J. T. PATTERSON.

MODIFICATION OF PLANES, WHEN STATIONARY AND MOVING.

APPLICATION FILED DEC. 7, 1918.

1,344,244. **Patented June 22, 1920.**

3 SHEETS—SHEET 1.

Fig. 1

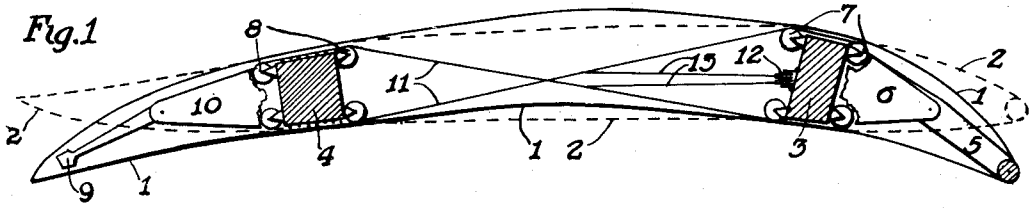


Fig. 2

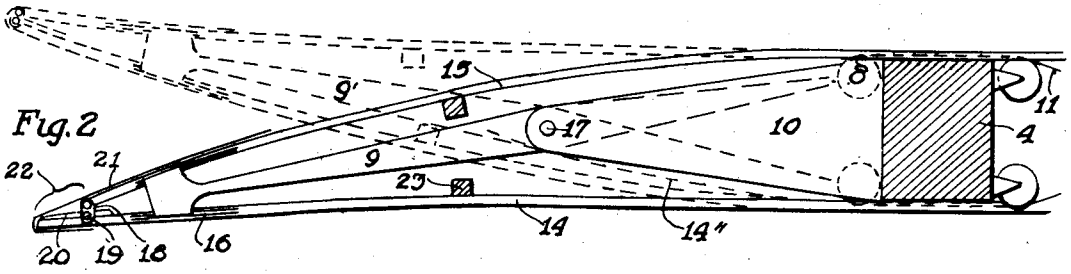


Fig. 3

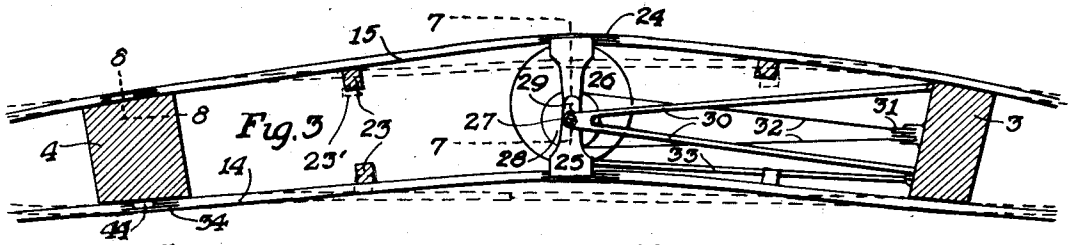


Fig. 4

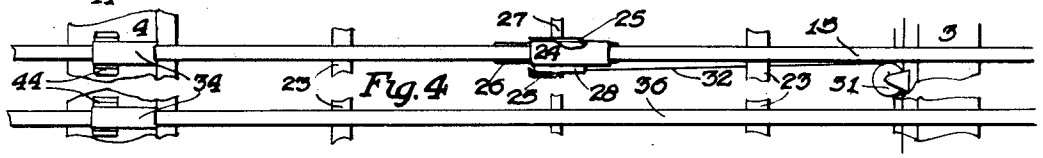
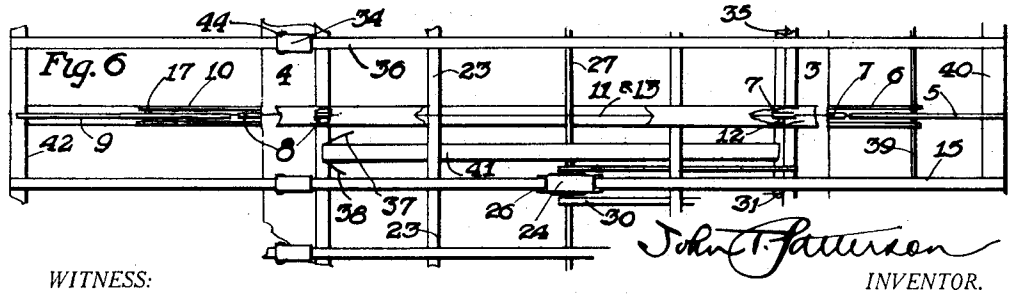


Fig. 5



Fig. 6



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3 SHEETS SHEET 2.

