

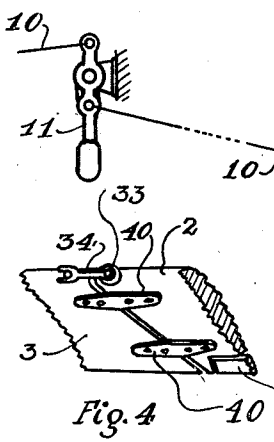
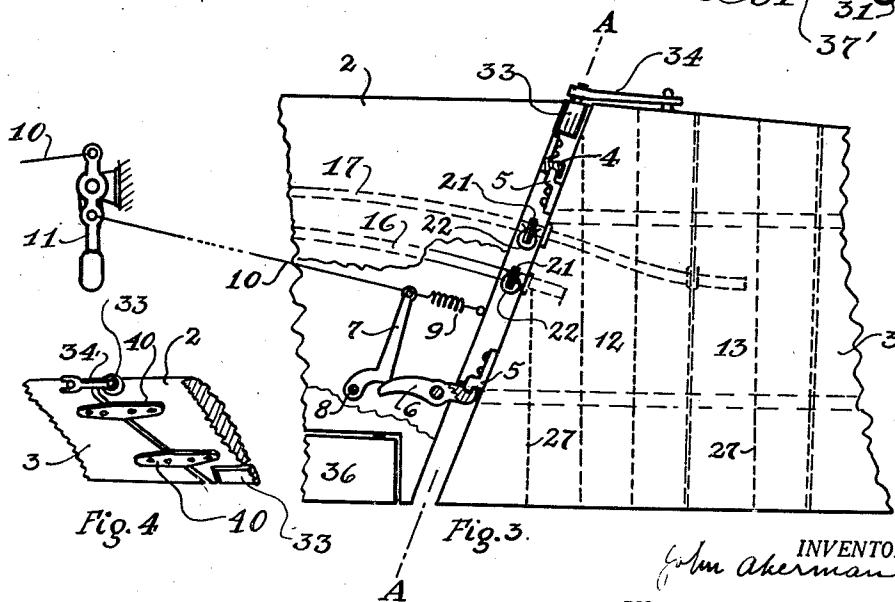
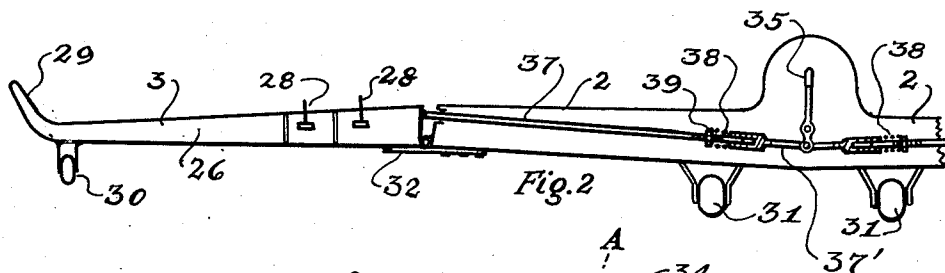
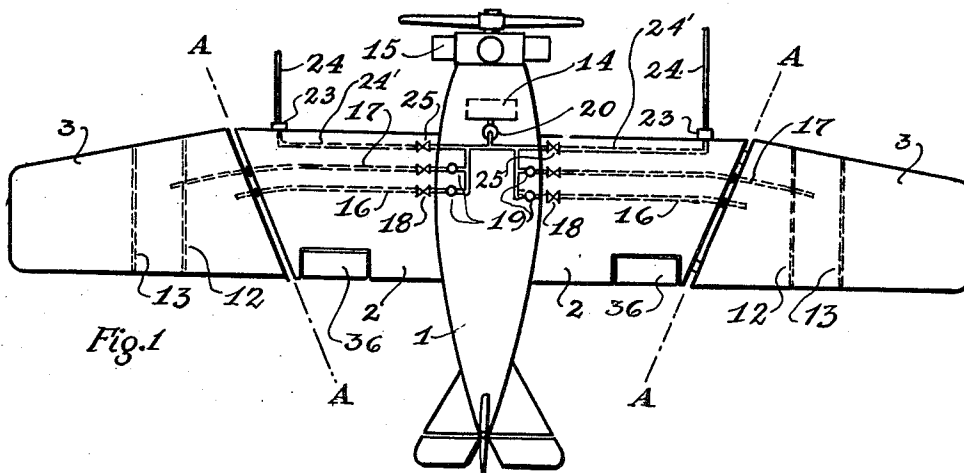
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J. AKERMAN

