N° 16,068 A.D. 1909

(*Under International Convention.*)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in the United States), 15th July, 1908

Date of Application (in the United Kingdom), 9th July, 1909

At the expiration of twelve months from the date of the first Foreign Application, the provision of Section 91 (3) (a) of the Patents and Designs Act, 1907, as to inspection of Specification, became operative

Accepted, 5th Aug., 1909

COMPLETE SPECIFICATION.

Improvements in Mechanism for Actuating the Rudders or Controlling Planes of Aeronautical Machines.

We, ORVILLE WRIGHT and WILBUR WRIGHT, both of 1127 West Third Street, Dayton, County Montgomery, State of Ohio, United States of America, Manufacturers, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to mechanism for actuating the rudders or controlling planes of aeronautical machines, and is specially applicable to such apparatus and mechanism as is shewn and described in the British Patent granted to us as of the 23rd March 1903, under the No. 6732/04.

The object of this invention is to provide means all as hereafter described, whereby both the front and rear edges of a flexible rudder will be positively actuated at different angular velocities to adjust the rudder to the desired angle relative to its normal position, and to simultaneously flex the rudder in such a manner as to present the rear portion thereof to the action of the wind, at a greater angle than the forward portion, thereby greatly increasing the effectiveness of the rudder.

In the accompanying drawings, Fig. 1 is an end elevation of a rudder embodying our invention; Fig. 2 is a transverse sectional view, taken on the line *x x* of Fig. 1 and looking in the direction of the arrows; and Fig. 3 is an end elevation showing a modified form of the invention.

In carrying out our invention we have applied the same to a flexible rudder 1, which, in its normal position, is substantially flat and has both its front and rear edges in substantially the same plane with the body portion of the rudder. This rudder may be of any suitable construction, but preferably comprises a skeleton frame consisting of the longitudinal members 2 and the transverse members 3 extending between the longitudinal members, this frame having a suitable covering of fabric or other material. The flexibility of the frame may be secured in any desired manner, but we prefer to accomplish this by forming the transverse members or rods 3 of flexible material, such as strips of wood which have the necessary strength combined with a certain amount of flexibility. Suitable means are provided for positively actuating both the front and rear edges of this rudder to turn the same to the desired angle relative to its normal

position, and, at the same time, to flex the rudder in such a manner as to present a concave surface to the action of the wind, the forward portion of which surface will present a small angle of incidence to the wind, which angle of incidence will rapidly increase toward the rear.

For purposes of illustration we have, in the present instance, shown the flexible rudder 1 as a horizontal rudder mounted on suitable supports 4 carried by some part of the machine to which the rudder is attached. The rudder is pivotally connected to the support at a point intermediate of its ends and preferably slightly in front of a line equidistant from the front and rear edges of the rudder. The operating mechanism, in the present instance, comprises one or more two-armed levers 5 having arms of unequal lengths and being pivotally supported near the rudder 1, the said levers being of different lengths than the corresponding arms of the transverse members or rods of the rudder, and having the pivotal centers of said levers eccentrically arranged relative to the pivotal center of said rudder and having their opposite ends connected to the front and rear edges, respectively, of said rudder. In the present instance, we have provided three of these levers 5 and have shown the same as rigidly secured to a shaft 6, extending longitudinally of the rudder and journaled in forwardly extending bearing brackets 7 secured to the upright members 4. These levers are connected at their opposite ends to the adjacent edges of the rudder by means of links 8. The rudder may consist of one, or more than one plane. In the present instance, we have shown the rudder as a double rudder comprising two single rudders or planes 1, each of these planes having its front and rear edges, respectively, connected to the adjacent ends of the levers 5 by the links 8, whereby both planes or rudders are simultaneously actuated when the levers are moved, the links 8 forming connecting rods between the adjacent edges of the two rudders. These connecting rods, which are formed by the links 8, have a certain amount of flexibility owing to the pivotal connection between the adjacent ends of the two links, and this flexibility enables those portions of the rods to which the levers 5 are connected to move laterally to accommodate themselves to the movement of the ends of these levers, which, owing to the eccentric arrangement of the pivotal centers of the levers, is different from the movement of the edges of the planes or rudders.

