Sept. 15, 1942. W. I. FERNALD 2,295,836

RUDDER REFLEX DEVELOPER

Filed Nov. 4, 1941

Fig. 3

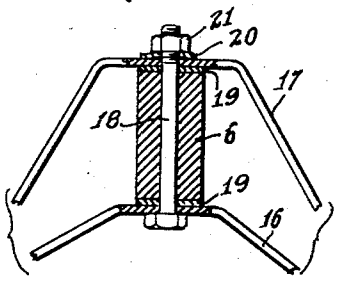


Fig. 2

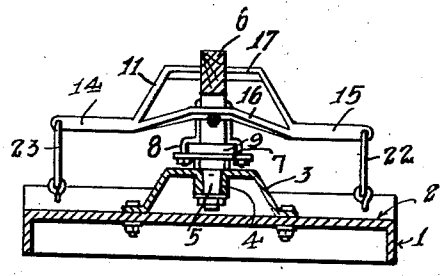
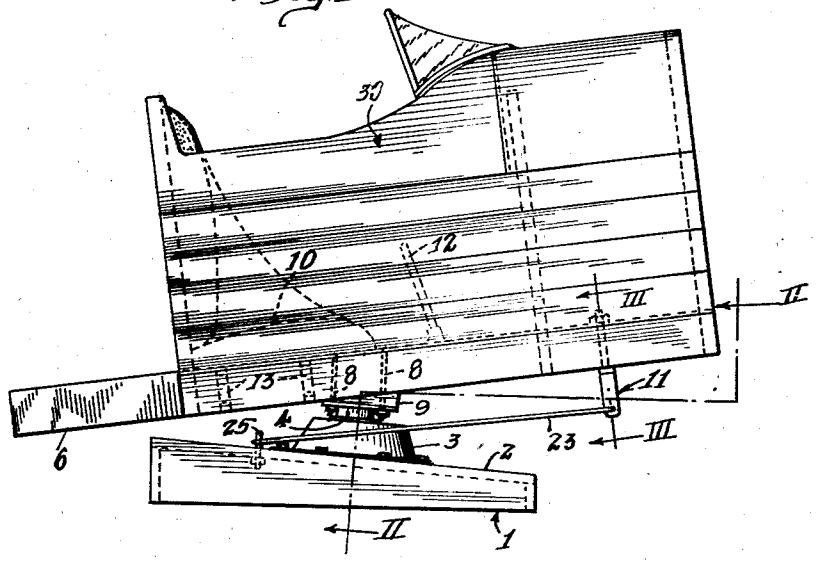


Fig. 1



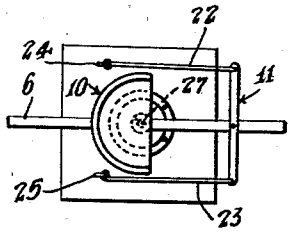


Fig. 4

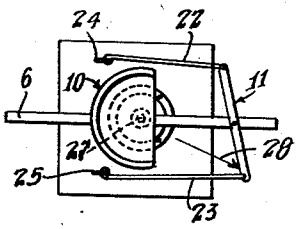


Fig. 5

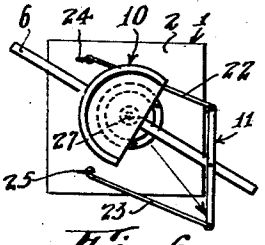


Fig. 6

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RUDDER REFLEX DEVELOPER

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4 Claims. (Cl. 35—12)

This invention relates to machines for training airplane pilots on the ground.

An object of the invention is to provide a particularly simple and inexpensive machine for developing in a student pilot natural or instinctive steering ability.

Airplane controls are so constructed that the rudder bar is turned in the opposite direction to that in which the airplane is to be deflected. Thus, a pilot presses with his right foot to turn the plane to the right. This is in contrast to most foot steered devices, such as bob sleds, in which one presses with the right foot to turn to the left and vice versa.

