April 6, 1937. B. MALINOWSKI 2,076,088

CONTROL MECHANISM FOR AIRPLANES

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Fig. 1.

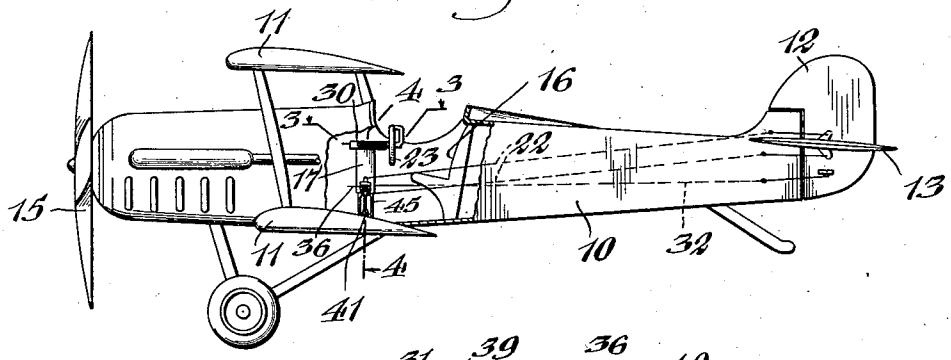


Fig. 2.

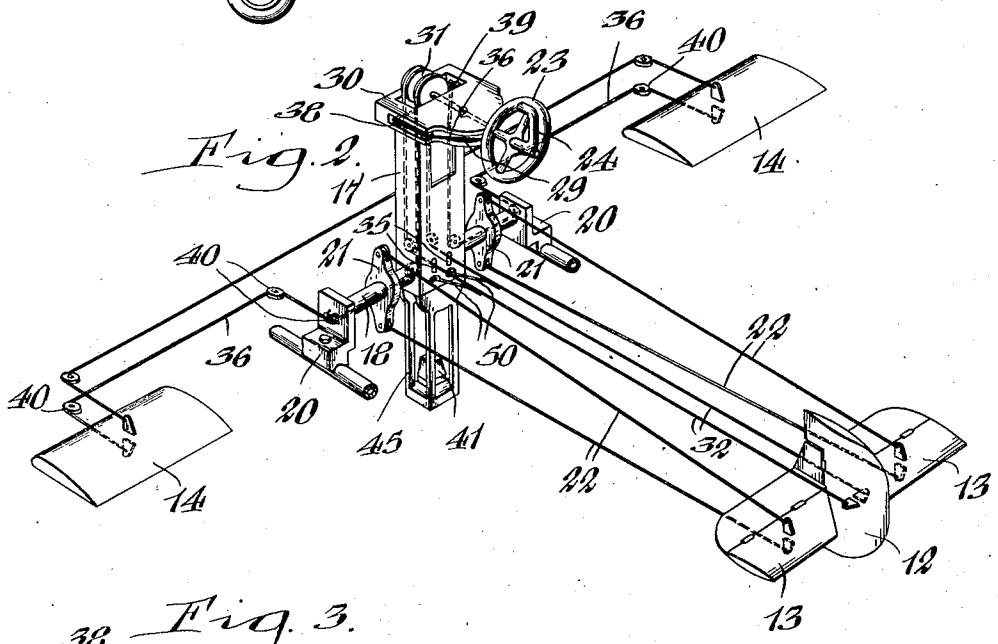
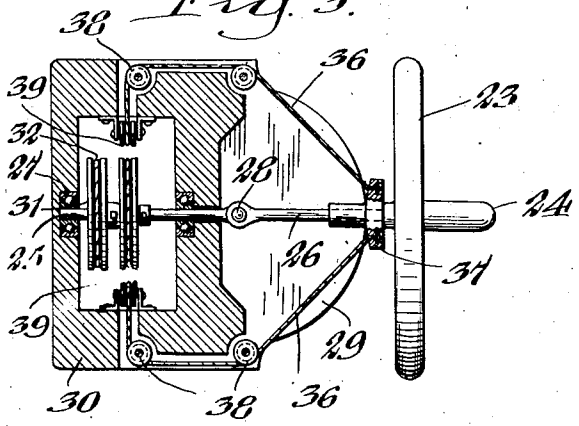


Fig. 3.