Any suitable mechanism may be provided for operating the shaft 6 and the levers 5. In the present instance, we have mounted on the shaft 6 a drum 9, about which extends an endless cable 10 which also extends about a drum 11 rotatably mounted on the aeroplane, or other machine to which the rudder is attached, and provided with a handle 12 for rotating the same. Thus, it will be apparent that by the actuation of the drum 11 on the machine, the shaft 6 and the levers 5 carried thereby will be moved about their pivotal center and that this movement of the levers will positively move the front and rear edges of the rudder in opposite directions, to tilt the same at the desired angle to their normal or horizontal position, and that, owing to the different ratio between the arms of the lever and the arms of the rudder, and to the eccentric arrangement of the pivotal centers of the levers relative to the pivotal center of the rudder, the opposite edges of the rudder will be moved at different angular velocities, with reference to their pivotal center, thus flexing the rudder in such a manner as to present a concave surface to the action of the wind, the forward portion of the rudder having a small angle of incidence, which angle of incidence rapidly increases toward the rear, thus greatly increasing the efficiency of the rudder.

As above stated, the flexibility of the rudders or planes may be secured in any suitable manner, and we have, in Fig. 3 of the drawings, illustrated a modified form of the device in which this flexibility is secured by forming the planes of which the rudder is comprised in sections and pivotally connecting these sections one to the other in such a manner that, when the sections of the rudder are moved about their pivotal centers at different angular velocities, the

forward and rearward portions of the rudder will be presented to the wind at different angles of incidence. As shown in this figure, the upper and lower planes each consist of a forward portion 13 and a rearward portion 14, the rearward portion being preferably of considerably greater width than the forward portion. These sections have their adjacent edges pivotally connected one to the other by means of hinges 15, the point of connection being preferably in substantially the same vertical plane with the supporting standards 4. The sections of the planes may be moved about their pivotal centers at different angular velocities by means of the levers 5, which as in the form of the device above described, have their arms of different lengths than the widths of the corresponding portions or sections of the plane or rudder. In this form of the device we have also shewn the shaft 6 as mounted directly upon the upright supports 4 and in approximately the same vertical plane therewith, and have shown the links 16, which connect the ends of the levers 5 with the outer edges of the corresponding sections of the planes or rudders, as inclined relatively to said plane, thus compensating for the difference between the lengths of the arms of the levers and the widths of the corresponding sections of the plane.

We wish it to be understood that we do not desire to be limited to the details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In actuating the rudders or controlling planes of aeronautical machines; constructing the rudder so that it is flexible and so that its opposite edges will normally lie in substantially the same plane with the body thereof, said rudder being mounted on a pivotal centre, and providing means for positively actuating the edges of the rudder upon opposite sides of the said pivotal centre at different angular velocities with respect to the latter.

2. In actuating the rudders or controlling planes of aeronautical machines; constructing the rudder so that it is flexible and so that its opposite edges will normally lie in substantially the same plane with the body thereof, and providing means for positively moving the front and rear edges of said rudder in opposite directions and at different angular velocities with reference to its pivotal centre.

3. In actuating the rudders or controlling planes of aeronautical machines substantially as claimed by Claim 1; providing means for positively actuating both edges of a normally flat and substantially horizontal flexible rudder, so that the said edges of said rudder are moved at different angular velocities to flex the said rudder so as to present a concave surface to the action of the wind.

4. In actuating the rudders or controlling planes of aeronautical machines substantially as claimed by Claims 1 to 3, and in which such a rudder is pivotally mounted on a support and has its front and rear portions normally in substantially the same plane with its pivotal centre; providing a lever pivotally supported near said rudder and having its pivotal centre eccentrically arranged relative to the pivotal centre of said rudder, means for connecting the ends of said lever to the adjacent edges of said rudder, and means for actuating the said lever.

