

996,106.

J. MEANS.
AERONAUTICAL CLINOMETER.
APPLICATION FILED MAR. 22, 1909.

Patented June 27, 1911.

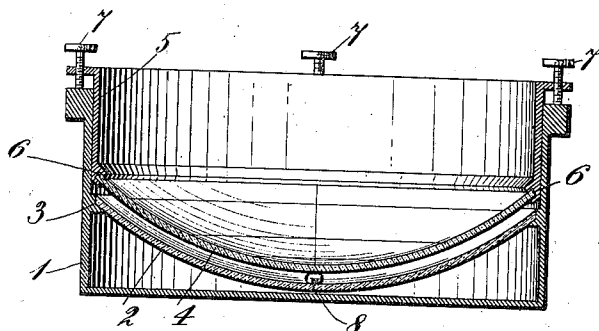


FIG. 1.

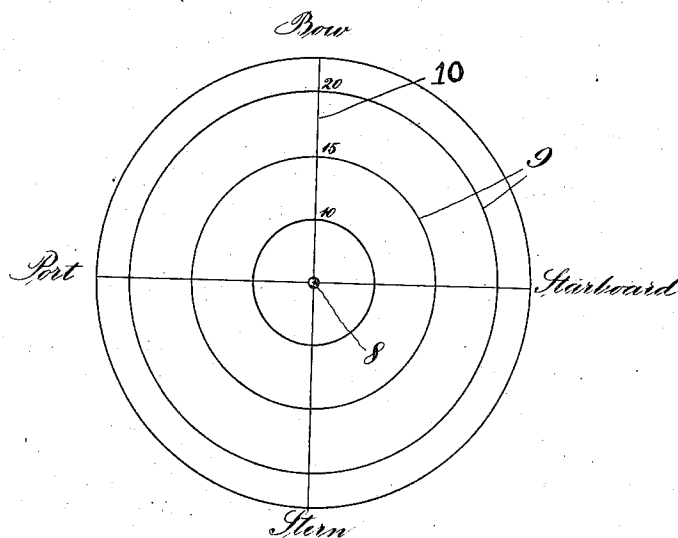


FIG. 2.

WITNESSES:
George Woodworth,
E. B. Conlinson.

INVENTOR:
James Means

UNITED STATES PATENT OFFICE.

JAMES MEANS, OF BOSTON, MASSACHUSETTS.

AERONAUTICAL CLINOMETER.

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Specification of Letters Patent. Patented June 27, 1911.

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To all whom it may concern:

Be it known that I, JAMES MEANS, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Aeronautical Clinometers, of which the following is a specification.

My invention relates to aeronautical clinometers or apparatus for indicating the direction and degree of inclination of an aerial machine from the horizontal.

In aerial machines, especially those of the heavier-than-air type, control-apparatus is sometimes employed for maintaining the lateral and longitudinal stability of the machine; but when traveling over country that is irregular or when for any reason the earth cannot be observed, the operator is unable to make proper use of such control-apparatus.

The object of my invention therefore is to provide means whereby the direction and degree of the inclination of the machine from the horizontal may be indicated to the operator and the manipulation of the controlling apparatus rendered independent of outside observation. With this object in view I may employ a globule of liquid, preferably mercury, confined between two curved surfaces which preferably are spherical surfaces, one of which may carry a suitable scale, and I may provide means for restraining erratic movement of said globule.

In the drawings which accompany and form a part of this specification Figure 1 is a central section of my improved clinometer, and Fig. 2 is a diagram of one form of scale that may be employed.

In the particular embodiment of my invention selected for illustration, 1 is a cylindrical box of brass or other suitable material provided with an internal off-set 3 for rigidly supporting the curved plate 2 which may be of glass and which preferably is spherical.

5 is a cylinder closely fitting the upper portion of the box 1 and provided with a groove 6 for carrying the curved glass plate 4 which preferably is concentric with the plate 2. The set screws 7 which pass through a flange on the cylinder 5 and cooperate with the box 1 may be employed for regulating the separation between the plates 2 and 4.

8 is a globule of liquid, preferably mercury, confined in the space between the

plates, and as shown, the upper plate is so adjusted that said globule is slightly compressed so that its movement in said space is suitably restrained. The lower plate may be and preferably is blackened and one of the plates may be provided with a scale consisting, for example, of circles 9 and straight lines 10 as shown in Fig. 2, whereby the direction and degree of inclination from the horizontal of the apparatus or an aerial machine carrying the same may be read.

The operation is as follows: The clinometer is secured to the aerial machine in a position where it may be readily seen by the operator and is oriented relatively to the machine so that the two straight lines on the dial extend respectively in the direction of the longitudinal and transverse axes of the machine. The upper plate of the clinometer is then adjusted to adapt the same to the particular type of machine on which the device is employed and the globule 8 is thereby slightly compressed to restrain the movement thereof. During the flight of the machine, when the bow moves downward, the globule will move toward the bow. When the stern moves downward, the globule will move toward the stern. When the machine has a list to port or starboard, the globule will move to the left or right respectively, and when the movement is a compromise between pitching and rolling, the globule will take a corresponding compromising position. In any case the degree of inclination from the horizontal may be read by the position of the globule with respect to the circles on the dial which may be graduated to read degrees, and the direction of such inclination may be read by the position of the globule with respect to the straight lines on the dial. After the first adjustment of the upper plate 4 above referred to it may be necessary to make other adjustments either by increasing or decreasing the pressure on the globule in order to prevent erratic movement of the same and secure the most advantageous degree of sensitiveness. I may also effect changes in the degree of sensitiveness by applying various kinds of coatings, such for example as vaseline, to one or both of the proximate surfaces of the plates 2 and 4, the said coatings serving to increase or decrease the retardation of the movement of the globule.

The expression "horizontal position" with respect to a flying machine is employed to

mean, in the case of a heavier-than-air machine that the lateral and longitudinal axes of the machine are parallel with the plane of the horizon and, in the case of a lighter-
5 than-air machine, that the longitudinal axis of the car is parallel with the horizon and the car has no list to port or starboard.

It will be obvious to those skilled in the art that various modifications may be made
10 in the apparatus hereinbefore described without departing from the spirit of my invention.

I claim:

An aeronautical clinometer having in com-

bination two separated curved plates, a
15 globule of mercury inclosed between the same and means for varying the separation of said plates whereby said globule may be slightly compressed and its movement re-
strained.

In testimony whereof, I have hereunto
20 subscribed my name this 20th day of Mch. 1909.

JAMES MEANS.

Witnesses:

E. B. TOMLINSON,
GEO. K. WOODWORTH.