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STEERING DEVICE FOR AEROPLANES

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Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

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Fig. 6.

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STEERING DEVICE FOR AEROPLANES

This invention relates to improvements in steering devices for aeronautics. Aeroplanes are provided with three controls by means of which they are guided while in flight. A horizontal rudder is provided for turning towards the right, or towards the left, or for horizontal steering. Elevators are provided for upward and downward movement while in flight and ailerons are provided for the purpose of controlling the transverse inclination of the aeroplane.

It is evident that the operation of the three different control devices is quite difficult and necessitates much skill on the part of the pilot. The control devices usually employed in aeroplanes comprise two separate control members, one of which is a lever by means of which the ailerons and the elevator are controlled and the other is a foot operated control device by means of which the horizontal rudder is controlled. The usual control device requires the pilot to employ both his hands and his feet and is objectionable for this and several other reasons which will not be explained.

It has long been recognized that an aeroplane pilot or any one riding in an aeroplane as well as in any other vehicle, will involuntarily retain his body in a vertical position as this position seems to be naturally assumed due to some inherent faculty with which everyone is endowed.

It is the object of this invention to produce a steering mechanism for use with aeroplanes that shall be so constructed that the pilot does not have to use his feet in the steering of the aeroplane, but can operate all of the control devices above referred to by means of his hands alone. It is another object of this invention to produce a steering mechanism that shall be so designed that if the steering post, which forms part of the mechanism is maintained in a position corresponding with the natural upright position of the body, the different controls will be automatically moved in the proper direction and in this manner, a natural and simplified steering apparatus is produced.

The improved steering device which forms the subject of this invention is also so constructed, that turning towards the right or towards the left, is effected by means of a corresponding rotation of a steering wheel that resembles in appearance and function the steering wheel of an automobile. Automobiles are now so universally used that their operation has become almost a second nature to most drivers and therefore if the same result is produced by a similar apparatus in an aeroplane it can readily be seen that a pilot can more readily learn to operate an aeroplane than if he had to learn, in addition to the many other things, to control the right and left motion of the aeroplane by means of foot operated pedals as is now necessary.

This invention, briefly described, consists of a casing that is adapted to be secured to the fuselage of an aeroplane and which is provided with a bottom to which a universal joint is pivoted in such a manner that it can rotate about a vertical axis. A steering post is secured to the upper part of the universal joint and is provided at its upper end with a steering wheel. Since the universal joint is pivotally connected with the casing, it is evident that the steering post can be rotated and that it can also be tilted in any direction with respect to the casing. Two arms are connected with the universal joint and extend outwardly from the axis of rotation. Cables or other means are connected to the extremities of these arms and to the horizontal rudder, so that the latter will be moved when the steering post and the universal joint are rotated. Means is connected to the steering apparatus and to the ailerons so that the latter will be moved when the steering post is tilted transversely. Means is also provided for connecting the steering device with the elevator in such a manner that the latter will be moved when the steering post is tilted forwardly or rearwardly. The mechanism by means of which motion is transferred from the steering post to the several control devices, and which will hereinafter be described in detail, is so constructed that each of the control devices can
be operated independently of the others or simultaneously with each other.

Having thus briefly described the invention, the same will now be described in detail, and for this purpose reference will be had to the accompanying drawings in which the preferred embodiment of the device has been illustrated and in which:

Fig. 1 is a top plan view of an aeroplane showing the connections from the steering device to the different control devices in a general way;

Fig. 2 is a section taken on line 2—2, Fig. 1, and shows one way of making connection from the elevator to the steering device;

Fig. 3 is a vertical section taken on line 3—3, Fig. 4;

Fig. 4 is a horizontal section taken on line 4—4, Fig. 3;

Fig. 5 is a section taken on line 5—5, Fig. 3;

Fig. 6 is a diagrammatic representation of a slightly modified connection between the steering device and the elevator.

The invention has been illustrated in connection with an aeroplane having a fuselage, a wing, ailerons, a horizontal rudder, and an elevator, which is made in two parts, one of which is located on each side of the horizontal rudder. The plane is also provided with stabilizers and a propeller. The steering device which will now be described is so constructed that it can be used in connection with any standard aeroplane and the parts shown in Fig. 1 are intended merely to assist in the proper description of the mechanism.

