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R. H. MILES

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AUTOMATIC CONTROL FOR AEROPLANES

Filed March 27, 1946

2 Sheets-Sheet 1

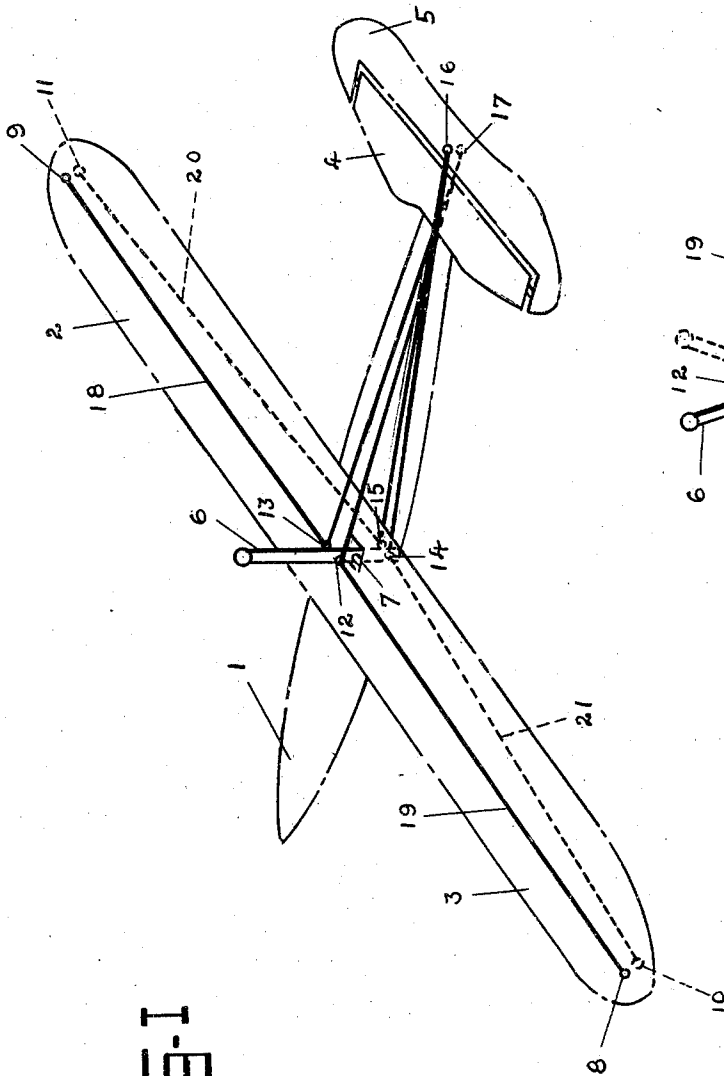


Fig. 1

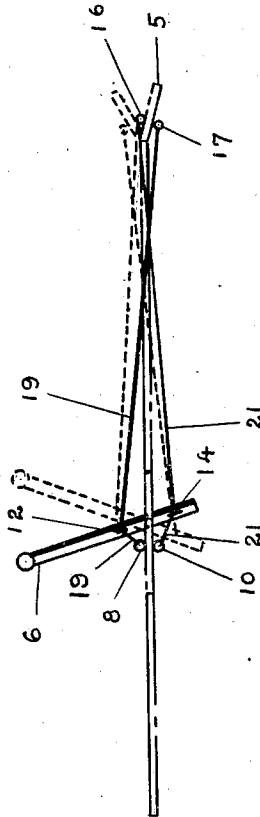


Fig. 2

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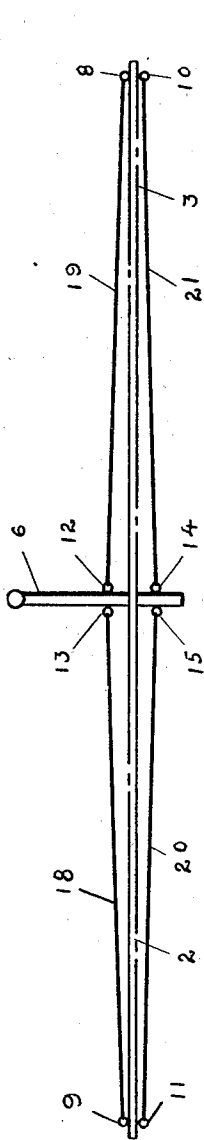