5. In mechanism substantially as claimed by Claim 4; providing a shaft carried by the support or supports of said rudder and arranged eccentrically to the pivotal centre of said rudder, a plurality of levers mounted on the said shaft and having their opposite ends connected to the front and rear edges respectively of said rudder, and means for actuating the said shaft.

6. In mechanism substantially as claimed by Claim 5; providing a plurality of forwardly extending brackets carried by the supports of the flexible rudder to receive the shaft carrying a plurality of levers rigidly secured thereto, and

providing links connecting the opposite ends of the said levers to the front and rear edges respectively of the said rudder, and means for actuating the said lever-carrying shaft.

7. In actuating the rudders or controlling planes of aeronautical machines; constructing the rudder with upper and lower flexible planes pivotally connected to supports, providing connecting rods extending between the adjacent edges of said upper and lower planes, and providing levers pivotally mounted on the said supports and having their pivotal centres arranged eccentrically to the pivotal centres of said planes and their opposite ends connected to said connecting rods, and means for simultaneously actuating the said levers.

8. In actuating the rudders or controlling planes of aeronautical machines substantially as specified; providing one or more two-armed levers having arms of unequal length and pivotally supported near the rudder or rudders, the arms of said levers being of different lengths than the corresponding arms of the transverse members or rods of the rudder, the pivotal centre of said levers being eccentrically arranged relative to the pivotal centre of the said rudder or rudders, and said levers having their opposite ends connected to the front and rear edges respectively of the said rudder or rudders so as to adjust the rudder or rudders to the required angle relatively to the normal position thereof, and to simultaneously flex the same so as to present the rear portion or portions of the rudder or rudders to the action of the wind at a greater angle than the forward portion or portions, substantially as described.

9. In actuating the rudders or controlling planes of aeronautical machines; the construction and mechanism for actuating the same, arranged substantially as described with reference to Figs. 1 and 2 of the accompanying drawings.

10. In actuating the rudders or controlling planes of aeronautical machines; the construction and mechanism for actuating the same, arranged substantially as described with reference to Fig. 3 of the accompanying drawings.

Dated this 9th day of July 1909.

BREWER & SON,
33, Chancery Lane, London, and
7, East Parade, Leeds,
Patent Agents for the Applicants.

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WRIGHT & *another's* COMPLETE SPECIFICATION. *(1 SHEET)*

[This Drawing is a reproduction of the Original on a reduced scale.]

FIG. 1.

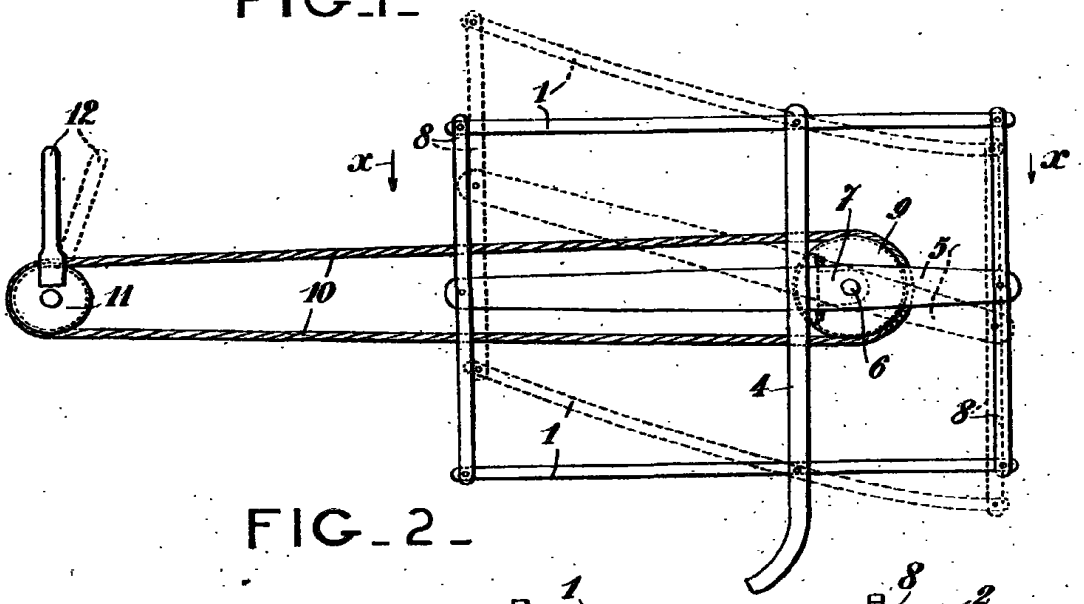


FIG. 2.

