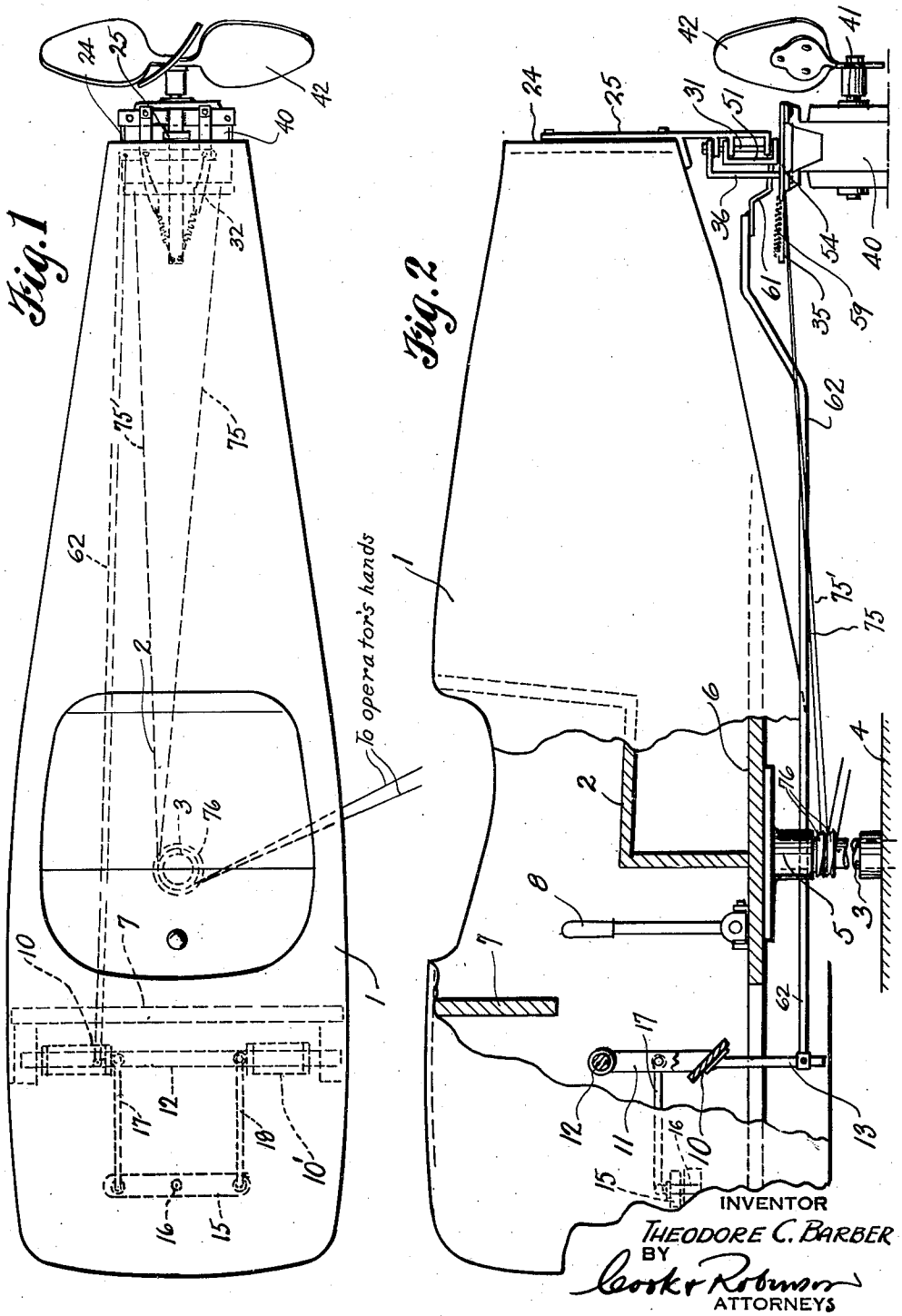
April 17, 1945. T. C. BARBER 2,373,653

TRAINING EQUIPMENT FOR AIRPLANE PILOTS

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TRAINING EQUIPMENT FOR AIRPLANE PILOTS

