Oct. 7, 1930. L. CONSTANTIN 1,777,282

WIND VANE DEVICE FOR VARIOUS APPLICATIONS

Filed Nov. 2, 1921

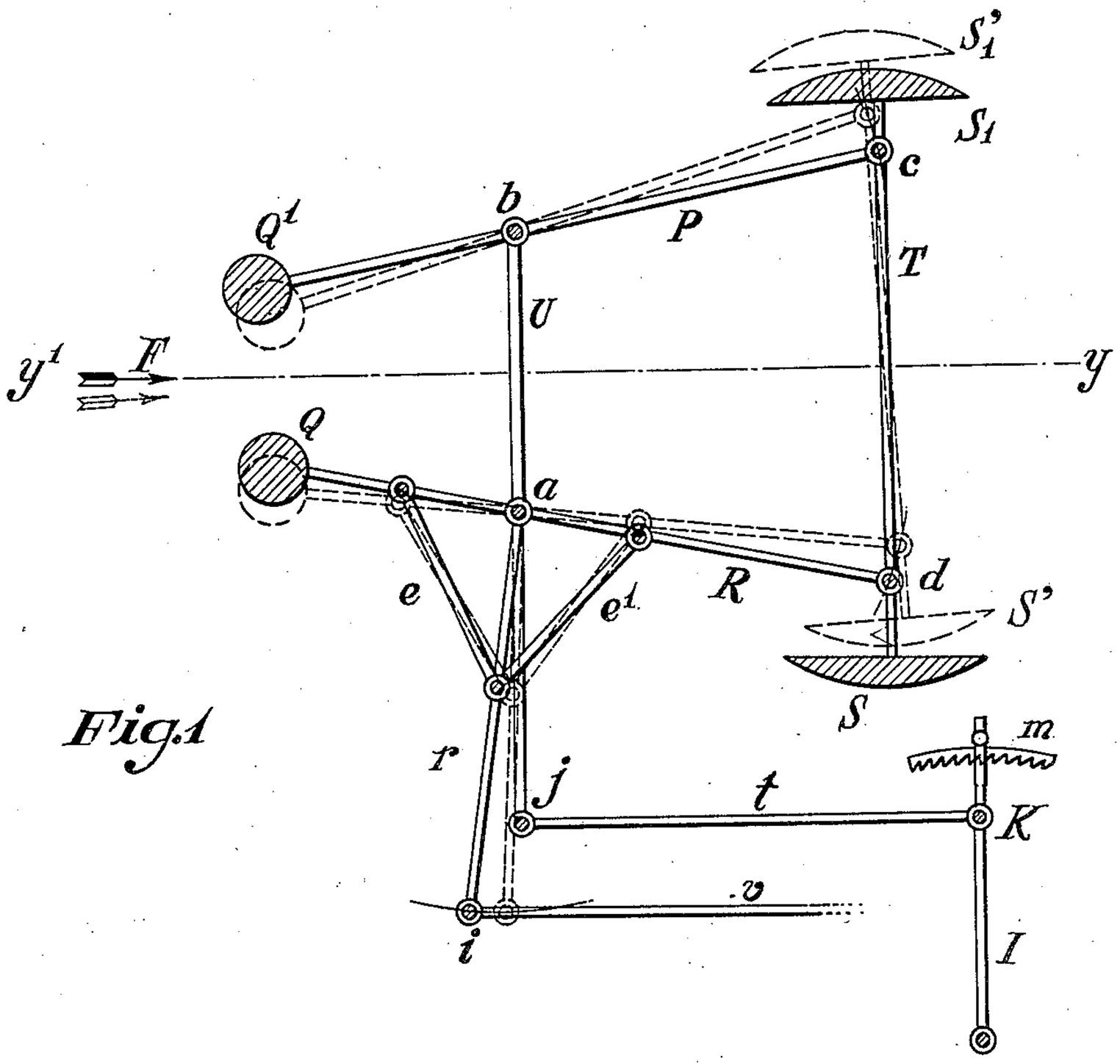

Fig. 1

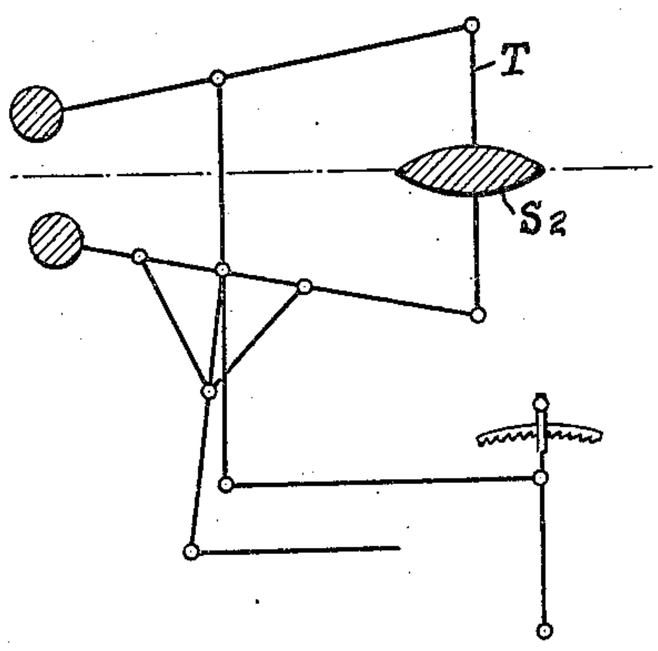

Fig. 2

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Patented Oct. 7, 1930 1,777,282

UNITED STATES PATENT OFFICE

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WIND-VANE DEVICE FOR VARIOUS APPLICATIONS

Application filed November 2, 1921, Serial No. 512,367, and in France November 10, 1920.

My invention relates to a wind vane device which is particularly designed to ensure automatic longitudinal or lateral stabilization of air-craft or to act as an indicator of the angle of incidence, of sliding or of turning.

A first object of the invention resides in a wind vane device consisting of two vanes whose section has an outer contour curved in a way that the coefficient of lift increases very rapidly with the angle of incidence of the relative wind, which vanes are symmetrically secured upon a rod common thereto and forming part of a pivoted arrangement having the shape of a trapezoid, the pivot points of the trapezoid being placed at the four apices thereof. The common rod interconnecting the vanes constitutes one of the bases of the trapezoid, while the other base can be maintained in fixed position but adjustable, by means of a locking mechanism carried by the air-craft. The whole of the wind vane device is balanced by counterweights situated at the extremities of the links forming the inclined sides of the trapezoid, in a way that the wind vane device is in a state of equilibrium indiscriminately and can become oriented about the pivots formed by the two apices of the base of the trapezoid maintained in adjustable position, the whole of the wind vane device turning about the said pivots in order to take the position in the direction of the relative wind.

