April 3, 1956 S. J. WITTMAN 2,740,597

AIRFOIL

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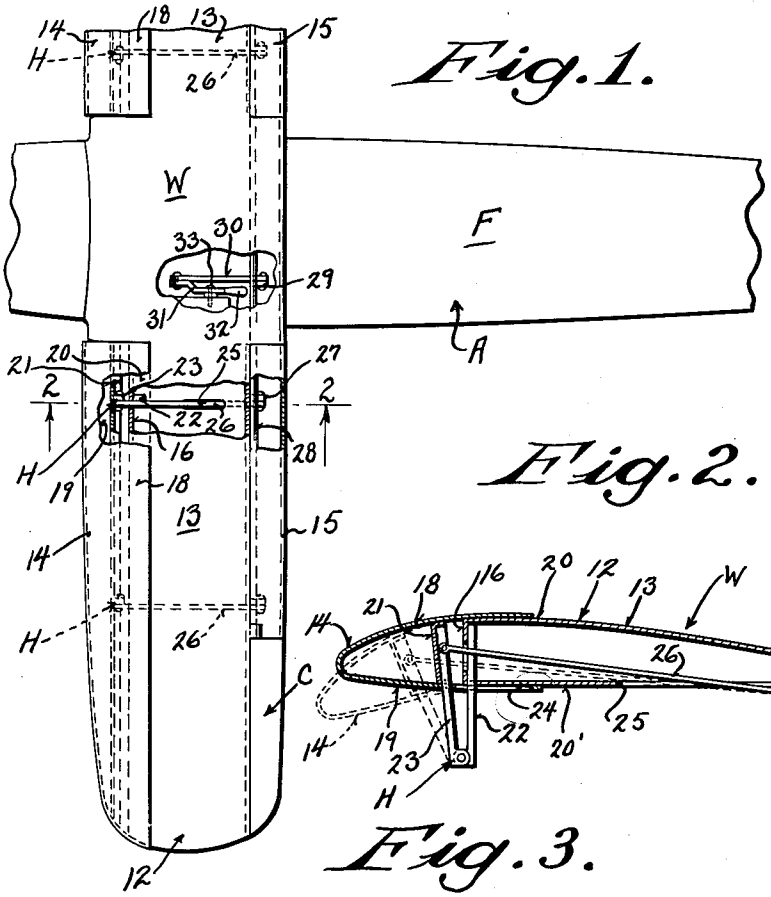


Fig. 1.

Fig. 2.

Fig. 3.

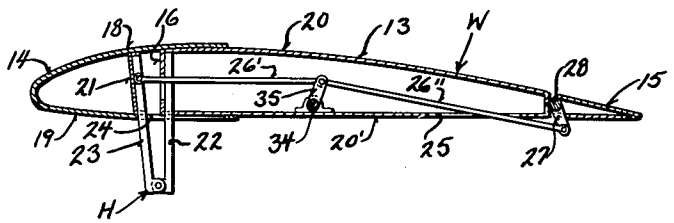
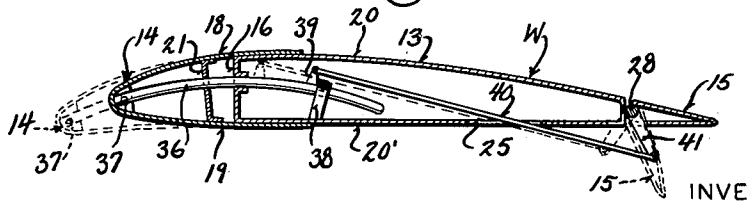


Fig. 4.



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AIRFOIL

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1 Claim. (Cl. 244—44)

This invention appertains to improvements in airfoils used on airplanes and other aircraft and in particular to a means for producing a very radical and advantageous alteration in the form of the airfoil in flight.

Generally speaking, in airfoils of different shapes, the one with the greatest camber or curvature will carry more weight per square foot than the others. Thick and deeply cambered airfoils have an unusually high lift coefficient, and are suitable for low speed such as take-offs and landings. Thin and slightly cambered airfoils, on the other hand, have a low lift coefficient but offer very little resistance to propulsion, and therefore are suitable for high speed flight.

One of the primary objects of my invention is to provide an airfoil which can be changed in flight from a high lift to a low lift airfoil and vice versa, by altering the area and curvature of the airfoil and thus varying the camber while still preserving the curvature of the upper side of the airfoil.

