Feb. 21, 1933. V. W. STRODE 1,898,322

HULL

Filed Dec. 11, 1931 2 Sheets-Sheet 1

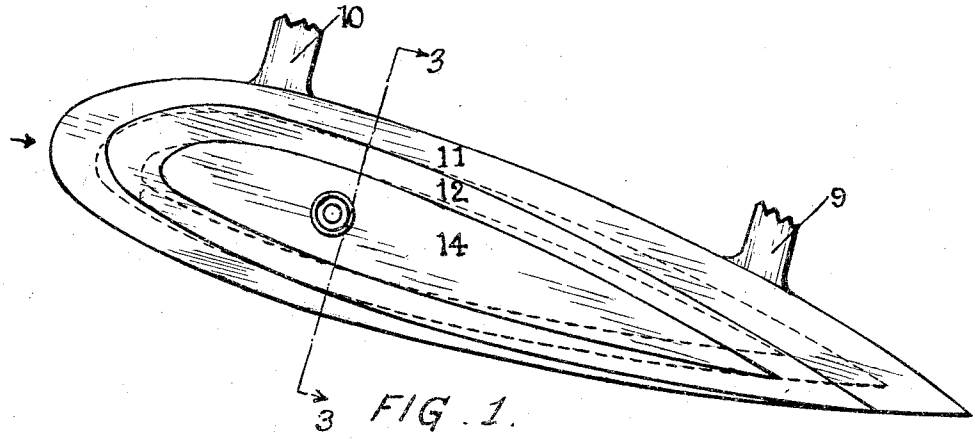


FIG. 1.

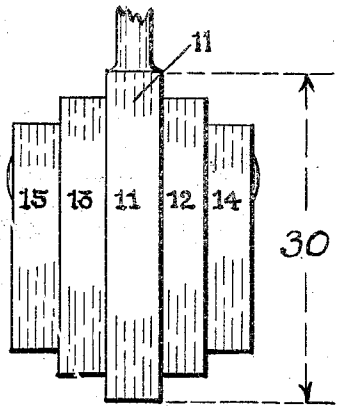


FIG. 2.

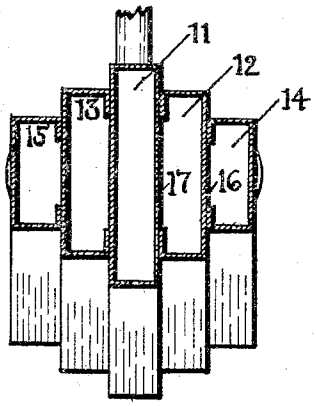


FIG. 3.

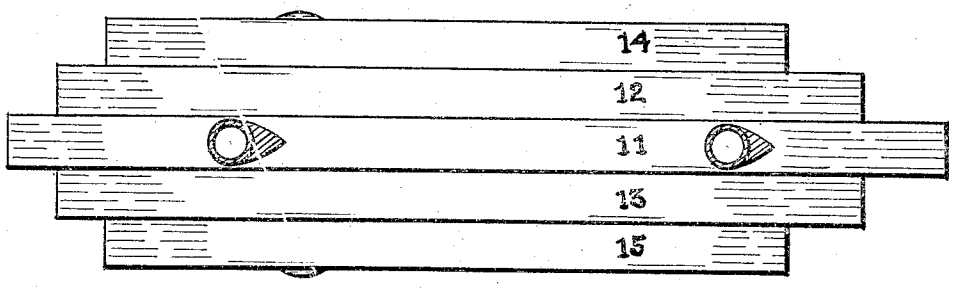


FIG. 4.

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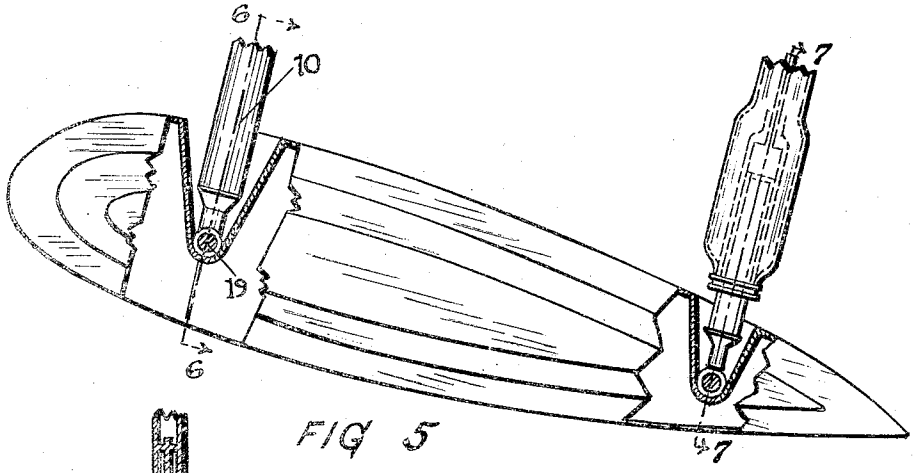


