

Co. No.

200796

UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas

CARL J. CRANE,
of
Albrook Field, Canal Zone,

PRESENTED TO THE COMMISSIONER OF PATENTS A PETITION PRAYING FOR THE GRANT OF LETTERS PATENT FOR AN ALLEGED NEW AND USEFUL IMPROVEMENT IN

AIRPLANE STABILIZERS,

A DESCRIPTION OF WHICH INVENTION IS CONTAINED IN THE SPECIFICATION OF WHICH A COPY IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND COMPLIED WITH THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED, AND

Whereas UPON DUE EXAMINATION MADE THE SAID CLAIMANT IS ADJUDGED TO BE JUSTLY ENTITLED TO A PATENT UNDER THE LAW.

NOW THEREFORE THESE Letters Patent ARE TO GRANT UNTO THE SAID

Carl J. Crane, his heirs

OR ASSIGNS

FOR THE TERM OF SEVENTEEN YEARS FROM THE DATE OF THIS GRANT

THE EXCLUSIVE RIGHT TO MAKE, USE AND VEND THE SAID INVENTION THROUGHOUT THE UNITED STATES AND THE TERRITORIES THEREOF. PROVIDED, HOWEVER, THAT THE SAID INVENTION MAY BE MANUFACTURED AND USED BY OR FOR THE GOVERNMENT FOR GOVERNMENTAL PURPOSES WITHOUT THE PAYMENT OF ANY ROYALTY THEREON.

In testimony whereof, I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington this sixteenth day of July, in the year of our Lord one thousand nine hundred and thirty-five, and of the Independence of the United States of America the one hundred and sixtieth.



Attest

Law Examiner.

Raymond C. Cox
Commissioner of Patents.

July 16, 1935.

C. J. CRANE

2,007,964

AIRPLANE STABILIZER

Filed Feb. 15, 1933

2 Sheets-Sheet 2

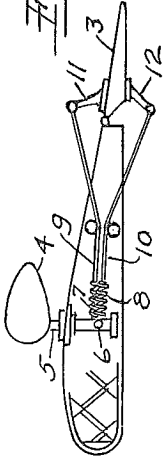


Fig. 4.

Fig. 6.

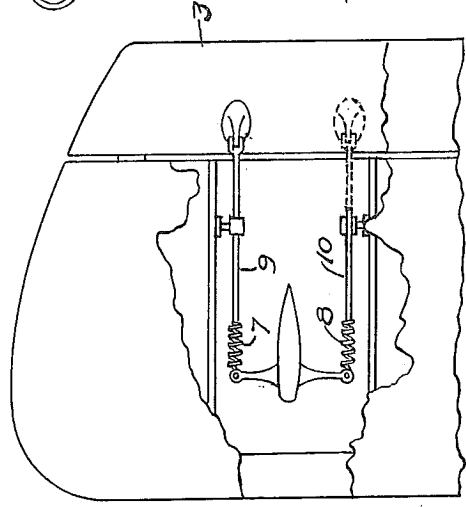
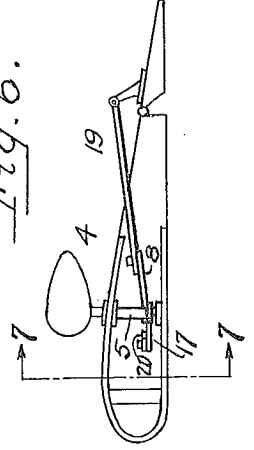


Fig. 5.

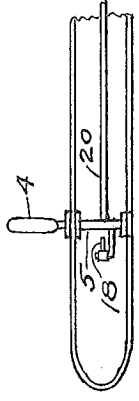


Fig. 7.