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Fig. 4.

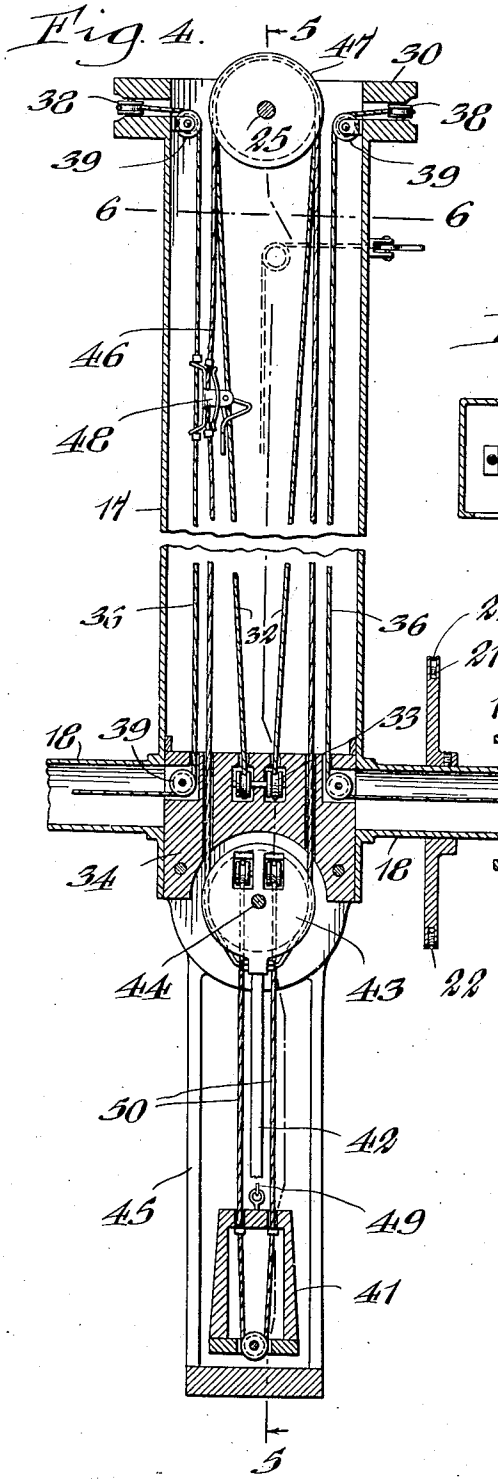


Fig. 5.

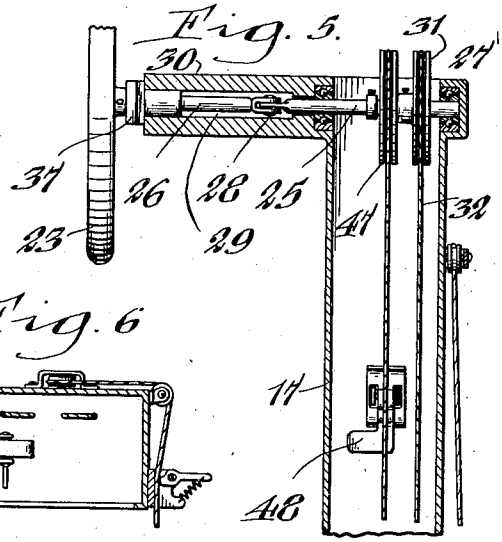
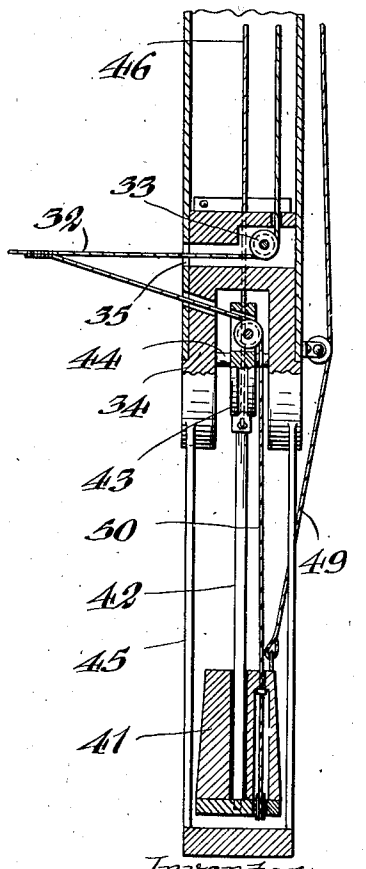


