Aug. 19, 1930. R. F. HALL 1,773,225

AIRPLANE

Original Filed Oct. 18, 1926

Fig. 1.

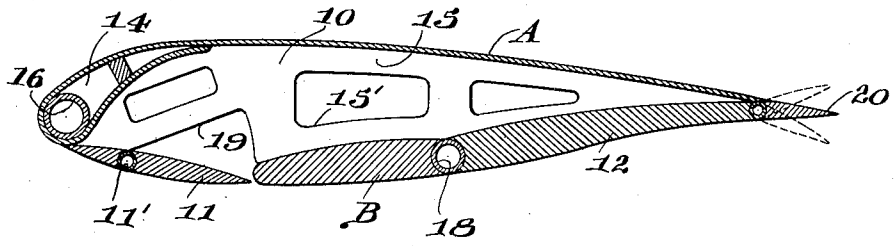
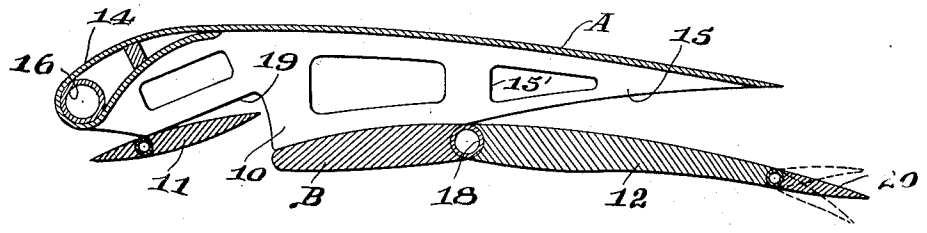


Fig. 2.



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UNITED STATES PATENT OFFICE

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AIRPLANE

Original application filed October 18, 1926, Serial No. 142,493. Divided and this application filed February 27, 1929. Serial No. 343,225.

This invention relates to certain improvements in airplanes; and the nature and objects of the invention will be readily recognized and understood by those skilled in the arts involved in the light of the following explanation and detailed description of the accompanying drawings illustrating what I at this time believe to be the preferred embodiment or mechanical and aerodynamical expression of my invention from among various other forms, arrangements, embodiments, combinations and constructions of which the invention is capable within the spirit and the scope thereof.

This application is a division of my pending United States patent application filed October 18, 1926, Serial No. 142,493, for certain improvements in airplanes, and presents an invention which deals primarily with airplane wings or lift surfaces of those types having an air displacement slot or passage therethrough, with a vane, auxiliary airfoil, or wing flap for opening and closing the slot or passage to control discharge of air therefrom, such for example as the types of wing disclosed by the aforesaid application, or by United States Letters Patent No. 1,559,091, granted to me October 27, 1925. It is to be here understood, however, that this invention is not limited or restricted to the particular types of wings, or their specific forms, above referred to, nor is the invention limited in all respects to wings of the displacement slot or passage types, but is also adapted to and intended for embodiment with wings of the so-called "flap" types generally, irrespective of the presence of slots or passages, or of whether if present the flaps cooperate with the slots or passages.

The present invention pertains to the ailerons or lateral control surfaces for wings of the foregoing types, and is characterized by a mounting and arrangement of the ailerons or lateral control surfaces on and carried by the wing flaps, such that the ailerons are operable for lateral control independently of the operation or function of the wing flaps and in any and all positions of the flaps throughout the operating range thereof.

The invention is further characterized by such an aileron mounting and arrangement on the flaps, vanes, or auxiliary airfoils of a wing of the air displacement slot or passage type in which the flaps or vanes function to open and close the slot or passage, and by which mounting the ailerons are operable for lateral control independently and in all positions of the flaps or vanes, including slot or passage opening and closing positions, as well as all intermediate positions, without interfering with the functions of the flaps or vanes.

With the foregoing characteristics, as well as certain objects and results in view which will readily appear from the following explanation, the invention consists in certain novel features in mounting and arrangement and in combination of elements, as will be more fully and particularly referred to and specified hereinafter.

Referring to the accompanying drawings:

Fig. 1, is a vertical, transverse section, more or less diagrammatical, through that type of wing or lift surface having an air displacement passage therethrough controlled at its discharge end by a wing flap, with the aileron or lateral control surface mounting and arrangement of the invention incorporated therewith and embodied therein, the wing being shown in the low attack angle position with the wing flap in passage closing position, and the aileron in normal position being shown in full lines, while the aileron in lateral control positions is indicated in dotted lines.

