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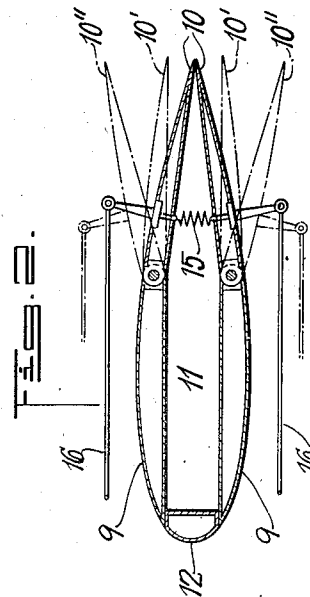
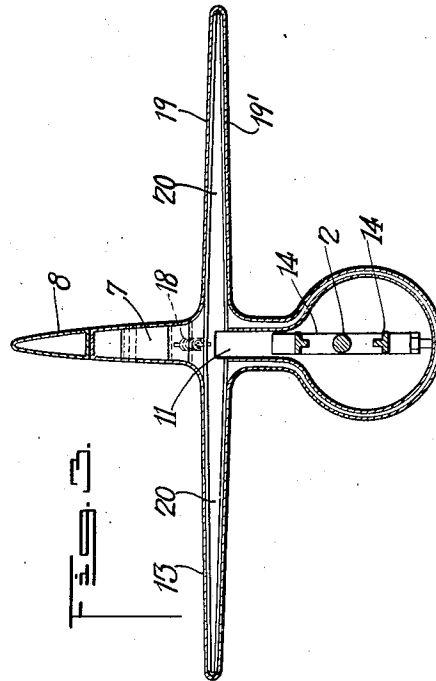
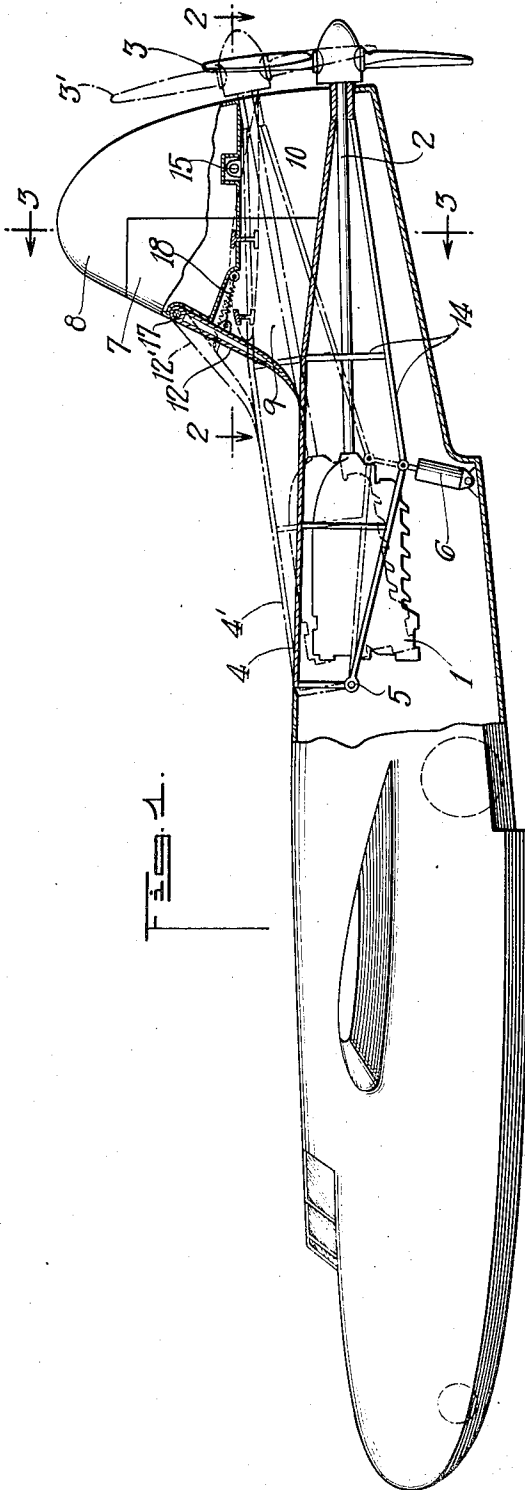
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2,257,940

