The invention relates to aircraft, and more particularly to devices for use in teaching the operation of aircraft.

An object of the invention is to provide a device of the above kind which is used on the ground and which will give the person operating such device all the sensations of actual flying and which will be absolutely safe to use.

Another object of the invention is to provide a glider or other type of plane suitably supported on the ground and a source of artificial wind for operating the glider while on the ground.

Another object of the invention is to provide a support for the plane and wind fan which is rotatable so that when used outdoors advantage can be taken of prevailing winds.

Another object of the invention is to provide a glider which is so constructed as to operate satisfactorily under the above stated artificial conditions.

Other objects will be apparent from the following description and claims when considered with the accompanying drawings, in which

Fig. 1 is a side elevation of one form of arrangement;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is a side elevation of a modified form;

Fig. 4 is a front view of the glider;

Fig. 5 is a side view of the glider;

Fig. 6 is a top view of a part of the glider;

Fig. 7 is a section on the line 7-7 of Fig. 5;

Fig. 8 is a detail illustrating the cross wires;

Fig. 9 is a detail illustrating the universal mounting of the glider;

Fig. 10 is a section on the line 10-10 of Fig. 9;

Fig. 11 is a detail illustrating the bumpers for the wings; and

Fig. 12 is a detail illustrating a 3-way valve.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Like reference characters denote like parts in the several figures of the drawings.

In the drawings accompanying and forming part of this specification, practical commercial embodiments of the invention are shown, but as such illustrations are primarily for purposes of disclosure, it will be understood that the structures may be modified in various respects without departure from the broad spirit and scope of the invention as hereinafter defined and claimed.

Referring now to the drawings and more particularly to Figs. 1 and 2, the arrangement illustrated comprises a glider 20 mounted upon a support 52, a shutter arrangement 21 for varying the wind and a blowing arrangement 22 for supplying the wind. These devices are mounted upon a framework indicated by 24 which is supported by a plurality of flanged wheels 25 riding on a track 23. If desired, a piece of canvas 120 or similar device may also be arranged on the ground to prevent blowing of dust.

The wind supplying arrangement 22 comprises an electric motor 27 driving a fan 26, as illustrated.

The shutter arrangement 21 comprises a set of vertical shutters 31 pivoted to the framework of the device at 33. The free ends of the shutters are connected by a bar 131 which is driven by a connecting rod 32, which is connected to a rotating crank 30 mounted on a vertical shaft 130. The shaft 130 is driven by a suitable worm and gear arrangement indicated by 23 which in turn is driven by a flexible shaft or other transmission device 28 connected to motor 27.

The horizontal shutters 34 are individually pivoted to the framework at 35 and are connected together by a bar 36 which is driven by connecting rod 37 connected to a crank 38. The crank 38 is driven by a suitable worm and gear arrangement indicated by 138, which in turn is driven by the flexible shaft 28.

It will be understood that, if desired, both horizontal shutters 34 and vertical shutters 31 may oscillate back and forth as the fan 26 rotates to vary the breeze and thereby to simulate the shifting of the wind which would take place in actual flight. Of course, if desired, the entire shutter arrangement 21 may be omitted. In fact, in some cases it is preferable to omit the shutter device 21 entirely, depending upon the natural eddies and wind variations obtained directly from the fan 26.

Referring now to Figs. 4, 5 and 6, the aircraft shown is a glider and comprises a central frame 40 made up of structural members in accordance with modern aircraft practice. The wings are denoted by 41 and are connected to the frame 40 and are reinforced by suitable trusses or struts 44. It will be noted that the dihedral angle of the wings 41 is approximately 4°.

Pivoted to the wings 41 at 43 are the ailerons 42. It will be noted that the ailerons do not extend all the way to the frame 40 and that the wings 41 extend full depth at their inner portions.

The rear of the frame 40 is provided with metal plates 50 and the horizontal stabilizer 45 is disposed above the line of the wings 41. The ele-
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ator is denoted by 46 and is pivoted to the frame at 47. The rudder is denoted by 48 and is pivoted at 49. A tail skid 54 is provided for limiting the backward movement of the glider. It is noted that a side web 74 is provided between the structural members, as shown, to give stability to the glider and to help hold it in the wind stream.