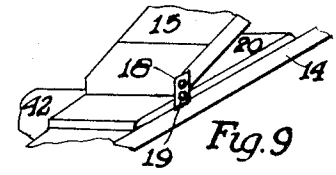


Fig. 9

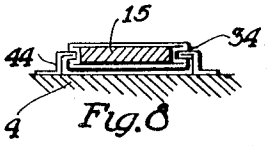


Fig. 8

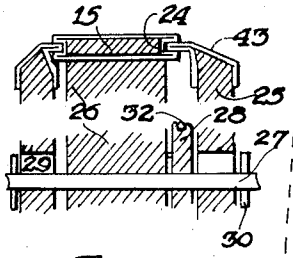


Fig. 7

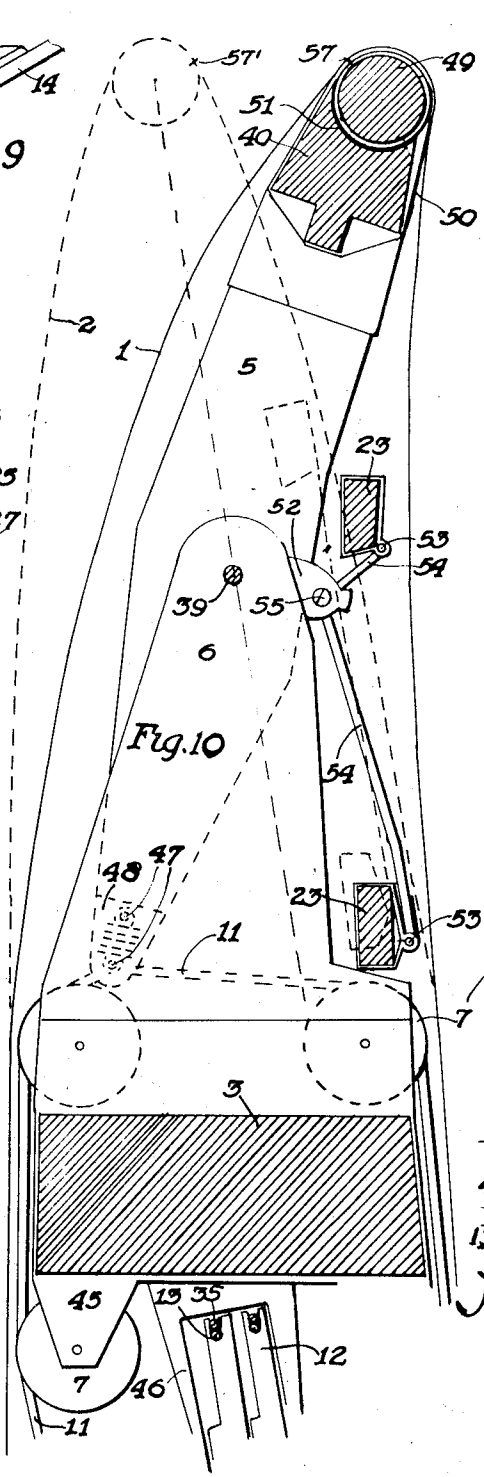


Fig. 10

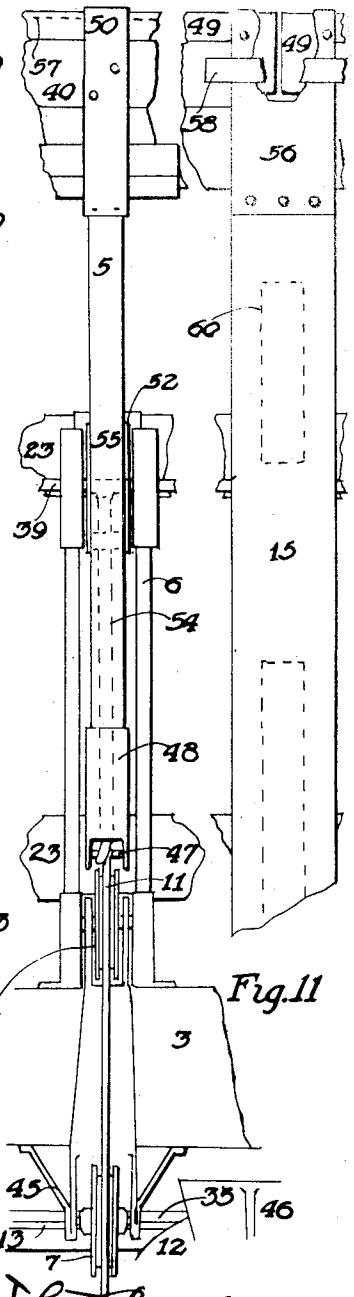


Fig. 11

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3 SHEETS—SHEET 3.

