J. R. JUNKIN.

STABILIZING MEANS FOR AEROPLANES.

APPLICATION FILED JAN. 15, 1914.

1,125,850.

Patented Jan. 19, 1915.

2 SHEETS—SHEET 1.

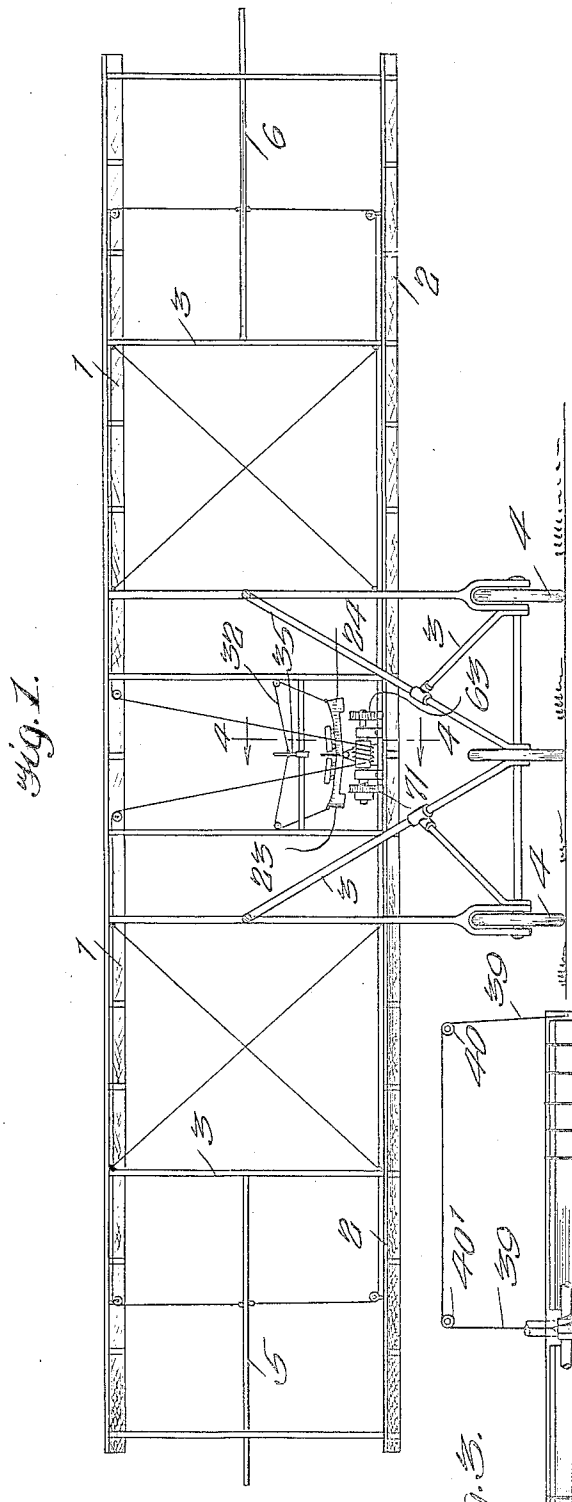

Fig. 1.