AIRPLANE HAVING A LIFTABLE PUSHER PLANT

Filed June 5, 1939

2 Sheets-Sheet 1



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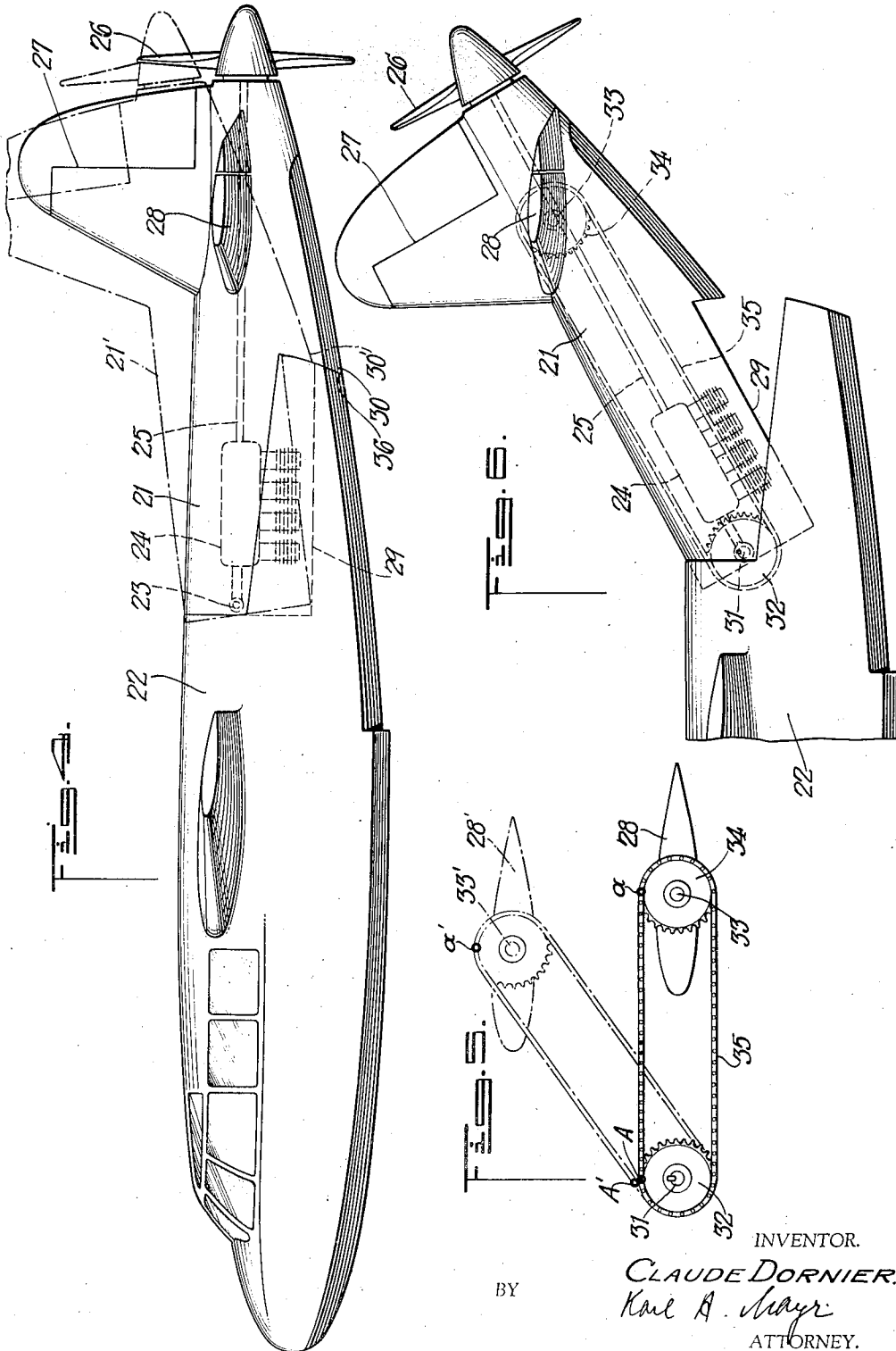
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

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AIRPLANE HAVING A LIFTABLE PUSHER PLANT

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14 Claims. (Cl. 244—53)

The present invention relates to airplanes having a propelling plant adjacent to the tail unit which plant can be lifted upward in order to avoid contact of the stern propeller with the ground or water when landing and starting, more particularly to airplanes of the type set forth in which the tail unit has special provisions to facilitate swinging up of the propelling plant and comprises movable parts for making way for the propelling plant or is movable or swingable as a whole together with the propelling plant and with respect to the fuselage.