Another object of the invention resides in the connection means allowing to transmit to the rudders or other members for stabilizing or any other movable part provided on the air-craft, the angular displacement which is imparted to the whole of the wind device about the pivots.

Another object of the invention consists in providing regulating means for modifying the position of the base of the trapezoid carrying the two pivots, with respect to the initial direction of the relative wind, said means determining an angular displacement of the base about one of the apices or pivots and ensuring the locking or maintaining of the said base in its new position.

In the accompanying drawing, Fig. 1 represents a diagram partly in section of one embodiment of my improved wind vane device; and

Fig. 2 represents a diagrammatic elevation partially in section, of another embodiment of my improved wind vane device in which but a single vane is used.

The wind vane device comprises two vanes S S_1 shown in section on the drawing, and of which the section has an outside contour curved in a way that the coefficient of lift increases very rapidly with the incidence, which vanes are symmetrically disposed with respect to a plane having for an outline the line of dot and dash character $y\ y^1$.

The said two vanes S S_1 are rigidly connected to each other by a rod T. At two points c d on the rod are pivoted inclined links P R. Said links P R are likewise pivoted at a b to another rod U which is carried by the air-craft. It will be obvious from the drawing, that when the wind vane device is in the position illustrated in full lines, the geometric figure $a\ b\ c\ d$ is a regular trapezoid whose symmetrical axis is the line $y\ y^1$. The said trapezoid can become deformed as indicated in dot and dash lines.