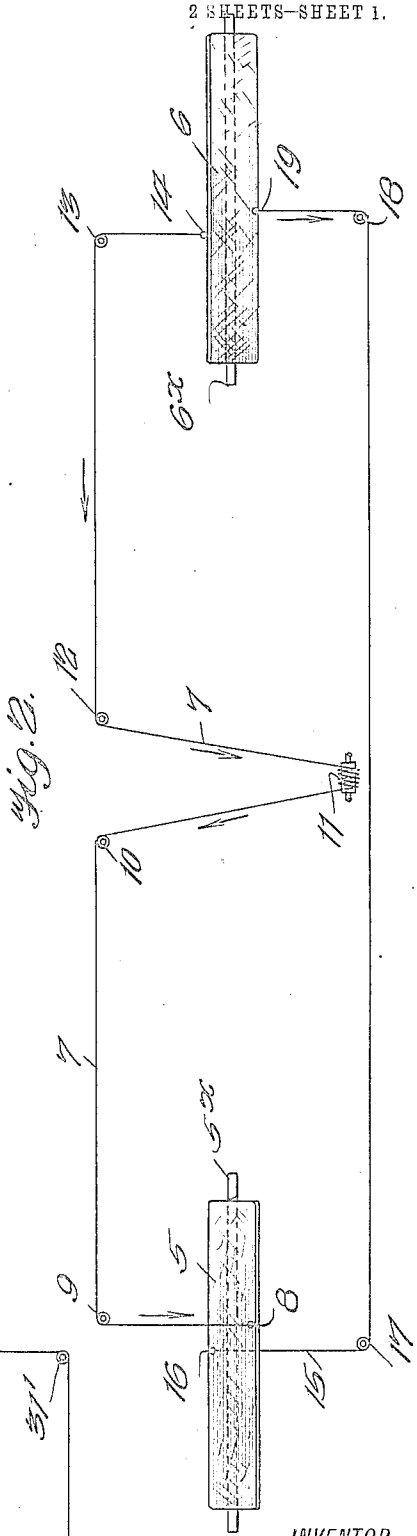

Fig. 2.

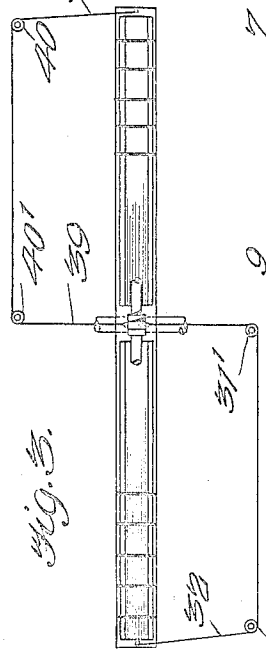

Fig. 3.

WITNESSES

E. M. Carraghan

L. A. Stanley

INVENTOR

JOHN R. JUNKIN,

BY Munn & Co.

ATTORNEYS

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2 SHEETS—SHEET 2.

Fig. 4.

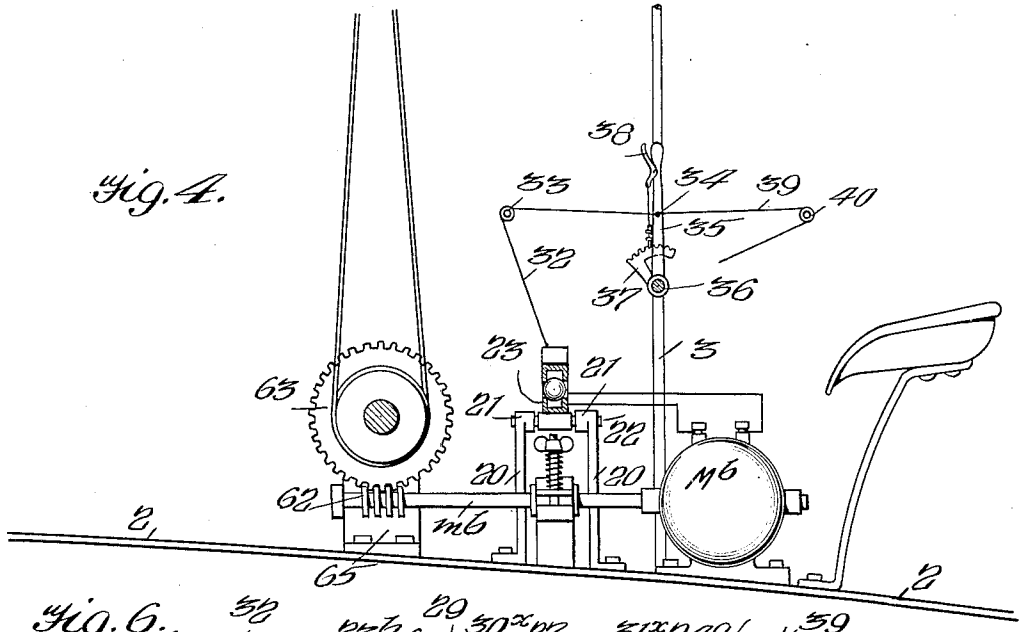



Fig. 6.