FIG 5

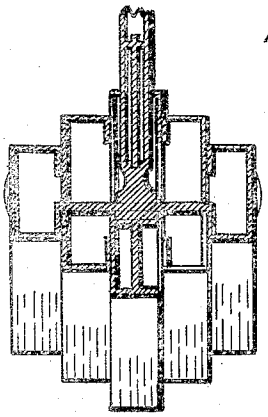


FIG 6

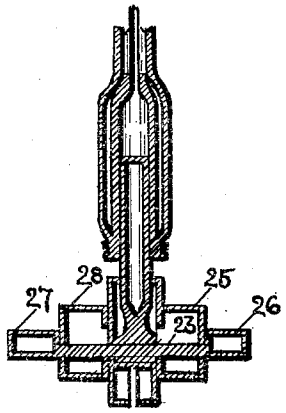


FIG 7

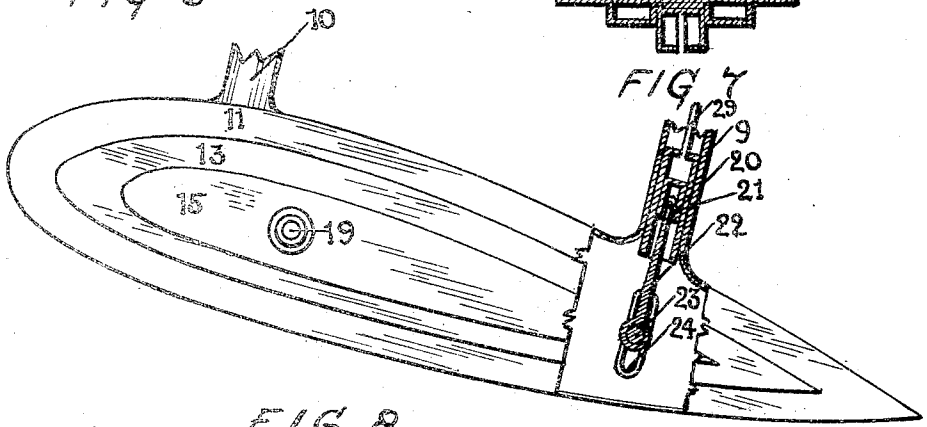


FIG 8

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Patented Feb. 21, 1933 1,898,322

UNITED STATES PATENT OFFICE

VICTOR W. STRODE, OF PORTLAND, OREGON

HULL

Application filed December 11, 1931. Serial No. 580,287.

My invention relates to the construction of sections for purposes of buoyancy and is beneficially applicable, probably in the order now given, to various uses:

First, for what is known as floats or pontoons on seaplanes;

As a design for the hull portion of flying boats;

As a hull section for speed boats and high speed water craft generally.

The objects of my invention are to provide a hull that will utilize the lift afforded by a properly designed airfoil section and at the same time be efficient as a support when resting or moving on water.

Another object of my invention and one of the primary ones is to provide such a section and means for changing the angle of incidence of the section with respect to the angle of the primary wing surface of a seaplane of which it may be an essential part.

Another object of my invention is to provide a float, pontoon or hull section for a plane that will have decided attributes of lateral stability.

A further object is to provide a float of the general character indicated that may be brought into contact with a water surface at high speed and that will exhibit characteristics of shock absorption hitherto unobtainable in constructions of this character.

These and other objects which will be apparent in the subjoined specification and claims constitute the primary purpose of my invention.

The following drawings accompanying and forming a part of this specification are directed to that exemplification of my invention applied to what is known as pontoons for seaplanes though my invention is by no means limited to such a device.