The steering device in its preferred form consists of a casing which may be round or square but which has been illustrated as consisting of a square box having a bottom. This casing can be secured to the body of the aeroplane in any suitable way and by any suitable means so as to be held rigidly in place. Located within the casing is a universal joint consisting of a lower member, having two short upwardly extending arms between which the cubical metal block is located and to which this block is secured by means of pins. Member 10 is provided on its lower side with a pivot pin 14 that extends through a bearing in the bottom 9 and which is held in place by means of a nut or other equivalent means.

The pivotal connection between the lower part of the universal joint and the casing which has just been described, is merely illustrative of a means for this purpose, and in actual construction this pivotal connection is made in a more substantial manner than that shown in the drawings. Member 10 is also provided with two diametrically placed arms 16, whose ends 17 extend upwardly in a vertical direction and terminate in pivot pins 18, to which the links 19 are connected. The other ends of links 19 are connected to bars 20 that are slidable in the bearings 21 in the rear vertical side of the casing, in the manner shown in Fig. 5. The second part of the universal joint has been indicated by reference numeral 22 and is provided with spaced downwardly extending arms 23 that are pivotally connected to the cubical block 24 by means of pins 25 that are located at right angles to pins 13. The member 22 is provided at its upper end with an opening for the reception of the lower end of the steering post 25, which is held therein by means of a pin 26 or other equivalent means. A sleeve 27 is preferably provided about the lower end of the steering post which has a short section of reduced diameter for the reception of this sleeve. The steering post extends upwardly to the height desired and terminates in a steering wheel 28. A movable collar 29 is secured to the steering post and a spring 30 is interposed between this collar and the upper surface of the concavo convex cover 31. The upper end of the casing is preferably flanged inwardly as indicated by numeral 32 so as to provide a flange on which the cover 31 is supported. It is evident from the description already given that the steering post 25 can be rotated and that it can also be tilted in any direction with respect to the casing. Secured to the rear ends of the rods 20 are steel cables 33 that extend rearwardly to the transverse bar 34 which is secured to the horizontal rudder 4. It is therefore obvious that when the steering post is rotated, the horizontal rudder will also be turned so that the plane will move in the direction in which the steering wheel is rotated. For the purpose of controlling the elevator 5, I have provided a yoke member 35 which has a slot 36 that extends transversely of the casing and through which the sleeve 27 extends in the manner shown in Fig. 4. Rods 37 and 38 extend respectively rearwardly and forwardly from the yoke member 35 and are slidably mounted in bearings 30. It is evident from an inspection of Fig. 4, that if the steering post is tilted towards the right or towards the left, it will not move the yoke member 35 because the tilting movement is in the direction of the slot, but if the steering post is tilted forwardly or rearwardly, yoke member 35 will be correspondingly moved, because the slot is only slightly larger than the sleeve 27 and therefore must move whenever this sleeve moves in any direction except in the direction of the slot. It is also evident that if the steering post is tilted diagonally, the yoke member 35 will be given a forward or rearward movement that is a component of the diagonal movement of the steering post. A rod 40 is secured to the rear end of member 37 and extends to the
crank arm 41 that projects downwardly from the elevator 5. Whenever yoke member 35 is moved forwardly or rearwardly the elevator 5 will be correspondingly moved.

For the purpose of controlling the ailerons 3, I have provided another yoke member 35a, which is provided with a slot 36a and with oppositely extending guide bars 42. The yoke member 35a is exactly the same in size and shape as yoke member 35, but is located above the latter and the arms 42 extend outwardly at right angles to arms 37 and 28. Secured to the outer ends of the arms or bars 42 are cables 43 that extend to the lower ends of the lever arms 44 on the ailerons 3. These lever arms have portions 45 that extend over the ailerons and these are connected by means of a cable 46. It is now evident that if the yoke member 35a is moved, it will tilt the ailerons in opposite directions and if the steering post is maintained in a vertical position, the ailerons will be moved so as to rectify any transverse rotation of the plane.