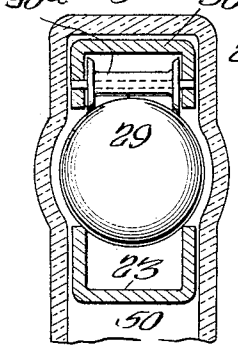



Fig. 5.

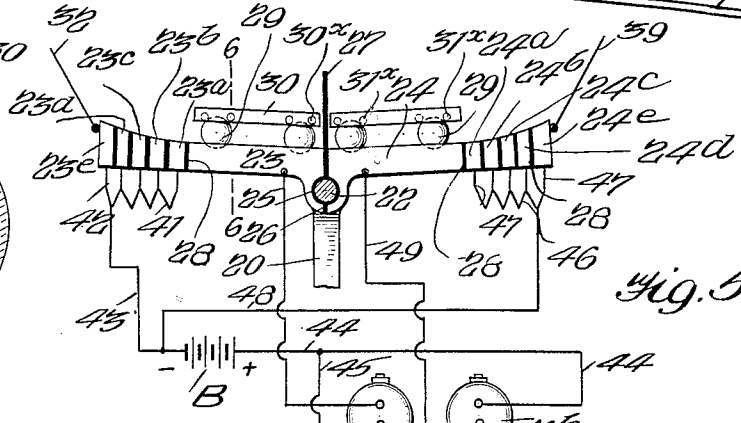



Fig. 7.

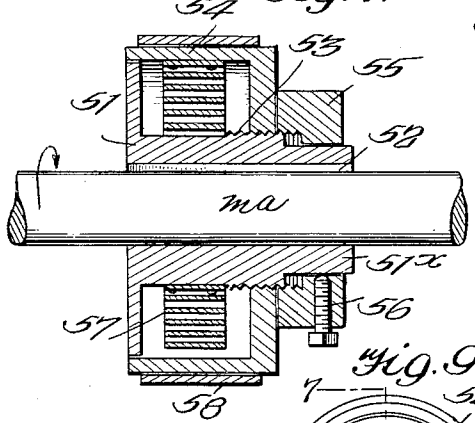



Fig. 8.

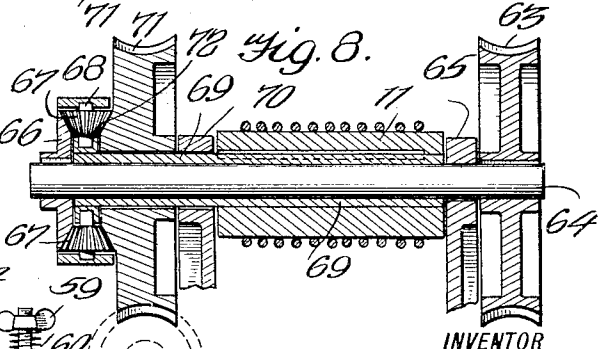
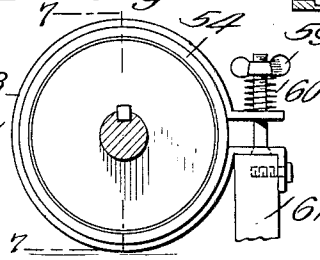



Fig. 9.




WITNESSES

E. M. Callaghan

L. A. Stanley

INVENTOR

JOHN R. JUNKIN,

BY Munn & Co.

ATTORNEYS

# UNITED STATES PATENT OFFICE.

JOHN R. JUNKIN, OF FAIRBANKS, TERRITORY OF ALASKA.

## STABILIZING MEANS FOR AEROPLANES.

1,125,850. Specification of Letters Patent. Patented Jan. 19, 1915.

Application filed January 15, 1914. Serial No. 812,248.

*To all whom it may concern:*

Be it known that I, JOHN R. JUNKIN, a citizen of the United States, and a resident of Fairbanks, Alaska, have made certain new and useful Improvements in Stabilizing Means for Aeroplanes, of which the following is a specification.

My invention relates to improvements in devices for controlling the movement of aeroplanes and it consists in the combinations, constructions and arrangements herein described and claimed.

An object of my invention is to provide means for automatically maintaining an aeroplane in horizontal position and at the same time having means for permitting the tipping of the aeroplane at such times as it is desirable to have it tipped, as for instance when turning corners.

