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AUTOMATIC LATERAL STABILIZING MECHANISM FOR AEROPLANES.

APPLICATION FILED FEB. 25, 1910. RENEWED APR. 15, 1911.

1,009,384.

Patented Nov. 21, 1911.

2 SHEETS—SHEET 1.

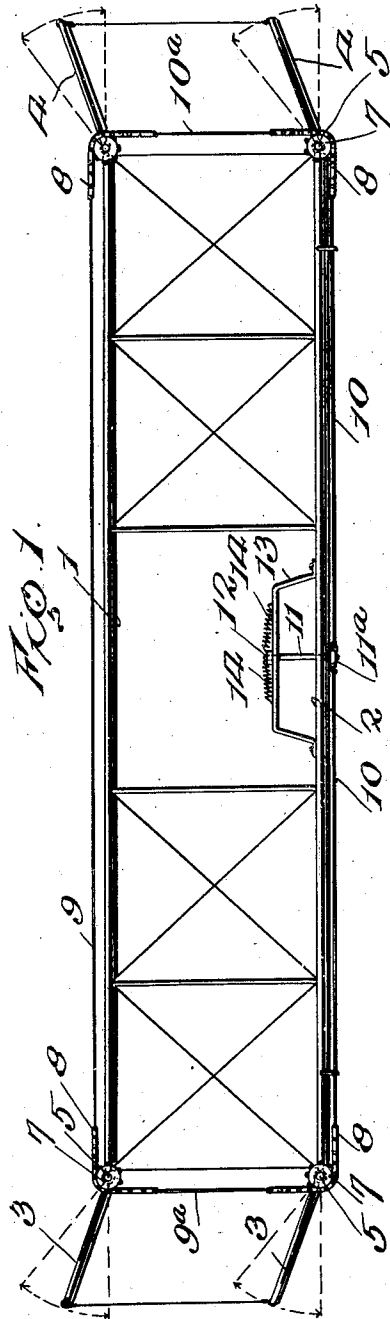


Fig. 1.

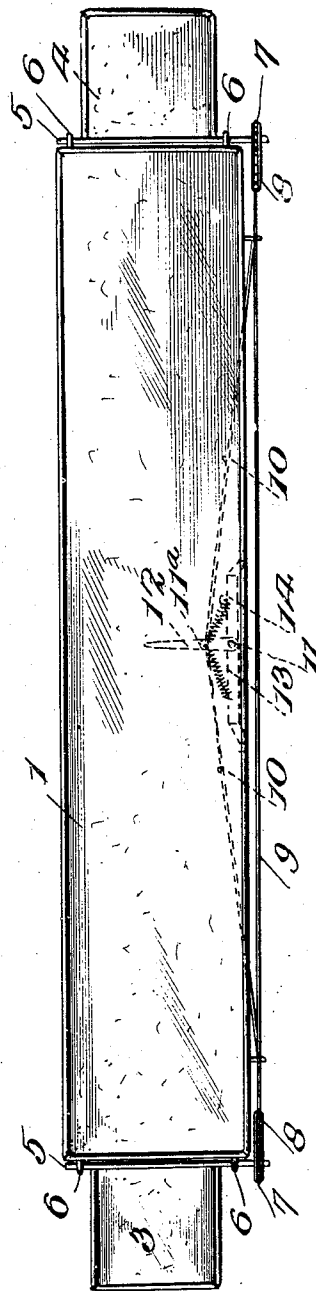


Fig. 2.