In the drawings, Fig. 1 represents a side elevation showing relative vertical displacement of sections hereinafter explained in detail;

Fig. 2 is a front end view looking in the direction of the arrow at the left of Fig. 1;

Fig. 3 is a section taken at 3—3 of Fig. 1;

Fig. 4 is a top view of Fig. 1;

Fig. 5 and Fig. 8 are alternate constructions representing substantially the same structure, both being partly in section; Fig. 8 represents Fig. 1 in normal flying position and is sectioned to show the means of accomplishing the displacement, diagrammatically; and Fig. 5 is a view showing how Fig. 1 may be constructed so that the entire structure may be vertically displaced to change the angle of incidence with respect to the main wing of a plane of which it may form an essential part;

Fig. 6 is a cross-section on the line 6—6 of Fig. 5;

Fig. 7 is a section on the line 7—7 of Fig. 5.

Beginning now with Figs. 1 and 3, the struts, 9 and 10 are broken away and serve to indicate the means commonly employed in attaching such a structure to a plane.

It will be noted by examining Fig. 3 that the hull as a whole is made up of a plurality of sections; in the present instance the center section, 11, has a greater depth than the sections, 12 and 13, next adjacent to it and these in turn have greater depth than the sections, 14 and 15, laterally disposed with respect to sections 12 and 13.

It will be understood that the bulkheads or vertical partitions when used, such as 16, 17, etc., are water-tight with respect to their outside surfaces and to each other and in the present instance 13 and 15 are made rigid with respect to each other on their vertical lines as are 12 and 14, and that 12 and 14 are movable as a unit with respect to their vertical position on the side of 11 as are also 13 and 15. In the present exemplification they are arranged to be moved together, the purpose of which will be hereinafter explained.

In Fig. 8 will be noted a pivot, 19, and it will also be noted that the strut indicated by numeral 9 contains a cylinder, 20, a piston, 21, to which is operatively attached a piston rod, 22, operatively connected to a trunnion pin, 23, movable in a slot, 24, the said slot, 24, it will be understood being formed interiorly in the element, 11, and the trunnion operable by the trunnion pin, 23, is movable vertically under the influence of the piston, 21, and the shoulders, 25, 26, 27 and 28 are adapted to en-

gage and move the sections 12, 13, 14 and 15 in unison with respect to 11.

A fluid pressure supply pipe, 29, is shown and will be presumed to be attached operatively to a reservoir of fluid pressure which is not shown since such things are old and well known and need no explanation. Suitable valves or other means of control will be supplied between the said reservoir and the supply pipe, 29, to permit actuating the piston, 21, selectively by fluid pressure.

No means are shown or required for the reverse of the action produced by the piston 21 since as soon as the wing is in the air the lift of the wing itself will accomplish this function.

In operating a plane having pontoons for landing gear up to this time the pontoon has served a single purpose—that is, to act as a float upon which a plane could be landed in the water and upon which it would rest due to the buoyancy of the pontoon when the plane was not being used.

A great deal of thought and study, testing in wind tunnels and the like has convinced airplane designers generally that what is known in the terminology of aeronautics as "parasite drag" was unavoidable. The ordinary pontoon from the moment of its being lifted clear of water upon which it rests starts to fight the horizontal rudders and the ailerons continuously and to a degree dependent upon the air speed and increasing with the square of the speed until the plane is again landed on the water. This characteristic of the ordinary pontoon has reduced the pay load of a seaplane to which they are attached, greatly increased the consumption of fuel and substantially subtracted from general reliability.

It is well known in the art that "taking off" from the surface of the water with a seaplane is accomplished with greater facility if the surface of the water is somewhat rough from the wind and has wavelets traveling toward the plane that will give the pontoon a jump as a wave strikes the pontoon.

One of the main features of my invention is found in that my upper surfaces, that is surfaces that are always in contact with the air, are of airfoil shape and will in most cases conform very closely to the upper surface of the wing of the plane upon which they are intended to be used. The under surface will also be curved somewhat but less and will ordinarily be made as straight as can be safely done.

Since a surface, as the underside of a wing, adapted to air pressure, is not normally the same thing as a surface adapted to water contact such as a boat bottom or the under side of a pontoon, somewhat of a compromise is necessary; the under or wetted surface as illustrated in the drawings fairly represents the state of present knowledge on the subject though it is expected to be modified somewhat in the light of experience. This compromise surface being a practically new intangible, will for the purpose of this specification and claims be referred to as a "dual surface".

It will be noted also from the drawings, well illustrated in Fig. 2 and Fig. 3, that the several sections such as 11 to 15 inclusive are stepped on both their upper and lower surfaces from companion sections. This affords what amounts to a plane surface such as the projected area the width of which is indicated by numeral 30. This is intended to prevent drift either in the water or in the air, particularly when making a turn either in landing or taking off from the surface of the water.

