, 34, respectively, that on normal position of the rotor casing the air stream

issuing from the nozzle is bisected into equal halves as indicated by arrows 49, 50 in Figure 2. Upon tilting of the casing 6 the nozzles are moved with respect to the deflecting edge of the part 45, 46, respectively, and the air flow will be increased at the one side of the vertical frame 5 whereby a reactive component is caused which tends to turn the frame thereby erecting the gyro rotor.

As has been pointed out beforehand, the air leaving the nozzles is so directed that no disturbing moment is exerted about the horizontal axis 7-8 which would cause wandering in azimuth. When the gyro casing 6 is tilted with respect to the vertical frame a reactive moment is created about the vertical axis only which already tends to precess the rotor back into its normal position at right angles to the vertical frame. However, no high degree of accuracy is obtained with this effect only, therefore, the deflecting surfaces 45, 46 are provided to cooperate with the nozzle in the manner already described.

What I claim is:

1. As a means for preventing tilt in a free directional gyroscope the combination with a vertical ring mounted for rotation in azimuth; a gyro casing mounted for oscillation about a horizontal axis in said ring; and a gyro rotor journaled in said casing; of means for creating a differential air pressure within and without said casing; at least one nozzle on said casing communicating with the interior thereof and normally lying in the same vertical plane as said horizontal axis,

and sharp-edged deflecting means on said vertical ring with its knife-edge horizontal so as to normally bisect said jet, whereby upon relative inclination of the casing and vertical ring about said horizontal axis an unbalanced torque is exerted on the vertical ring about its vertical axis to correct the tilt of said gyro casing.

2. As a means for preventing tilt in a free directional gyroscope the combination with a vertical ring mounted for rotation in azimuth; a gyro casing mounted for oscillation about a horizontal axis in said ring; and a gyro rotor journaled in said casing; of means for creating a differential air pressure within and without said casing; a pair of nozzles on said casing oppositely disposed at both sides of the rotor axis; air channels to supply said nozzles with air from the interior of said casing; a throttle valve in at least one of said channels for varying the differential action of the air jets issuing from said nozzles; and sharp-edged deflecting means on said vertical ring, which normally bisect the air jets emitted from said nozzles.

3. A directional gyroscope as claimed in claim 1, having a second similar nozzle of a different rate of discharge than the first nozzle and located in the casing to one side of the spin axis of the gyroscope opposite to the first mentioned nozzle, and a second similar sharp edged deflecting means on said vertical ring positioned to normally bisect said second jet.

GERT ZOEGE VON MANTEUFFEL.