Fig. 3

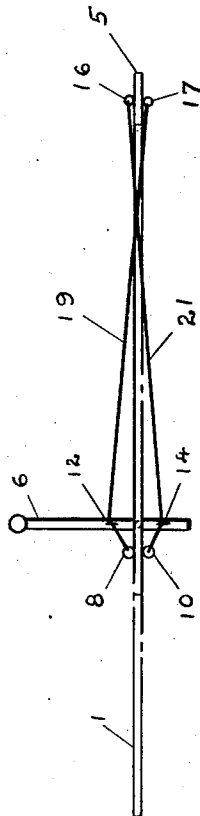


Fig. 4

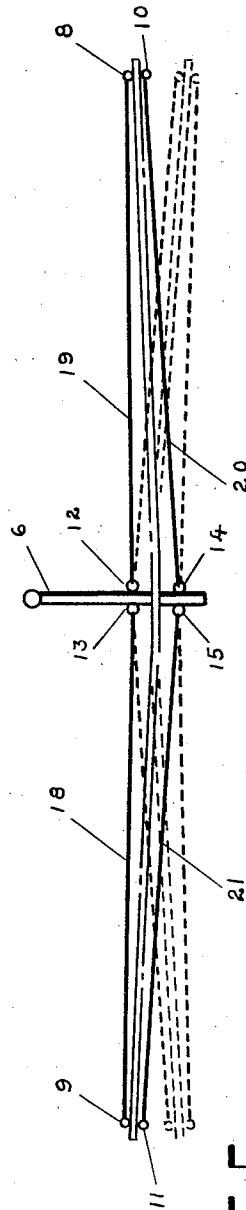


Fig. 5

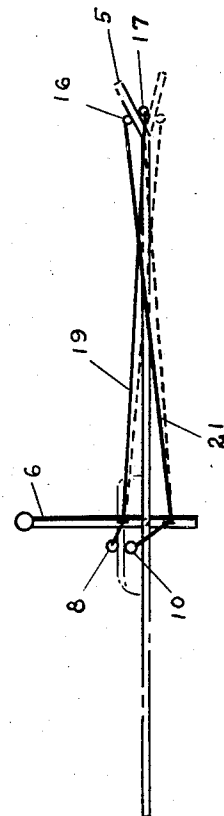


Fig. 6

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UNITED STATES PATENT OFFICE

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AUTOMATIC CONTROL FOR AEROPLANES

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1 Claim. (Cl. 244—82)

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Flying machines are driven by motors and the power developed by the motor is governed by a throttle valve which is opened or closed as the need for power varies. The more power that is developed by the motor, the faster the flying machine will travel if the machine is held to a uniform altitude, but if the machine is not held to a uniform altitude then there is a tendency for the machine to climb and travel at practically the same speed so that the extra power is used up in raising the flying machine rather than increasing the speed of it. This is due to the fact that the air under the wings tends to press the wings up and the suction created above the wings tends to lift the machine as well. This reaction is caused by the increase in speed which tends to lift the machine which in turn causes the speed to decrease, the excess energy being absorbed in the lifting of the machine.

Heretofore the flying machine has been kept at the same altitude when the engine power is increased by shifting the stabilizer or the elevator or the trim tab on the elevator. This is done by turning a crank in the fuselage. This also necessitates pushing the joy stick forward which would shift the position of the elevator, until the one balanced the other. The pilot would have to hold the stick forward until the cable had been wound so that the stabilizer and the elevator would balance themselves after which the joy stick would remain in proper position if the pilot let go. Until this condition was reached a great muscular effort would be used by the pilot and the pilot would be at a disadvantage in holding the stick in one hand and winding the cable with the other until the stabilizer and elevator were in balance, and then the flying machine would travel forward without changing altitude.

My invention consists of combining the parts so that the stabilizer and the elevator are operated to coordinate with each other by the movement of the joy stick in which case the trim tabs can be omitted. For this purpose, I provide a cable attached to the tip of each wing on the under side. In this way two cables are attached to the tip of each of the two wings, four cables in all being so attached, two of which are attached to the upper side of the tips of the two wings and the other two are attached to the under side of the tips of the two wings.

In the ordinary operation of flying machines cables run directly from the joy stick to the elevator by which the elevator is raised or lowered as the joy stick is moved backward or forward, that is when the joy stick is pulled back the ele-

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vator is raised and when the joy stick is moved forward the elevator is lowered.

These two cables are dispensed with or replaced by the four cables above referred to.

5 The two cables above the wings pass through guides that are placed above the center on which the joy stick swings and the two cables that are below the wings pass through guides that are placed on the joy stick below the center on which the joy stick swings. These four cables extend 10 backward and are attached to the elevator in such manner that when the joy stick is moved backward the elevator raises and when the joy stick is moved forward the elevator is lowered.

15 When the joy stick is pulled back the elevator is lifted and this causes the flying machine to rise. In starting to rise, an extra strain is put on the tips of the wings bending them up which pulls on the lower cables which tends to pull the 20 elevator up further. The joy stick will then remain in the position in which the pilot has set it without any extra muscular effort on the part of the pilot, it being understood that the trim tabs operated by the crank can be omitted.

