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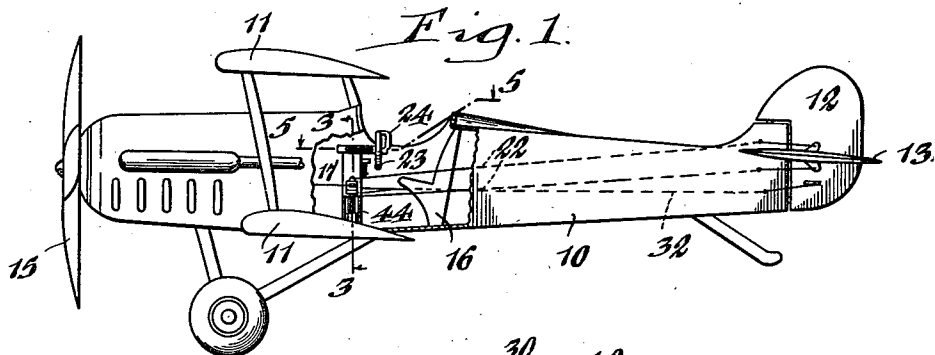
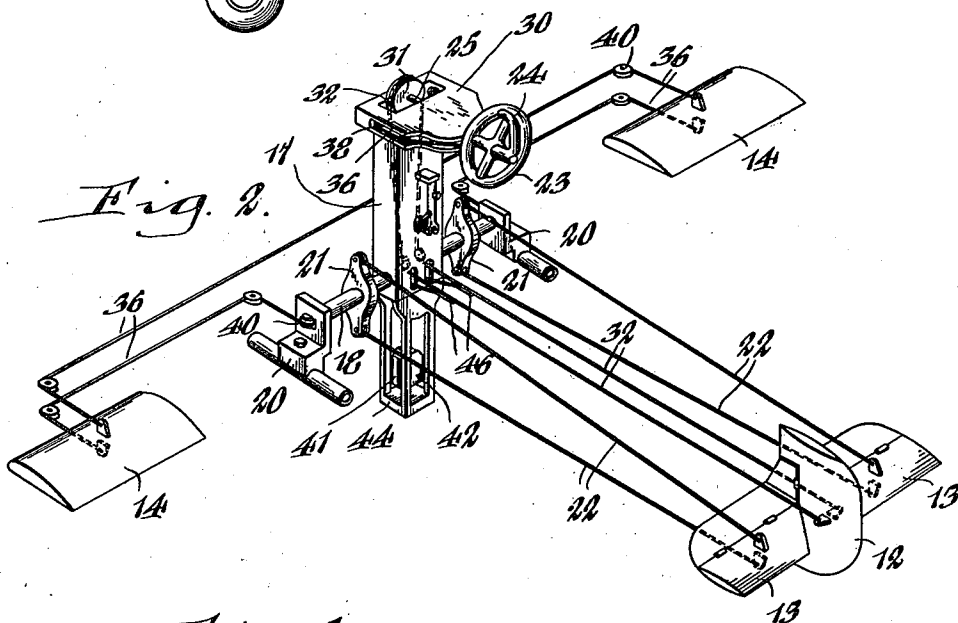
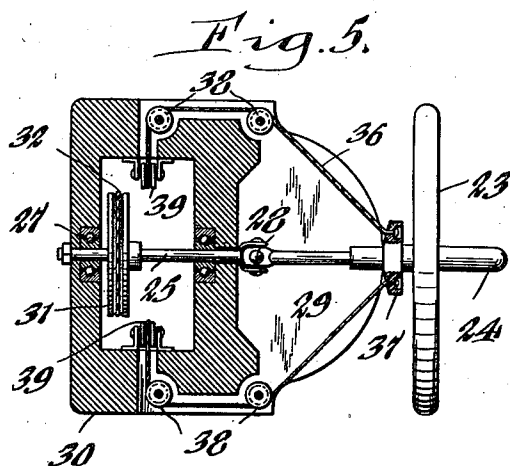
B. MALINOWSKI

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CONTROL MECHANISM FOR AIRPLANES