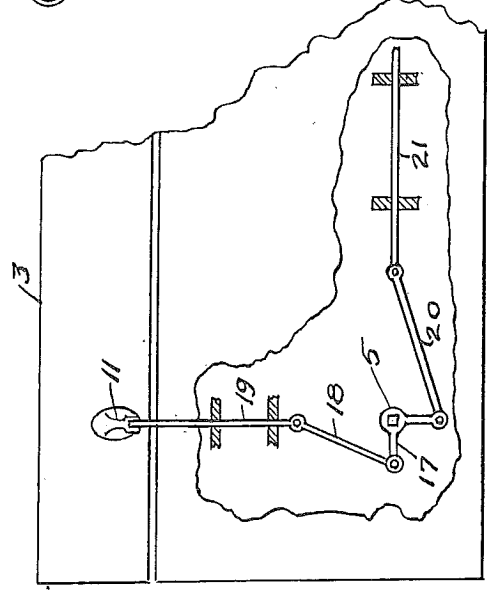


Fig. 8.

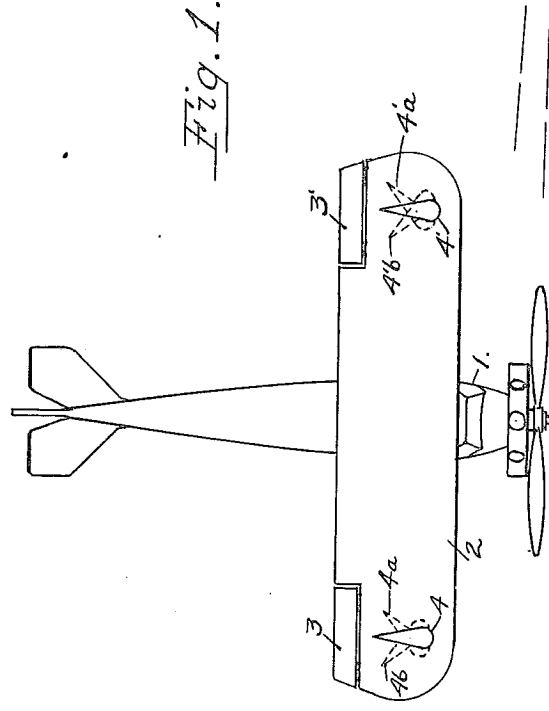
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July 16, 1935.

C. J. CRANE
AIRPLANE STABILIZER
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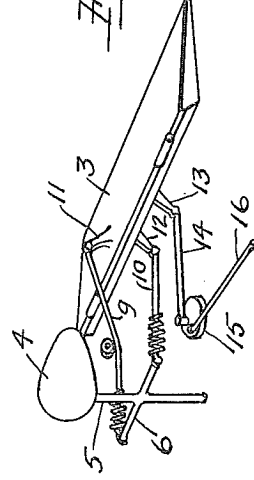
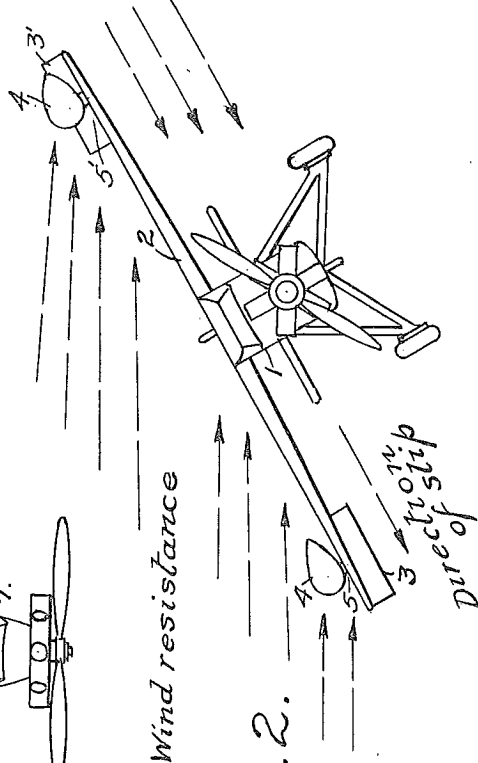
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2 Sheets-Sheet 1



Wind resistance

Fig. 2.



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Attorney

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UNITED STATES PATENT OFFICE

2,007,964

AIRPLANE STABILIZER

Carl J. Crane, Albrook Field, Canal Zone

Application February 15, 1933, Serial No. 656,861

3 Claims. (Cl. 244—29)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates generally to airplanes but more specifically to a stabilizing means therefor, the operation of which is in the nature of an automatic aileron control.