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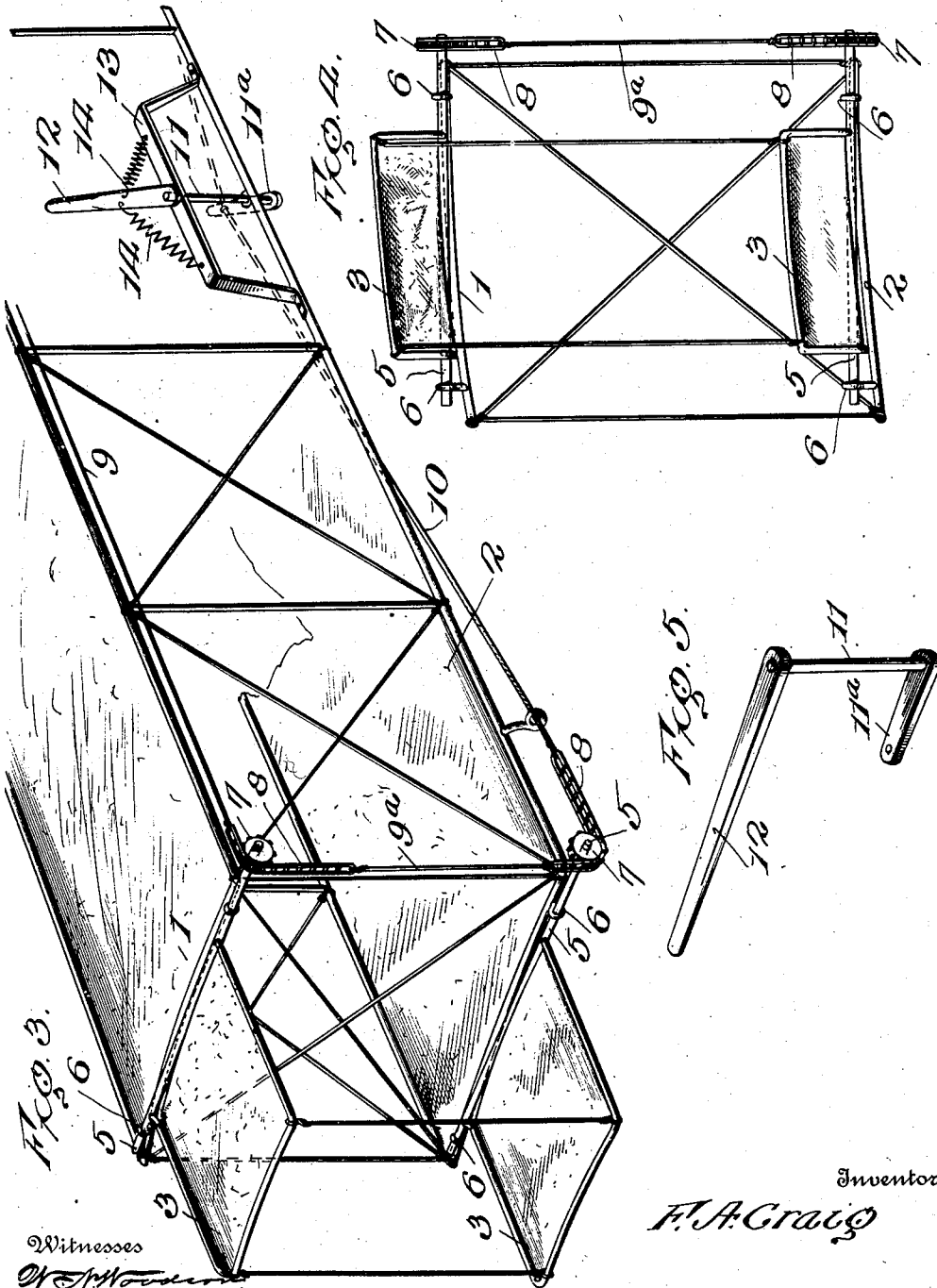
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UNITED STATES PATENT OFFICE.

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AUTOMATIC LATERAL-STABILIZING MECHANISM FOR AEROPLANES.

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To all whom it may concern:

Be it known that I, FRANCIS A. CRAIG, citizen of the United States, residing at Carmichaels, in the county of Greene and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Lateral-Stabilizing Mechanism for Aeroplanes, of which the following is a specification.

This invention comprehends certain new and useful improvements in flying machines of the heavier than air type, and relates particularly to an automatic lateral stabilizing device for aeroplanes.

The invention has for its primary object an improved lateral stabilizing device which will possess to a considerable degree the characteristic of simplicity in that the parts are few in number and add comparatively little of weight or mechanical complication to the aeroplane, and the characteristic of sensitiveness in that the automatic devices are acted upon directly by the disturbing influence itself, and are not dependent upon pendulums, weights, gyroscopes or other mechanical accessories which cannot act until they themselves are acted upon by the whole machine being thrown considerably out of its normal position.

The invention also has for its object a simple, durable and efficient mechanism of the character above set forth which will be equally susceptible to automatic or manual control, and which will add to the effective lifting surface of the machine.

With these and other objects in view as will more fully appear as the description proceeds, the invention consists in certain constructions, arrangements and combinations of the parts that I shall hereinafter fully describe and claim.