On prolongations of the links P R are respectively fixed the counter-weights Q and Q′. These counter-weights ensure the balancing of the whole of the wind vane device (vanes S S_1, rod T, links P R) in a way that when the rod U is maintained in a stationary position, the wind vane device pivots freely about the pivots a b, and is therefore in a state of equilibrium indiscriminately. Under these conditions, if it be assumed that the relative wind has the direction indicated by the arrow F on the drawing, the wind vane device will take the position indicated by full lines. If the relative wind changes direction, and takes that indicated by the arrow in dot and dash lines, the vanes S S_1 become displaced and occupy the direction of the new relative wind, that is to say, take the position S′ S'_1, the whole of the wind vane device pivoting about the points a b.

The adjustment of the position of the rod U can be obtained by angular displacement of the said rod about the point a which remains stationary. In this end, the rod U is

prolonged and articulated at *j* to a link *t* pivoted at *k* to a lever *l* for manipulating purposes within reaching distance of the hand of the aviator.

Said lever *l* can be maintained in any angular position, in any suitable manner, such as by a sector having notches *m*, for example, by means of which the extremity of the lever may be released in a manner well known in the art.

Obviously the pivot *a* being maintained stationary on the aeroplane, any displacement of the lever *l* will determine an angular displacement of the rod U about the pivot *a* and consequently a displacement of the whole of the wind vane device about the said pivot.

Finally, on the rod R are fixed the struts *e* e^1 connected to a link *r* on which is pivoted the extremity *i* of a rod *v*, which rod may be used for acting on any movable member of the aeroplane. By way of example, the said rod may be connected either to an indicating apparatus, or to a horizontal rudder when the wind vane device is utilized for longitudinal stabilization of the aeroplane, assuming that the drawing represents a view in elevation.

When the wind vane device is utilized as an indicator of the angle of incidence for aeroplanes, the plane of symmetry *y* y^1 of the wind vane device is placed in a position parallel to the span of the wings.

The relative wind then makes with the line *y* y^1 an angle equal to the angle of incidence and in a direction indicated by the arrow in dot and dash lines on the figure. The vanes S S_1 become displaced in a way to take the position indicated by dot and dash lines S′ S'_1 for which position the wind vane device is again in equilibrium in the direction of relative wind indicated by the arrow in dot and dash lines.

The angular displacement of the wind vane device about the points *a b* for taking the position indicated in dot and dash lines from the position indicated in full lines is transmitted by the struts *e* e^1 and the link *r* to the rod *v*. The measurement of the displacement rectilinearly of said rod allows determining the value of the angle of incidence.

When the wind vane device serves as an automatic longitudinal stabilizer for aeroplanes, the rod *v* is connected to the elevation rudder. For using the wind vane device as a longitudinal automatic stabilizer, the rod U is displaced angularly about the fixed point *a* thereof by acting on the lever *l* until the outline *y′ y* of the plane of symmetry of the wind vane device makes the desired angle of incidence with the span of the aeroplane wing, such as 3°, for example.

The angular displacement of the said vanes and consequently of the wind vane device, about the points *a b*, is transmitted by the rods *e e′* and the link *r* to the rod *v* and from there to the elevation rudder of the aircraft. Obviously the said elevation rudder will bring the aeroplane automatically back to its normal position for which the angle of incidence is the normal angle of 3°, which assures automatic longitudinal stabilization.

Said wind vane device can likewise serve as a turning indicator and sliding indicator for aeroplanes and as an automatic lateral stabilizer. In such a case it is merely necessary to consider the figure as a plan view.

Said wind vane device may also be used in other fluids than air, such as in water in connection with submarines for example.

The distance between the two vanes may be made anything and in particular zero if desired. In such a case the two vanes are replaced by a single vane, as diagrammatically illustrated in Fig. 2, in which all of the elements shown in Fig. 1 may be incorporated, except that a single vane S_2 is mounted symmetrically on rigid rod T.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. A wind vane device particularly suitable for air craft, comprising two vanes symmetrically disposed with respect to a plane, rigid means interconnecting the said vanes, two pivots symmetrically disposed with respect to the said plane, connecting means articulated at one end to said pivots and at the other end to said rigid means interconnecting said vanes, and counter-weights on said connecting means, whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots.

2. A wind vane device particularly suitable for air craft, comprising two vanes symmetrically disposed with respect to a plane, rigid means interconnecting the said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, connecting means articulated at one end to said pivots and at the other end to said rigid means interconnecting said vanes, counter-weights on said connecting means, whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots, and means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof.

3. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, rigid means interconnecting the said vanes, two pivots symmetrically disposed with respect to the said plane, connecting means articulated at one end to said piv-

ots and at the other end to said rigid means interconnecting said vanes, and counter-weights on said connecting means, whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots.

4. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, rigid means interconnecting the said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, connecting means articulated at one end to said pivots and at the other end to said rigid means interconnecting said vanes, counter-weights on said connecting means whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots, and means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof.

5. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, a rigid rod interconnecting said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, links symmetrically inclined with respect to the plane of symmetry pivoted at one end to the rods interconnecting said vanes and at the other end to the said pivots, and counter-weights fixed to said links in such a way that the assembly formed by said vanes, said rod interconnecting said vanes and said inclined links is balanced indiscriminately about said pivots.

6. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, a rigid rod interconnecting said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, links symmetrically inclined with respect to the plane of symmetry pivoted at one end to the rods interconnecting said vanes and at the other end to the said pivots, adapted to form a deformable articulated trapezoid, counter-weights fixed to said links in such a way that the assembly formed by said vanes, said rod interconnecting said vanes and said inclined links is balanced indiscriminately about said pivots, and means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof.

7. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, a rigid rod interconnecting said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, links symmetrically inclined with respect to the plane of symmetry pivoted at one end to the rod interconnecting said vanes and at the other end to said pivots, adapted to form a deformable articulated trapezoid, counter-weights fixed to said links in such a way that the assembly formed by said vanes, said rod interconnecting said vanes and said inclined links is balanced indiscriminately about said pivots, means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof, consisting of a rigid rod interconnecting said two pivots, extended beyond said fixed pivot, means for displacing said rod angularly about said fixed pivot in a way to bring the plane of symmetry of the wind vane device in a predetermined direction with respect to the initial relative wind and for maintaining said rod in a fixed position after displacement thereof.

8. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, a rigid rod interconnecting said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, links symmetrically inclined with respect to the plane of symmetry pivoted at one end to the rod interconnecting said vanes and at the other end to said pivots, adapted to form a deformable articulated trapezoid, counter-weights fixed to said links in such a way that the assembly formed by said vanes, said rod interconnecting said vanes and said inclined links is balanced indiscriminately about said pivots, means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof, consisting of a rigid rod interconnecting said two pivots, extended beyond said fixed pivot, a link pivoted at its extremity to said last mentioned rod, a manually operated lever pivoted to the other extremity of said rod, and a sector plate adapted to release and maintain said hand lever in the desired position.

9. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, rigid means interconnecting the said vanes, two pivots symmetrically

disposed with respect to said plane, connecting means articulated at one end to said pivots and at the other end to said rigid means interconnecting said vanes counter-weights on said connecting means, whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots and means for transmitting the angular displacement of the assembly about said fixed pivot outside the wind vane device.

10. A wind vane device particularly suitable for air craft, comprising two vanes having a section of an outside contour which is curved symmetrically disposed with respect to a plane, a rigid rod interconnecting said vanes, a fixed pivot, a second pivot disposed symmetrically with respect to said first pivot and said plane, links symmetrically inclined with respect to the plane of symmetry pivoted at one end to the rods interconnecting said vanes, and at the other end to the said pivots, adapted to form a deformable articulated trapezoid, counter-weights fixed to said links in such a way that the assembly formed by said vanes, said rod interconnecting said vanes and said inclined links is balanced indiscriminately about said pivots, means for regulating the position of said second pivot by displacing said second pivot angularly with respect to said first fixed pivot and for maintaining said second pivot in fixed position after displacement thereof, consisting of a rigid rod interconnecting said two pivots, extended beyond said fixed pivot, a link pivoted at its extremity to said last mentioned rod, a manually operated lever pivoted to the other extremity of said rod, a sector plate adapted to release and maintain said hand lever in the desired position, a link, and struts interconnecting the inclined side of the trapezoid passing through the fixed pivot and said last mentioned link pivoted on said pivot in a way that said pivot follows the displacement of the said inclined link, and a rod pivoted to the extremity of said last mentioned link.