An object of the present invention is to provide in airplanes having one tail unit located in the center of the rear end of the fuselage a propelling plant which can be swung up to avoid contact with ground or water when landing and starting. Parts of the propelling plant such as its shaft are disposed, according to this invention, within the fin which latter is of extraordinary thickness and provided with a slot chamber to accommodate and permit movement of said parts. The front end or nose of the fin is swingably connected with the main body of the fin and is adapted to be pushed out of the way by the propelling plant when the latter is swung upward. Resilient means are associated with said swingable nose and the main part of the fin for automatically holding the nose to the main part of the fin when the propelling plant is in lowered position.

The rudder is divided into an upper and a lower part. The upper part has the customary configuration of a fin with rudder and holds the fulcrum for the swingable nose part of the fin set forth in the paragraph next above. The lower part of the rudder is vertically divided into two flap members which are held closely adjacent to one another by resilient means when the propelling plant is in lowered, i. e., normal operating position and below the rudder and which are spread apart by the propelling plant when said plant is lifted up. In closely adjacent position said two flap members together with the lower part of the fin form a body of streamlined outside configuration.

The tail plane or stabilizer and elevator is preferably arranged above the slot chamber within the fin which houses parts of the swingable propelling plant or its beams have an upper flange which is located above said chamber and a lower flange which is interrupted at said chamber.

A further object of the present invention is to provide an airplane of the type set forth in which not only parts of the tail unit are movable for

permitting lifting up of the propelling plant but the whole of the tail unit is lifted or swung upward together with the propelling plant.

An object of the present invention is to provide, in airplanes of the type set forth in the paragraph next above, an automatic setting mechanism for the tail planes and elevators whereby the angle of incidence of said elements is maintained when the position of the tail and propelling unit is changed.

Another object of the present invention is to provide, in hydroplanes of the type set forth in the two foregoing paragraphs, a step in the undersurface of the fuselage when the tail and propelling unit is lifted for landing or starting purposes. Such a step facilitates separation of the water-stream from the bottom of the fuselage and reduces resistance when starting. The step disappears completely when the tail and propelling unit is lowered for normal flying and does not give cause for the formation of undesired eddy currents.

According to the present invention the stern of the fuselage comprises the propelling plant and tail unit and is upward swingable together with the propelling plant and tail unit and is so constructed that, if swung up particularly high, it provides for convenient access to the motor and power transmitting parts of the propelling plant.

Further and other objects and advantages of the present invention will be apparent from the accompanying specification and claims and shown in the drawings which, by way of illustration, show what I now consider to be preferred embodiments of my invention.

In the drawings:

Figure 1 is a diagrammatic, longitudinal, part sectional view of an amphibian airplane according to the present invention.

Figure 2 is a sectional view of the airplane shown in Figure 1 and taken along line 2—2 of said figure.

Figure 3 is a sectional view of the airplane shown in Figure 1 and taken along line 3—3 of said figure.

Figure 4 is a diagrammatic side view of a modified amphibian airplane according to the present invention.

Figure 5 is a diagrammatic showing of the mechanism for automatically maintaining the position of the stabilizer and elevator unit.

Figure 6 is a diagrammatic showing of the tail end of the airplane shown in Figure 4 with the fuselage stern, propelling plant and tail unit in fully swung up position.

Like parts are designated by like numerals in all figures of the drawings.