For supporting the glider on the ground a base frame 32 is provided having a sufficiently large area to give the necessary stability. Supported at the top of the frame is a rod 53 on which is universally mounted a supporting plate 54 which is secured to the structural members of frame 46, as shown. For adjusting this supporting point the plate 54 is provided with a guide plate 154 carrying a pair of guides in which is slidably mounted a member 55 which actually engages the rod 53. The rod passes freely through a slot 153 in plate 54 and the connection between rod 53 and member 55 is loose so that a substantially universal connection. At this point is provided the plane being free to tip sideways and forward and backward in operation.

For adjusting the position of the member 55 with respect to the frame plate 54, adjusting screws 76 are provided having suitable lock nuts. Screws 56 are threaded into ears 156 stuck out from guide plate 154 to engage ears 155 secured to member 55.

Another manner in which the glider may be balanced for operations of different weight is by adjusting the seat 60. The seat 60 is supported by a member 63 which carries a nut threaded on the adjusting screw 62. The seat is further supported by a depending member 161 which straddles the square end 162 of the adjusting screw 62 the seat 60 may be shifted. It will be understood that any one of the three balancing devices above described may be used separately with the other, or any of the others. For instance, the balancing may be obtained by shifting the seat 60 alone, or it may be obtained by shifting the glider with respect to the supporting shaft 53, or it may be obtained by shifting the weight 74.

The glider may be controlled in the usual way. It has a control stick 65 which is so connected to the ailerons 42 and to the elevator 46 that when pulled backwards the elevator is raised; when pushed forward, the elevator is depressed; and when thrown sideways, the aileron on the side to which the stick is pulled will be raised, and the aileron on the other side will be lowered. Suitable steering foot pedals 66 may be provided connected to the rudder 48 in the usual way.

If desired, a sighting device 67 may be provided comprising cross wires 68 (Fig. 5) supported on a pair of telescoping rods 69 having an adjusting setscrew 169 by which the elevation of the cross wires 68 can be adjusted to meet the requirements of the particular operator. For this sight device an artificial horizon may be provided which may be in the form of a strand or wire 170 (Fig. 5). By this arrangement, if desired, the operator can keep the glider flying on the level, using the artificial horizon as a guide by keeping the cross wires trained on the wire 170.

For preventing the wings 41 from crashing against the ground if the glider should dip too far to either side, spring bumpers 74 (Fig. 11) may be provided. The rudder 48 is connected to the wings by ordinary hinge devices indicated 75 by 76 so that they may pivot at these points as they are flexed when they hit the ground.

It has been found that a commercial glider such as the one for making actual flights is unsuitable for artificial use, as described. It has been found necessary, in order to make the glider respond properly to the controls, to shorten the wings 41 crosswise of the glider and to narrow the wings 41 lengthwise of the glider. Similarly, it has been found desirable to increase the width of the ailerons 42 lengthwise of the glider considerably. Also, it was necessary to enlarge the tail surface by enlarging the elevators 46 and it was also necessary to enlarge the rudder 48. Furthermore, it was found desirable to increase the area of the stabilizing area 74 to assist in bringing the glider back into the air after falling and the ailerons 42 have also been made considerably thinner than those used on a glider for actual flight. In addition, it was found desirable to make the sweep of the lower part of the frame 40 from stem to stern more nearly straight so as to give more clearance when the glider drops down so that the tail skid 51 can take the shock as the glider drops to the ground.

If desired, the entire arrangement may be mounted upon a pneumatic or hydraulic hoist indicated by 50 in Fig. 3. In this case the circular track 23 would be omitted since it is possible to rotate the table 52 of the hoist or lift about the cylinder 51. It will be understood 40 that this lift will be similar to the hydraulic lift used for raising automobiles.