For a full understanding of the invention, reference is to be had to the following description and accompanying drawings, in which:

Figure 1 is a front elevation of an aeroplane embodying the improvements of my invention; Fig. 2 is a top plan view thereof; Fig. 3 is a perspective view of a portion of the aeroplane; Fig. 4 is an end view; and, Fig. 5 is a detail perspective view of an actuating lever hereinafter specifically referred to.

Corresponding and like parts are referred to in the following description and indi-

cated in all the views of the drawings by the same reference characters.

The aeroplane illustrated in the drawings for the purpose of disclosing one embodiment of my invention, is of the biplane type, although it is to be understood that the invention is clearly applicable to the monoplane type by merely omitting the duplication of some of the parts, as will be evident to those skilled in the art to which this invention appertains. The aeroplane in the present instance comprises an upper plane 1 and a lower plane 2 which are braced and secured together in spaced relation to each other in any desired way, the said planes being transversely elongated as is usual in the type of machine in which the invention is shown and embodied.

3 designates the upper and lower stabilizing planes at one side of the machine, and 4 designates the corresponding planes at the opposite side of the machine, the said planes being arranged in pairs, upper and lower, as above stated, and each plane being secured for movement about a horizontal axis to a shaft 5, the said shafts being journaled to rotate about their longitudinal axes and extending longitudinally, as shown, in bearings 6 at the ends of the upper and lower planes 1 and 2. Each shaft is provided at one end with a sprocket wheel 7. Relatively short lengths of chains 8 extend partially around the respective sprocket wheels, said chains being of a length to secure the requisite amount of movement of the stabilizing planes, and the chains are connected together at their ends by cables 9, 10, 9^a and 10^a, said cables being provided at any desired number of points with turn buckles or any other tensioning and adjusting devices. The several chains 8 with their connecting cables practically constitute an actuating belt or band which may be of any desired construction other than that above specifically described, so long as it is capable of simultaneously moving the lateral stabilizing planes, and one portion of this belt, which in the present instance is the lower stretch 10 of the connecting cables, is connected to a crank 11^a secured to or formed on the lower end of a vertically disposed shaft or spindle 11, said spindle being mounted for rotation about a vertical axis and being provided at its upper end with a handle

12, preferably extending substantially perpendicularly thereto. The shaft 11 is journaled in any desired way, as in a standard or bracket 13.

5 14 designates tensioning devices which in the present embodiment of the invention are composed of contractile springs secured at one end to the handle 12 and extending in opposite directions therefrom and secured
10 at their opposite ends by some adjustable means so that their tension may be increased or diminished, to the horizontal cross bar of the standard 13.

In describing the practical operation of
15 my improved automatic lateral stabilizing devices, let it be assumed that the aeroplane is flying straight ahead in calm air. Under these conditions all of the planes 3 will define dihedral angles with the respective
20 plane 1 and 2, the planes being inclined slightly upward, as clearly illustrated in Fig. 1. The machine, with the parts in this position, will, of course, be balanced laterally, as the velocity of movement at both
25 ends of the machine is the same; and as the angle of incidence, the dihedral angle and the number of square feet of superficial area exposed are the same in both cases; the stabilizing planes at both ends of the machine will lift the same and the aeroplane
30 will be balanced laterally. Now let it be assumed that the machine be turning and that the stabilizing planes 3 at the left hand end of the machine are at the outside of the curve described in turning, the tendency of the aeroplane is to lift the highest on the
35 outside end of the curve, because that side of the machine which is on the outside of the curve is traveling faster than the other side, and as the lift of an aeroplane is directly proportionate to its velocity, that part of the main planes which is at the outside of the curve and traveling relatively faster, lifts more than the other side and the lateral
40 balance is disturbed. But at the same time the stabilizing planes 3 lift more than the complementary planes 4, because the former are also at the outside and traveling comparatively faster. Consequently, the balance between the two sets of stabilizing
45 planes is disturbed and the planes 3 are forced upward, which results at the same time in pulling the planes 4 downward. It is evident that when the planes 3 are pushed upward, more air slips off of the ends of the planes and the higher they are pushed, the less they lift. As the planes 4 are pulled
50 downward, less air slips from under them and the lower they are pulled the more they lift. Thus the stabilizing planes accurately and automatically act to establish new balance between themselves and lift the whole machine into perfect lateral balance. Again, let it be supposed that the aeroplane is being
55 driven straight ahead in calm air and now a