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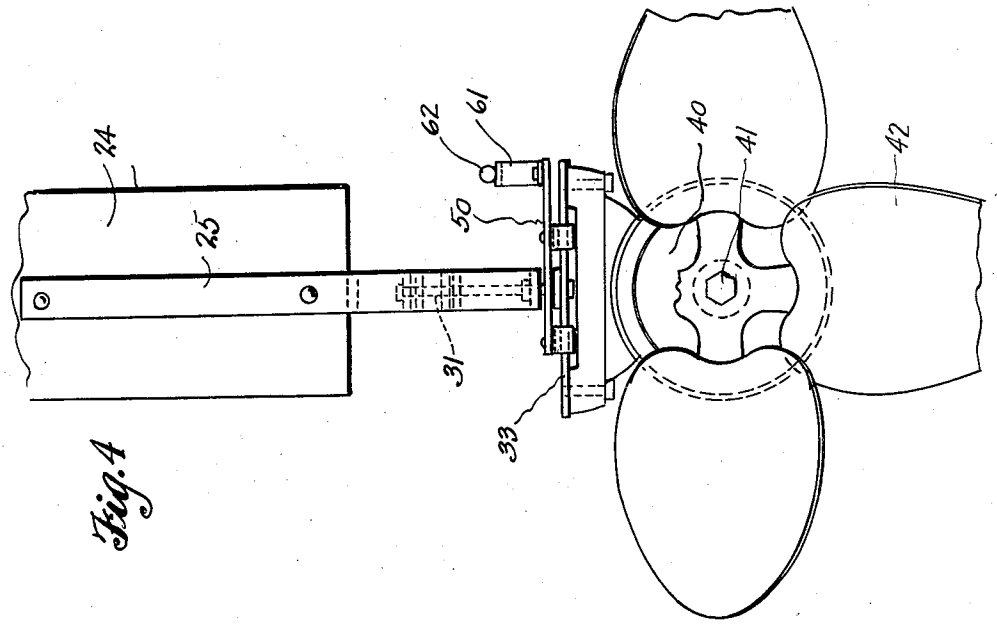


Fig. 4

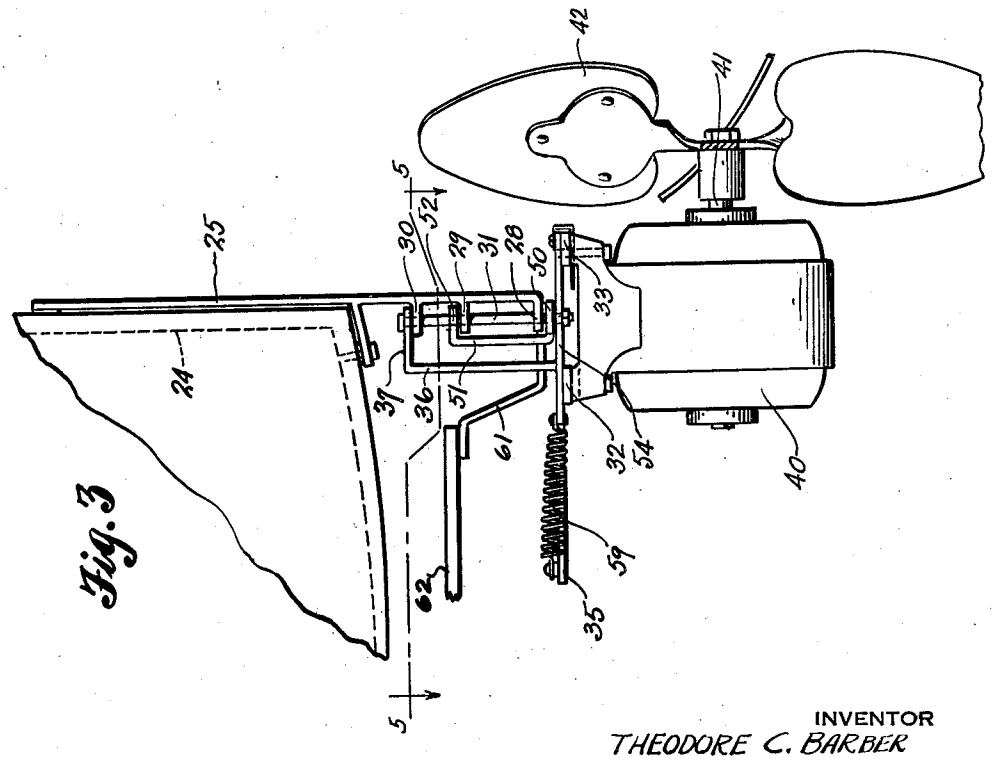


Fig. 3

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TRAINING EQUIPMENT FOR AIRPLANE PILOTS