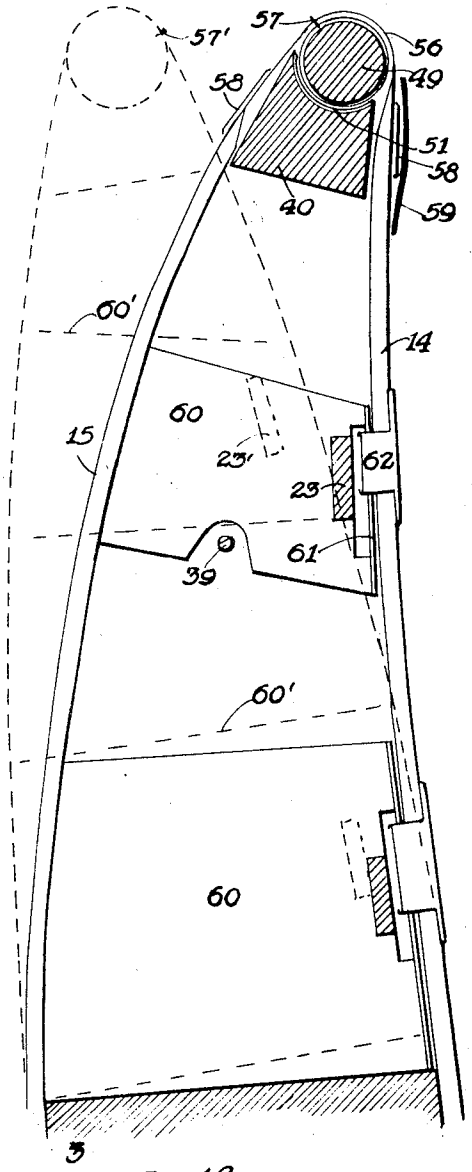
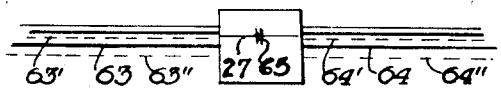


Fig. 12

Fig. 13



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MODIFICATION OF PLANES, WHEN STATIONARY AND MOVING.

1,344,244. Specification of Letters Patent. Patented June 22, 1920.

Application filed December 7, 1918. Serial No. 265,811.

To all whom it may concern:

Be it known that I, JOHN THOMPSON PATTERSON, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in the Modification of Planes, when Stationary and Moving, of which the following is a specification.

This invention relates to improvements in modifying the camber or curvature of a plane with the object of varying the ratio or lift to drag or drift and thus, together with other advantages, altering the speed of the plane or its direction, also compensating for variation in the load.

These improvements are capable of diversified uses which are broadly claimed. The immediate application is to an airplane. To reduce head resistance streamlining of the plane surfaces and inclosing of the mechanism are considered important. Double covering of the plane is therefore preferred. Surfaces are preferably continuous.

The camber modification may be attained by change in the form or attitude of the front portion of a plane as seen in a cross-section, the rear portion and the intermediate portion independently, in combination of any two, or in combination of the three. The plane or planes may be divided into two or more parts or wings and the camber modifications may be applied to any part separately or to any combination of parts simultaneously and similarly or differentially.

In each wing master ribs are preferably interspersed among form ribs to save weight and cost of construction. Each front portion master rib is connected to a rear portion master rib directly behind it. Between the two is a mid-portion form rib. Where the mid portion master rib occurs the front and rear portions have form ribs.

Radical alterations are allowable in the sliding devices. The cam mechanism might be used in the front portion of the plane, in the intermediate, or in the rear, alone, in any two portions, or in all three. The lever system similarly. Also the web block system similarly. Any arrangement might be made of any two or of all three systems. They may be operated separately or simultaneously. Also the upper and lower rib battens may be in one continuous piece over the whole or any part of the wing. These improvements are available, with suitable changes from the details shown, for metal as well as wood airplane framework, and for one-beam planes, etc.