The principal object of the invention is to provide a simple, reliable and inexpensive automatic means for controlling the longitudinal and lateral movements of airplanes during flight.

Another object is to provide an automatic stabilizer for airplanes which depends for its operation on changes in the normal directional flow of air past the airplane while in flight.

A further object is to provide a stabilizer of the type stated above which may be applied to all standard forms of airplanes, without alteration of the controls.

Briefly stated, the stabilizer which forms the subject matter of this invention consists of slip fins rotatably mounted upon the wing and operatively connected to the ailerons for the purpose of trimming the lateral spread of the wings through the action of said ailerons.

It is well known that in the conventional airplane control system there are three principal controlling surfaces, namely; the rudder, the ailerons and the elevators. It is also well known that in making a turn all three of the controlling surfaces may be called into play. The usual control surfaces to be moved in executing a turn are the rudder and ailerons. The airplane must be banked at the same time that it is turned in order to prevent a slip or skid. This control coordination is usually brought about by the pilot in handling the aileron and the rudder controls in such a manner that the slip and/or skid will be prevented.

It is also a well known fact that certain types of airplanes are somewhat unstable laterally during straight flight. This lack of lateral stability during straight flight requires constant attention of the pilot as he must, by means of the ailerons, keep the wing level laterally. It is to correct this unstable condition and to avoid lateral skidding or slipping without necessitating the operation of the controls by the pilot, that the automatic control, which forms the subject matter of this invention, was devised.

The device set forth by this invention is especially useful during blind flight such as in a fog or other conditions of darkness that prevent outside visual reference. It is then that the pilot

desires to simplify his control movement to a minimum. It will be noted that with this type of control it is only necessary to steer with the rudder, since the resultant skid will produce the necessary movement of the ailerons to bring about a coordinated air position of the airplane. In stopping the turn by the rudder alone the resulting slip will raise the low portion of the wing through the interrelation of the slip fin and the aileron. The pilot will not have to use the aileron control mounted within the airplane, the rudder sufficing to bring about the coordinated turning flight or laterally trimmed straight flight.

In order that the invention may be more readily understood, reference is had to the accompanying drawings forming a part of this specification:

Fig. 1 is a top plan view of an airplane showing the relative positions of the ailerons with respect to the stabilizing fins;

Fig. 2 is a front elevation of an airplane pictured in a right hand slip, and showing the position in which the fins are yawed and the corresponding position of the ailerons;

Fig. 3 is a perspective view showing a slip fin and aileron and the linkage connecting the two. It also shows a portion of the linkage between the aileron and the control stick;

Fig. 4 is a side elevation partially in section of a plane with aileron hingably attached thereto, a slip fin and linkage between said fin and said aileron;

Fig. 5 is a partial top plan view of the structure shown in Figure 1 with a portion of the covering of the plane torn away to show the linkage of the fin to the aileron;

Fig. 6 is a similar view of Fig. 4 showing a modified form of linkage between the fin and the aileron;

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 6 showing a portion of the linkage between the fin, aileron and the control stick, and Fig. 8 is a top plan view of a portion of a plane and aileron, with a section of the plane covering torn away to expose the modified form of linkage shown in Figs. 6 and 7.

Referring to the drawings, the numeral (1) represents the fuselage of an airplane, (2) the wing, (3) and (3') the right and left ailerons, and (4) and (4') the right and left slip fins. The relative positioning of the ailerons and fins are shown in Fig. 1. The slip fins (4) and (4') are pivotally mounted on perpendicular shafts (5) and (5') above the planes and are so linked to the ailerons that when they are turned

in the direction indicated by (4a) and (4'a), the right aileron (3) is turned downward and the left aileron (4') is turned upward as is shown in Fig. 2. When the slip fins (4) and (4') are turned in the direction indicated by (4b) and (4'b), the right aileron (3) is turned upward and the left aileron (3') is turned downward.