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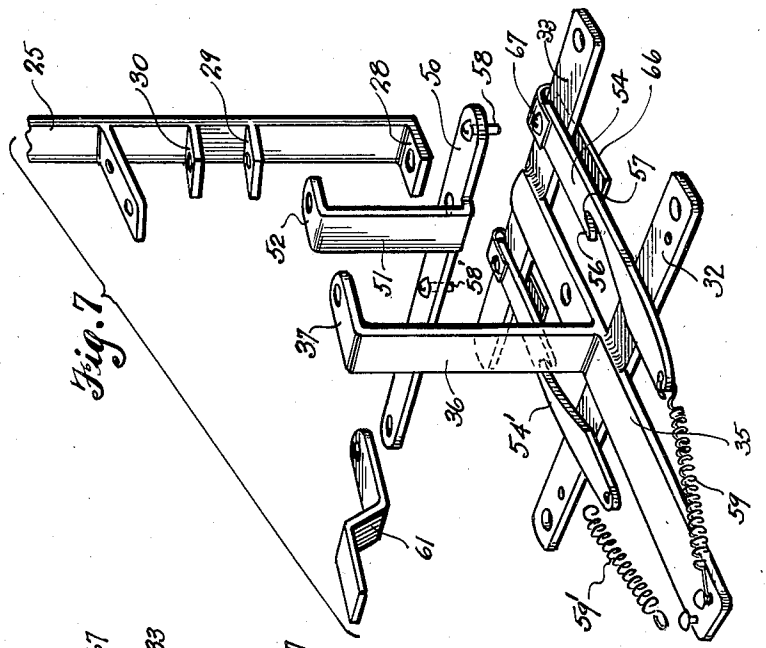


Fig. 7

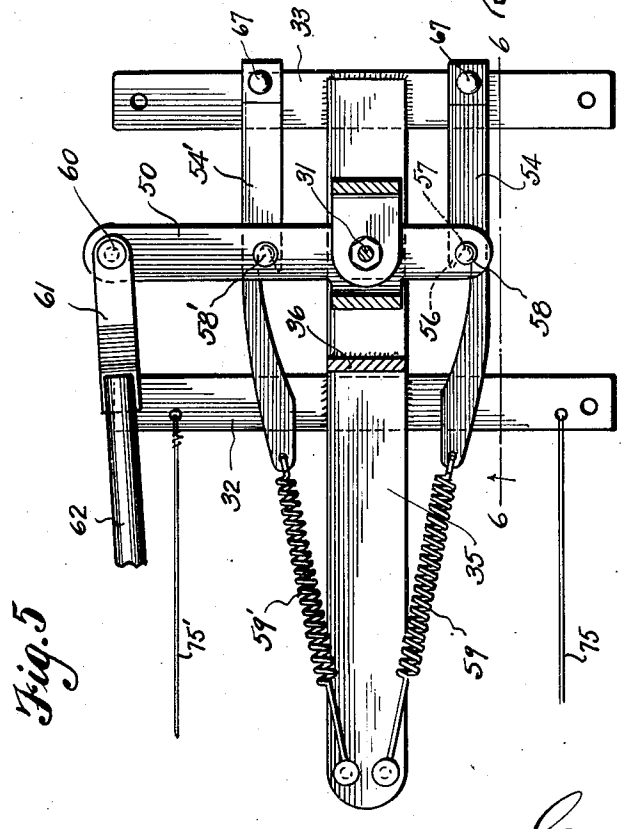


Fig. 5

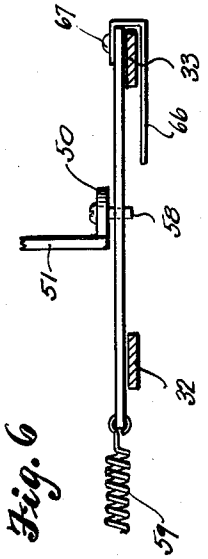


Fig. 6

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UNITED STATES PATENT OFFICE

2,373,653

TRAINING EQUIPMENT FOR AIRPLANE PILOTS

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Application March 1, 1943, Serial No. 477,497