Preferred means of obtaining the enumerated objects are illustrated in the accompanying drawings. The improvements are detailed in the claims.

Figure 1 is a general view of the camber change or modification of a wing section. Fig. 2 is a view of camber change mechanism in a rear portion master rib. Fig. 3 shows camber change mechanism in a middle portion master rib. Fig. 4 is a plan view of the ribs shown in Figs. 3 and 5 (with brackets 30 and one of blocks 25 omitted). Fig. 5 shows camber change in the middle portion of a form rib. Fig. 6 is a plan view of part of a wing showing portions of camber change mechanisms, etc. Fig. 7 is a vertical section through the line 7—7 in Fig. 3. Fig. 8 is a vertical section through the line 8—8 in Fig. 3. Fig. 9 is a view in perspective of the sliding batten mechanism at the extremity of the rib portion shown in Fig. 2. Fig. 10 illustrates camber change mechanism in a forward portion master rib. Fig. 11 is a plan view of rib portions shown in Fig. 6 on a smaller scale, also in Figs. 10 and 12. Fig. 12 shows a transverse rod and sliding block arrangement in the forward portion of a rib. Fig. 13 shows a pair of wings, including two planes.

In Fig. 1, etc., part 1 is the outline of the wing section for deep camber, 2 the outline of wing section in flattened camber, 3 the front beam and 4 the rear beam. 5 is the front camber lever pivoted to support bracket 6 fastened to front beam 3. 7 are pulleys attached to front beam 3 and 8 pulleys attached to rear beam 4. 9 is the rear camber lever pivoted to support bracket 10. 11 are cables communicating motion between front camber lever 5 and rear camber lever 9. 12 are pulleys on front beam 3 for cables 13 which communicate motion to cables 11 over pulleys 12 from the operator. Bracket 10 serves as a stop for the lower and upper rib battens 14 and 15 respectively, fastened to front beam 3 and slideably attached to rear beam 4. Battens 14 and 15 do not extend directly above and below lever 5 and bracket 6. 14″ is the extreme position of batten 14 against stop 10. 16 are batten grooves along which lever 9 slides when it is turned on the pivot 17 of lever 9. Attached to the end of batten 15

is a clip 18 holding a pin 19 which slides in the slot of batten 14 formed by a metal strip 20. 21 is a non-elastic section of the wing covering of which 22 is an elastic piece over the space between the ends of battens 14 and 15. The naturally weak trailing edge, still further weakened as illustrated by lack of rigid bracing for the battens, is thus enabled by the elastic section to yield instead of breaking in response to shock and pressure in the air and when handled on the ground.

23 are transverse rods by which master ribs control form ribs. 24 are groove slides on battens 14 and 15. 25 is a pair of blocks maintaining distance between battens 14 and 15 while slidable on slide 24. 26 is a cam or eccentric between blocks 25 with its center at a rockshaft 27 through them (used as an auxiliary or emergency camber modifier by the operator). 28 is a pulley fastened to rockshaft 27 and cam 26. 29 is a slot on block 25 which permits it to move vertically on rockshaft 27. 30 is a pair of brackets from beam 3 holding rockshaft 27 in place. 31 are pulleys (similar to pulleys 12) fastened to beam 3 for cable 32 which turns pulley 28 and cam 26 thus giving vertical movement to battens 14 and 15 and blocks 25. 33 is a spacer rod hinged at its ends to beam 3 and blocks 25. If necessary a slot is cut in rod 23 to allow rod 33 clearance. 34 is a grooved device in batten 14, also in batten 15 which permits them to pull forward over beam 4 for deep camber or backward for flattened camber. 35 master cable (from operator) is fastened to cable 13 or 32 in each master rib. 36 are form rib battens fastened to beam 3 and rod 23 but with connection to beam 4 and arrangement at rear and front edges similar to battens 14 and 15. 37 and 38 are internal brace wires. 39 is a rockshaft through bracket 6 and keyed to lever 5. Nose beam 40 is a part of the plane framework. 41 is a distance strut from front to rear wing-beam. 42 is a trailing edge piece which is joined to batten 14. 43 are guides on blocks 25 which fit in grooves of slides 24. 44 are guides on beam 4 which fit in grooves of grooved device 34. Similar guides are fastened to lever 9.

