G. H. CURTISS & J. P. TARBOX.

MULTIPLE STEP FLYING BOAT.

APPLICATION FILED JAN. 13, 1916.

1,223,320. Patented Apr. 17, 1917.

FIG. 1.

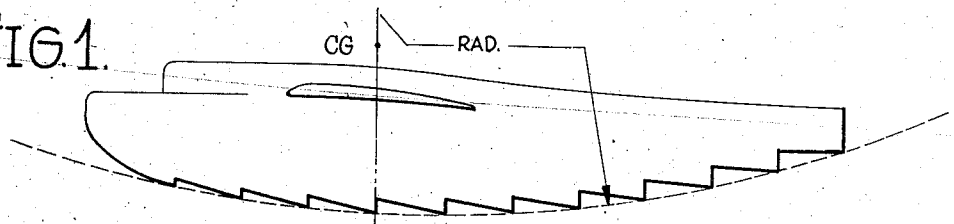


FIG. 2.

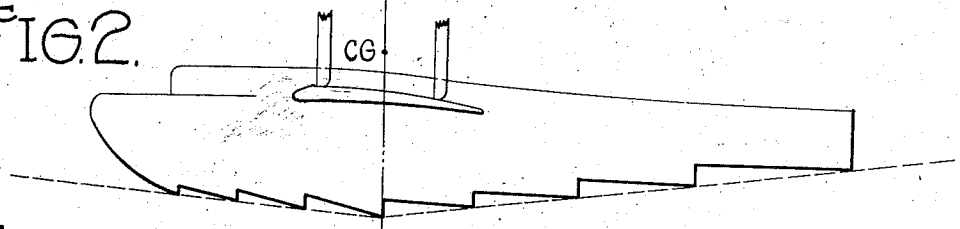


FIG. 3.

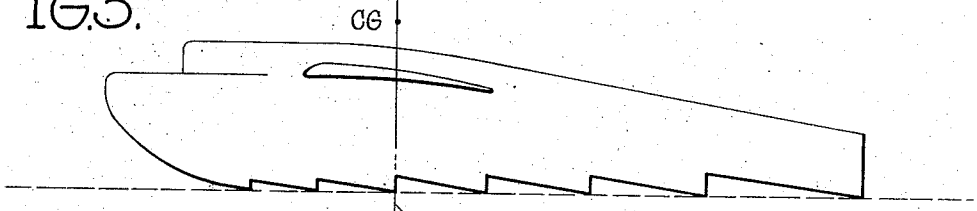


FIG. 4.

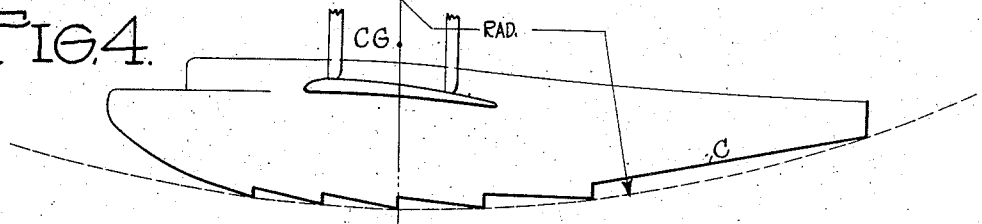


FIG. 5.

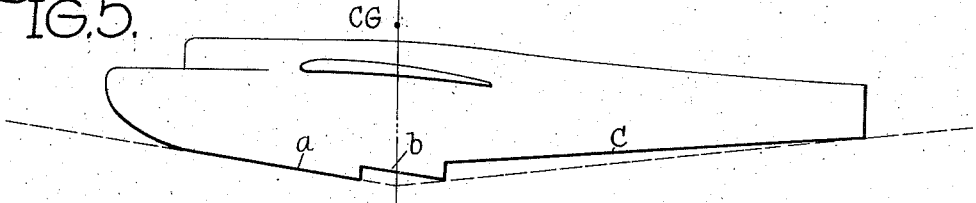
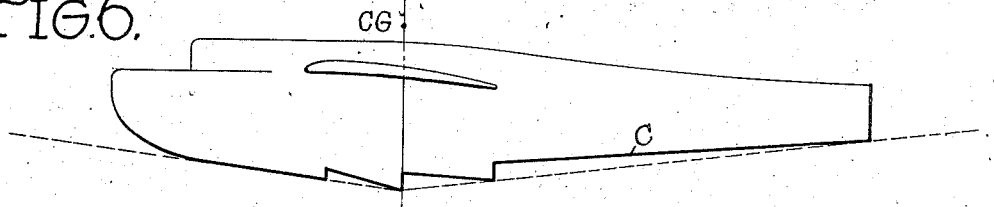


FIG. 6.



INVENTORS
GLENN H. CURTISS
JOHN P. TARBOX.
BY
John P. Tarbox
ATTORNEY

UNITED STATES PATENT OFFICE.

GLENN H. CURTISS AND JOHN P. TARBOX, OF BUFFALO, NEW YORK, ASSIGNORS TO THE CURTISS MOTOR CO., A CORPORATION OF NEW YORK.

MULTIPLE-STEP FLYING-BOAT.

1,223,320. Specification of Letters Patent. Patented Apr. 17, 1917.

Application filed January 13, 1916. Serial No. 71,944.

To all whom it may concern:

Be it known that we, GLENN H. CURTISS and JOHN P. TARBOX, citizens of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Multiple-Step Flying-Boats, of which the following is a specification.