25 When the plane increases its power and speed it flexes the wings and the excess power and speed is taken up in lifting the airplane without materially changing the speed, and this is especially true when the joy stick is in a fixed position, so that the joy stick does not have to be 30 moved for the purpose of holding the plane at a uniform speed.

In the drawings;

35 Figure 1 is a perspective diagrammatic view of the aeroplane showing the cables for the automatic control in position above and below the wings and connected to the top and bottom of the elevator.

40 Figure 2 is a diagrammatic view of the plane showing the joy stick and the elevator and the cables connecting them.

Figure 3 is a diagrammatic view of the horizontal wings and the joy stick and the cables connecting the tips of the wings with the joy stick.

45 Figure 4 is a diagrammatic view of the plane showing the joy stick and the elevator and the cables connecting the joy stick and the elevator.

50 Figure 5 is a diagrammatic view of the wings of the plane, the wings being shown flexed upwardly in full line and flexed downwardly or in normal position in dotted lines, the flexing being exaggerated to some extent.

Figure 6 is a diagrammatic view of the plane 55 showing the elevator raised up in full lines and

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pushed down in dotted lines, due to the flexing of the wings as shown in Figure 5.

It will also be understood that in Figures 1, 3, 4, 5 and 6 the joy stick is shown in neutral position and in Figure 2 the joy stick is shown advanced in full lines and is shown retracted in dotted lines.

In the drawings like reference numerals indicate like parts.

In the drawings reference numeral 1 indicates the body or fuselage of the plane, 2 and 3 indicate the wings of the plane. 4 indicates the stabilizer and 5 indicates the elevator, 6 indicates the joy stick which is pivotally mounted at 7 on a compound pivot that permits it to swing in any direction, this being the usual manner of mounting the joy stick. On the top of the wings at either end are fastened the eyes 8 and 9 and on the bottom of the wings are fastened the eyes 10 and 11. On the joy stick are fastened the eyes or pulleys 12 and 13 above the pivot 7 and the eyes or pulleys 14 and 15 below the pivot.

On the elevator is fastened the eye 16 on top of the elevator and the eye 17 below the elevator.

Fastened to the eye 9 is the cable 18 shown in full lines which passes through the eye or pulley 13 above the wings and is fastened to the eye 17 below the elevator. In like manner the cable 19 shown in full lines is fastened to the eye 8 and passes through the eye or pulley 12 above the wing and is fastened to the eye 17 below the elevator.

The cable 20 shown in dotted lines is fastened to the eye 11 and passes through the eye 15 or pulley below the wing and is fastened to the eye 16 above the elevator. The cable 21 shown in dotted lines is fastened to the eye 10 and passes through the eye or pulley 14 below the wing and is fastened to the eye 13 above the elevator. All of the foregoing is shown in Figure 1.

When the joy stick 6 is moved forward at the top as shown in Figure 2 the eyes or pulleys 12 and 13 will move forward with it and will draw on that part of the cables 18 and 19 that are connected to the bottom of the elevator and will pull the elevator down to the full line position shown in Figure 2 and the eyes or pulleys 14 and 15 on

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the bottom of the joy stick will move back and will give slack to the cables 20 and 21 that run to the top of the elevator and will permit the elevator to move down, and between the tension of the two sets of cables above and below the elevator the elevator will remain fixed in the position to which it is moved by the movement of the joy stick. If the joy stick remains in neutral position the elevator will remain in neutral position as is shown in Figure 4.

As the plane rises or the speed of the plane increases the wings will bend up and the cables 18 and 19 on top of the wings will shorten and the cables 20 and 21 below the wings will lengthen and this will raise the elevator and when the wings move back to normal, the cables will readjust themselves and return the elevator to its normal position.

In this way the elevator is shifted by the bending of the wings to correct any error in the flying of the plane that would be caused by the bending of the wings.

In this way an automatic effect on the elevator is secured by any bending of the wings and direct manual effect is secured by the shifting of the joy stick.

By this arrangement any great loss of speed due to too rapid climbing or to any abnormally retracted joy stick would cause the elevator to drop and correct the position of the plane without the pilot's intervention or in spite of the mistake of the pilot.

I claim:

In a flying machine the combination of a fuselage, wings, an elevator and a joy stick, a cable attached to the end of each wing above the wing, said cables passing through guides on the joy stick above the pivot of the joy stick and being attached to the elevator on the underside thereof, a similar cable attached to the end of each wing below the wing, which cables pass through guides on the joy stick below the pivot, said cables being attached to the elevator on the top side thereof, said cables being adapted to cause a movement of the elevator on the flexing of the wings.

ROBERT H. MILES.