In the embodiment of my invention shown in Figures 1 to 3 the propelling plant unit comprises the motor 1 which drives propeller 3 by means of shaft 2 and a part 4 of the wall of the fuselage which is connected with the motor and shaft by means of structural elements 14. The propelling plant unit is upwardly swingable about an axis 5. The swinging motion may be produced by a hydraulic cylinder 6 which is movably connected with the fuselage and contains a piston which is connected with the support structure 14 of the propelling unit. The position 3' of the propeller 3 when swung up and 4' of the fuselage cover 4 is shown in dash and dotted lines.

The rudder unit comprises an upper fin part 7 to which the rudder 8 is connected and a lower hollow fin part 9 having side flaps 10 swingably connected thereto. These flaps are forced apart into positions 10' when the propelling unit is swung upward and thus extend the space 11 to the rear and provide space for said propelling unit. In normal flying position flaps 10 are held together by means of a spring 15 and close the rear end of space 11. Flaps 10 may be individually operated and swung into positions 10'' by means of control cables 16. In this case, each flap serves as rudder for directing the plane to the side at which the flap is positioned.

The forward end of space 11 is closed by means of a fin nose part 12 which is swingable about a fulcrum 17 in the upper fin part 7. It is held in closing position by means of a spring 18. When the propelling plant is swung upward and the fuselage cover moved into position 4' nose element 12 is pushed and swung forward and upward against the action of spring 18 into position 12' so that there is space for the movement of the propelling unit.

In the tail plane 13 shown, the upper flange 19 of the cross beam 20 extends all the way through above space 11 whereas the lower flange 19' is interrupted. If it is desired that both flanges extend all the way across the tail plane then the stabilizer and elevator unit must be arranged somewhat higher.

In the embodiment of my invention shown in Figures 4 to 6 the whole stern part of the fuselage together with the propelling plant and the tail unit can be swung upwards and not only part of its cover and structural elements connected thereto as is the case in the embodiment shown in Figures 1 to 3. The stern part 21 can be swung about an axle 23 which is connected to the main part 22 of the fuselage and brought into position 21' shown in dash and dotted lines. The motor 24, transmission shaft 25, propeller 26, rudder unit 27 and elevator unit 28 are connected with the stern part 21 of the fuselage and form a unit therewith. The side skin of the stern part of the fuselage has a part 29 which extends so far downward that overlapping of the adjacent side skin of the main part of the fuselage is assured also when the stern unit is swung up, i. e., starting position. The point 30 of the stern unit is closely adjacent to point 36 of the main part of the fuselage when in normal flying position so that there is a smooth continued bottom surface. When the stern unit is in starting or landing position and therefore swung upward point 30 assumes position 30' and a step is produced in the bottom surface which facilitates gliding of the fuselage on the water.

According to the present invention the general position of the elevator unit relative to the horizon is maintained when the stern part is moved upward. Figure 5 diagrammatically shows a system for accomplishing this. A chain wheel 32 is rigidly connected with a shaft 31 which is rigidly connected with the fuselage of the airplane. The axis of shaft 31 coincides with the axis 23 about which the stern unit is swingable. The stern part carries another axle 33 which revolvably supports sprocket wheel 34. The elevator unit 28 is rigidly connected with the wheel 34. A loop of chain 35 is laid around wheels 32 and 34. This chain contacts wheel 32 at point A and wheel 34 at point a when the system is in normal flying position. When the stern unit is lifted up point A assumes the position A' and point a of the chain 35 the position a'. Because wheel 32 remains in fixed position wheel 34 and elevator unit 28 connected thereto are moved parallel to themselves into positions 33' and 28' and the general position of the elevator unit is maintained.

Figure 6 shows the stern unit in particularly high swung up position. The position of elevator unit 28 is retained. There is a wide gap between the main part 22 and the swingable stern part 21 of the fuselage which gap provides for easy access to the motor 24 and the power transmission plant. The construction according to the present invention can easily be made so that the stern part can be brought into substantially vertical position so that the motor can be removed or replaced.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. In an airplane, a fuselage, a tail unit connected with said fuselage, a push propelling plant upwardly swingably connected with said fuselage and being directly associated with said tail unit, said tail unit comprising swingable flight control elements, and element position control means connected with said fuselage and with said elements for simultaneously swinging both said elements and said propelling plant.

