G. A. SPRATT.

BUOYANCY INDICATOR.

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1,050,573. Patented Jan. 14, 1913.

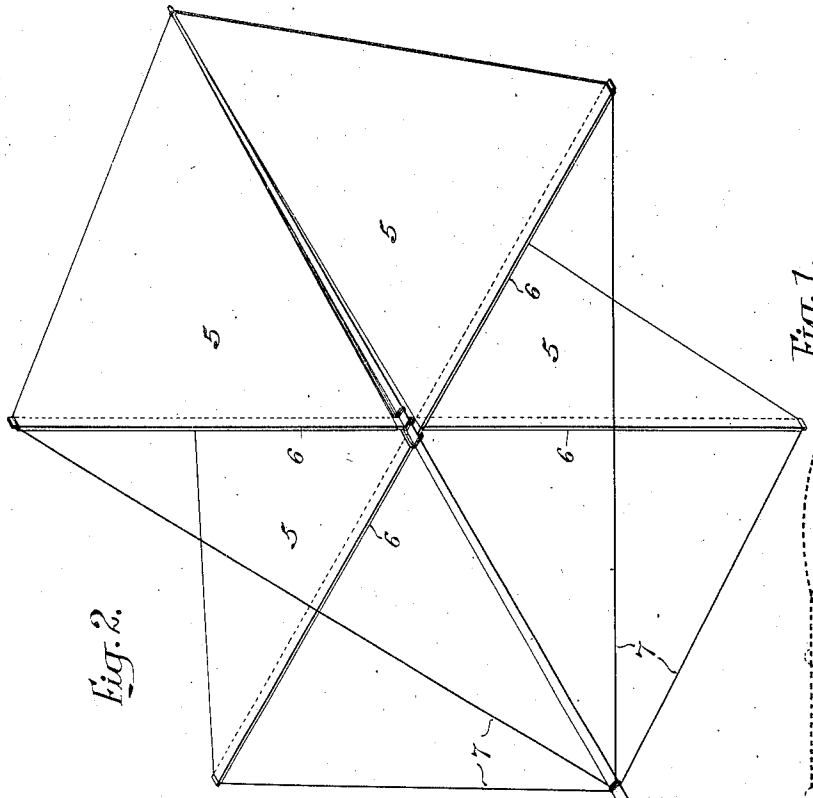


Fig. 2.

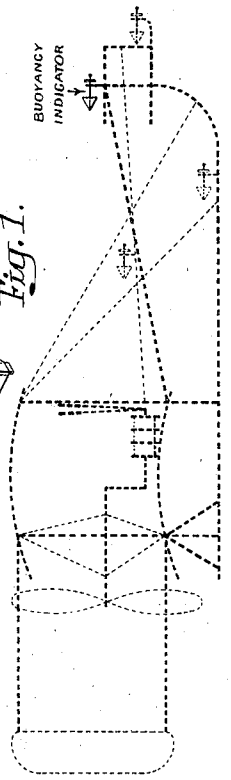


Fig. 1.

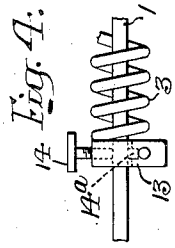


Fig. 4.

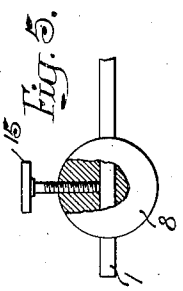


Fig. 5.

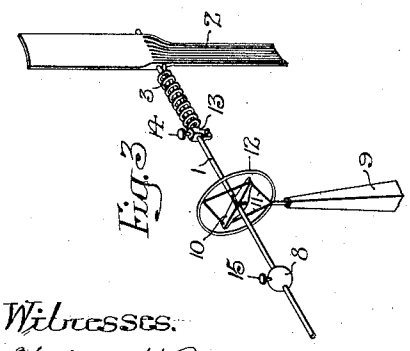
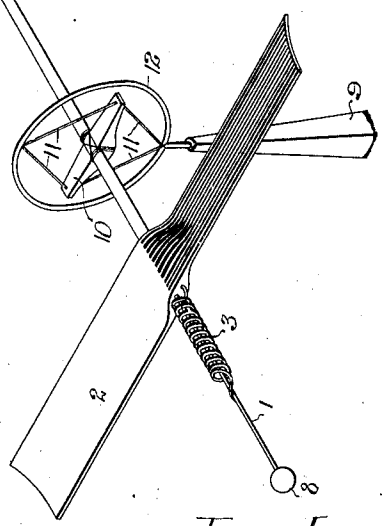


Fig. 3



Witnesses.