sudden gust of wind strikes the left hand end of the machine. The action in such event would be precisely the same as in turning, because the velocity of the air current would be added to the velocity of the forward
70 movement of the machine. Consequently, the left hand side would lift the most, the stabilizing planes 3 would be forced upward, the opposite planes 4 would be forced downward, and the machine would be restored to
75 perfect lateral balance, as before. Similarly, if the left hand end of the machine should pass over an ascending current of air, it would act to lift the left hand end higher than the right, but this disturbance
80 would also force the stabilizing planes upward and they would at once act to establish a lateral balance. Again, if the left hand end of the machine should be struck by a downward gust of wind, it would force
85 the planes 3 downward and they would immediately lift more in direct opposition to the disturbing element, and at the same time pull the planes 4 at the right end higher, causing said last named planes to lift less
90 and reducing the tendency of the machine to turn around its center of lateral stability, thereby restoring the lateral balance. In short, any disturbance, acting from any direction, upon either end of the machine, will
95 immediately cause the stabilizing planes to assume positions which will restore the lateral balance of the machine.

In the foregoing explanation it has been assumed that all of the disturbance affected
100 the left hand end of the machine only, for convenience in explanation, but it is manifest that any disturbance affecting the right hand end of the machine will produce exactly the same results.
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Relative to the function and importance of the springs 14 and the hand lever 12 to which they are connected, it is to be observed that when the stabilizing planes 3 are forced upward to the position illustrated
110 by the upper dotted lines in Fig. 1, and the complementary planes 4 are pulled downward to a substantially horizontal position, as indicated by the lower dotted lines at the right hand end of Fig. 1, the direction of
115 movement of the over-running cable 9 and the under-running cable 10 is shown by the arrows parallel thereto. As the direction of motion of the under-running cable 10 is toward the left hand end of the machine,
120 and as the crank 11^a and the hand lever 12 both point in the same direction, the hand lever would also be pulled toward the left hand end of the machine. Consequently, if the aeroplane should meet with a disturbance so violent that the device could not
125 handle it by automatic action, it would only be necessary to push the hand lever toward the high end of the machine, so as to aid the automatic mechanism in restoring the
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lateral balance of the machine. Obviously also, the hand lever gives the operator a means of raising or depressing either end of the machine at will. It is, of course, to be understood that when the hand lever 12 is at its middle or what might be termed neutral position, the torsional pull of the springs 14 exactly balance, but when the lever 12 is pulled toward the left hand end of the machine, the spring at the right of the lever is lengthened, giving a gradual increasing tension, while the one at the left of the lever is shortened, giving less tension. Thus the tendency of the springs is to produce a gradual increasing resistance to the movement of the stabilizing planes in either direction in any position, and also to bring them back to their normal position as soon as the disturbing influence has been removed. The principal function of the springs is to steady the automatic devices, particularly in gusty winds and other like disturbances.

From the foregoing description in connection with the accompanying drawings, it will be seen that I have provided a durable and efficient construction of lateral stabilizing mechanism for aeroplanes, which is marked by extreme simplicity, and automatic action, an action which may be controlled at will by the operator, an action which will be sensitive and not dependent upon pendulums, weights or other mechani-

cal complications for its operation, and one which will in itself add to the effective lifting surface of the machine.

Having thus described the invention, what is claimed as new is:

1. In a flying machine, the combination with a main plane, of lateral stabilizing planes connected thereto, a belt arranged to move said planes simultaneously, a crank connected to one stretch of said belt, a spindle to which said crank is connected, a standard in which said spindle is journaled, a hand lever connected to the spindle, and oppositely acting contractile springs connected to the hand lever and to the standard.

2. In a flying machine, the combination with a main plane, of lateral stabilizing planes connected thereto, a belt arranged to move said planes simultaneously, a crank connected to one stretch of said belt, a spindle to which said crank is connected, a standard in which said spindle is journaled, a hand lever connected to the spindle, oppositely acting contractile springs connected to the hand lever, and an adjustable connection between said springs and the standard.

In testimony whereof I affix my signature in presence of two witnesses.

FRANCIS A. CRAIG. [L. S.]

Witnesses:

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