A further object of my invention is to provide electric means for controlling the movements of the aeroplane in which motors are employed for operating the ailerons, and in which greater or less current is sent to the motors by means depending upon the variation of the main sustaining planes from a horizontal position.

Other objects and advantages will appear in the following specification and the novel features of the device will be particularly pointed out in the appended claims.

My invention is illustrated in the accompanying drawings forming part of this application in which—

Figure 1 is a front view of an aeroplane equipped with my stabilizing device, Fig. 2 is a diagrammatic view showing the cables for shifting the positions of the ailerons, Fig. 3 is a plan view showing the means for manually shifting a portion of the stabilizing means, Fig. 4 is an enlarged section on the line 4—4 of Fig. 1, Fig. 5 is a detail view showing the construction of a portion of the stabilizer and also showing the circuit connections for the motors, Fig. 6 is an enlarged section on the line 6—6 of Fig. 5, Fig. 7 is an enlarged section on the line 7—7 of Fig. 9, Fig. 8 is a section on the line 8—8 of Fig. 5, and Fig. 9 is a section on the line 9—9 of Fig. 5.

I may make use of an aeroplane of any type. In the present application I have shown a biplane, but it will be understood that the invention is equally efficient on a monoplane or a polyplane.

In carrying out my invention I provide the usual upper and lower main sustaining planes 1 and 2 respectively. These are secured to a frame 3 consisting of the usual uprights, cross members, and braces. The frame may be supported on wheels 4, as shown in Fig. 1.

Ailerons such as those shown at 5 and 6 are disposed between the upper and lower main sustaining planes, each of these ailerons being pivoted at its center on an axis or a pivoted rod such as shose shown at $5^x$ and $6^x$. As will be seen from Fig. 2 the aileron 5 has a cable 7 secured to the forward edge at 8 running upwardly around a pulley 9, thence laterally around a pulley 10, downwardly around a drum 11, upwardly around a pulley 12, laterally around a pulley 13 and downwardly where it is fastened at 14 to the forward edge of the aileron 6. The rear edge of the aileron 5 has a cord 15 fastened to it at 16. This cord extends downwardly around a pulley 17, thence laterally around a pulley 18 and upwardly, being fastened to the aileron 6 at 19.

Referring now to Fig. 4 it will be seen that just above the main sustaining plane 2 are disposed uprights 20 having bearings 21 at their tops arranged to receive the trunnions 22 of a track which is composed of two laterally extending arms 23 and 24 respectively (see Fig. 5). These arms are both secured to the trunnions 22, but are insulated therefrom by suitable insulation 25, which surrounds the trunnions, as shown in Fig. 5, and are insulated from each other by a downwardly extending insulating plate 26, and an upwardly extending insulating plate 27. The ends of the arms 23 and 24, which form the track are provided with conducting portions such as those shown at $23^a$, $23^b$, $23^c$, etc., on the track portion 23, and $24^a$, $24^b$, $24^c$, etc., on the track portion 24. These conducting segments are insulated by suitable insulating strips 28. As will be seen from Fig. 4, the arms 23 and 24 are substantially U-shaped in cross section, so as to provide a runway for balls or other similar anti-friction devices. These balls or anti-friction devices are preferably arranged in pairs, each pair bearing a conducting plate. Thus the balls on the track portion 23 bear a conducting plate 30, which is provided with rollers $30^x$ (see Fig. 6) for retaining the balls in position. The balls 29 on the track portion 24 bear a plate 31 having similar rollers $31^x$ to retain the balls

in position. The balls of each arm are spaced apart far enough so as to span a distance at least equal to that between the outermost conducting portion, as for instance $23^e$ of the arm 23 and the main body portion of the arm. A protective casing such as that shown at 50 in Fig. 6 may be provided for inclosing the track and the movable conducting members 30 and 31, this casing preventing accumulation of dust and also forming a housing for protection of the conducting elements.

