Dec. 31, 1946. A. E. OSBORN 2,413,577

AIRPLANE CONTROL MECHANISM

Filed Feb. 25, 1943

FIG. 1

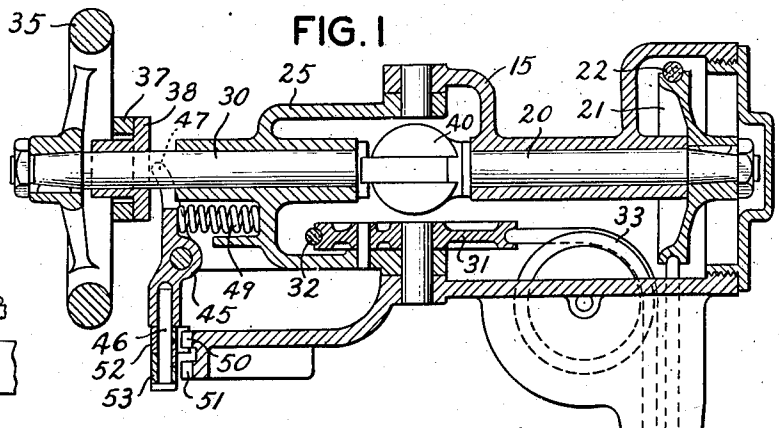
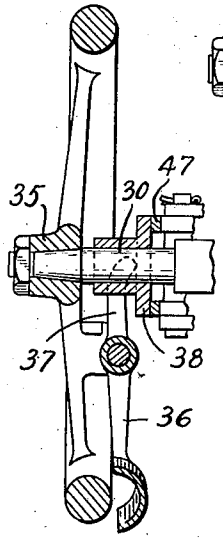


FIG. 2



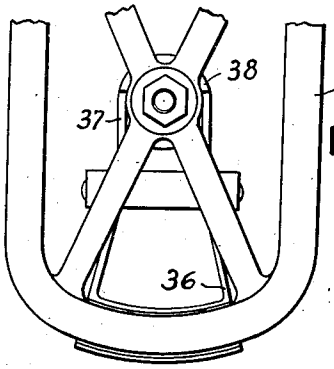


FIG. 3

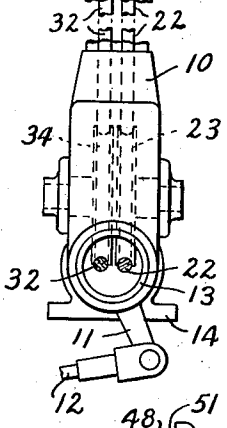
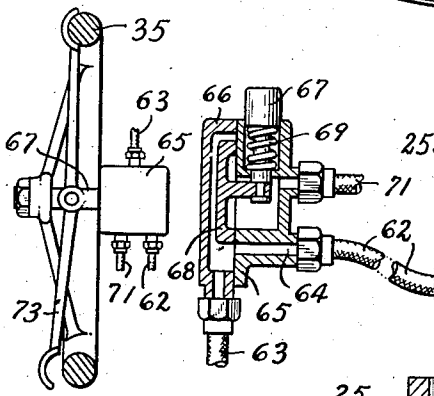


FIG. 8



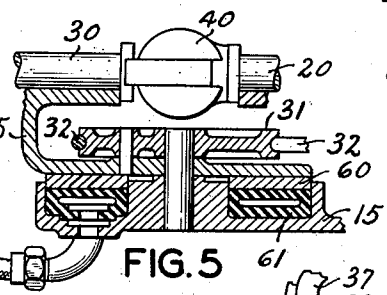


FIG. 5

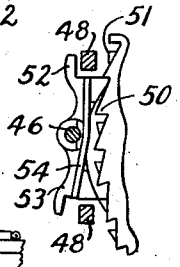


FIG. 4

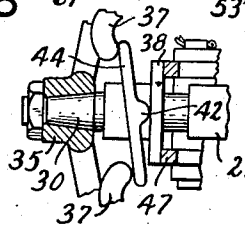


FIG. 7

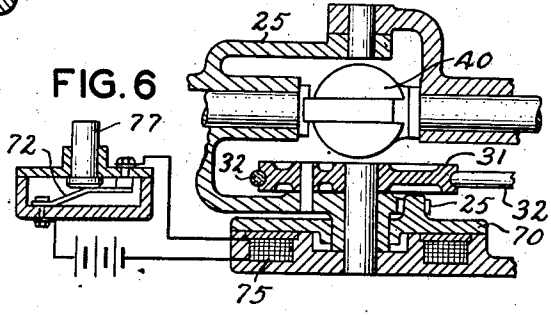


FIG. 6

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AIRPLANE CONTROL MECHANISM

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Application February 25, 1943, Serial No. 477,162

