April 12, 1932. J. M. CUNNINGHAM ET AL 1,853,510

INDICATOR

Filed Jan. 23, 1929

Fig. 1.

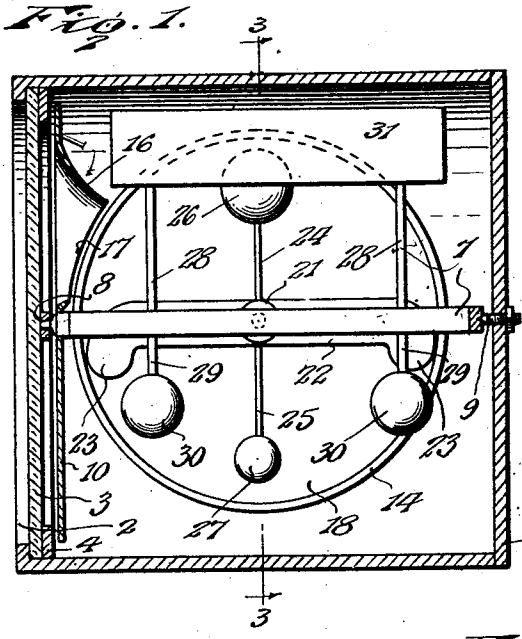



Fig. 2.

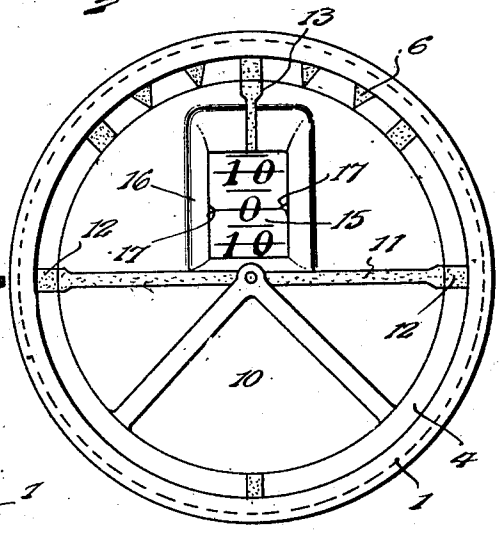



Fig. 3.

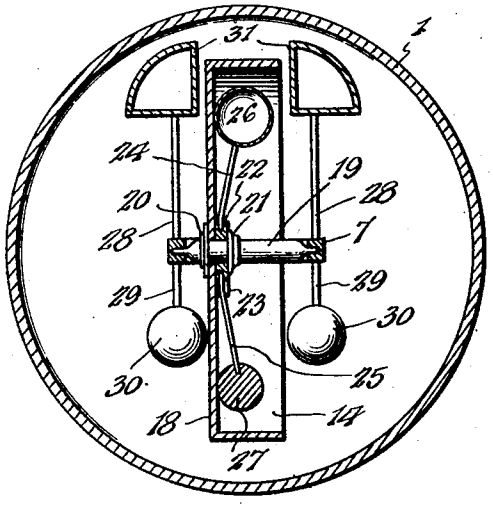



Fig. 4.

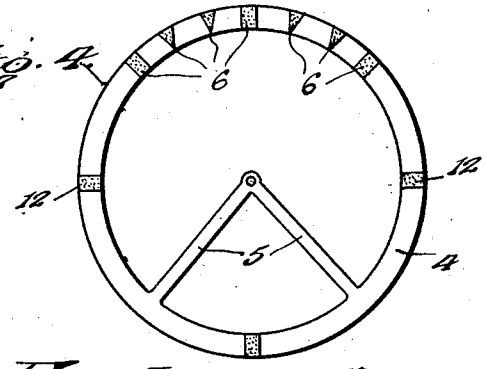
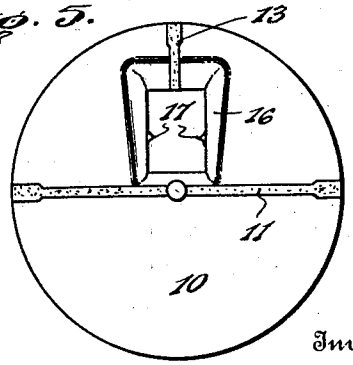



Fig. 5.