Numerous machines have been developed for training pilots on the ground and various rather complicated structures have been devised for causing a dirigible seat, containing the pilot, to rotate to the right in response to application of right rudder, and to the left in response to application of left rudder. The present invention differs essentially from such other machines for the same purpose in that it is extremely simple and inexpensive while at the same time producing a very realistic simulation of the rudder response of an actual airplane.

The invention will be explained by describing in detail a particular embodiment thereof as disclosed in the drawing, in which:

Fig. 1 is a side elevation of a pilot training device in accordance with the invention;

Fig. 2 is a vertical section taken along the broken line II—II of Figure 1;

Fig. 3 is a detail section in the plane III—III of Figure 1, and

Figs. 4, 5 and 6, are schematic diagrams illustrating the operation of the machine.

Referring to Figure 1, there is shown a stationary base 1 on which the movable part of the device is supported. This base 1 has a sloping top wall 2 to which there is bolted a bearing member 3 having a socket 4 (Fig. 2) which rotatably receives a tapered spindle 5. The spindle 5 is clamped to a longitudinally extending beam 6. Thus the spindle 5 may have formed integrally therewith a supporting plate 7 to which the beam 6 is clamped by yokes 8. A wedge member 9 may be inserted between the plate 7 and the beam 6 to elevate the forward end of the beam.

The beam supports a bucket seat 10 near its rear end and a rudder bar 11 adjacent the forward end. A control stick 12 may be swivel mounted at its lower end on the beam 6 intermediate the seat 10 and the rudder bar 11. The bucket seat 10 may be secured to beam 6 by angle braces 13.

The rudder bar 11 is rotatably mounted on the beam 6. Thus, as shown to best advantage in Figures 2 and 3, the rudder bar includes a right pedal 14 and a left pedal 15 which are secured to the opposite ends of a pair of vertically spaced connecting members 16 and 17, respectively. The lower member 16 passes below the beam 6 and the upper member 17 passes above the beam. Both members are pivotally connected to the beam by a bolt 18 extending therethrough. Metal thrust plates 19 are provided on the upper and lower surfaces of the beam to contact the members 16 and 17 and I prefer to provide a resilient washer 20 between the nut 21 on bolt 18 and the upper member 17. By tightening or loosening the nut 21 the frictional resistance to rotation of the rudder bar may be varied.

To normally maintain the beam 6 in a predetermined position of orientation with respect to the base 1 and maintain the rudder bar 11 in neutral or crosswise position with respect to the beam 6, a pair of resilient tension members 22 and 23 are stretched between the base and the ends of the rudder bar. Thus the tension member 23 is connected between the right end of the rudder bar 11 and an eye 25 on the base 1, which eye is positioned directly back of the right end of the rudder bar 11 when the bar and the beam are in neutral position. Similarly the tension member 22 is stretched between the left end of the rudder bar and an eye 24 on the base 1, as shown schematically in Figure 4.

By virtue of the fact that the eyes 24 and 25 are spaced from the pivotal axis 27 of the beam 6, the tension members 22 and 23 yieldably retain both the beam and the rudder bar in the neutral position shown in Figure 4. This will be apparent by observing that, if the beam 6 is rotated clockwise about the axis 27, it tends to stretch the member 22 more than the member 23 and, although the rudder bar 11 will rotate counterclockwise on the beam 6 in response to the differential tension applied thereto by the members 22 and 23, the total tension of both members will be increased so that force is required to maintain the beam out of neutral position.

The operation of the device will be apparent from an inspection of Figures 4, 5 and 6, which indicate what happens when the pilot applies right rudder. Thus referring to Figure 5, the

application of right rudder has stretched the member **23** while relieving the tension on member **22**. The force resulting from the increased tension of member **23** is applied through the leg of the pilot (as indicated schematically by the arrow **28**) to the beam **6**, causing the latter to rotate clockwise as shown in Figure 6. Obviously, if left rudder is applied, the rudder bar **11** is rocked clockwise with respect to the beam **6**, thereby increasing the tension on the member **22** and causing it to swing the entire rotatable assembly in counterclockwise direction, or to the left.