Filed May 8, 1935

2 Sheets-Sheet 1



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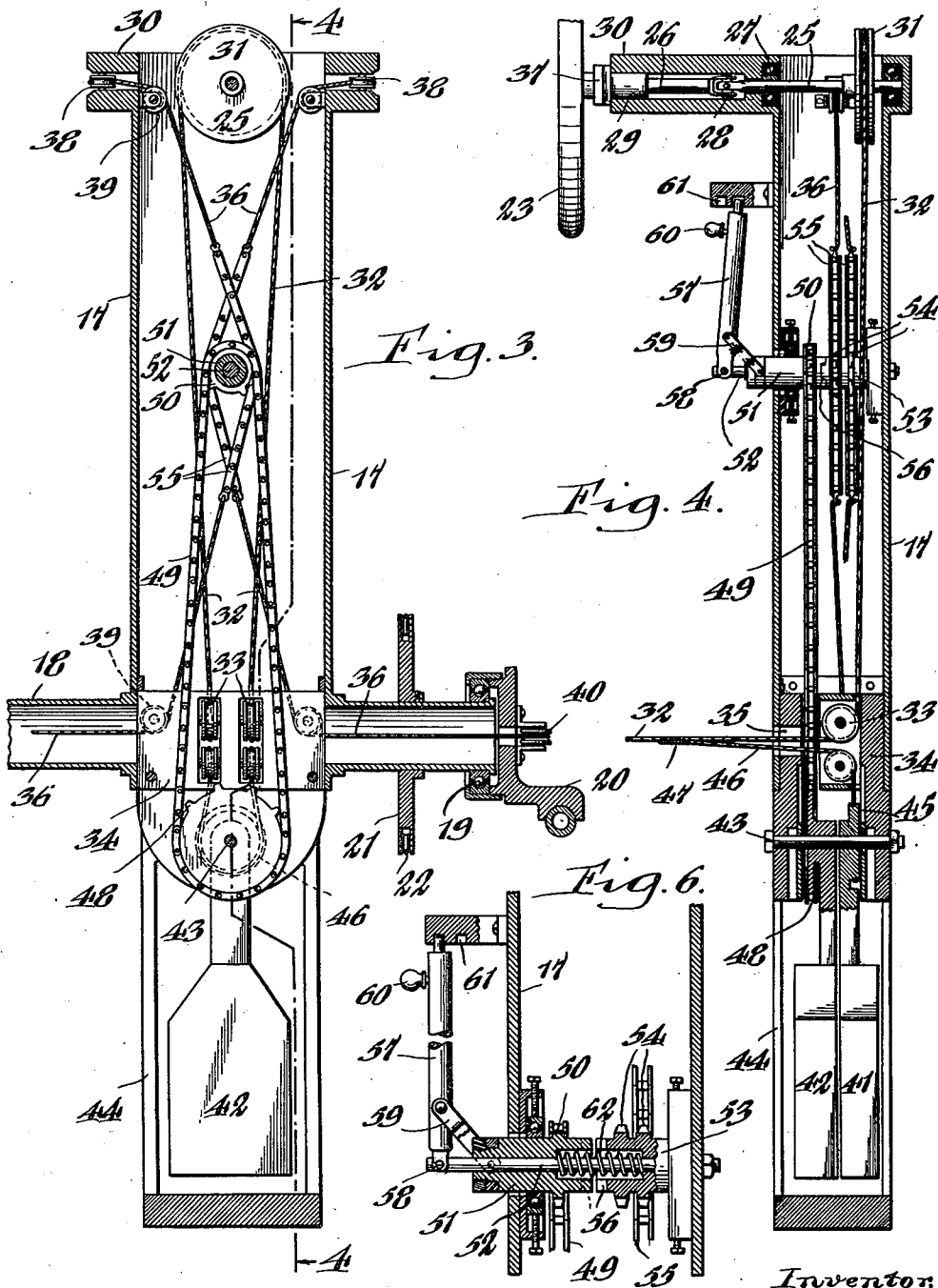
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UNITED STATES PATENT OFFICE

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CONTROL MECHANISM FOR AIRPLANES

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8 Claims. (Cl. 244—29)

This invention relates to airplanes but more particularly to certain new and useful improvements in the control mechanism therefor.

Its chief object is the provision of a reliable and efficient control means which is so designed and constructed as to be capable of either manual or automatic operation.

Another object of the invention is to provide a universal control mechanism for airplanes whereby the pilot may readily control from a common point the rudder, the elevators and the ailerons of the plane with a minimum of effort, in conjunction with means for automatically governing such controls to maintain the plane in a level flight.

A further object is the provision of selective means for rendering the control mechanism manually or automatically operative.

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 transverse vertical section taken on line 3—3, Figure 1. Figure 4 is a vertical section taken substantially in the plane of line 4—4, Figure 3. Figure 5 is an enlarged horizontal section taken substantially in the plane of line 5—5, Figure 1. Figure 6 is an enlarged fragmentary sectional view, similar to Figure 4, showing the aileron clutch control in its released position.

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 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 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 govern the various control elements of the plane and maintain them in proper position for a level flight. This pendulum-like element is preferably composed of two laterally-swinging sections 41, 42 fulcrumed on a horizontal pivot 43 secured to the lower portion of the stick and housed within a cage or protective enclosure, as shown in Figures 2, 3 and 4. One of the pendulum-sections is operatively connected to the rudder 12 and the companion section is operatively connected to the ailerons 14, and to this end the section 41 has a pulley 45 fixed thereon axially of its pivot 43 and extending around the lower side of the same is a cable 46 whose free ends 47 are joined to the corresponding rudder-connecting cable 32. The companion pendulum-section 42 is provided axially of its pivot with a sprocket wheel 48 about which the lower portion of a sprocket chain 49 passes, the upper portion thereof passing around a sprocket wheel 50 fixed on a shiftable sleeve 51 slidably supported on an arbor 52 mounted on the stick 17. The sleeve 51 is shiftable axially into and out of clutching engagement with an alining sleeve 53 also mounted on the arbor and having sprockets 54, 54 thereon with which sprocket chain elements 55, interposed in the aileron-connected cables 36, engage. It will be noted in Figure 3 that one of the aileron chain elements passes around one side of its companion sprocket while the other chain element extends around the opposite side of its sprocket. The opposing ends of the sprocket-sleeve 51 and the adjoining sprocket-sleeve 53 have clutch-faces 56 thereon so that the same serve also as elements of a clutch for releasably coupling the weight-actuated transmission assembly 48, 49 and 50 with the aileron-connected sprockets 54. The pendulum-sections or weighted arms 41, 42 function jointly to maintain the stick 17 in a substantially upright or neutral position for normal or level flight control, and function independently of each other in a laterally-swinging direction relative to the stick to automatically maintain the ship on an even keel when the clutch 56 is engaged.