3 Claims. (Cl. 244—83)

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The object of this invention is to provide a means for adjusting the various main airplane control surfaces, comprising the elevators, rudder and ailerons, by the operator's hands, thus making it unnecessary for him to co-ordinate hand and foot movements and also leaving his feet free to operate the brakes. It particularly relates to that type of control mechanism in which the longitudinal movement of the upper end of a pivoted column controls the elevator position, the rotation of a control wheel mounted on the upper end of the column controls the ailerons, and the oscillation of that same wheel about a line of pivoting substantially at right angles to its axis of rotation and parallel to the plane of the column controls the rudder position, and it provides means to hold the rudder surfaces from movement when one of the operator's hands is removed from the control wheel, as it is necessary to do for many reasons. The accompanying drawing showing my mechanism illustrates only the parts and the construction required to disclose my invention as it is obvious that various modifications and refinements would be made in the mechanism when actually applied and used on a plane. In the specification and claims the term "longitudinal" means a direction substantially parallel with the line of travel of the plane, while the terms "vertical" and "horizontal" also are relative and are substantially correct when the plane is in its normal flying position.

In the accompanying drawing

Fig. 1 represents a longitudinal partial sectional elevation of the control mechanism showing the parts essential to the illustration of my invention,

Fig. 2 represents a horizontal sectional view of the control wheel end of Fig. 1,

Fig. 3 represents a partial elevation of the control wheel end of Fig. 1 view from the rear,

Fig. 4 represents a partial sectional top view of a part of Fig. 1,

Fig. 5 represents a partial sectional elevation of a modification of the locking mechanism of Fig. 1,

Fig. 6 represents a partial sectional elevation of a further modification of the locking mechanism of Fig. 1,

Fig. 7 represents a horizontal partial sectional view of the locking mechanism of Fig. 1 as modified for operation by both hands, and

Fig. 8 represents a horizontal partial sectional view of the locking mechanism of Fig. 5 also modified for operation by both hands.

In Fig. 1 10 represents the pivoted control column of the plane that is shown as connected, thru the lever 11 and rod 12, to the plane's elevator surfaces and operates these surfaces by the forward and backward movement of its upper end in the usual manner. This column and certain of its associated parts are only partially shown in Fig. 1, as the intermediate section has been removed, while the part below the removed section is shown as representing a side elevation of the device and not in line with the upper part of the figure which is a view taken in partial section on the center line of the mechanism. The upper end of the column 10 carries the casing 15 which supports a shaft 20 and another casing 25 that is pivotally mounted on the casing 15 so that it can be swung from side to side. This casing 25 in turn supports a second shaft 30 approximately on the same line as the shaft 20. The shaft 20 carries a wheel 21 which is shown as being in the form of a pulley to which a cable 22 is fastened, altho it obviously may be a sprocket with a chain substituted for a cable. The cable or chain 22 extends outward thru each column member (only one being shown, as the other is parallel to it and a duplicate) and passes around pulleys or sprockets 23 and passes out and thru each tubular column trunnion or pivoting member 13, mounted in the bracket 14, and is thereafter connected to the aileron surfaces of the plane so that the turning of the shaft 20 and the movement of the cable or chain 22 is communicated to the ailerons as with the customary aileron control system. The shaft, which is turned to actuate the ailerons, is rotated by turning the control wheel 35 that is carried by the shaft 30 which is connected to the shaft 20 by means of a universal joint 40 that is shown as of the simple grooved ball type, altho any other type of joint or connection may be used that will transmit the rotation of one of the shafts to the other while, at the same time, one shaft may be at a considerable angle to the other, as is the case when the casing 25 is turned to one of the other sides of the axis of the shaft 20. The casing 25 is shown as provided with a pulley 31 for the cable 32, altho, as stated in reference to the pulley 21 and cable 22, a sprocket and chain can be substituted, and this cable 32 passes around the pulley or sprockets 33 and 34 and out thru the hollow pivoting supports 13—14 of the column 10 and is, thereafter, connected to the rudder surfaces so that the movements of the cable or chain 32 thru the swinging of the casing 25 from side to side moves the rudder surfaces. Thus it will be seen that moving the control wheel 35 towards