Fig. 2, is a view similar to Fig. 1, but showing the wing in a high angle of attack or passage open position with the wing flap opening the discharge end of the misplacement passage, and the aileron being shown in

a normal position by full lines and in lateral control positions by dotted lines.

The form, design, and type of airplane wing or lift surface shown in the accompanying drawings and described herein, with which the aileron or lateral control mounting and arrangement of the invention is incorporated, is employed purely by way of an example for purposes of illustrating and explaining the principles and features of the invention so that those skilled in the aeronautical art may readily understand the same, while recognizing the fact that the invention is capable of and includes embodiment thereof in and with other types and designs of wings, whether of the air displacement slot or passage type or not, having wing flaps or similar or equivalent members, for varying the characteristics and performance of an airplane wing or lift surface.

The wing here selected as an example and illustrated in the accompanying drawings, to which reference is now had, comprises the spaced, superposed upper and lower airfoils A and B, respectively, which provide the wing or lift surface having the air displacement passage 10 extending rearwardly therethrough between the airfoils A and B. The upper airfoil A is formed of a relatively thin section having a nose or leading edge portion or section 14 of substantial thickness and curving downwardly toward the lower airfoil B. The fixed portion of lower airfoil B is of considerably less chord than the upper airfoil A and is disposed spaced below and intermediate the leading and trailing edges of the upper airfoil, with the leading edge section 14 of upper airfoil A extending downwardly to and terminating substantially in the plane of the lower airfoil B but spaced forwardly therefrom, so that the forward or inlet end of passage 10 opens downwardly through the under side of the wing between the leading edge section 14 of the upper airfoil and the leading edge of lower airfoil B which is spaced rearwardly therefrom.

A series of ribs 15 are disposed between and transversely of and across the upper and lower airfoils A and B, spaced at intervals along the span of the wing, with the airfoils fixed thereto and connected together in proper spaced relation to form the wing or lift surface. The ribs 15 extend throughout the chord of the upper airfoil A which is secured over and across the upper edges thereof, with the wings extending forwardly and beyond the lower airfoil B. A single forward wing beam or spar 16 is disposed within the leading edge section 14 of the upper airfoil, across and connecting the forward ends of the ribs 15. The lower airfoil B is provided with and secured to a rear wing beam or spar 18, with the spar 18 secured to and across the lower edges of the ribs 15. The ribs 15 are formed with the openings or holes 15′ therethrough which serve to decrease the weight of the ribs, as well as providing passages through which air flowing through the displacement passage 10, may pass.

Provision is made for opening and closing the forward intake and rear discharge ends of the air displacement passage 10 of the wing, so as to convert the spaced airfoils to present the wing into what is in effect a single wing section. A vane or flap 11, in the present instance of airfoil section, is pivotally mounted on the axis 11′ longitudinally of the wing along the open forward end of passage 10, in such a relation to lower airfoil B and the leading edge section 14 of upper airfoil A, that it can be swung to position shown in Fig. 1 across and closing the passage 10, and forming a forward continuation of the lower airfoil B, extending to and joining with the under side of the upper airfoil section 14, or can be swung to the position shown in Fig. 2, to open the passage 10 for flow of air thereinto. In order to permit such swinging movement of vane 11, the wing ribs 15 are cut away at 19 to receive the trailing portion of the vane in passage opening position as shown in Fig. 2.

The trailing edge of the fixed portion of the lower airfoil B terminates a considerable distance forwardly of the trailing edge of the upper airfoil A, and a rear flap 12 is mounted pivotally along the referred to trailing edge of the lower airfoil. This rear flap 12 in the example hereof extends from and as a continuation of the lower airfoil B, to and terminating at its trailing edge substantially beneath and in line with the trailing edge of the upper airfoil A. The rear flap is swingable vertically to positions opening and closing the rear discharge end of the wing air displacement passage 10. The raised, passage closing position of the wing flap 12 is shown in Fig. 1 of the drawings, in which position this flap extends across the passage to and with its trailing edge disposed at and joining the trailing edge of the upper airfoil A, while the lowered passage opening position of this flap is shown by Fig. 2 of the drawings, in which position it functions additionally as a wing flap to assist in changing the characteristics and performance of the wing.

Any suitable or desired operating mechanism (not shown) is provided for opening and closing the forward vane 11 and the rear flap 12, operating to either simultaneously open and close these members, or permit of their being independently operated. However, such mechanism forms no part of the present invention and it is not deemed necessary to show and describe the same in detail herein.