11. A wind vane device particularly suitable for air craft, comprising two vanes coupled together to form a single vane, rigid means carrying the said coupled vanes, two pivots, connecting means articulated at one end to said pivots and at the other end to said rigid means carrying said vanes, and counter-weights on said connecting means, whereby the assembly formed by said vanes, said rigid means and said connecting means is balanced indiscriminately about said pivots.

12. A wind vane device particularly suitable for air craft, comprising a vane, rigid means carrying said vane, two pivots, connecting means articulated at one end to said pivots and at the other end to said rigid means carrying said vane, and counter-weights on said connecting means, whereby the assembly formed by said vane, said rigid means and said connecting means is balanced indiscriminately about said pivots.

13. A wind vane device particularly suitable for air craft, comprising a vane, means carrying said vane, two pivots, connecting means articulated at one end to said pivots and at the other end to said means carrying said vane, said carrying means, connecting means, and vane being indiscriminately balanced about said pivots.

14. In a wind vane device particularly suitable for air craft, an adjustable support, links pivoted to the support, a relatively movable element pivoted on the links, a vane mounted on the element with the vane, links and elements in indiscriminately balanced relation, means to be moved, and means operatively associating said movable means for actuation in response to movement of said vane.

15. A wind vane device particularly suitable for air craft, comprising in combination a vane, means carrying said vane, two pivots, connecting means articulated at one end to said pivots and at the other end to said means carrying said vane, the assembly formed by said vane, said carrying means and said connecting means being so disposed as to be balanced indiscriminately about said pivots, with an element to be moved, and means connecting said element in operative association with said assembly.

16. A wind vane including a pivoted lever device, a vane carried by the lever device, the vane and lever device being indiscriminately balanced relative to and movable about a pivot of said device, and means operable to change the angular relation of the vane and device as the latter swings on a pivot, to secure amplified vane movement in response to an angular change in the incident airstream.

17. In a wind vane device particularly suitable for aircraft, an adjustable support, a relatively movable element, a vane mounted on the element and symmetrically disposed relative to a predetermined plane extending through the element and support and of such contour as to be immovable when exposed to an airstream parallel to said predetermined plane, means for supporting the element for pivotal movement relative the support, said vane, said element and said means so arranged that angular change of direction of the airstream moves the vane and element through a greater movement than if the element had a single pivot at the intersection of said plane with the support, said vane, element, and supporting means being so arranged as to be indiscriminately balanced relative to the fixed support.

18. In a wind vane device particularly suitable for aircraft, an adjustable support, a wind vane in spaced relation to said support

with the chord of the vane normally parallel to a predetermined plane, means for supporting said vane in a state of indiscriminate balance and operative movable relation to the support and said vane arranged to move transversely of said plane under aerodynamic action and simultaneously to change the angularity of the chord of the vane to said plane in response to an airstream angularly divergent from said plane, to a position in which the chord of said vane is parallel to the angularly divergent airstream and supporting means so arranged that for a given angular change of airstream the vane is caused to travel a greater distance transversely of said plane than if the vane were mounted radially of a single pivot on said support, and means operatively associated with the movable vane for actuation upon movement of said vane.

19. In a wind vane device, a support, a wind vane in spaced relation to said support, means for supporting the vane in a state of indiscriminate balance and operative movable relation to the support so that the vane has an arcuate movement relative to the support with the chord of the vane lying always in a plane parallel to an incident airstream but said means so arranged that the arc of movement of said vane is on a radius greater than the distance between the vane and the support whereby in response to a given angular change of airstream flow the vane travels a greater distance before the chord of the vane becomes parallel with the airstream flow than would be the case if the vane were disposed radially of a single pivot on the support.

20. In a wind vane device, a support, a vane, the chord of which is normally parallel to a predetermined plane intersecting said support, means for floatingly supporting said vane in a state of indiscriminate balance so as to be responsive solely to change of direction of the incident airstream when such airstream is angularly divergent from said plane, said vane being movable in a path transverse to said plane, and said means so arranged as in effect to retard the rate of angular change between the chord of the vane and said plane so that for a given angular change of airstream flow the vane is caused to move bodily transversely of said plane to a greater distance than if the vane were pivoted at the intersection of said plane and said support.

In testimony that I claim the foregoing as my invention, I have signed my name hereto.

LOUIS CONSTANTIN.