Oct. 28, 1924. 1,513,241

B. B. HARDING

VACUUM FORMING STRUCTURE FOR AIRCRAFT

Filed Nov. 10, 1922

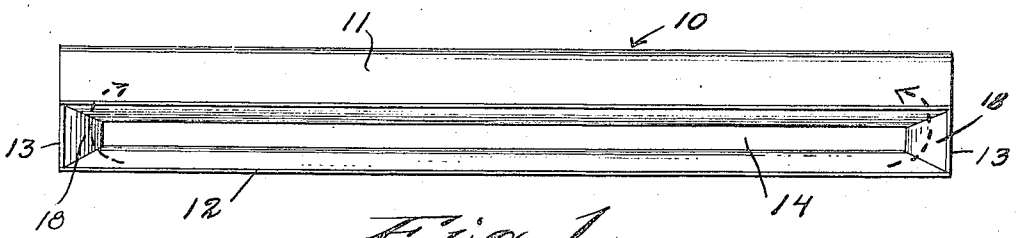


Fig. 1.

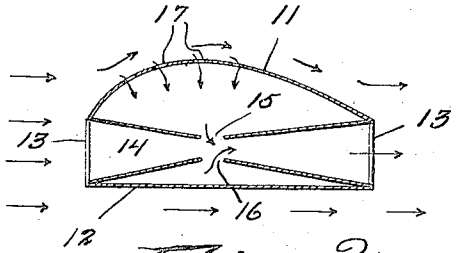


Fig. 2.

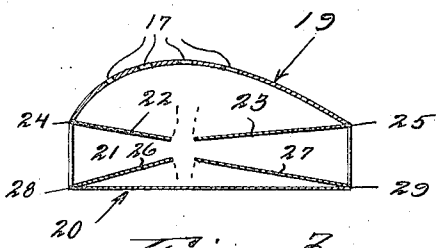


Fig. 3.

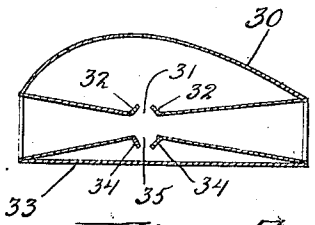


Fig. 4.

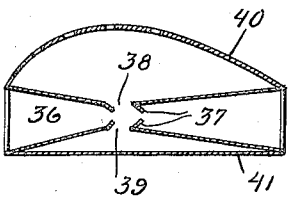


Fig. 5.

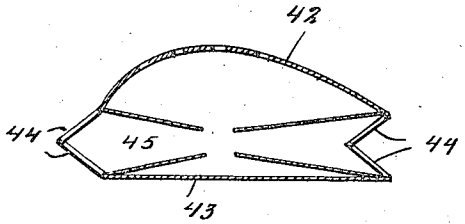


Fig. 6.

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UNITED STATES PATENT OFFICE.

BROOKS B. HARDING, OF HUMBOLDT, NEBRASKA.

VACUUM-FORMING STRUCTURE FOR AIRCRAFT.

Application filed November 10, 1922. Serial No. 600,125.

To all whom it may concern:

Be it known that I, BROOKS B. HARDING, a citizen of the United States, residing at Humboldt, in the county of Richardson and State of Nebraska, have invented certain new and useful Improvements in Vacuum-Forming Structures for Aircraft, of which the following is a specification.

This invention relates to air craft and has for its object the provision of means for incorporating therein the Venturi principle whereby to increase the buoyancy by increasing the degree of vacuum on the wing or other structural element.

An important and more specific object is the provision of a structural arrangement of parts whereby to form one or more Venturi passages which will increase the lifting power by causing a greater degree of vacuum on the upper surface of, for example, the wings, it being, however, to be understood that the fuselage and other elements may be likewise formed with one or more similar passages for the identical purpose, the underlying principle involved being the same in all instances and being capable of modification to meet various requirements which may be developed from experimentation or in the course of actual practice.

With the above broad idea in view, I have shown, in the accompanying drawings, an embodiment of the principle involved applied to the wing structure, and in the drawings:

Figure 1 shows a front elevation of an aeroplane wing constructed to embody my invention.

Figure 2 is a cross section therethrough.

Figure 3 is a similar view showing one method of varying the shape of the Venturi passage.

Figure 4 is a cross sectional view through the wing showing another method of adjustment.

Figure 5 is a similar view showing still another method.

Figure 6 is a sectional view showing a still further modification.

Referring more particularly to the drawings, and especially Figures 1 and 2, the numeral 10 designates an aeroplane wing constructed in accordance with my invention and including suitably connected upper and lower sections 11 and 12, respectively, which may be formed of the usual materials and of any form, size and shape and of conventional curvature in some respects. These sections might be connected as for instance by means of struts 13 or any equivalent structure.

The essential feature lies in the spacing apart of the sections 11 and 12 to define between them a Venturi passage 14 which is contracted at its intermediate portion, as shown, in accordance with the well known Venturi principle. The upper section 11 is formed with a longitudinal opening 15 which communicates with the narrowest point of the passage 14, and at the corresponding point the lower section 12 is formed with a similar opening 16. The upper surface of the upper section 11 is formed with holes 17 which will permit the inflow of air from the atmosphere above the wing into the interior of the hollow upper section. The ends of the upper and lower sections are connected by passage members 18 which provide a means of communication between the sections and which also operate to prevent the air rushing in at the ends.