One way of accomplishing this result is to provide a three-way valve 83 (Fig. 12) having 50 a pipe 84 connected to the lower side of the cylinder 81 of the lift 50. Another pipe 85 is the exhaust pipe and the third pipe 86 is connected to a source of supply of water or air under pressure. The lever 183 of the valve 85 is connected by rod 87 to the stick 65. The arrangement may be such that in normal operation of the glider the conditions of the valve 83 will not be necessary to raise the cylinder 81, thereby raising the table 82. When the cylinder 81, thereby raising the table 82 to the top. When it is desired to descend, the stick 65 is pushed forward all the way which connects the exhaust pipe 85 to pipe 84 allowing the pressure in the cylinder 81 to be relieved, the table 82 descending by gravity.

In order to operate the above device, the glider will be balanced for the weight of the operator by any of the means above described. The fan 22 will be turned on either with or without the shutters 21 (these being omitted in Fig. 5). The operator will then operate the control stick 65 and the foot pedals 66 in the way described.
same manner as he would operate an actual glider in flight and he will receive substantially the same sensations. If he desires, he may keep the glider on the level by keeping the cross wings 5 on the artificial horizon 178. If the glider starts to tip to one side or the other, the operator can rectify such condition by moving the joy stick 65 in the proper direction, and likewise, if the glider starts to take an ascending or descending direction such condition may be similarly controlled. Within limits, the direction of the glider in azimuth may be controlled by the foot pedals 66.

The above arrangement has obviously many advantages. It is very useful as an instruction device for teaching students to fly. It helps to coordinate the various movements which are necessary to fly an actual glider or airplane. The arrangement is also useful as an amusement device by which laymen may indulge in an enjoyable sensation of actual flight at small cost and with absolutely no danger since the arrangement is always supported by the ground.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A device of the character described, a glider comprising a body having means for controlling said glider, means for universally mounting said glider on a support, a substantially vertical stabilizing web on said body, a source of wind external to said glider, whereby said web assists in holding the glider in the wind stream.

2. A glider for the purpose specified comprising a body, wings, ailerons, stabilizer, elevator and rudder, and a stabilizing web on said body between front and rear.

3. A glider for the purpose specified comprising a body, wings extending laterally from said body, ailerons pivoted to the rear of the wings, a stabilizer at the rear of said body, an elevator pivoted to the stabilizer, a rudder, and a stabilizing web on the body between said wings and rudder, said stabilizer and elevator being raised above the line of the wings, said wings being smaller, both across the plane and lengthwise the plane, said ailerons being smaller across the plane but larger lengthwise the plane, said elevator and rudder also being larger, than a corresponding glider suitable for actual flight.

4. In an arrangement of the character described, a ground aircraft trainer comprising a body having wings, ailerons, a seat forward and below said wings, controls at said seat, a stabilizer, an elevator, a rudder, a base support adapted to rest on a flat surface, a universal connection between said body and support near the center of gravity of the glider, and means for balancing said glider about said universal connection for operators of different weight.

5. In combination, a lift, an aircraft on said lift, and connections between the control element of the aircraft and the lift to cause said lift to rise and lower at the will of the operator.

6. In combination, a lift, an airplane universally mounted on said lift, a fan for supplying an air stream to said airplane also on said lift, and connections between the control stick and the lift to cause said lift to rise when the stick is pulled all the way back, and to lower when the stick is pushed all the way forward.

7. In an outdoor aircraft arrangement for simulating actual flight, a circular track supported on the ground, a framework bridging said track, an air fan on said framework for creating an air stream, an aircraft also on said framework universally mounted thereon to receive the stream of air, whereby the person operating said aircraft will receive sensations of actual flight, said framing being rotatable on said track to take advantage of natural atmospheric winds.

8. In an outdoor aircraft arrangement for simulating actual flight, a framework, an air fan on said framework for creating an air stream, an aircraft also on said framework universally mounted thereon to receive the stream of air, whereby the person operating said aircraft will receive sensations of actual flight, and means for rotating said framework to take advantage of natural atmospheric winds.

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