Fig. 6



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2,076,088

UNITED STATES PATENT OFFICE

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CONTROL MECHANISM FOR AIRPLANES

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Application October 29, 1934, Serial No. 750,462

8 Claims. (Cl. 244—80)

This invention relates generally to improvements in airplanes but more particularly to the control mechanism thereof.

Its chief object is the provision of a universal control mechanism which is so designed and constructed that the pilot may effectually control the rudder, the elevators and the ailerons of the plane from one point and solely by the use of his hands.

Another object of the invention is to provide a universal and self-contained control mechanism for airplanes which is simple and rugged in construction, which is positive and reliable in operation, and which, by eliminating joint control by both hands and feet, affords a greater comfort to the aviator.

A still further object of the invention is to provide the control mechanism with means for automatically maintaining it in a position for effecting a level flight of the plane.

Other features of the invention reside in the construction and arrangement of parts hereinafter described and particularly pointed out in the appended claims.

In the accompanying drawings:—

Figure 1 is a side elevation of an airplane, partly in section, showing my improved control mechanism applied thereto. Figure 2 is a perspective view of the mechanism showing its connections to the rudder, elevators and ailerons. Figure 3 is an enlarged horizontal section taken substantially in the plane of line 3—3, Figure 1. Figure 4 is an enlarged transverse vertical section taken on line 4—4, Figure 1. Figure 5 is a vertical section taken substantially in the plane of line 5—5, Figure 4. Figure 6 is a horizontal section taken on line 6—6, Figure 4.

Similar characters of reference indicate corresponding parts throughout the several views.

By way of example, my invention is shown applied to a standard type of airplane wherein 10 indicates the fuselage, 11 the wings, 12 the rudder, 13 the elevators, 14 the ailerons, 15 the propeller and 16 the pilot seat.

Stationed adjacent to the pilot seat is my improved stick or control mechanism which is so designed and constructed as to enable the operator, only with his hands, to control the rudder, elevators and ailerons from one common point. To this end, a self-contained, universally-mounted device is provided which is capable of movement in various directions to accordingly actuate the respective control elements of the airplane. This device preferably consists of a hollow upright member 17 positioned adjacent the operator's seat 16 and having transverse journals or trunnions 18 adjacent its lower end which engage corresponding bearings 19 fitted to brackets 20 suitably mounted on the floor of the fuselage 10, whereby this member is capable of rocking vertically lengthwise of the plane to and from the operator. Fixed on the trunnions 18 to rock therewith are arms 21 whose opposing ends are connected by links or cables 22 with the elevators 13 to accordingly raise and lower the elevators as the vertically swinging member 17 is shifted forwardly and backwardly, respectively. This movement of the vertically-swinging member may be conveniently effected by a hand wheel 23 disposed at the upper end of said member and having a hand grip 24 applied thereto for effecting the fore and aft movement of such member.