Now, in accordance with the main features of the present invention, a mounting and ar-

rangement of ailerons or lateral control surfaces is provided for a wing of the above described type, by which the ailerons are carried by and mounted on the wing flaps or flap 12, and are operable independently thereof, while permitting the independent and normal operation of the flap or flaps in their function as such, and in their function of opening and closing the wing air displacement passage 10. In the particular example hereof, ailerons or lateral control surfaces 20, only one of which is disclosed in the accompanying drawings, are pivotally mounted on and extending rearwardly from the trailing edge of the wing flap or flaps 12, so that these ailerons 20 are operable for lateral control of the wing independently of the operation of the wing flap or flaps on which they are mounted and by which they are carried. Each aileron or lateral control surface 20, so mounted, thus extends rearwardly from the wing flap 12 and is disposed beyond the trailing edge of the upper airfoil, with the result that the aileron 20 in the raised, displacement passage 10 closing position of the wing flap 12 as shown in Fig. 1 of the drawings, is free for independent operation in the lateral control of the wing, such positions being indicated by dotted lines in Fig. 1.

Similarly, in the lowered passage opening position of the wing flap 12, as shown in Fig. 2 of the drawings, the aileron 20 is carried by the flap to such position, and is there so mounted and disposed as to be free for operation independently of the wing flap for lateral control of the wing, such positions of the aileron being indicated by dotted lines in Fig. 2. In the wing flap lowered-passage opening positions of Fig. 2, it should be noted that the upper surface of aileron 20 is subjected to the action of the airflow discharging from passage 10, and a maximum control effect from the aileron in its positions swung upwardly from flap 12, is thereby insured. So with all intermediate positions of the flap 12 between maximum lowered and closed position, the aileron 20 is carried thereby, but is freely operable independently thereof to perform its lateral control functions.

The present invention is not concerned with the mechanism for operation the ailerons or lateral control surfaces 20, as any of the suitable and well known ailerons controlling and operating mechanism can be employed for the purpose, and hence it is not deemed necessary for the purposes of the present application to illustrate such mechanism.

It is evident that various changes, variations, modifications, substitutions and eliminations might be resorted to without departing from the spirit and scope of my invention, and hence I do not wish to limit myself in all respects to the exact and specific disclosures hereof.

Desiring to protect my invention in the broadest manner legally possible, what I claim, is:

1. In an airplane wing having an air displacement passage therethrough, a pivotally mounted flap for opening and closing said passage, and an aileron pivotally mounted on and carried by said flap.

2. In an airplane wing embodying spaced, superposed airfoils forming an air displacement passage therebetween, a flap for opening and closing the rear discharge end of said passage, and an aileron pivotally mounted on and carried by said flap.

3. In an airplane wing, including spaced upper and lower airfoils, a wing flap pivotally mounted along the trailing edge of the lower airfoil and extending rearwardly at least to the trailing edge of the upper airfoil, and an aileron pivotally mounted extending rearwardly from the trailing edge of said wing flap.

4. In an airplane wing embodying spaced upper and lower airfoils forming an air displacement passage therebetween through the wing, the lower airfoil of less chord than the upper airfoil and having its trailing edge spaced forwardly from the trailing edge of the upper airfoil, a wing flap pivotally mounted on and extending rearwardly from the lower airfoil to the trailing edge of the upper airfoil, said flap vertically swingable to positions opening and closing the air displacement passage formed between the upper and lower airfoil, and an aileron pivotally mounted extending rearwardly from and carried by said wing flap, said aileron operable independently of the wing flap in all positions of the flap.

5. In an airplane wing embodying spaced upper and lower airfoils forming an air displacement passage therebetween through the wing, the lower airfoil including a rear vertically swingable portion forming a wing flap for opening and closing the discharge end of the passage, said wing flap in raised position extending to and joining with the trailing edge of the upper airfoil to close said passage, and in lowered position opening the passage, and an aileron pivotally mounted along the trailing edge of said flap and carried thereby, said aileron operable in all positions of said wing flap.

6. An airplane wing having a vertically swingable wing flap on the under side thereof extending rearwardly to the wing trailing edge, and an aileron pivotally mounted on and carried by said flap, said aileron extending rearwardly from the flap and operable in all positions of the latter.

7. In an airplane wing having an air displacement passage extending therethrough and discharging at the trailing edge portion

of the wing, a wing flap mounted for vertical swinging and in normal position closing the discharge from the wing air displacement passage, said flap extending rearwardly to and joining with the wing trailing edge in normal passage closing position, and an aileron pivotally mounted along and extending rearwardly from the flap trailing edge, said aileron operable in all positions of the wing flap.

Signed at Rochester, New York, this 14th day of February, 1929.

RANDOLPH F. HALL.