3 Claims. (Cl. 35—12)

This invention relates to airplane pilot training devices and it has reference more particularly to what is known as a "rudder control trainer," to be used for the ground training of student pilots in the uses and manipulation of the airplane rudder for controlling the altitude or action of an airplane when moving on the ground, such, for example, as when landing, or when taking off or taxiing from place to place.

To better explain the objects of the present invention, and to impart a better understanding of its uses, it will here be stated that the rudder of the typical, present-day airplane is used quite differently, with reference to aileron and elevator operation, for the control of an airplane when moving on the ground, as in landing or in taking off, than it is used when the plane is in normal flight maneuvers, and it is quite significant that while slight misuse of the rudder in flight may result only in "sloppy" flying, the same degree of misuse when the plane is moving on the ground, as in landing, taking off or taxiing, may result in the airplane getting completely out of control and being damaged due to ground looping. Therefore, it is quite important that adequate training in the control or handling of an airplane on the ground be had before flying is attempted.

It is further to be explained that, due to the characteristic design of the usual types of airplanes, except those using a tricycle landing gear, when a plane traveling on the ground once starts to turn to right or left, it has a decided tendency to continue to turn; this being due to the fact that the center of weight is rearward of the center of pivot which latter is in the axial line of the front wheels. An experienced pilot will intuitively detect the turning action of the airplane on the ground and will act promptly to correct it before the turn reaches a dangerous degree, but an inexperienced pilot may permit the airplane to turn too far before he realizes the condition or moves opposite rudder for correction. It is to be remembered, in this connection, that since flying speed of the airplane is lost immediately upon landing, the effectiveness of the rudder for direction control decreases materially because of the decreased air pressure against it. Therefore, the greatest danger of damage from ground looping is during that period when the plane is moving at a comparatively slow speed and does not have adequate rudder control, but still is moving fast enough to cause serious damage to the plane if it ground loops.

In view of the foregoing explanation, it has been the principal object of this invention to provide a pilot training equipment whereby a student pilot may be taught and will be helped in learning how to manipulate the rudder of an airplane for the control of the airplane when moving on the ground.

It is also an object of the invention to provide training equipment for the purpose above stated that is constructed to simulate the construction of the cockpit of the typical training airplane, and to equip this with parts corresponding to the usual controls including stick, throttle lever and rudder pedals in connection with parts that operate to cause turning and whereby a student may practise changing direction or turning to any designated direction and then holding the trainer steady by manipulation of the rudder control pedals in a manner like that required in actual control of an airplane moving on the ground as in landing or taking off.

Still another object of this invention is to provide a trainer comprising a cab, resembling the airplane cockpit, equipped with seat for the student pilot, with controls as above mentioned and also with means whereby an instructor may turn or influence the turning of the cab to different directions on a supporting pivot so that the pilot may practise the rudder action that is necessary to overcome these outside influences which might be made to resemble cross winds, or other conditions apt to be encountered.

Still further objects of the invention reside in the details of construction of parts, in their assembled relationship, their action and in the mode of use of the device.

In accomplishing these and other objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a plan view of a rudder control trainer embodied by the present invention.

Fig. 2 is a side view of the same.

Fig. 3 is an enlarged side view of the turning and direction control devices of the present invention.

Fig. 4 is a rear end view of the trainer and its control devices.

Fig. 5 is a horizontal section on line 5—5 in Fig. 3.

Fig. 6 is a sectional detail on line 6—6 in Fig. 5.

Fig. 7 is a perspective view of parts of the equipment in a disassembled relationship.