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# UNITED STATES PATENT OFFICE

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## INDICATOR

Application filed January 23, 1929. Serial No. 334,496.

This invention is a device for indicating the inclination or angle assumed by an aeroplane when banking, climbing or descending. The invention seeks to provide a simple, inexpensive and automatic device which may be secured in an aeroplane in front of the pilot so that it may be easily read by him and which will operate instantly to indicate departures from an even keel. The invention is illustrated in the accompanying drawings and will be hereinafter fully set forth.

In the drawings:

Figure 1 is a longitudinal section through a casing containing the operating mechanism of an indicator embodying the invention,

Fig. 2 is an end view of the same,

Fig. 3 is a transverse section on the line 3—3 of Fig. 1,

Fig. 4 is a detail view of the relatively stationary dial, and

Fig. 5 is a detail view of the relatively movable dial.

In carrying out the present invention, there is provided a case 1 which may conveniently be cylindrical in form, as will be understood upon reference to Fig. 3, and this casing is constructed so that it will be leak-proof and may contain a stabilizing liquid, such as alcohol, which will absorb violent movements of the operating devices and thereby prevent jumping or uneven action in the indicating elements. The casing 1 is secured in the areoplane by any convenient means and is so located that one end 2 will be in the view range of the pilot, said end being referred to as the front end, for convenience, and being equipped with a pane 3 of transparent material covering the open end and permitting a reading of the indexes. Immediately at the rear of the pane 3 and bearing against the same, the fixed dial is secured in the case 1, said dial consisting of an annulus 4 having radial arms 5 extending from low points thereof to its center to constitute a support for the front bearing of the carriage. In its upper portion, the annulus 4 carries graduations, indicated at 6, which may be of any approved form and which cooperate with a movable indicator to denote the degree of inclination assumed in banking. The carriage 7 is a rectangular frame provided at its front end with a bearing point 8 adapted to engage in the upper end of the support provided by the arms 5 of the relatively stationary dial, as shown most clearly in Fig. 1, while the rear end of the carriage is supported upon an adjustable needle point bearing 9 mounted in the end wall of the case, as shown in Fig. 1. The indicator 10 is secured rigidly to the front end of the carriage and is preferably in the form of a disk fitting closely to the annulus 4 or stationary dial and having its normally horizontal diameter defined by a line 11 contrasting with the face of the disk, so as to be easily read, and indicating the true horizon. Cooperating index markers 12 are provided on the fixed dial to aline with the line 11 and thereby aid the pilot in reading the indicator. The rotating disk also has a pointer 13 marked upon its face at its normally highest point to cooperate with the graduations 6 upon the stationary dial and thereby give the pilot a correct reading of the degree of bank. A drum 14 is rotatably mounted within the carriage 7 and has its circumferential surface calibrated in degrees in both directions from the zero point, as indicated at 15. The rotary indicator disk has a bezel 16 stamped in its upper portion to fit closely to the circumference of the drum and facilitate a reading of the same. The index marker 13 is continued across the top wall of the bezel, and at the center of each side wall is a tapered lug 17 which will facilitate the reading of the drum.