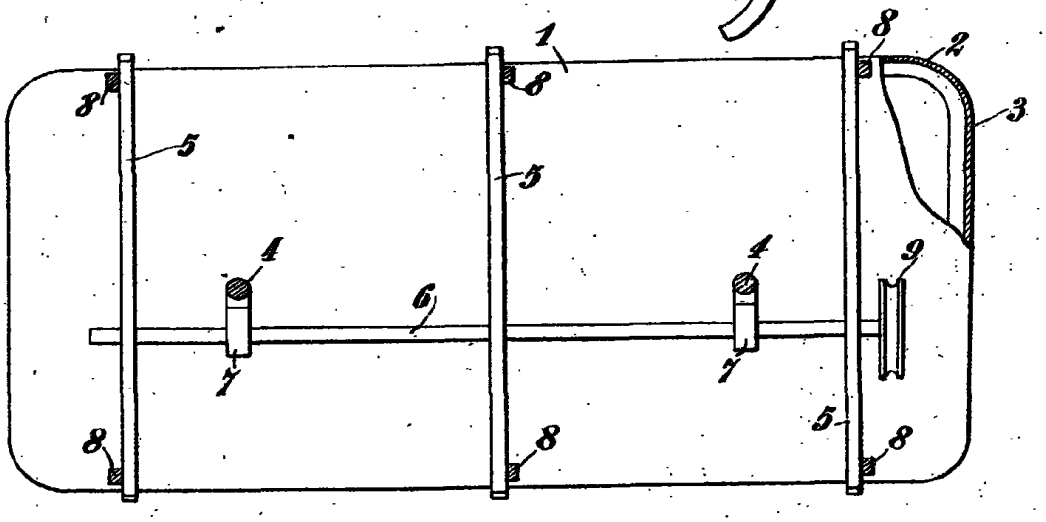
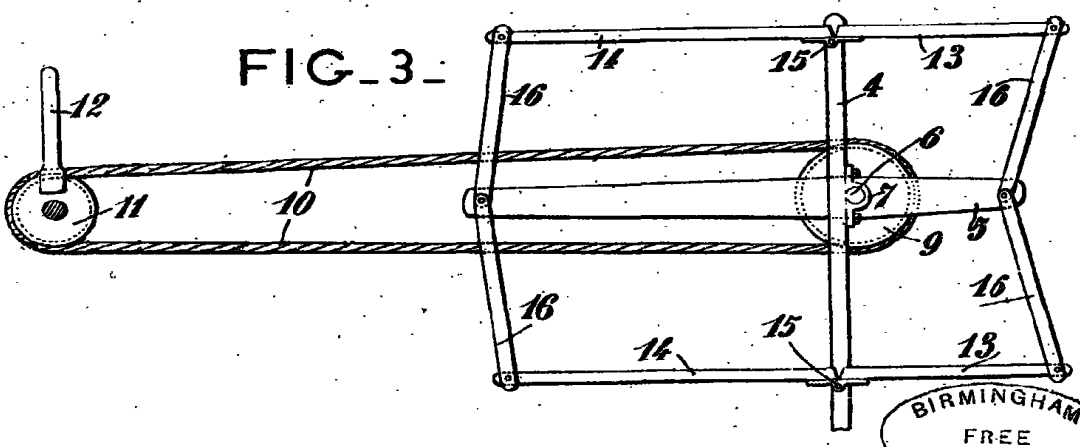


FIG. 3.



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