Carried by the vertically swinging member for bodily movement therewith, as well as rotary and oscillatory movement relative thereto, is the means for controlling the rudder 12 and the ailerons 14. This means comprises the hand wheel 23 secured to one end of a sectional shaft 25, 26, the section 25 being journaled in suitable bearings 27 formed in the front and rear walls of the member 17, while the companion wheel-bearing section 26 is pivoted at 28 to the opposing end of the shaft-section 25 and is capable of oscillating horizontally about said pivot 28 in a direction transversely of the fuselage. The pivoted shaft-section 26 is guided in its rocking movement in a horizontal groove or race-way 29 formed in a head-plate 30 secured to the upper end of the member 17, whereby this sectional shaft is capable of rotation for the purpose of actuating the rudder 12 and the section 26 thereof is capable of transverse oscillation to actuate the ailerons 14. The connections between the sectional shaft and the rudder consist of a pulley 31 fixed on the shaft-section 25 and a cable 32 looped around said pulley and connected at its free ends to the rudder 12 in the manner shown in Figures 1 and 2. The depending portions of this cable are directed and guided rearwardly toward the rudder by means of guide wheels or pulleys 33 disposed substantially axially of the trunnions 18 and fitted in a block 34 positioned adjacent the lower end of the member 17 and extending rearwardly through corresponding openings 35 formed in the rear wall of said member.

The connections between the oscillating shaft-section 26 and the ailerons consist of cables 36 extending from diametrically opposite sides of

said shaft-section and secured to a head 37 carried thereby. These cables extend forwardly from this head about a series of pulleys 38 suitably mounted in the head plate 30, then downwardly about pulleys 39 fitted in the top portion of the member 17 and in the block 34, and thence laterally outward through the journals 18 from which they are further guided on pulleys 40 to direct them to the ailerons 14. By this construction, when the hand wheel 23 is oscillated about the pivot 28 in one direction or the other in its race-way 29, the ailerons are correspondingly actuated.

For the purpose of automatically maintaining the airplane in a substantially level state both laterally and horizontally, I preferably provide the lower end of the vertically-swinging stick or member 17 with a pendulum-like element which functions to maintain it in a pendant or upright position irrespective of the angular position of the plane while in flight and to thereby automatically control the elevators 13 and the ailerons 14 and maintain them in proper position for a level flight. This pendulum-like element is indicated at 41 and is slidingly mounted on a pendant post 42 secured to a rock member 43 mounted on a pivot post 44 disposed longitudinally of the fuselage and carried by the lower portion of the block 34. Depending from the latter is a skeleton frame-like structure 45 which constitutes a cage or protective enclosure for the pendulum, and further as an additional weight for maintaining the stick in an upright position. The oscillatory movement of the rock member 43 is adapted to be transmitted to the aileron cables 36 through a cable 46 looped about said rock member and a pulley 47 loosely mounted on the shaft-section 26 and having each of its stretches connected by a releasable clamp or coupling 48 with the companion aileron cable 36, as shown in Figure 4. By this construction, should the plane tilt laterally while under automatic flight control, the swinging movement of the pendulum-like element in one direction or the other will accordingly oscillate the rock member 43 and in turn actuate the corresponding aileron to correct the position of the plane. When the plane is under manual control of the pilot, the clamp 48 is disconnected, and under these conditions the weight 41 may be raised by an actuating cable 49 to a position adjacent the axis of the member 17 so as not to materially affect the actuation of such member by the pilot. The elevation of this weight may be also controlled during steering of the ship while otherwise in automatic flight by having attaching cables 50 connected to the rudder-actuating cables 32, so that during the turning of the plane the weight is brought inward so as not to materially affect the aileron action.

I claim as my invention:—

1. An airplane, comprising flight-control means including an elevator, a rudder and ailerons, a vertically-swinging member, a combined rotatable and laterally shiftable member mounted thereon and including axially-jointed sections permitting joint rotation of the sections and lateral swinging of one section relative to the other connections between said vertically-swinging member and the elevator for actuating the same in response to its swinging movements, and independent connections between said second-named member and the rudder and the ailerons for actuating the same in response to its rotatable and laterally-shiftable movements, respectively.