The drum consists of a disk 18 having a circumferential flange or rim bearing the calibrations 15. The drum is carried by a shaft 19, the ends of which are journaled in the sides of the carriage 7, as shown in Fig. 3, the shaft being provided with a fixed collar 20 bearing against the outer side of the disk 18 and a movable collar 21 which is mounted upon the shaft at the inner side of the disk. The movable collar may be adjusted upon and secured to the shaft 19 in any preferred manner and between the same and the disk 18 is a bar 22 which is clamped against the disk 18 by said collar, as will be understood upon reference to Fig. 3. The ends of the bar are

preferably enlarged, as indicated at 23, and extending from the upper and lower sides of the bar are arms 24 and 25, respectively, the arm 24 carrying a float 26 while the arm 25 carries a weight 27. Similar arms 28 and 29 extend upwardly and downwardly from the sides of the carriage 7, and these arms are preferably arranged adjacent the ends of the carriage, the arms 29 carrying weights 30 at their lower ends, while the arms 28 support at their upper ends floats 31, and it will be noted upon reference to Fig. 1 that the floats 31 are elongated so that one float is provided at each side of the drum and said float constitutes a connection between the adjacent arms 28.

Assuming that the plane is on an even keel, the parts will appear as shown in Fig. 2, the index 13 alining with the central graduation 6 and the horizon line 17 alining with the markers 12 while the drum has its zero point alined with the indicator lugs 17. Should the plane be steered into a rise or a drop, the drum will rotate about its pivotal support in the carriage 7 so that the zero point thereof will be moved away from the lugs 17 and a different calibration or degree mark of the drum will be brought into alinement with said lugs. The angle at which the plane is rising or falling will thus be automatically and quickly denoted and may be read by the pilot. Should the plane be entering a turn, the carriage 7 will rotate upon its bearings so that the index marker 13 will be shifted relative to the graduations 6 and the horizon line 11 will be shifted relative to the markers 12, the pilot being thereby notified if his bank is sufficient for a safe turn.

The floats or hollow members 26 and 31 tend to remain at the top of the device in all positions so that there is a constant tendency of the working elements to remain in a single vertical plane. The weights 27 and 30 cooperate with the floats to accomplish this end. The bar 22 with its enlarged ends 23 is rather heavy and acts with the weights 27 and 30 in tending to maintain the working elements in a vertical plane. As previously stated, the case is constructed with leak-proof joints and it may be provided with a filling opening through which a stabilizing liquid, such as alcohol, may be poured, the opening being permanently closed by sealing when the case has been filled. The presence of the stabilizing liquid will prevent the weights and floats imparting a jerky motion to the several working parts and, consequently, stability in the device and accuracy in the readings will be maintained.

Having thus described the invention, we claim:

1. An indicator of the type described comprising a casing having an open end, a frame pivotally mounted at the ends of the casing, a drum pivotally mounted at its sides centrally within the frame and having a calibrated circumference, the drum and frame oscillating in planes at a right angle to each other and the calibrated circumference of the drum being viewable through the open end of the casing, a fixed dial in the open end of the casing receiving one pivot of the frame, and a rotatable indicator disk secured to the frame immediately at the rear of the dial and cooperating with the dial and having a bezel extending close to the circumference of the drum to permit reading of the drum.

2. An indicator of the type described comprising a case having an open end, a frame pivotally mounted at the ends of the case, a drum pivotally mounted at its sides centrally within the frame and having a calibrated circumference viewable through the open end of the case, a fixed dial in the open end of the case, and a rotatable indicator disk secured to the carriage immediately at the rear of the dial and cooperating with the fixed dial and having a bezel extending close to the circumference of the drum to permit reading of the drum, the bezel being provided with indicator elements cooperating with the calibrations on the drum and there being an index at the top of the bezel extending to and cooperating with the graduations on the face of the rotary dial.

3. An indicator of the type described comprising a casing having an open end, a stationary dial comprising an annulus secured in the open end of the casing and having graduations upon its upper portion and radial arms extending from its lower portion, a carriage journaled in the upper ends of said radial arms and in the casing at a point remote from the open end of the casing, a calibrated drum pivotally mounted in the carriage, and a rotatable indicator disk secured upon the carriage to cooperate with the fixed dial and having a sight opening through which the drum may be viewed, the disk having a horizon line marker upon its normally horizontal diameter and the stationary dial having markers to cooperate with said line upon its marginal portion.

In testimony whereof we affix our signatures.

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