A more specific feature of my invention consists in providing an airfoil with a hinged telescopic nose and a hinged rear flap, forming separate rigid elements, the two being interconnected so that they are both lowered or raised to vary the angle of entry and trail simultaneously for the purpose of changing the camber of the section so as to increase or decrease the lift coefficient of the airfoil, without a correspondingly dangerous displacement of the center of pressure or the producing of undesirable eddy currents, either of which is likely to render the airfoil unstable.

A salient feature of my invention resides in the fact that the camber can be varied as described, by changing the surface curvature uniformly and maintaining it in that position or curvature.

Further advantages in utilizing an airfoil of my invention are, first, greatly increased speed may be obtained by decreasing the camber and, secondly, by increasing the camber the factor of safety in take-offs and landings is greatly increased, the machine can be more quickly raised from the ground and its carrying capacity may be increased.

A further object of my invention is to provide a simple, practical and reliable construction that is economical to manufacture, easy to assemble, and positive in its operation.

With the above and other objects in view, and to the end of attaining any other advantage hereinafter appearing, this invention consists in certain features of construction and combinations and arrangement of parts hereinafter described, pointed out in the claim and illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a fragmentary top plan view of an airplane illustrating my invention associated with the airplane wing;

Figure 2 is a transverse section through the airfoil of my present invention, taken on the line 2—2 of Figure 1 and looking in the direction of the arrows;

Figure 3 is a transverse section similar to Figure 2 but showing a slight modification of the control for the hinged telescoping nose and rear flap; and

Figure 4 is a similar section disclosing a still further modification of my invention.

Referring now to the drawings in detail wherein similar reference characters designate corresponding parts throughout the several views, the letter A generally indicates an aircraft of any standard type or make, having the usual fuselage F, wing W, and ailerons C.

The improved airfoil **12** comprises three main sections, a center section **13** having a fixed area and camber, a telescoping leading edge or nose portion **14**, and a hinged rear flap **15**. Both the left and right sides of the wing W are identical, the center section **13** of each being formed with a front longitudinally extending reinforcing spar **16** and a correspondingly formed rear spar **17**. Any number of standard transverse wing ribs (not shown) may be provided as is necessary to give the desired strength to the wing. The nose portion **14** is also provided with a longitudinally extending bracing spar **21**, and the nose extends the length of the entire leading edge of the airfoil **12**, with the top surface **18** and bottom surface **19** fitting snugly over the top and bottom surfaces **20**, **20'** of the center section **13**. The nose **14** is adapted to slide forwardly and downwardly with respect to the center section **13**, and is moved from the full line position to the dotted line position. This will increase the area and curvature of the airfoil and change the camber thereof.

In the form of my invention illustrated particularly in Figures 1, 2 and 3 of the drawings, this movement is accomplished by the provision of a number of depending hinges H, the elongated legs **22** and **23** of which extend upwardly, and are secured to the spar **16** of the center section **13** and spar **21** of the nose portion **14**, respectively. As shown, the hinge legs **22** and **23** are made long enough so that the pivot point of the hinge will be positioned well below the under or bottom surface **20'** of the airfoil **12**. This permits the nose portion **14** to telescope and slide over the upper and lower surfaces of the center section **13** as a unit, thereby maintaining an even and smooth curvature, eliminating any real break in the top surface of the airfoil as would be the case if the nose **14** were pivoted directly to the center section **13**. The under surface **19** of the nose portion **14** is provided with a transverse slot **24** through which the hinge legs **22** and **23** extend.

The under surface of the main section **13** is also slotted at **25** and through this slot extends a rod **26**. The rod **26** is pivotly secured at one end to the leg portion **23** of the hinge H and has its other end pivotly connected to a short lever **27** which is in turn rigidly fixed to a longitudinally extending control rod **28**.

This control rod **28** is rigidly secured to the rear flaps **15**. Each end of control rod **28** is pivotly secured to the main wing section **13** by having its respective end received in the hinge member **28'** of section **13**. It is readily apparent that by rotating control rod **28**, the rear flap will be rotated from its full line position to its dotted line position, and through the movement of the rod **26** the nose portion **14** will be pushed forwardly and downwardly to its dotted line position. In this position, the area and camber will be greatly increased and the airfoil **12** will have a high lift coefficient. This position is very advantageous for take-offs and landings and may also be utilized at such other times when slow flight is desired.