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UNITED STATES PATENT OFFICE.

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BUOYANCY-INDICATOR.

1,050,573. Specification of Letters Patent. Patented Jan. 14, 1913.

Application filed February 23, 1910. Serial No. 545,369.

To all whom it may concern:

Be it known that I, GEORGE A. SPRATT, a citizen of the United States, and a resident of Coatesville, Chester county, Pennsylvania, have invented a Buoyancy-Indicator, of which the following is a specification.

My invention relates to aeroplanes and accessories therefor; and the object of my invention is to provide means for indicating to the operator the approximate force of the wind and consequently its approximate extent of buoyancy or lifting power; the term "wind" as here used referring to the relative speed between air and aeroplane. A knowledge of the amount of the available supporting power of the wind, and the actual amount of supporting power being used as support, is highly desirable at all times, and especially so in making a landing, for contact with the ground should be made when the supporting pressure just equals the weight of the aeroplane. The aeroplane should not be driven against the ground by an excessive speed nor be allowed to fall against the ground as a result of too slow a speed. It is essential for safe aviation to be able to recognize and acquire that speed at which the pressures will just support the weight.

My invention consists of a speed indicator so correlated to the weight of the aeroplane that it shows at a glance, the supporting power of the wind in terms of the weight of the aeroplane. It presents a minimum of weight and of resistance to advance through the air. It comprises a tell-tale in the form of a bladed fan or propeller of light construction to be mounted at some convenient point upon the aeroplane in advance of the operator.

Other features of my invention will be pointed out hereinafter, reference being had to the accompanying drawing, in which:

Figure 1, is a perspective view illustrating a conventional form of a biplane to which my invention may be applied; Fig. 2, is an enlarged perspective view of the buoyancy indicator structure illustrated in Fig. 1; Fig. 3, is a view illustrating a modification embodying my invention, and Figs. 4 and 5, are views of details of my invention.

The buoyancy indicator may comprise a supported shaft or spindle 1 so mounted as to be free to move horizontally and vertically from a substantially definite point. On the spindle 1, blades 2 are journaled; by preference a pair of blades being sufficient for the purpose, and these blades are free to rotate on the spindle; being arranged to turn against the tension of a spring, preferably coiled, indicated at 3, one end of which is connected to the spindle and the other end to said blades. At the opposite end of the spindle, tail vanes 5 may be employed, triangular in shape, extending to a point at the rear end of the spindle, and connected at their inner ends to cross-bars 6 carried by the spindle; the ends of which may be connected to the spindle by cords 7. At the forward end of the spindle, a weight 8 may be placed. If desired, the blades may be of distinctive colors.

The spindle 1 is supported by a swivel or universal joint carried by a suitable standard 9. As shown in the drawings, this consists of a yoke member 10, suspended by cords 11 within a ring 12 mounted on the standard 9 which may be secured at a convenient point with respect to the aeroplane structure directly within the vision of the operator. I have shown in full lines on Fig. 1, the preferred position of the indicator and in dotted lines other positions in which such indicator may be placed. The form of swivel or universal joint shown may be employed, but I do not wish to be limited to the precise construction, since many other forms of swivel or universal joint connections, all within the scope of my invention may be employed.

The tension of the spring is preferably proportioned to the weight of the aeroplane, and the object of such proportioning is to so correlate the action of the blades that one complete revolution of the same will indicate wind or air currents of sufficient force or velocity to provide the necessary buoyancy to sustain the aeroplane. Proportionate movements of the blades, therefore, will indicate the variations in such range, and whether or not the wind or air currents are above or below the degree of force or velocity necessary to provide sufficient buoyancy to sustain the aeroplane.

In the form of structure shown in Fig. 3, the tail vanes are omitted and the blades are mounted on a spindle supported in substantially the same manner as that indicated in Figs. 1 and 2, with the exception that the blades are placed at the rear and are sufficient to counterbalance the weight disposed on the other side of the support and perform

substantially the same functions as the tail vanes in addition to those described with respect to the structure shown in Figs. 1 and 2. The mounting for the spindle shown in Fig. 3 may be substantially the same as that shown in Fig. 2, or any other mounting that will provide a yielding support for the spindle may be employed.