45 is a bracket holding pulley 7 to beam 3. 46 is a bracket holding pulley 12 to beam 3. 47 are pins on lever 5 about which cable 11 is fastened. Lever 9 is similarly attached to cable 11. 48 is a ferrule on lever 5 in which pins 47 are held. 49 is a nose rod which may be in sections from rib center line to rib center line or in one piece across the wing. 50 is a lever strap which is rigidly fastened to lever 5 and nose beam 40 and holds noserod 49 to nosebeam 40 while permitting noserod 49 to rotate. 51 is a bearing of nosebeam 40 against which noserod 49 rotates. 52 are bearing clips on lever 5. 53 is a hinge pin of rod 23 holding 54 connecting rod pivoted at 55 hinge pin in clip 52. 56 is a strap joining batten 15 to batten 14. 57 is the only line (lengthwise of noserod 49) of fastening between noserod 49 and strap 56. 57′ is the position to which line 57 turns when lever 5 is moved to flatten camber. 58 is a guide on nosebeam 40 to keep strap 56 in alinement. 59 is a covering fastened to battens 14 and 15 and (at line 57 only) to noserod 49. 60 are web blocks fastened to batten 15 and rod 23 but adjustably connected to batten 14. 61 is a slide plate fastened to blocks 60. 62 is a guide (fastened to batten 14) through which plate 61 runs when blocks 60 are moved. Movement of the transverse rod 23 causes blocks 60 to which it is attached to move to position 60′. The block rib shown in Fig. 12 is a form rib with reference to the rib of Fig. 10 though it is a master rib with reference to the type of rib shown in Fig. 5 whenever rods 23 are moved directly by the operator.

63 and 64 are wings. 63′ and 64′ are the flat camber positions of the wings while 63″ and 64″ are the deep camber positions of the wings. 65 are small hand wheels in the fuselage attached to shafts 27. Either wheel may be moved along for camber variation of one wing; the two wheels may be rotated differentially and simultaneously; and by a single hand-grip the two wheels may be moved together for similar, simultaneous camber variation of the wings.

To change camber of front, middle and rear portions simultaneously manipulate cables 35 which connect with cables 13 and 32. (Front portion.) Cables 13 actuate cable 11 which moves lever 5 with consequent movement of nosebeam 40, noserod 49 and battens 14 and 15. Movement of strap 56 entails slight rotation of nose rod 49 to permit proper adjustment of battens 14 and 15 to new positions. The covering 59 moves similarly to preserve tautness. Similar blocks 60 in all ribs in which they are placed are joined by transverse rods 23. Rods 23 move on impulse from lever 5 which governs them.

(Middle portion.) Cables 32 cause rotation of pulley 28 and cam 26 to which it is connected. Rotation of cam 26 to flatten camber causes depression of battens 15 and 14 and forces them to slide rearwardly along guides 44 on rear beam 4. Proper distance between battens 14 and 15 is maintained by blocks 25 which accommodate themselves to changing elevations of cam 26 by movement on rockshaft 27 permitted by slot 29. In the middle portion the master ribs control form ribs by means of transverse rods 23 (which may be supplemented by a block arrangement as in the front portion).

(Rear portion.) In the rear portion cables 11 move lever 9 which causes battens 14 and 15 to adjust their positions by sliding at their extremities. Slack or tension in wing covering 21 at the rear edge is compensated for by elastic piece 22.

When more convenient to the operator or in case of emergency camber may be varied through rockshaft 39 or 27 instead of through cable 35. Also rods 23 might be given initial movement for camber change with consequent movement of lever 5 or with omission of lever 5. Or rods 23 without blocks may be fastened to battens 14 and 15 and camber may be changed by lever 5.

To change camber by movement of front portion of plane alone disconnect lever 9 from cable 11 and cable 32 from cable 35. Manipulate cables 35 or rockshaft 39. The resulting movements are as indicated above —"cables 13 actuate cable 11 which moves lever 5 with consequent movement of nosebeam 40, noserod 49 and battens 14 and 15" etc.

To change camber by movement of rear portion alone detach lever 5 from cable 11 and cable 32 from cable 35. Manipulate cable 35. (A rockshaft might be used at 17.)

To change camber by movement of front and rear portions without radically modifying middle portion disconnect cable 32 from cable 35. Manipulate cable 35 or rockshaft 39.

To change camber by movement of middle portion principally cables 13 are disconnected from cable 35. Manipulate cable 35 or rockshaft 27.

It is not desired to be limited to the details disclosed in these specifications and drawings as changes may be made within the intent and purposes of the improvements and of the claims therefor.