The control rod **28** may be rotated in any desired manner and by any type of control means located in the cockpit or cabin of the aircraft. One form shown in Figure 1 of the drawings is merely to provide a series of pivoted levers **29**, **30** and **31**. Lever **29** is rigidly secured at its upper end to the control rod **28**, and pivotly

secured to lever **30**. Lever **30** is in turn pivotly secured to lever **31**. Lever **31** is formed with a handle portion **32** and has a fixed pivot **33** intermediate its ends. By swinging the handle portion **32**, the control rod **28** will rotate and the nose **14** and rear flap **15** may be moved to any desired position.

One very desirable advantage of interconnecting the forward nose portion **14** and the rear flaps **15** so that they both move up or down simultaneously, is that the danger of excessive stresses being thrown onto the control mechanism under certain conditions, for example, at small or negative angles of incident may be avoided, as the pressure on the nose portion may be partly balanced by the pressure on the rear flap. This would be particularly desirable when my invention is associated with high speed type of aircraft.

Referring now to the modification illustrated in Figure 3 of the drawings, it can be seen that the construction of the airfoil sections **13**, **14** and **15**, including hinge H, are identical to the form illustrated in Figures 1 and 2. However, in this form of my invention, while the control rod **28** is rigidly affixed to the rear flap **15**, it is not connected through the levers **29**, **30** and **31** to the control handle **32**. For the purpose of controlling and moving nose portion **14** and rear flap **15**, I provide an additional control rod **34** which extends longitudinally through the main airfoil section **13** and is secured to the lever control handle **32** in a manner similar to control rod **28**, as shown in Figures 1 and 2.

Control rod **34** has a small upwardly extending arm **35** secured thereto and pivotly connected at its upper end are two smaller rods **26'** and **26''**. Rod **26'** is pivotly fastened to leg **23** of hinge H, and rod **26''** is pivotly secured to lever **27**. By rotating control rod **34**, the nose portion **14** and rear flap **15** are moved in a manner similar to that illustrated in Fig. 2 of the drawings.

In the modification illustrated in Figure 4 of the drawings, I eliminate hinge H altogether. This type of airfoil is particularly suited to aircrafts of higher speed, where even a small downwardly extending hinge would produce undesirable eddy currents. Here again the center section **13**, nose portion **14**, and rear flap **15** are quite similar to those illustrated in Figures 2 and 3 of the drawings. However, I provide a curved arcuate shaped plunger **36** which is firmly but pivotly secured at its forward end to a reinforced portion **37** of the nose **14**, and is braced by spar **21**. The rear portion of the plunger **36** is slidably received in the spar **16** of the main airfoil section **13**, and is further supported by an upright guide member **38**. Intermediate its ends plunger **36** is provided with an upwardly extending ear **39** to which one end of rod **40** is pivotly connected. Rod **40** is quite similar to rod **26** in use and operation and is similarly connected through a lever **41** to control rod **28**. As clearly illustrated, rotation of control rod **28** will move the nose portion **14** and rear flap **15** from their full line position to the dotted line position.

From the above description, it can be seen that I have provided an extremely simple yet positive means for altering the area and curvature of an airfoil and thereby varying the wing camber, and by allowing the nose portion to telescope over the main airfoil section **13** rather than hinging and breaking therefrom, I eliminate the development of undersirable eddy currents which would produce a drag and a decreased lift.

From the foregoing, it is believed that the features and advantages of the invention will be readily apparent to those skilled in the art, and it will, of course, be understood that changes in the form, proportion and minor details of construction may be resorted to without departing from the spirit of the invention or the scope of the appended claim.

I claim:

An airfoil for an aircraft having an intermediate center section of fixed area and camber, a telescoping nose portion overlying said center section on both top and bottom surfaces thereof, a rear flap pivotly connected to the rear portion of said center sections forming the trailing ends of said airfoil, a series of depending hinges, each hinge having one leg secured to the center section and the other leg secured to the nose portion, a longitudinally extending control rod rotatably secured to the intermediate center section, a nose rod pivotly connected to the nose hinge leg and to said control rod, a second rod pivotly connected to said control rod and to said hinged rear flap, and means including a series of control levers having one end of a lever secured to said control rod and having one lever extending into the pilot compartment of the aircraft, said levers being so constructed and arranged as to impart rotation to the control rod, whereby rotation of the control rod in one direction will materially increase the distance from the leading edge to the trailing edge of the airfoil and change the area and camber to give increased lifting power to the airfoil.

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