In Fig. 6 I have shown a slightly modified means for transmitting power from the steering mechanism to the elevator 5. In Figs. 1 and 2 I show a rod 40 connected to the end of the vertical lever 41 but it is evident that by having a single rod this must be rigid and must be so mounted that it will not buckle when it is put under compression. If two cables 40a and 40b are employed, and connected to the arms 41 and 41a in the manner shown in Fig. 6, the elevator will be controlled without putting any member under compression and therefore steel cables can be employed instead of the rigid bar 40.

If we now bear in mind that the pilot automatically and involuntarily tends to retain his body in vertical position, it is evident that if the aeroplane tilts towards the right or the left, he will automatically tilt the steering post in the casing whereby the ailerons will be moved so as to produce a force that tends to turn the aeroplane in the opposite direction until it comes back to even keel.

If the ship tends to nose downwardly into a tailspin, the pilot will involuntarily lean back and carry the steering post with him and thereby adjust the position of the elevator so as to neutralize the tendency of the aeroplane to move downwardly. The turning to the right and left, as has already been explained, is effected by the turning of the steering post in a manner analogous to the corresponding steering mechanism of an automobile.

I am aware that mechanisms having two right angularly placed yoke members like those indicated by reference characters 35 and 35a have been employed in connection with automatic stabilizers of the type using a weighed pendulum, but in the previous devices of which I have knowledge, no means has been provided for changing the direction of travel in a horizontal plane, and I have therefore added an essential element to the old combination. The horizontal control is of great importance for the reason that since it is effected by the same mechanism that controls the ailerons and the elevator, the pedal controls can be eliminated and all of the three control devices moved by a single steering element that is controlled by the hands of the pilot.

I want it understood that when reference is made to the “horizontal rudder” member 4 is intended. The designation “horizontal rudder” is used because this rudder turns the plane to the right or left in a horizontal plane, as distinguished from the elevators that control the up and down motion. I also want it understood that when reference is made to ailerons any equivalent means such as distorbable wings is included. The term steering post refers to the control bar or post 25 and is not to be confused with the steering post of an automobile which is rotatable only.

From the above description it will be apparent that this invention relates to a device that can be assembled as a separate unit and applied to aeroplanes that have already been built or provided as standard equipment with new planes, and that the device is so constructed that it makes use of the natural instincts of the pilot for effecting a control of the aeroplane and for this reason simplifies the steering mechanism to such an extent that pilots can more quickly and more readily master the control of aeroplanes and since it is operated in accordance with the natural instincts of the pilot, he will involuntarily apply to the steering mechanism the proper force to correct the conditions prevailing thereby assuring that even a pilot which may have become temporarily confused, will move the steering mechanism in the right position to effect the desired correction.

Having described the invention what is claimed as new is:

1. A steering mechanism for use with aeroplanes comprising, in combination, a casing having a bottom and sidewalls, a universal joint secured to the bottom of the casing and mounted for rotation about an axis that extends upwardly from the bottom, a steering post connected with the casing by means of the universal joint whereby it may be tilted in any direction and also rotated with respect to the casing; the universal joint having outwardly extending arms, a yoke member having an elongated slot through which the steering post extends, said yoke member having guide rods
extending outwardly from each side thereof at right angles to the slot, said rods passing through holes in opposite sides of the casing, and a second yoke member surrounding the steering post with the slot at right angles to that of the first whereby the two yoke members may be moved independently or simultaneously by tilting the steering post.

2. A unitary steering mechanism for aeroplanes comprising, in combination, a casing having a bottom and side walls arranged to form a box, a universal joint having its lower portion secured to the bottom and mounted for rotation about an axis perpendicular to the bottom, a steering post connected to the upper portion of the universal, two yoke members each having a central portion provided with an elongated slot and a guide member extending outwardly from each side at right angles to the slot, the two yoke members being arranged in superposed relation with their slots at right angles, the guide members extending through bearings in the sides of the casing, the steering post extending through the slots whereby the yoke members can be moved by moving the steering post, laterally extending arms secured to the lower portion of the universal, and a handle secured to the upper end of the steering post.

In testimony whereof I affix my signature.

HAROLD G. DAVIS.