I claim:

1. In an aircraft or the like, the combination of two batten members, a web member attached to one of said batten members and movably attached to the other of said batten members, and a roller attached to said batten members only on a line perpendicular to their length.

2. In an aircraft or the like, the combination of a plane, including a beam and a flexible rib batten and means for modifying the curvature of said plane, said means including a bracket attached to said beam, a lever pivoted to said bracket and a roller rotatably connected to said lever and attached to said batten on a line perpendicular to the length of said batten.

3. In an aircraft or the like, the combination of a plane, including a beam and a flexible rib batten and means for modifying the curvature of said plane, said means including a bracket attached to said beam, a lever pivoted medianly to said bracket and a roller rotatably connected to said lever and attached to said batten on a line perpendicular to the length of said batten.

4. In an aircraft or the like, the combination of a batten member and a roller attached to said batten member only on a line perpendicular to the length of said batten member.

5. In an aircraft or the like, the combination of a batten member, a roller attached to said batten member only on a line perpendicular to the length of said batten member and a rockshaft coöperating therewith.

6. In an aircraft or the like, the combination of a batten member, a roller attached to said batten member only on a line perpendicular to the length of said batten member and transverse member means of modifying the curvature of said batten member.

7. In an aircraft or the like, the combination of a batten member, a roller attached to said batten member only on a line perpendicular to the length of said batten member and connecting rod means of modifying the curvature of said batten member.

8. In an aircraft or the like, the combination of a batten member, a covering and a roller attached to said batten member and said covering only on a line perpendicular to the length of said batten member.

9. In an aircraft or the like, a substantially continuous upper rib batten, a substantially continuous lower rib batten and a pivoted cam for modifying the curvature of said battens by directly raising them together and lowering them together while maintaining the distance between said battens substantially unchanged.

10. In an aircraft or the like, a substantially continuous upper rib batten, a substantially continuous lower rib batten, a pivoted cam for modifying the curvature of said battens by directly raising them together and lowering them together while maintaining the distance between said battens substantially unchanged, and a rock shaft coöperating therewith.

11. In an aircraft or the like, a beam, an upper rib batten, a lower rib batten and a cam supported from said beam for modification of the curvature of said battens while maintaining the distance between said battens substantially unchanged.

12. In an aircraft, or the like, a pair of battens and a cam for modification of the curvature of said battens together and similarly by impulse given substantially perpendicular to the length of said battens.

13. In an aircraft or the like, a pair of battens, a cam for modification of the curvature of said battens together and similarly by impulse given substantially perpendicular to the length of said battens, and a transverse member coöperating therewith.

14. In an aircraft or the like, two beams, upper and lower rib battens fastened to one of said beams and slidably attached to the other of said beams and a cam between said battens for modifying their curvature between said beams.

15. In an aircraft or the like, the combination of a roller and a batten member bending partially around and movable over said roller.

16. In an aircraft or the like, the combination of a plane portion having a non-elastic covering of continuous surface forming a continuous, unangular curve and unexposed means of modifying the curvature of said plane portion without substantial movement of said covering with reference to said plane portion and without losing continuity of surface and continuity and unangularity of curve.

17. In an aircraft or the like, a pair of wings, each including a roller and a batten member bending partially around said roller and movable over said roller, and a means of modifying said wings singly or simultaneously, similarly or differentially.

18. In an aircraft or the like, a pair of wings, each including two batten members, a web member attached to one of said batten members and movably attached to the other of said batten members, a roller attached to said batten members only on a line perpendicular to their length and an unexposed means of changing the camber of said wings, singly or simultaneously, similarly or differentially.

19. In an aircraft or the like, the combination of a plane, an enveloping non-elastic covering having a gap at the trailing edge of said plane and a transverse elastic piece joined to said covering, bridging said gap and forming with said covering a continuous surface.

20. In an aircraft or the like, a plane covering and a roller attached to said covering at a distance from the extremities of said covering, said covering and said roller being movable together to a limited extent less than one rotation of said roller.

21. In an aircraft or the like, an enveloping covering having continuous surface, a plane, and a roller at an extremity of said plane, said roller having limited movement less than a single rotation in coöperation with said covering.

22. In an aircraft or the like, the combination of a batten member and a roller attached to an extremity of said batten member, said batten member and said roller being revoluble together to an extent less than one rotation of said roller.

JOHN THOMPSON PATTERSON.