In the operation it will be seen that when the air craft is in flight, the air rushes over the upper surface of the upper wing section 11, causing a vacuum or rarity of atmosphere along the upper surface which gives the buoyancy and causes a tendency to rise. In this wing, the air also rushes through the Venturi passage 14 and owing to the contraction thereof at its intermediate portion, a high vacuum will be produced in the vicinity of the contraction, this vacuum being greater than that produced by the rush of air over the upper surface of the upper section. Owing to the fact that the air rushing through this passage 14 creates a higher degree of vacuum than that produced at the upper surface of the upper section, the air above the upper surface of the upper section will be sucked through the holes 17 into the interior of the upper section and will pass out through the opening 15 into the Venturi passage. There is, of course, an equal degree of suction produced at the opening 16 and this suction or vacuum is transferred to aid in rarifying the air on the upper surface of the upper section by means of the communicating passages 18 at the ends of the wing.

It is of course conceivable that various

expedients may be resorted to for the purpose of varying the width of the Venturi passage and the size of the openings which establish communication between the Venturi passage and the upper and lower wing sections, and for the purpose of illustrating various possibilities along this line, reference is had to Figures 3 to 6, inclusive.

In Figure 3 the wing is shown as including upper and lower sections 19 and 20, respectively, which are hollow as in the above described form and which are spaced apart to define a corresponding Venturi passage 21. It will be noted, however, that the bottom of the upper section is formed of two wall members 22 and 23 pivoted at 24 and 25 whereby their angular inclination with respect to each other and with respect to the lower section may be varied. The lower section is illustrated as having its upper surface formed of two walls 26 and 27 similarly hinged at 28 and 29, respectively. Any lever means within control of the pilot may be employed for swinging the wall members 22, 23, 26 and 27 for varying the shape of the Venturi passage and the degree of contraction of the intermediate portion thereof.

In Figure 4 the upper section 30 has its bottom rigid instead of hinged, as in Figure 3, and formed with an air passage 31, the size of which may be varied by means of damper plates 32 which are swingably mounted wherby to be disposed in different positions for regulating the size of the opening. The bottom section 33 may have its upper surface provided with hinged dampers 34 for regulating the size of the opening therein.

In Figure 5 I have illustrated a tentative means of a different type for varying the size of the Venturi passage. In this instance the Venturi passage 36 is shown as being provided with hinged damper plates 37 located either in advance, or to the rear, or both in advance and to the rear, of the openings 38 and 39 which establish communication between the Venturi passage and the hollow upper and lower wing sections 40 and 41, respectively.

Figure 6 shows still another possible arrangement in which the upper and lower wing sections 42 and 43 are connected by some adjustable lever mechanism such as the toggles 44 which may be operated by some convenient means for shifting either the upper section with respect to the lower or the lower section with respect to the upper whereby to vary the size of the Venturi passage 45 between the sections. The actual operation in all instances is of course the same and these four figures, namely, 3 to 6, inclusive, are merely exemplifications of means for supporting my claims to the broad feature of adjustment.

I claim:

1. In an aircraft, a wing provided internally with a Venturi passage leading out to the front and rear edges thereof.

2. An aircraft wing formed with a Venturi passage extending from the forward to the rear edge, the wing being hollow and having its upper and lower portions communicating with the Venturi passage.

3. An aircraft wing consisting of hollow upper and lower sections having a Venturi passage therebetween and communicating at their ends.

4. An aircraft wing consisting of hollow upper and lower sections having a Venturi passage therebetween and communicating at their ends, the Venturi passage communicating with the upper and lower sections.

5. An aircraft wing consisting of hollow upper and lower sections having a Venturi passage therebetween and communicating at their ends, the Venturi passage communicating with the upper and lower sections, and the upper section being provided with openings establishing communication between the interior and the atmosphere.

6. An aircraft wing consisting of upper and lower sections spaced apart to define a Venturi passage therebtween extending from front to rear, said sections being hollow and communicating with each other at their ends.

7. An aircraft wing consisting of upper and lower sections spaced apart to define a Venturi passage therebetween extending from front to rear, said sections being hollow and communicating with each other at their ends, and means for controlling the communication.

8. In an aircraft, a structural element formed with a Venturi passage extending from front to rear, and means for varying the size of the passage.

9. In an aircraft, a structural element formed with a Venturi passage extending from front to rear, and means for changing the size and shape of the passage.

10. In an aircraft, a structural element including sections of hollow formation spaced apart to define a Venturi passage and communicating with the passage, and means for regulating said communication.

11. In an aircraft, a structural element including sections of hollow formation spaced apart to define a Venturi passage communicating with the passage, means for regulating said communication, and other means for regulating the size of the Venturi passage.

12. In an air craft, a sectional wing having a Venturi passage between the sections thereof.

13. In an air craft, a sectional wing having a Venturi passage between the sections thereof, the intermediate portion of the Venturi passage having controllable communication with the sections.

14. In an air craft, a sectional wing hav-

ing an adjustable Venturi passage therebetween.

15. In an air craft, a sectional wing having an adjustable Venturi passage therebetween, the sections of the wing being hollow and the intermediate portion of the Venturi passage communicating therewith.

16. In an air craft, a sectional wing having an adjustable Venturi passage therebetween, the sections of the wing being hollow and the intermediate portion of the Venturi passage communicating therewith, and means for regulating said communication.

17. In an air craft, a sectional wing having an adjustable Venturi passage therebetween, the sections of the wing being hollow and the intermediate portion of the Venturi passage communicating therewith, and means for varying the size of the Venturi passage.

In testimony whereof I hereto affix my signature.

BROOKS B. HARDING.