Let us follow out the action of the airfoil sections in taking off from the surface of the water.

It is generally agreed among aeronautical engineers that, roughly, 75% of the lift of an airfoils is due to vacuum on top. It is notable, however, that only about 15% of the 75% is available unless air is also in contact with the underside of the wing or airfoil section. It therefore appears that for the most part the actual lift comes from the underside and that the vacuum on top of the airfoil merely lowers the resistance against which the lift is acting.

In taking off with a seaplane equipped with pontoons made after the pattern of my new hull each separate section, such as 11 to 15 inclusive, will exert lift in a small amount while its undersurface is wetted and is a true airplane wing the instant it breaks contact with the water. Let us take for example the two sections indicated by numerals 14 and 15 and assume that 14 has an upper area of 5 square feet and that all of the other similar surfaces, such as 15 on the same pontoon and 14 and 15 on the other pontoon, have equal areas, then the total area will be 20 square feet. Assuming that a speed over the surface of the water in taking off has been attained that will lift these four sections clear of the surface of the water and assuming that at that speed the wings of the plane have a lift equal to 8 pounds per square foot, then the instant these four sections are lifted clear of the water the total lift, due to sections 14 and 15, will at assumed conditions be 160 pounds, or the effect on the plane precisely the same as if a 160 pound sand bag were thrown overboard. This produces that highly desirable jump heretofore mentioned as an assistance in taking off and to a degree and in a manner far better than can be produced by a wave on the surface of the water. It will also be remembered that this jump will in most cases allow air to get under the next adjoining section when an additional and greater lift will be instantly effective.

It will thus be seen that a plane equipped

with pontoons made according to the plan of my new hull will lift a larger load, and load conditions being equal will leave the surface of the water quicker at a given speed or will actually take off at a much lower speed than with the conventional pontoon.

When flying the hulls eliminate parasite drag and add their area to the wing surface area. The takeoff speed of the plane will be effected favorably by changing the angle of the outside sections as shown in Fig. 1. This change is also desirable alike in landing as in taking off. When it is desired to land the control device, of which the fluid pressure means shown is an example, will change the relative position of the outside sections with respect to the inside section, 11, so that contact with the water will occur first well back on the bottom and if the fluid pressure control is used it may act as a substantial and efficient shock absorber to prevent the shock of landing on the surface of the water being transmitted through the struts to the fuselage of the plane. This is a very valuable feature that may be attained without extra first cost or increased weight.

Fig. 5 is a modification of Fig. 1 in that the pivot, 19, supports also the strut, 10*a*, and the angle of incidence then of the whole hull will be changed at once. This is shown as an alternative construction and is not thought at present to be as desirable as the form previously described in detail. In a flying boat, that is to say an airplane having a fuselage adapted to be landed directly on the water, it will be difficult to make the several sections such as 11 to 15 inclusive movable with respect to each other and it is believed that making them so movable would not have advantages sufficient to offset increased cost and excess weight. This will also be true in a hull such as that for a speed boat or any craft intended to remain upon the water.

My new hull, in a flying boat will have the effect of adding a substantial amount of wing surface and reducing the parasite drag and in a speedboat it will have the effect of lightening the craft by the amount of the lift afforded by each section as it comes clear of the water. In the speedboat as in the flying boat lateral stability will be enhanced and the lifting power of an airfoil will be available to lighten the craft as the speed increases and to provide a stability hitherto unattainable.

Many variations of the construction illustrated and/or described may be possible now that the basic idea is disclosed. I therefore do not desire to limit myself except as specifically stated in the following claims.

What I claim as new and desire to secure by Letters Patent, is—

1. In a hull of the character described, stepped airfoil upper surfaces for said hull and dual purpose under surfaces for said hull adapted to function as wetted surface in water and wing under surface in air, said under surfaces being in respective symmetry upwardly stepped both ways from the center as specified.

2. In a hull of the character described, a series of airfoil surfaces comprising a high central surface and lateral surfaces on each side thereof which are stepped downwardly from the said central surface by vertical steps and an upwardly stepped dual purpose under surface adapted to air or water contact.

3. In a hull of the character described, a plurality of hull sections adjacent each other and water-tight with respect to each other, the upper surfaces of each of the several sections being of airfoil design and vertically stepped downwardly, in respective symmetry both ways from the center section, and a dual purpose under surface for said sections stepped oppositely to the upper surfaces and adapted to the dual purpose of air or water contact.