For the purpose of shifting the sleeve 51 into and out of clutching engagement with the companion sleeve 53 to couple the ailerons for automatic control by the companion pendulum 42 and disconnect them therefrom for manual control by the pilot, respectively, a clutch lever 57 is employed which is pivoted at 58 to the arbor 52 and connected by links 59 with the clutch sleeve 51, as seen in Figures 4 and 6. At its free end this clutch lever has a spring-pressed latch bolt or dog 60 adapted to engage one or the other of a pair of sockets 61 for latching the lever in a given position of adjustment. A spring 62 interposed between the sleeves 51, 53 serves to constantly urge them to a clutch-released position. By this construction, when automatic control

of the airplane is desired, the pilot shifts the clutch lever 57 from released to engaged position shown in Figure 4 to transmit the lateral movement of the pendulum 42 to the aileron cables 36 through the medium of the transmission elements 48, 49, 50, 54 and 55. In conjunction with this automatic aileron control, the companion pendulum section 41 acts to automatically govern the rudder 12 through the medium of the connections 45, 46 to the rudder-cables 32. For manual control, the clutch lever is shifted from the position shown in Figure 4 to that shown in Figure 6, thereby disconnecting the aileron-governing pendulum 42 and permitting the movement of the ailerons 14 from the hand wheel 23 of the control stick. Under manual control, the companion pendulum 41, while always connected with the rudder controls acts to assist in returning the rudder from an offset steering position to a normal straight position.

I claim as my invention:—

1. 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, said means consisting of a plurality of independent laterally-swinging elements, and means for connecting said elements to the rudder and ailerons of the plane, respectively.

2. 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, said means consisting of a plurality of independent laterally-swinging elements, and means for connecting said elements to the rudder and ailerons of the plane, respectively, for automatically actuating them in response to the swinging of such elements; one of said connecting means including a releasable coupling for disconnecting its weighted element from its plane-control part.

3. 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, said means consisting of a plurality of independent laterally-swinging elements, means for permanently connecting one of said weighted elements to its plane-control part for actuating the same, and releasable transmission means connecting the other of said weighted elements to its plane-control part.

4. 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, said means consisting of a plurality of independent laterally-swinging elements, means for permanently connecting one of said weighted elements to its plane-control part for actuating the same, releasable transmission means connecting the other of said weighted elements to its plane-control part, and a pilot-control for governing said transmission means.

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, said means consisting of a plurality of independent laterally-swinging elements fulcrumed on a common pivot and having flexible connections operatively connected to the rudder and ailerons of the plane, respectively, for automatically actuating such controls in response to the

swinging movements of their companion swinging elements.

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, said means consisting of a plurality of independent laterally-swinging elements fulcrumed on a common pivot and having flexible connections operatively connected to the rudder and ailerons of the plane, respectively, for automatically actuating such controls in response to the swinging movements of their companion swinging elements, and clutch-controlled transmission means interposed in one of said operative connections for releasing the companion plane-control part from automatic actuation.

7. An airplane, comprising flight-control means including an elevator, a rudder and ailerons, a vertically-swinging, elevator-control member, a combined rotatable and laterally-shiftable member mounted thereon, connections between said vertically-swinging member and the elevator for actuating the same in response to its swinging movements, independent connections between said second-named member and the rudder and the ailerons for actuating them in response to its rotatable and laterally-shiftable movements, respectively, pendant weighted means applied to said elevator-control member for constantly urging

ing it to a neutral upright position, said means consisting of a plurality of independent laterally-swinging elements, and operative connections between said elements and said rudder and ailerons, respectively, for automatically actuating them in response to the lateral swinging of such elements.

8. An airplane, comprising flight-control means including an elevator, a rudder and ailerons, a vertically-swinging, elevator-control member, a combined rotatable and laterally-shiftable member mounted thereon, connections between said vertically-swinging member and the elevator for actuating the same in response to its swinging movements, independent connections between said second-named member and the rudder and the ailerons for actuating them in response to its rotatable and laterally-shiftable movements, respectively, pendant weighted means applied to said elevator-control member for constantly urging it to a neutral upright position, said means consisting of a plurality of independent laterally-swinging elements, operative connections between said elements and said rudder and ailerons, respectively, for automatically actuating them in response to the lateral swinging of such elements, and clutch-controlled means associated with the operative connection between the aileron and its pendant actuating element.

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