2. A control assembly for airplanes, comprising a vertically-swinging member having trunnions adjacent its lower end journaled to the fuselage of the plane, connections between said trunnions and the elevator of the plane for actuating the same in response to the swinging movements of said member, a combined rotatable and laterally-swinging actuating means mounted in the upper end of said member and having its axis of rotation at substantially right angles to said trunnions, two sets of guide rollers applied to said member in the plane of the trunnions, one set of rollers having their axes substantially co-axial with the trunnion-axis and the others at substantially right angles thereto, a cable looped about the rotatable portion of said actuating means and said first-named set of guide rollers and connected at its ends to the rudder of the plane and a cable attached at one end to the laterally-swinging portion of said actuating means and at its free ends to the ailerons of the plane, the intermediate portions of said last-named cable engaging said second-named guide rollers.

3. A control assembly for airplanes, comprising a vertical-swinging member adapted for pivotal mounting in the fuselage of the plane, connections between said member and the elevator of the plane for actuating the same in response to the fore and aft movements of the member, a substantially horizontal sectional shaft journaled in said member including a section rotatable therewith but free to swing laterally relatively thereto, a connection between the journaled shaft-section and the rudder of the plane for actuating the latter upon rotation of the shaft, and a connection between the laterally-swinging shaft-section and the ailerons of the plane for actuating them in response to the swinging movement of such section.

4. A control assembly for airplanes, comprising a vertical swinging member adapted for pivotal mounting in the fuselage of the plane, connection between said member and the elevator of the plane for actuating the same in response to the fore and aft movements of the member, a substantially horizontal sectional shaft journaled in said member including a section rotatable therewith but free to swing laterally relatively thereto, a connection between the journaled shaft-section and the rudder of the plane for actuating the latter upon rotation of the shaft, a connection between the laterally-swinging shaft-section and the ailerons of the plane for actuating them in response to the swinging movement of such section, and a control member fixed on the free end of said laterally-swinging shaft-section for controlling the rotatable and swinging movements of the sectional shaft and the fore and aft movements of the vertically-swinging member.

5. A control assembly for airplanes, comprising a vertically-swinging elevator control member including pendant weighted means thereon for constantly urging it to a neutral upright position, an oscillating support for the weighted means fulcrumed adjacent the lower end of said member to rock crosswise thereof, and an operating connection between the oscillating support of the weighted means and the ailerons of the plane for automatically actuating them in response to the lateral swinging of such means caused by a sidewise tilting of the plane.

6. A control assembly for airplanes, comprising a vertically-swinging elevator control member including pendant weighted means thereon for constantly urging it to a neutral upright position, an oscillating support for the weighted means fulcrumed adjacent the lower end of said member to rock crosswise thereof, an actuating element at the upper end of said elevator control member for movement relative thereto and including a cable operatively connected to the ailerons of the plane for controlling them, a pulley mounted on said member above said oscillating support, a cable engaging the latter and said pulley, and means for coupling the actuating element cable with the pulley-engaging cable for automatically governing said actuating element in response to the laterally swinging of the weighted means caused by a sidewise tilting of the plane.

7. A control assembly for airplanes, comprising a vertical-swinging elevator control member having an oscillating supporting element below its pivot and at substantially right angles thereto, a pendant rod connected thereto and having a weight mounted thereon, and means for operatively connecting said oscillating element with the ailerons of the plane to automatically actuate them in response to any lateral tilting of the plane while in flight.

8. A control assembly for airplanes, comprising a vertically-swinging elevator control member having an oscillating supporting element below its pivot and at substantially right angles thereto, a pendant rod connected thereto, a weight slidably mounted thereon, means for shifting said weight to a plurality of positions on said rod and toward and from the axis of said oscillating element, and means for operatively connecting said oscillating element with the ailerons of the plane to automatically actuate them in response to any lateral tilting of the plane while in flight.

BOLESLAW MALINOWSKI.