2,105,307

AIRPLANE WITH FLOATING WINGS

Filed May 27, 1935



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AIRPLANE WITH FLOATING WINGS

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Application May 27, 1935, Serial No. 23,702

1 Claim. (Cl. 244—46)

My invention relates to improvements in airplanes where the outer portions of the wings are yieldable about axes that converge aft of the airplane, and where said outer portions or floating wings are provided with compartments for fuel and other load.

The object is to provide a construction where excessive stresses are eliminated by proper distribution of the load over the wings, particularly for landing, and to arrange the axes about which the wings may swing in such a way that an increase in load will increase the angle of incidence of the yieldable wing, and a decrease will decrease it. This arrangement is therefore intended to compensate for fuel consumption, and to hold the floating wings in a lateral position regardless of load, without imposing any stresses from lift on the center wing or body; thus making possible a lighter construction.

A further object is to provide means to release the outer wings during flight, in an emergency, as well as for storage.

Another improvement is accomplished by providing means for towing by another plane, and to provide means for feeding fuel to the towplane during flight. This last named feature is shown similarly in my co-pending application Serial #750,163.

I also aim to make possible an airplane with a great span in order to reduce the induced drag.

These objects are attained by the embodiment illustrated in the accompanying drawing, in which:

Fig. 1 is a top view of the airplane;

Fig. 2, a lateral sectional elevation with one side broken off, as the airplane is symmetrical about the center;

Fig. 3, an enlarged top view diagrammatically showing means for releasably pivoting a floating wing to the center structure; and

Fig. 4, a perspective view showing a modification where springs take the place of hinges.

The center portion is similar to a conventional airplane having a fuselage or body 1, and laterally disposed wings 2, and being provided with lateral, longitudinal, and directional control surfaces, operated in any of the known manners.

The outer wings or floating wings 3 are pivoted or yieldably connected to wings 2 so as to deflect or swing about axes A—A which diverge forwardly so that a downward movement of a wing 3 relative to the center portion increases the angle of incidence, and an upward movement decreases it. The hinges or pivots are shown in detail in Fig. 3 where a part 4 (partly

shown in section) secured to the wing 2 has a socket adapted to receive a hinge 5 secured to wing 3. A similar hinge 5 is secured near the trailing edge and fits into the socket of a lever 6 pivoted to a structural member of wing 2. Another lever 7 pivoted at 8 holds lever 6 in engagement with hinge 5 by the tension of a spring 9. A cable or rod 10 leads to an operating lever 11 within reach of the pilot. Application of the operating lever 11 releases wings 3 simultaneously. This arrangement is to provide safety in an emergency, while for cheapness permanent hinges may be used. The wings 3 are provided with compartments 12, 13, to contain fuel. The latter is conveyed from 12 and 13 to the central fuel tank 14 or engine 15 thru flexible tubes 16 and 17, respectively, valves 18 operable by the pilot, fuel flow indicators 19, and pump 20. At the knee portion the tubes are split and provided with flanges 21, held together with springs 22 which yield and allow disengagement upon release of the wings 3.

Means are provided to allow the airplane to be towed by another. For this purpose I show a release-mechanism 23 shown in detail in my co-pending application 750,163, releasably holding tow tubes 24 leading to the main fuel tank of the tow plane, which is standard and therefore need not be shown. The tube 24 communicates thru tubes 24', valves 25, pump 20, with the tank 14. The tubes 24 are electrically insulated from each other, so that they can be used as a telephone connection between the two planes.

As shown in Fig. 2, the wings 3 may not only contain fuel tanks, but also have some baggage space 26 for other load, depending on the purpose of the plane. In long distance flights additional fuel tanks would be placed in compartment 26. The fuel tanks or compartments 12 and 13 are provided with baffles 27 to prevent shifting of the fuel, and visual fuel gages 28. The tips of the floating wings are tipped up at 29 to provide stability in a side slip, as well as some end plate effect.