In Fig. 2 the airplane is pictured flying in a right hand slip. The slip fins (4) and (4') are yawed in a manner which will cause the right aileron (3) to be lowered and the left aileron (3') to be raised which will correct for the slip. The direction of the wind resistance and the direction of slip of the airplane are indicated by the arrows shown in this illustration.

A type of linkage between a slip fin and aileron is shown in Fig. 3. In this illustration which shows the right aileron (3) and slip fin (4), it will be noted that the slip fin (4) is rigidly mounted on a revolvable shaft (5) having attached thereto a cross member (6). At either end of this cross member (6) are fastened the springs (7) and (8), which connect with the cables (9) and (10). These cables (9) and (10) are in turn attached to the upper and lower horns (11) and (12) which are mounted respectively on the upper and lower surfaces of the aileron (3).

The horn (13) mounted on the lower surface of the aileron (3) is pivotally attached to link (14) which in turn is pivoted to a disc (15). The disc (15) is rotated by the control stick (not shown) through the instrumentality of a connecting linkage, a portion of which is indicated by the numeral (16).

Figs. 4 and 5 show other views of the linkage between the slip fin (4) and the aileron (3). It will be noted that in this linkage there is included an elastic system, the purpose of which is to allow a damping of the relative movements of the aileron and the slip fin, and also to prevent a too rigid control of the lateral movement of the wings and to damp out the effects of gusts from the side.

Figs. 6, 7, and 8 show another method of interconnecting the slip fin (4) and the aileron (3). In this type of linkage the rotatable shaft (5), to which the fin (4) is rigidly attached, is provided with a bell-crank (17), connected to the horn (11) of the aileron (3) through the link (18) and the longitudinally slidable rod (19), all of which are pivotally connected to each other. The bell crank (17) is connected to the control lever (not shown) by means of the link (20) and rod (21). In this type of linkage no elastic system is provided, and but a single linkage is required for both elevating and lowering the aileron.

The sizes and shapes of the fins and methods of mechanically linking the slip fins with the ailerons may be varied to include a large number of combinations. It should be noted that the position of the slip fin may vary from the posi-

tion shown in the drawings. The fin may be above or below the individual wing or wings of monoplane or biplane respectively.

It is obvious that those skilled in the art may vary the details of construction and arrangement of parts without departing from the scope and spirit of the invention, and therefore it is not desired to be limited to the foregoing description except as may be required by the claims.

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

1. In an airplane having a wing with manually controlled ailerons, horns projecting from the upper and lower surfaces of said ailerons, vertically rotatable shafts mounted within said wing and projecting above the same, rotating means comprising horizontal cross members rigidly attached to the portion of said shafts located within said wing, air engaging elements comprising slip fins rigidly attached to the upper portion of said shafts, tension linkage elements comprising a cable and spring, uniting said cross members with said horns for coordinating the movements of said ailerons with those of the slip fins and additional linkage for operatively connecting the ailerons with the manual control device.

2. In an airplane having a wing with manually controlled ailerons, horns projecting from the upper and lower surfaces of said ailerons, vertical rotatable shafts mounted within said wing and projecting above the same, rotating means comprising horizontal cross members rigidly attached to the portion of said shafts located within said wing, air engaging elements comprising slip fins rigidly attached to the upper portion of said shaft, linkage elements uniting said horns with said cross member adapted to transmit the rotary movement of said ailerons, about their horizontal axis to the slip fins to produce therein rotary movement about their vertical axes, and additional linkage for operatively connecting the ailerons with the manual control device.

3. In an airplane having a wing with manually controlled ailerons located at its rearward lateral extremity, horns projecting from the upper and lower surfaces of said ailerons, vertical rotatable shafts mounted within said wing and projecting above the same in advance of said ailerons, rotating means comprising horizontal cross members rigidly attached to the portion of said shafts located within said wing, air engaging elements comprising slip fins rigidly attached to the upper portion of said shafts, tension linkage elements comprising a cable and spring, uniting said cross members with said horns for coordinating the movements of said ailerons with those of the slip fins, and additional linkage for operatively connecting the ailerons with the manual control device.

CARL J. CRANE.