Briefly described, the present device comprises a cockpit structure or cab mounted for turning about a vertical pivot shaft, or standard, and

equipped at its rear end with an electrically driven fan carried on a frame that may be rotatably adjusted about a vertical axis or pivot to cause lateral reaction on the cab that will cause it to turn on its supporting pivot in the direction determined by the direction of reacting forces, and which adjustment of the motor is under control of the student pilot by his manipulation of the rudder control pedals. Also, provision is made whereby an instructor, or person outside the trainer, may apply certain turning forces to simulate those of cross winds, or the like, that the student pilot may counteract or correct by rudder action.

Referring more in detail to the drawings—

1 designates, in its entirety, what I have referred to for convenience in description, as the cab of the training device. This cab is constructed to resemble and is substantially in accordance with the cockpit of a training airplane, and is equipped with a seat 2 for the student in training and also has parts resembling the usual control devices to which he has access when in the seat. This cab is supported by and is adapted to rotate on a vertical pivot standard 3 fixed in a base 4. The upper end of the standard is rotatably contained in a bearing 5 fixed to the bottom or floor 6 of the cab, and preferably the location of the bearing is such that there will be an approximate balance when the student is seated in the cab.

Inside the cab and forwardly of the seat, is the instrument panel 7. Also, at the usual location, is the joy stick 8, and the right and left rudder control pedals 10 and 10'. The rudder control pedals are suspended each by a stirrup 11, from a horizontal cross rod 12 that is fixedly supported in the cab, and extended downwardly from one of these stirrups below the pedal, is a lever arm 13, for a purpose presently explained.

The rudder control pedals are so connected together, that in normal position, they are alined and also provide that when one is moved forwardly from normal position, the opposite one will move rearwardly a corresponding distance. This relative action of the pedals is accomplished by the following means: Extended transversely of the cab, within its forward end portion, is a cross beam 15 centrally pivoted by a pivot bolt 16, and connected pivotally with opposite ends of this cross beam and with the pedal suspending stirrups, are links 17 and 18. Thus, when one pedal is pushed forward, the other will move rearwardly a corresponding distance.

Affixed rigidly to the rear end wall 24 of the cab frame and centrally thereof, is a vertical bar 25. This bar extends somewhat below the bottom wall of the cab, as noted in Fig. 3, and is formed at its lower end with a forwardly turned foot 28. Also, extending forwardly from the lower end portion of the bar 25, at locations above the foot and spaced somewhat apart, are lugs 29 and 30, and extended downwardly through openings in these parts 28, 29 and 30, is a pivot bolt 31 whereby a base frame structure for the mounting of the electric motor which drives the fan, is pivotally secured.

The base frame structure comprises two spaced, parallel cross bars 32 and 33, that are rigidly joined across their center portions by a forwardly extended bar 35 as seen best in Figs. 5 and 6. On the bar 35, is a vertical post 36 with back turned foot 37 at its top end that closely overlies the lug 29. The pivot bolt 31 extends through the foot 37 and also through the bar 35 thus to mount the motor mounting frame for pivotal movement about the bolt 31 as a pivot axis.

Fixed to the frame structure embodied by the bars 32, 33 and 35, is an electric motor 40. This motor, as is shown in Figs. 3 and 4, is suspended from the frame by bolts 38 through its base, and the axial line of its shaft 41 is in the vertical plane of the bar 35, passing through the pivot bolt 31.

Mounted on the motor shaft 41 is an air propeller fan 42 which, in operation, will exert a counteracting force against the pivot bolt and incidentally this will be applied to the rear end of the cab. When the fan is in operation, and positioned so that the axis of the fan is alined with the pivot shaft which supports the cab, there will be no apparent turning influence on the cab, but when the motor is turned so that its shaft is pointed toward one side or the other of the cab, the reaction forces will exert a certain amount of turning pressure against the cab, depending upon the extent or angle to which the motor is tuned.