As has been stated the portions 23 and 24 form in fact a unitary structure pivotally mounted on the trunnions 22. The track is normally held in a position parallel with the main sustaining plane by means of cords attached at the ends of the track. One of these cords 32 is attached to the outer end of the track and extends upwardly around the pulleys 33 and 33′ being fastened at 34 to a lever 35, which is pivoted at 36 on one of the uprights 3 and which is provided with a locking segment 37, the lever having a locking means 38 of the ordinary type for securing it in any position with respect to the segment 37. A cord or cable 39 is secured to the lever 35 at 34, passes laterally over the pulleys 40′ and 40 (see Figs. 3 and 4) and downwardly, being connected to the opposite end of the track, as shown in Figs. 1 and 5. As long as the lever 35 is in the position shown in Fig. 4 the track will be in a position parallel with the main sustaining planes.

Referring now to Fig. 5 it will be seen that I have provided a variable resistance or rheostat 41, which has connections 42 to each of the conducting portions of the arm 23. A conductor 43 leads to a battery B. The opposite side of the battery is connected by the conductors 44 and 45 with a motor $M^a$. The opposite end of the track has a similar variable resistance 46 connected by conductors such as that shown at 47 to the conducting portions of the arm. A conductor 48 connects one side of the battery with the resistance 46. A conductor 49 connects the body portion of the arm 24 with a motor $M^b$, the opposite side of the motor being connected by the conductor 44 with the battery. It will be observed that these motors $M^a$ and $M^b$ are so connected as to rotate in opposite directions when actuated by the battery B.

The shaft of each motor is provided with a device like that shown in Fig. 7. A description of one of these devices will be sufficient since they are both substantially the same. It will be seen that the shaft $m^a$ of the motor $M^a$ is secured to a sleeve 51 by means of a key 52. The sleeve is threaded externally at 53 to engage a threaded opening in a barrel 54. These threads are also designed to engage the threaded recess in a collar 55, which may be adjustably secured to the reduced portion $51^x$ of the sleeve 51 by means of a set screw 56. The spiral spring 57 has one end secured to the exterior portion of the sleeve 51 and the opposite end is secured to the interior wall of the barrel 54.

The barrel 54 is encircled by a band brake 58, the tension of which may be adjusted by means of a thumb screw 59 which passes through the ends of the band, and which normally bears on a helical spring 60 disposed between the screw and one end of the band. The other end of the band is securely held to a fixed member 61.

The shaft $m^b$ of the motor $M^b$ bears a worm 62, which is arranged to engage a worm wheel 63 rigidly secured to a shaft 64 (see Fig. 8) which passes through a bearing 65. The opposite end of this shaft has a gear 66 secured to it. This gear is designed to engage the beveled gears 67 which are carried by a wheel or rotatable member 68 which is secured to a sleeve 69 loosely mounted on the shaft 64, but rigidly keyed to the drum 11. The sleeve 69 passes through a bearing member 70 similar to the member 65. On the outer portion of the sleeve 69 is loosely mounted a worm wheel 71 which bears an integral gear 72 arranged to engage the gears 67 carried by the rotatable member 68. The shaft $m^a$ of the motor $M^a$ bears a worm similar to that shown at 62 in Fig. 4 and adapted to engage the worm wheel 71. The construction just described forms a reverse differential.

From the foregoing description of the various parts of the device the operation thereof may be readily understood. When the aeroplane is in its normal horizontal position the plates 30 and 31 will be in the position shown in Fig. 5. There will therefore be no circuit flowing from the battery B to either of the motors. The ailerons will therefore remain in the position shown in Fig. 1. If now the device should tip in one direction or the other it will cause a movement of one of the plates in the direction in which the device has tipped. Let us assume that the plane has tipped so as to cause the outer end of the arm 24 to lower. The plate 31 will roll outwardly on the balls and as soon as the first ball comes into engagement with the conducting member $24^a$ current will flow from the battery B through 44, motor $M^b$, 49, 24, ball 29 in contact with 24, 31, ball 29 in contact with $24^a$, 47, and 48 back to battery. This will cause the revolution of the motor shaft $m^b$ which will revolve the worm wheel 63 through the medium of the worm. The revolution of the worm 63 will cause the revolution of the shaft 64 and of the gear 66. Since the worm wheel 71 is held stationary by the shaft $m^a$ of the motor $M^a$, the rotary movement of the gear 66 will cause the revolution of the mem-

ber 68, which being fast to the sleeve 69 will revolve the latter and with it the drum 11. The cable 7 will therefore be moved in the direction shown in Fig. 2 so as to raise the forward edge of the aileron 6 and depress the forward edge of the aileron 5. The machine will therefore tend to right itself.