I may also provide means for shortening the length of spring, since any addition to the weight of an aeroplane demands a higher speed for support. This can be done by fastening the spring to the spindle by means of a running clamp 13 having a set screw 14, instead of fastening the spring permanently to the spindle as shown in Fig. 1. Then by revolving the clamp once around the spindle thereby taking up one coil of spring and moving the clamp along the spindle, the spring would tighten (*i. e.*, increase) the tensional resistance to represent the speed increase demanded by a definite load added. For instance, one coil or one-half coil or any proportionate and necessary amount as the case might be, would be taken up for each 100 lbs. added to the load. The clamp is noted as a "running" clamp to convey the meaning that the spring may be shortened by adjusting the clamp alone, and the angle of the blades, when at rest, is unaltered by such shortening of the spring.

The spring may be held to the clamp by a block 14ª, interposed between the spindle 1 and said spring or by any other convenient means affording a rigid connection between these parts when the clamp is adjusted with respect to the spindle.

It may also be desirable to provide means for adjusting the weight 8. This may be accomplished by providing a set screw 15, to engage the spindle when the weight is finally positioned at the desired point. Other means may be provided to accomplish the same purpose, for instance a wedge entering the hole in the weight along with the spindle might be just as serviceable and in some instances as satisfactory.

The main purpose of my invention is to assist the beginner. My improved indicator is a safety device, by which the supporting pressures or amount of buoyancy at the aviator's command is visually indicated in proportions of the total weight of the load carried. It is carried upon the aeroplane in advance of the aviator and in the most direct range or line of his vision. The blades may be colored black and white, or other easily distinguished, distinctive colors, red and green, etc.

At no speed, *i. e.*, in a calm, the white blade, for instance, should be down and lie in visual line, parallel with the supporting post. The spring should be of such strength that when a speed just sufficient to support the total load has been attained the pressures on the blades should cause one complete revolution. A greater speed will continue to tighten this spring and a lesser speed will allow the spring to turn the blades toward their original position.

My buoyancy indicator is also a guide to the wind direction. Its use may be described as follows: In starting, the aeroplane should head to the oncoming wind as indicated by this instrument. If the wind presses the blades one-fourth of a revolution, one-fourth the total weight is supported by the air and taken off the ground; when the aeroplane starts (either in calm or against a head wind) and the blades have reached one-half a revolution, one-half the weight is taken by the air, and when a full revolution is reached, the aeroplane is then supported, and as soon as the blades have passed a full revolution, the aeroplane can rise. Any degree of revolution of the blades shows to what degree inertia is accumulating, which may be used at the will of the aviator either in excessive speeding or in gaining elevation. If the blades indicate less than a revolution while in flight, the supporting pressures are insufficient for support and the machine slumps.

In preparing to alight, if the blades show less than a revolution; say three-fourths of a revolution at the time of alighting, the shock will be that of one-fourth of the total weight descending. If they show say one and one-quarter revolutions at the instant of striking the earth, there is a momentum of one-quarter of the weight of the machine that must be overcome by the contact.

I claim:

1. In a buoyancy indicator for aeroplanes, the combination of a support or standard, a ring carried at the upper end of the same, a yoke suspended within said ring and capable of universal movement therein, a spindle carried by said yoke, a blade mounted for rotation upon said spindle, and means for regulating the movement of said blade.

2. In a buoyancy indicator for aeroplanes, the combination of a support or standard, a ring carried by the upper end of the same, a yoke suspended within said ring for universal movement, a spindle carried by said yoke, a freely movable bladed member journaled thereon, tension means for said bladed member comprising a spring having one end connected to the spindle and the opposite end connected to the bladed member, and a weight carried by said spindle.

3. In a buoyancy indicator for aeroplanes, the combination of a support or standard, a ring carried by the same, a yoke suspended within said ring for universal movement, a spindle carried by said yoke, a bladed member journaled thereon and freely movable, means for keeping the structure headed into

the wind comprising a plurality of vanes carried by the spindle at or adjacent one end of the same, and a spring having one end connected to the spindle and the opposite end connected to the bladed member for imparting tension to the latter and regulating movement of the same.

4. In a buoyancy indicator for aeroplanes, the combination of a support or standard, a ring carried by the same, a yoke member, flexible cords carried by said ring for supporting said yoke member within the ring and permitting universal movement of the same, a spindle carried by said yoke, a rotatably mounted blade on said spindle, and adjustable means between said blade and spindle for regulating the movement of said blade.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

GEORGE A. SPRATT.

Witnesses:
THOS. SPACKMAN,
LEWIS H. BAIR.