The means here provided whereby the student pilot may move the motor supporting frame to so direct the fan that the counteracting forces of the fan will operate to turn the cab toward one side or the other, or whereby he may overcome turning influences as applied by an instructor, comprises a cross lever 50 that is pivotally mounted on the bolt 31 just above the bar 35 and intermediate the bars 32 and 33. This lever 50 has a fixed vertical leg 51 with rearwardly turned foot 52 at its upper end. The bolt 31 passes through this foot 52 and also through the lever. Also, as seen best in Figs. 5 and 7, two links, 54 and 54' overlie the bars 32 and 33 at opposite sides of and in the direction of the bar 35. Intermediate its ends, each link 54 and 54' is formed with a forwardly directed hook 56 forming a hook seat 57. These hook seats, respectively, receive thereagainst studs 58 and 58' which are fixed in and extend downwardly from the lever 50 at opposite sides of the pivot bolt 31. Coiled springs 59 and 59' are attached under tension to the forward ends of the links 54 and 54' and to the forward end of the lever arm 35. Retainer plates 66 are fixed by rivets 67 to the rearward ends of the links and these are bent downwardly then forwardly to underlie the bar 33 thus to retain the links against accidental displacement therefrom while permitting the bar 33 to move slidably relative to links 54 and 54' and the plates 66.

The lever 50 extends laterally from the frame as shown in Fig. 5 and at its end, is pivotally attached, as at 60, to a bracket 61 on the rear end of a forwardly extended rod or link 62 which, at its forward end has pivotal connection with the downwardly directed lever arm 13 of a foot pedal 10 so that pressure on the right pedal whereby to produce "right rudder" will pivotally actuate the lever 50 and this, through its connection by the links 54—54' with the motor suspending frame, will turn the latter and the motor accordingly. Thus, with the fan in operation, it is apparent that by the foot pedal action, the student pilot may so direct the counter-pressure of the fan that the cab will be caused to turn on its pivot standard 3 toward one side or the other and at a rate determined by the angle of the adjustment made.

Now, in order that the instructor, without being observed by the student, may cause a turning influence to be applied to the cab, I attach cables

75—75' to the opposite ends of the cross bar 32 and extend them forwardly and there pass them over guide rollers or wheels 76 on the pivot standard 3 and then extend them to the side of the cab or to any location where they are accessible to the instructor.

By pulling one or the other of these cables, the motor mounting frame may be caused to turn on its pivot bolt 31 to one side or the other; it being understood that this is possible regardless of the foot pedal setting as held by the student because of the yielding connection provided by the springs 59 and 59' with the lever 35. The student may then overcome these artificially applied turning influences by a counter-turning rudder pressure.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is:

1. A training device of the character described comprising a cockpit frame, a seat and rudder control pedals simulating an airplane, a support for the cockpit frame about which it may turn on a vertical axis, a base mounted on the cockpit frame at one end thereof for turning on a vertical axis, a motor driven air propulsion means fixed on said base to turn therewith, means including a yieldable element connecting the rudder control pedals with said base whereby it may be held at a set position or turned in different directions from a neutral position to determined the direction of application of the reaction forces of the air propulsion means for turning the frame on its support, and another means connected with the base for turning adjustment thereof against the holding tendency of the pedal connection as permitted by the said yieldable element.

2. A training device of the character described comprising a cockpit frame, a seat and rudder control pedals simulating an airplane, a support for the cockpit frame intermediate its ends and about which it can turn on a vertical axis, a base frame supported from one end of the cockpit frame to turn on a vertical pivot axis, a motor driven air propulsion device mounted on said base, a lever arm pivoted on said pivot axis and extending to one side of the base, yieldable means connecting the lever at opposite sides of the pivot axis with the said base, means connecting the said rudder control pedals with the lever arm for turning the base as provided through the yieldable connections to determine the direction of application of reaction forces of the air propulsion means for turning the frame on its support, and another connection with the base whereby it may be turned on its pivot to the extent permitted by said yielding means.

3. A training device of the character described comprising a cockpit frame, a seat and rudder control pedals simulating an airplane, a support for the cockpit frame intermediate its ends and about which it can turn on a vertical axis, a base frame supported from one end of the cockpit frame to turn on a vertical pivot axis, a motor driven air propulsion device mounted on said base, a lever arm pivoted on said pivot axis and extending to one side of the base, yieldable means connecting the lever at opposite sides of the pivot axis with the said base, means connecting the said rudder control pedals with the lever arm for turning the base as provided through the yieldable connections to determine the direction of application of reaction forces of the air propulsion means for turning the frame on its support, a pair of cables attached to the base at opposite sides of the pivot axis and extended along the frame and about its supporting axis, and to one side of the frame for the manual turning of the base as permitted through the yielding connecting means.

THEODORE C. BARBER.