2. In an airplane, a vertical rudder unit, a liftable push propelling plant, a chamber within said rudder unit, said chamber being so constructed as to accommodate part of said propelling plant when said plant is lifted up.

3. In an airplane, a tail unit comprising a rudder unit and an elevator unit, a chamber within said rudder unit, a liftable propelling plant partly extending through said chamber when said plant is lifted up, said elevator unit having an upper part situated above said chamber.

4. In an airplane, a fuselage, a vertical rudder unit mounted on said fuselage and comprising a substantially hollow part having stationary forward side walls and rear side walls laterally swingably connected with said forward side walls, a push propelling plant upwardly swingably connected with said fuselage and extending through the interior of said hollow part and between said side walls when swung upward.

5. In an airplane, a fuselage, a vertical rudder unit mounted on said fuselage and comprising a substantially hollow part having stationary

forward side walls and rear side walls individually laterally swingably connected with said forward side walls, a push propelling plant upwardly swingably connected with said fuselage and extending through the interior of said hollow part and between said side walls when swung upward, and resilient means for resiliently holding together said laterally swingable rear walls and closing the rear end of said hollow part.

6. In an airplane, a fuselage, a rudder unit mounted on said fuselage and comprising a substantially hollow part, having an open nose end, a push propelling plant upwardly swingably connected with said fuselage and extending through the interior of said hollow part when swung upward, and a nose end cover means upwardly swingably connected with the forward end of said rudder unit and covering and closing the nose end of said hollow part when said propelling plant is in flight position and being swung upward when said propelling plant is swung upward for starting or landing.

7. In an airplane, a fuselage, a rudder unit mounted on said fuselage and comprising a substantially hollow part having an open nose end, a push propelling plant upward swingably connected with said fuselage and extending through the interior of said hollow part when swung upward, a nose end cover means upwardly swingably connected with the forward end of said rudder unit and covering and closing the nose end of said hollow part when said propelling plant is in flight position and being swung upward when said propelling plant is swung upward for starting or landing, and resilient means connected with said nose cover and said rudder unit and tending to hold said nose cover in closing position.

8. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and constituting the stern part of said fuselage, a tail unit mounted on said stern unit, and a push propelling plant supported by said stern unit.

9. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and comprising a fuselage stern part, a tail unit mounted on said stern part, and a push propelling plant supported by said stern part, the bottom of said stern part and the bottom of said main part forming a step when said stern unit is swung up into starting or landing position.

10. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and comprising a fuselage stern part, a tail unit mounted on said stern part, and a

push propelling plant supported by said stern part, said tail unit having an elevator unit comprising a stabilizer and an elevator, elevator unit position maintaining means connected with said fuselage and with said elevator unit and maintaining the angular position of said elevator unit with respect to said fuselage when said stern unit is swung.

11. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and comprising a fuselage stern part, a tail unit mounted on said stern part, and a push propelling plant supported by said stern part, said tail unit having an elevator unit comprising a stabilizer and an elevator, elevator unit position maintaining means maintaining the angular position of said elevator unit with respect to said fuselage when said stern unit is swung, said position maintaining means comprising a stationary wheel disposed coaxially with the swing fulcrum of said stern unit, and a wheel rigidly connected with and supporting said elevator unit and being revolvably connected with said stern part, and a flexible means forming a loop around and operatively interconnecting said wheels.

12. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and comprising a fuselage stern part, a tail unit, and a push propelling plant supported by and including a motor disposed within said stern part, said stern part having a portion covering said motor and overlapping the rear end portion of said main part when in normal operating position and forming a gap with respect to the rear end of said main part through which gap said motor is accessible when said stern unit is in swung up position.

13. In an airplane, a fuselage having a main part, a stern unit upwardly swingably connected with said main part for starting and landing purposes and comprising a fuselage stern part, a tail unit mounted on said stern part, and a push propelling plant supported by said stern part, said main part and said stern part having side wall portions overlapping one another.

14. In an airplane, a fuselage, a tail unit upwardly swingably connected with said fuselage, a push propelling plant directly associated with said tail unit, said tail unit comprising swingable control elements, and element position control means connected with said fuselage and with said elements for swinging said elements, said tail unit, and said propelling plant simultaneously.

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