or away from the operator regulates the position of the elevator surfaces of the plane, that rotating the wheel about the axis of the shaft 30 regulates the position of the aileron surfaces, and that turning the wheel from side to side controls the rudder position. The mechanism as thus described, possesses one great disadvantage and the particular object of my invention is to overcome this disadvantage which is that it is necessary for the operator to keep hold of the wheel 35 with both hands, since, if it is held at one side only, the casing 25 might swing to one side, thus altering the rudder position and the column 10 might also move, thus affecting the elevator, in fact the plane may get out of control. This defect of the mechanism so far described is overcome in my invention by providing an automatic or semi-automatic means for locking the casing 25 against side to side movement and preventing an alteration in the rudder position whenever one or, in a modified form, either one of the operator's hands is removed from the wheel 35.

This locking mechanism is shown in Figs. 1, 2, 3, 4 and 7 as being mechanically operated, while, in Figs. 5 and 8, it is pressure operated, either air or fluid, and in Fig. 6, it is electrically operated. The feature of my invention is not only that I provide a locking mechanism, but also that this automatic action is brought into play by the operator releasing pressure on a button or hand lever carried by the control wheel.

In the mechanically operated forms of my invention a special lever handle 36, adapted to be grasped by the hand of the operator, is pivoted on the spokes of the wheel (see Figs. 2 and 3) and is provided with projecting fingers that rest against the sliding collar 38. This collar 38 rests, in turn, against the projecting ends 47 of the locking lever 45 which is pivoted on supporting lugs on the casing 15 and is provided at its lower end with a means adapted to engage teeth 50—51 arranged in a semi-circle on the casing 15 so that, when the lever 45 is allowed to swing toward the teeth on the casing under pressure of the spring 49, the lever 45 is prevented from moving in relation to the casing 15 and the casing 25 is held from its oscillating movement. It is obvious that the end of the lever 45 can be provided with a tooth or teeth adapted to engage teeth or notches on the semi-circular toothed part of the casing, but because such teeth must be relatively closely spaced and great reliability and certainty of engagement is desired, I prefer a special method of locking the lever and toothed semi-circular part of the casing together which positively insures that the parts will engage and be held from relative movement whenever such engagement is desired. This locking means comprises providing the casing with two sets of ratchet teeth 50—51 pointing in opposite directions (see Fig. 4) and providing two oppositely acting pawls 52–53 mounted on the pin 46 at the end of the lever 45 and adapted to be engaged with the ratchet teeth by a spring 54, these pawls being held, when the lever is drawn away from its locking position, from movement under the pressure of the spring 54 by stops 48 on the lever 45. By having pawls and ratchets instead of a rigid tooth or projection on the lever that would engage teeth or notches on the semi-circle of the casing 15, the parts are more certain to lock as, even if the teeth are closely spaced, the pawls cannot miss engaging whenever they are pressed against the teeth.

It will be noticed that this entire locking mechanism is very simple and direct and that it will act immediately upon the operator's hand releasing the lever even tho the spring 49 is relatively light in order to make the mechanism easily operated.

While it is believed that this mechanical operation of the locking device as shown in Figs. 1, 2, 3, 4 and 7 is simple and practical, I have, in Figs. 5 and 8, shown a modification in which the locking means is actuated by either fluid or air pressure, and in Fig. 6 I have illustrated a modification in which electricity is employed to actuate the locking mechanism. In Figs. 5, 6 and 8 the mechanism is illustrated in an extremely diagrammatic form in order that the principle involved will be clearly disclosed, as the refinements and modifications that would obviously be required can be easily understood by those skilled in the art.