If the aeroplane had tipped in the other direction then the motor $M^a$ would have been actuated and being connected up to revolve in the opposite direction it would have turned the drum in the opposite direction from that shown in Fig. 2, so as to raise the forward end of the aileron 5 and to depress the forward end of the aileron 6.

I will now explain the means whereby the drum is returned to its normal position. Consider Fig. 7. In this figure the shaft $m^a$ is designed to rotate in the direction shown by the arrow when winding up the drum. The threaded portion 53, it will be understood, has left hand threads. During the initial revolution of the shaft $m^a$ the sleeve 51 is carried around with it, but the barrel 54 is held by the brake band 58 until the tension of the spring 57 is such that the brake band will no longer hold when the barrel 54 will begin to revolve. The revolution of the sleeve 51 with respect to the barrel will cause a relative movement of the two, *i. e.*, it will cause the barrel to move longitudinally of the shaft and away from the collar 55. This movement will continue until the barrel begins to rotate with the sleeve 51. Now when the machine has righted itself, the plate 30 will roll back in position shown in Fig. 5, thereby shutting off the current from the motor $M^a$. The spring 57 being under tension will cause the revolution of the sleeve 51 and hence the revolution of the shaft of the motor, so as to bring it back to its normal position. The sleeve 51 will be revolved rather than the barrel 54 because the latter is held by the brake band 58. The reverse revolution of the shaft $m^a$ will tend to bring the aileron back to its original position. In case the machine should tip too far on the other side then the automatic action of the movable plate 31 will tend to restore it to its horizontal position. Thus the conjoint action of these movable conducting plates 30—31 on opposite sides of the center of the device will tend to maintain the aeroplane in its horizontal position and will restore the ailerons and the motors to their original positions as explained. During the reverse movement of the sleeve 51 it will resume its normal position with respect to the barrel 54 owing to the fact that it is threaded into the opening in the barrel. This will bring the barrel up against the collar 55 when the reverse movement will be stopped. The time at which the reverse movement is stopped may be regulated by screwing the collar 55 to the desired position on the threaded portion of the sleeve 51 where it may be held by means of the set screw 56.

It may be necessary sometimes to permit a tilting of the sustaining planes, as for instance when turning so as to bank the device against the wind. All that is necessary is for the operator to shift the lever 35 in a direction which will maintain the horizontal position of the track while the main sustaining planes are tilted. The operator therefore can put the stabilizing device out of commission when he desires to do so. When the machine is brought to the horizontal position the track is also brought to the horizontal position by reversing the direction of movement of the lever 35.

I claim:

1. In an aeroplane, a main sustaining plane, ailerons therefor, a pair of motors, a common drum, flexible connections between said common drum and each of said ailerons, a differential gearing connected with the shaft of each of said motors for rotating said drum, and means operatively connected with the shaft of each motor for returning the shaft to its normal position subsequent to the deënergization of the motor.

2. In a reversing mechanism for motors, a sleeve secured to the motor shaft, a barrel rotatably mounted on said sleeve, a brake for holding the barrel normally stationary, and a spring connected at one end to said sleeve and at the other end to said barrel.

3. In a reversing mechanism for motors, a sleeve secured to the motor shaft, a barrel rotatably mounted on said sleeve, a brake for holding the barrel normally stationary, a spring connected at one end to said sleeve and at the other end to said barrel, and means for limiting the reverse movement of the shaft.

4. In an aeroplane, a main sustaining plane, ailerons therefor, a pair of motors, a common drum, flexible connections between said common drum and each of said ailerons, a differential gear connected with the shaft of each of said motors for operating said drum, means operatively connected with the shaft of each motor for returning the shaft to its normal position subsequent to the deënergization of the motor, and means controlled by the tilting of the aeroplane for causing the energization of the motors in accordance with such tilting.

JOHN R. JUNKIN.

Witnesses:
SOLON C. KEMON,
AMOS W. HART.