The structure, therefore, always functions to rotate the beam **6** and the seat **10** about the pivotal axis **27** to the right when right rudder is applied and to the left when left rudder is applied. Furthermore, the response of the rotatable assembly is slow because of its inertia. The speed of response can be varied somewhat by increasing or decreasing the weight of the rotatable assembly and also by varying the strength of the resilient connecting members **22** and **23**.

The members **22** and **23** may be made of rubber, preferably in the form of laminated strands, or they may be helical tension springs.

There is shown in Figure 1 a housing **30** which largely encloses the pilot and tends to simulate to the pilot the fuselage of an airplane.

It is usually desirable to provide the dummy control stick **12** and instruct the student to use it, although it has no actual effect on the machine.

A student pilot while using the machine should keep his eyes focused on a distant object or the horizon and endeavor to swing the machine off neutral and then return it to neutral position with as little overswing as possible. It is often desirable for an instructor to stand behind the machine and force it off neutral position at intervals (by pressing against the rear end of the beam **6** with his foot) and then observe how the pilot manipulates the rudder to bring the machine back to neutral. Thus assume that the instructor has swung the machine to the right into the position shown in Fig. 6. If the student pilot's reflexes have been properly developed, he will immediately and instinctively apply left rudder, which will have the desired effect of swinging the machine leftward back toward neutral position. On the other hand, if the pilot's reflexes are not properly developed his natural inclination will be to apply right rudder, which will tend to hold the machine in the deflected position of Fig. 6, or advance it still further to the right.

The machine can be adjusted to simulate a plane on the ground before take-off by removing the wedge **9** to bring the beam **6** parallel to the top **2** of the base **1** and then elevating the front end of the base **1** to level the top **2**. When the machine is adjusted to the angle shown in Figure 1 it more nearly simulates the condition of an airplane at the time of take-off.

Although, for the purpose of explaining the invention, a particular embodiment thereof has been described in substantial detail, it is to be understood that various changes from the particular construction shown will occur to those skilled in the art and the invention is to be limited only to the extent set forth in the appended claims.

I claim:

1. A device of the type described comprising: a base member, a frame having a seat thereon, means rotatably supporting said frame on said base member, pedal means including right and left pedals, means supporting said pedal means for forward and rearward movement of said pedals with respect to said frame, yieldable connecting means directly connecting said pedal means to said base member for yieldably retaining said frame in a predetermined position of rotation with respect to said base and yieldably retaining said pedals in neutral position.

2. A device of the type described comprising: a base member, a frame having a seat thereon, means rotatably supporting said frame on said base member for horizontal swinging movement, a rudder bar pivotally mounted on said frame in front of said seat, and spring means interconnecting the opposite ends of said rudder bar to said base member, said spring means being connected to said base member at such points thereon that rocking movement of said frame in one direction with respect to said base and rocking movement of said rudder bar in the opposite direction with respect to said frame both distort said spring means in the same way whereby the reaction of said spring means in response to rocking of the rudder bar tends to rock the frame in the same direction.

3. A device as described in claim 1, including means for adjustably frictionally resisting rotation of said rudder bar on said frame.

4. A device of the type described comprising: a base member, a frame, and means rotatably supporting it on said base member for rotation about a vertical axis, a seat on said frame member, a rudder bar pivotally supported on said frame member in front of said seat, and a pair of tension spring means, one connected from one end of said rudder bar to said base member and the other connected from the other end of said rudder bar to said base member, both said tension members extending rearwardly from the ends of said rudder bar substantially parallel to the vertical longitudinal plane of said frame member and being connected to said base at points rearwardly disposed from the pivotal axis of said frame member.

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