In the mechanism of Fig. 5 15 represents a part of the main column casing carrying the shaft 20, and 25 a part of the pivoted casing carrying the shaft 30 with the control wheel steering cable pulley, aileron control, cables, etc., being arranged as shown in Figs. 1, 2 and 3. The pivoted casing 25 is shown as provided with a flat under surface adapted to be engaged by the friction plate 60 which is slidably mounted in the chamber situated in the casing 15 below the disc surface on the casing 25. The chamber also contains the flexible tube 61 that receives the lock-actuating air or fluid thru the pipe 62. The pipe, which contains a flexible portion that allows movement between the parts, connects to a casing 65 that is mounted in a convenient position on the spokes or rim of the control wheel of the mechanism of Figs. 1, 2 and 3, with the rest of the mechanism being the same as that shown in those figures except that the mechanical locking device therein illustrated is removed. The valve casing 65 is fitted with a cover 66 that encloses a slide valve 68 which is operated by the handle or push button 67 and is clearly held in the position in which it is shown by a spring 69 with the port 64 that connects to the pipe 62 opening into the chamber containing the valve 68. The valve chamber is supplied with fluid or air under pressure by means of the flexible pipe 63 and another flexible pipe or exhaust connection 71 is shown as attached to the valve casing 65, altho, if compressed air is used as the actuating means, it could be allowed to escape directly and this latter pipe be omitted. It will be obvious that when the push button or handle 67 is released and the parts are in the position in which they are shown, the air or fluid from the pipe 63 would pass thru the port 64 and the pipe 62 to the interior of the flexible tube 61 so that this tube would press the plate 60 against the friction surface on the pivoted casing 25 and hold the casing and rudder connected thereto from movement. If, however, the operator presses the button 67 either directly or by other means, the valve 68 would be moved against the action of the spring 69 and lap the port 64 and, therefore, put the port into communication with the exhaust pipe 71 so that pressure would be released from the tube 61 and the friction surfaces and allow the casing 25 to turn freely. Thus, as long as the operator keeps the button 67 depressed, the steering action would be free, but as soon as the button is released from restraint, the steering would be locked and the operator could take one hand from the control wheel.

This power-actuated locking device can be mod-

ified in many ways that are obvious to those skilled in the art without departing from the spirit of the invention. One modification is illustrated in Fig. 6 which, instead of employing air or fluid pressure as a source of power for operating the locking clutch, employs electricity which may be obtained from a battery, as shown, or in any other way desired. In this figure, a circumferential magnet having a coil 75 is substituted for the tube 61 and the movable friction plate 70 is carried by the casing. The magnetic coil is electrically connected to the switch 72 that is mounted on some convenient point on the spokes or rim of the control wheel 35 of the mechanism shown in Figs. 1, 2 and 3, but with the mechanical locking device omitted. The switch 72 is operated by the button 77 that can be depressed to break the circuit either by the operator's fingers or by a handle moved by the operator whenever it is desired to release the locking mechanism by demagnetizing the locking magnet and thus freeing the friction plate.

As above described, all forms of this mechanism lock the steering by the removal of one of the operator's hands from the control wheel, however, in some cases, it may be desirable to have the locking mechanism work when either hand is removed and, in Fig. 7, I have shown a means whereby the mechanical mechanism can be modified to enable its operation by either hand. In this figure 25 represents the pivoted casing, 30 the casing shaft, 35 a portion of the control wheel, 38 the sliding collar, 47 the ends of the locking lever adjacent to the collar, these parts being exactly the same and function in the same way as the corresponding parts of Figs. 1, 2 and 3. The control wheel 35 is provided with two lock-operating levers 36, the second of these being mounted on the wheel in exactly the same way as the lever 36 is shown as mounted on the wheel in Figs. 1, 2 and 3, the levers being practically the same as shown in Figs. 1, 2 and 3, except that they need not have a forked end adjacent to the collar 38. This end 37 of the lever 36, instead of engaging the collar 38 directly, bears against an intermediate washer 44 that is provided with a rib 43 that rests against this sliding collar and allows the washer to tilt from side to side. This washer 44 between the ends 37 of the levers and collar 38 functions as follows: When the hands are removed from both of the operating levers 36 the collar 38 is free and the spring 49 causes the engagement of the pawls 52—53 with the ratchet teeth 50—51 (Figs. 1 and 4.) If the operator moves only one lever by grasping the wheel with one hand the washer is simply rocked to a slanting position by that lever, as shown in Fig. 7, without moving the collar 38 and releasing the steering. If, however, both levers 36 are grasped by the operator taking hold of the wheel with both hands, the washer 44 is moved bodily in a longitudinal direction and, at the same time, moves the collar 38 so as to disengage the locking pawls and ratchets, thus allowing the steering to be accomplished thru the releasing of the casing 25.