Landing gears 30 of any conventional type are attached to the underside to take the landing shocks of the floating wings. The main landing gear 31 carries only the central part.

While the wings 3 normally are free-floating, I provide leaf springs 32 secured to wings 2, and in contact with wings 3 to prevent the latter from swinging down too far, as might occur in turbulent air. This necessitates the use of a damping device, to prevent the oscillations of the wings 3 from building up. Such a device is

indicated by 33, and is not shown in detail as it is well known to those skilled in the art. It is fastened to wings 2, and has an arm 34 forked at its end engaging a stud extending from the wing structure 3.

While normally the lateral stability of the airplane is controlled by the stick operating ailerons 36, I provide additional control, which entails considerable novelty in itself. Operating rods 37, shown in Fig. 2, are pivoted to the control stick, and contact wings 3. Lateral movement of the control stick and consequent pressure against one wing will swing it downwardly, increasing the angle of incidence and therefore the lift, while the opposite takes place at the opposite wing. The operating rods are divided into two pieces, 37 and 37', between which are interposed springs 38 whose pressure may be adjusted by nuts or collars 39. The rod 37' has a hollow end into which rod 37 fits to slide therein. Thus it is possible to exert a constant pressure on wings 3 tending to hold them down, when it is desired that they carry part of the weight of the central portion of the plane. The arrangement providing lateral control, it may take the place of the ailerons.

In Fig. 4 a modification is shown applicable where it is not desirable to have the wings 3 releasable. Instead of hinges I use flexible means of any suitable material; in the embodiment shown steel leaf springs 40 are bolted to wings 2 and 3, flexibly and elastically connecting the two. These springs would be similar to the springs 32, except that they are also secured to the outer wings. A damper is needed in this case also.

While I have shown the embodiment of my invention in a monoplane, I do not wish to be limited to this type only, as the principle of the invention is to provide a knee-action for any type of airfoil or a plurality of airfoils, the axis about which said knee-action takes place being placed at such an oblique angle that a downward swing increases the angle of attack, and an upward swing decreases it. While with this knee-action the load the pivoted airfoil has to carry must be placed into the airfoil, or the lift must be transmitted to the center structure by elastic means, the use of a pivoted wing, unloaded and without springs, is in no way with-

out benefit. First, it reduces the induced drag, and thereby indirectly increases the lift of the center wing, and, as the angle of incidence reduces towards the wing tips 29, the lift is greatest near the knee portion, while at the tip the lift drops to zero. The center of gravity of the wing 3 is therefore farther away from axis A—A than the point where the lift acts; axis A—A thus takes the reaction, as a lifting force. The tip may be made purposely heavy to increase this action, as is accomplished with the landing gears 30.

The use or omission of the mentioned elements depends largely on the size of the plane, or on the length of the floating wings 3. Is the latter very short, whereby the operating mechanism is more effective, springs 32 and ailerons 36 may be dispensed with. Are wings 3 very long, for instance extending all the way from the fuselage, the spring 32 must be sufficient to carry the fuselage, or the center of gravity of wings 3 must be sufficiently farther out than the point where the lift acts to generate a reaction at the pivot axis to lift the fuselage.

Thus the invention may be applied to monoplanes as well as airplanes with a plurality of superposed or tandem carrying surfaces, or tailless planes and gliders. And I do not wish to be limited to the proportions shown, as they will change according to the purpose of the aircraft. The center or body portion may consist of a thick section wing, eliminating the fuselage. Furthermore engines may be placed at the floating wings 3, in very large planes.

Having thus described my invention, I claim:

An airplane having laterally disposed fixed wings, ailerons at the tips of said fixed wings for lateral control, movable wings hinged to the outer extremities of said fixed wings, to swing about axes that converge aft of the airplane, whereby a downward swing increases the angle of incidence, and an upward swing decreases it, a release mechanism operable by the pilot for simultaneous release of said movable wings, leaf springs tending to hold said movable wings at a certain angle of incidence, dampers interposed between said fixed wings and said movable wings, and means to manually vary the angle of incidence of said movable wings.

JOHN AKERMAN.