4. In a hull of the character described, a plurality of sections divided on vertical lines from each other, water-tight diaphragms between the sections, downwardly stepped airfoil surfaces in respective symmetry on both sides of the center section, upwardly in respective symmetry stepped dual surfaces adapted to air or water contact, the steps being delimited by vertical division planes.

5. In a pontoon for a seaplane, a plurality of sections water-tight from each other and joined on vertical lines, airfoil upper surfaces for the said sections stepped from each other vertically comprising a center section and downwardly stepped side sections, dual purpose under surfaces for the said sections adapted to air or water contact, means for normally retaining the said sections in uniform position with respect to their upper and lower surfaces and means for changing the angle of side sections with respect to the center section.

6. In a pontoon for a seaplane, a plurality of sections water-tight from each other, airfoil upper surfaces for said sections, lower surfaces for said sections adapted for air or water contact, a center section for said pontoon adapted to support struts for attaching it to a plane, side sections adjacent said center section and stepped downwardly from the surface of said center section, means effective to render the said side sections movable on a vertical line with respect to said center section, means for selectively producing said movement whereby the angle of incidence of the said side sections may be varied with respect to that of the said center section.

7. In a pontoon for a seaplane, a plurality of sections water-tight from each other, airfoil upper surfaces for said sections, dual purpose under surfaces for said sections adapted for air or water contact, a center sec-

tion for said pontoon adapted to support struts for attaching it to a plane, side sections adjacent said center section and stepped downwardly from the surface of said center section, means effective to render the said side sections movable on a vertical line with respect to said center section, fluid pressure means for selectively producing said movement whereby the angle of incidence of the said side sections may be varied with respect to that of the said center section.

8. In a pontoon for a seaplane, a plurality of independent sections in juxtaposition, a center section thereof operatively attached to a plane, smaller sections on both sides thereof and having their angle of incidence movable with respect to that of said center section, means for movably attaching said smaller sections to said center section, means for accomplishing movement thereof selectively, the said center and the said side sections being provided with airfoil upper surfaces and dual purposes under surfaces, with a stepped relationship for said surfaces.

9. In a hull adapted to be used for a flying boat, a plurality of downward steps from the center in each direction of the upper surface, airfoil outlines for said steps, coinciding steps on the under surface of said hull provided with a dual purpose under surfaces as specified.

10. In a hull, a plurality of sections in juxtaposition on vertical planes, airfoil upper surfaces provided for said sections, said surfaces being progressively stepped downwardly in relation to adjoining sections, said stepping being both ways from the center of the aggregation, dual purposes under surfaces provided for the several sections, said under surfaces being stepped uniformly oppositely to said upper surfaces, means for varying the center line of the side sections with respect to the center line of the said center section and means permitting the return of the said sections to normal position under the influence of aerodynamic force.

11. In a hull, a plurality of vertical sections, the sides of which are planes, the upper surfaces of said sections being air foils of agreeing curvatures, the lower surfaces of said section being dual purpose surfaces, means for vertical displacement of a side section relative to a center section that includes means for absorbing shock upon contact of said side section with the surface of a body of water.

12. As a new article of manufacture, a hull section adapted to utilize airfoil outline on its upper surface to decrease the submergence of said hull under conditions of relatively high speed travel over the surface of a body of water, and stepped dual purpose under surfaces to progressively make the airfoil available as submergence decreases due to speed increase.

13. As a new article of manufacture, a hull member for a seaplane pontoon that is an aggregation of a plurality of elements having upper surfaces that are airfoils and lower dual purpose surfaces, the center section being adapted to be rigidly attached to a seaplane, adjoining sections being movable to change their angle of incidence with respect to the said center section, and means for selectively accomplishing said movement.

14. As a new article of manufacture, a pontoon for a seaplane having an upper surface that is a plurality of airfoils stepped relationship, a dual purpose lower surface adapted to air or water contact, means for attaching said pontoon to an airplane adapted to permit selectively changing the angle of incidence of the air foils and dual surface uniformly and in unison.

15. As a new article of manufacture, a pontoon for a seaplane having an upper surface that is a plurality of aifoils stepped downwardly on both sides of the center thereof, means for attaching said pontoon to a plane and means for varying the angle of incidence of a portion of said airfoils with respect to the angle of incidence of the remaining portion thereof.

In testimony whereof I have affixed my signature.

VICTOR W. STRODE.