The pressure-actuated locking device of Fig. 5 can easily be arranged for operation by both hands, as shown in Fig. 8 by mounting the control valve 65 at a central point on the upper or lower control wheel rim and pivotally attaching to the valve operating button 67 a lever 73 so that it extends to the wheel rim on both sides. This lever 73 is arranged so that it can be depressed to the limit at one end, as shown in Fig. 8, by grasping it with the hand or depressing it with the fingers without moving the valve button 67 to an extent to move the valve 68 to release the pressure in the locking brake actuating tube 61 (see Fig. 5) and is arranged so that, in order to move the valve to release the brake operating pressure, both ends of the lever must be depressed. Thus it is necessary for the operator to have both hands on the wheel and move both ends of the lever as far as possible in order to cause the steering to remain unlocked. In the case of the electrically operated locking device, provision for double-hand releasing of the locking brake is obviously simple, as it is only necessary to use two circuit-breaking switches 72 mounted on the control wheel 35 and electrically connected in parallel, as in that case, the circuit could only be broken and the steering unlocked if both switches were depressed and the removal of one hand from the wheel would complete the circuit thru the switch that was released by that hand and would lock the steering even tho the circuit was open at the switch operated by the other hand.

I claim:

1. A control mechanism for airplanes having elevator, aileron and rudder surfaces, comprising a column pivotally mounted on a horizontal axis at right angles to the center line of said aeroplane, connections between said column and said elevator surfaces whereby the forward or backward movement of the upper end of said column controls the position of said elevator surfaces, a member pivotally mounted on said column on a substantially vertical axis and at right angles to the pivotal mounting of said column, connections between said member and the rudder surfaces of said airplane whereby the oscillation of said member about its said vertical axis mounting moves said rudder surfaces, a shaft rotatably mounted on a horizontal axis on said member at right angles to the pivotal axis of both said column and said member and adjacent to the upper end of said column and said member, connections between said shaft and the aileron surfaces of said airplane whereby the oscillation of said shaft about its said horizontal axis controls the position of said aileron surfaces, a handle member for the manual operation of said shaft, said vertically pivoted member and said column, said handle member being adapted to turn said shaft, to cause said side to side oscillation of said vertically pivoted member and to also cause said forward or backward movement of said column, and a locking means comprising a manually operable lever on said handle member, a longitudinally slidable collar surrounding said shaft and contacting with said operable lever, a lever pivotally mounted on said vertically pivoted member and also contacting with said collar, an arm on said last-mentioned lever, a toothed segment on said column, said arm having a portion adapted to engage said toothed segment, and a spring means to normally cause said engagement whereby said vertically pivoted member is locked in relation to said column thru the action of said spring means, when said operable lever is released, said operable lever being adapted to move said collar and said last-mentioned lever on said vertically pivoted member against the action of said spring, and to withdraw said tooth-engaging portion of said lever arm from said toothed segment and allow the movement of said rudder surfaces.

2. A control mechanism for airplanes comprising a handle member rotatably mounted to turn about a substantially horizontal axis to control

the aileron surfaces of the airplane and oscillatable about a substantially vertical axis to control the rudder surfaces of the airplane, and a means to prevent the said oscillation of said handle member and the movement of the rudder surfaces connected thereto should the operator remove either or both hands from said handle member and to permit the oscillation of said handle member when both hands of the operator engage said handle member comprising a manually operatable means at both sides of the axis of said handle member adjacent to the outer edge thereof, with both said means requiring constant pressure thereon in order to operate said oscillation-locking means to release said handle member.

3. A control mechanism for airplanes comprising a handle member rotatably mounted to turn about a substantially horizontal axis to control the aileron surfaces of the airplane and oscillatable about a substantially vertical axis to control the rudder surfaces of the airplane, and a means to prevent the said oscillation of said handle member and the movement of the rudder surfaces connected thereto should the operator remove either or both hands from said handle member and to permit the oscillation of said handle

member when both hands of the operator engage said handle member comprising a lever means extending across said handle member to both sides of the horizontal axis of said handle member adjacent to the edge thereof, a collar operated by said lever means adjacent to said handle member and movable parallel with the horizontal axis thereof, a lever engaging said collar and movable with said handle member about its said vertical pivotal axis, a tooth-engaging member connected with said lever, a relatively stationary toothed member, and a spring means acting to engage said tooth-engaging member and said relatively stationary toothed member, whereby, when said lever means is actuated at both sides of the horizontal axis of said handle member against the pressure of said spring means, said tooth-engaging member is disengaged from said relatively stationary toothed member and, whereby, when said lever means is released at one or both sides of the horizontal axis of rotation of said handle member, said tooth-engaging member, by the action of said spring, is engaged with said relatively stationary toothed member.

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