Our invention relates particularly to that type of craft which may be broadly termed hydroplane flying machines. Water flying machines generally are provided with hydroplaning surfaces which enable them to rise quickly to the surface of the water when starting from a stationary position and having risen to the surface to skim thereover at very high speed. The invention has particularly to do with the form of this surface as related to the machine structure as a whole. However, it is capable of adaptation in other and perhaps simpler combinations, such for instance as in a hydroplane boat provided with lighter-than-air supporting means, or in a hydroplaning boat supported by its own buoyancy or lift.

The flying machines of today are ever growing larger. The original machine of this type was supported by a simple pontoon, the end surface of which was continuously flat and served as the hydroplane, being set at the correct planing angle with respect to the remainder of the structure. Later, the flying boat was developed. This was larger, longer and more seaworthy and its body approximated the form of a boat hull in shape, the passengers being seated therein, whereas passengers on the old pontoon type were seated in the aeroplane structure proper. The bottom of this is provided with a step located approximately vertically below the center of gravity of the structure as a whole, but this step defines only a single hydroplaning surface, located between itself and the prow of the boat, the tail of the boat having a bottom inclined rearwardly and upwardly and making an especially salient angle with the planing surface. As the craft become still larger, it is necessary to provide them with a plural number of hydroplane surfaces defined by a multiple number of steps after the fashion of the bottom of the high speed motor boats which have proved so efficient within recent years. When it is attempted, however, to apply this construction to hydroplane flying machines, it is found that it is wholly unadapted in the form in which it has been heretofore known, for to provide a multiple number of steps means a great elongation of the hydroplaning area both forward and rearward with the result that rocking action necessary in operating to leave the water, is wholly destroyed. Therefore, without making the controlling surfaces, rudders, elevators or the like of prohibitive size and strength, it is impractical to operate such boat.

Our invention eliminates this problem and gives to the art a practical embodiment in which are accomplished those things necessary for the success of the larger and more powerful types of hydroplane flying machines that are in use today. Instead of arranging the multiple steps horizontally, we arrange them in a longitudinally convex formation form front to rear. Therefore, no matter how many the number of steps and how far forward or rearward of the center of gravity or center of pressure of the structure these steps are extended, the machine can always have its longitudinal direction of travel in and over the water changed by the application of the comparatively small force necessary to rock the machine longitudinally upon its convex bottom. Thus longitudinal or fore and aft travel of the center of hydroplane lift with respect to the center of gravity of the machine is reduced to a minimum, for it is progressively transferred between a plural number of steps, as these steps on the rocking succeed each other in position relative to the center of gravity of the machine. Further, we arrange the convexity of the series of steps in such positional relation with respect to the center of gravity of the machine as a whole that when the craft is traveling horizontally, the lowermost point of convexity lies approximately vertically below the center of gravity. Still further, the steps are made increasingly long and increasingly deep from the prow of the boat toward its tail.

In the accompanying drawings we have shown the principal embodiments of our invention known to us at the present time but it is, of course, understood that the invention may be given many embodiments without departing from its generic principle.

Figure 1 shows an embodiment in which the convexity of the bottom is formed as a

curve having its mean center approximately in vertical alinement with the center of gravity of the machine;

Fig. 2 shows an embodiment in which the convexity conforms exactly to the lines of a salient angle. This is true, of course, as respects adjacent or semi-adjacent hydroplaning surfaces of the form of Fig. 1;

Fig. 3 is a diagram showing the old form of horizontally arranged multiple step bottom inserted here for showing the difference between that form and our invention;

Fig. 4 is a view of an embodiment similar to Fig. 1, showing the steps not only increasing in height from bow to stern but also surfaces increased in length of the steps;

Fig. 5 is an embodiment in which only two steps are used and two hydroplaning surfaces, the one "*a*" and the other "*b*", the tail portion "*c*" as in Fig. 4 making such an angle with respect to the surface "*a*" and "*b*" as to be devoid of hydroplaning function;

Fig. 6 shows a still further form in which three steps are provided and three hydroplaning surfaces, the center step constituting the apex of the salient angle formation of the convexity.

What we claim is:

1. A hydroplane boat, the bottom of which at the keel line is formed longitudinally on the arc of a curve having its center in an approximately vertical longitudinal plane and is provided with steps arranged respectively fore and aft of the vertical plane of said center.

2. A hydroplane boat, the hydroplaning bottom of which at the keel line is constituted by a series of steps arranged in a convex formation longitudinally of the boat, at least one of said steps being disposed in the vicinity of the point of maximum convexity.

3. A hydroplane boat, the hydroplaning bottom of which is provided with a multiple number of steps arranged in convex formation longitudinally of the boat, and each step of which is longer than the preceding step.

4. A hydroplane boat, the hydroplaning bottom of which is provided with a multiple number of steps arranged in convex formation longitudinally of the boat, and each step of which is deeper at its rear end than the preceding step.

5. A hydroplane flying machine comprising a hydroplane structure, and aerial supporting surfaces connecting therewith, said hydroplane structure having its hydroplaning bottom provided with a multiple number of steps arranged at the keel line in convex formation longitudinally of the boat, the lowermost step being disposed in the vicinity of a line projected vertically through the center of gravity of the machine.

6. A hydroplane flying machine comprising a hydroplane structure, an aerial supporting surface connecting therewith, a hydroplane structure having a multiple number of steps on its bottom arranged in convex formation longitudinally and having the lowermost point of convexity located substantially approximately below the center of gravity of the machine as a whole when the machine is on a horizontal course.

7. A hydroplane flying machine comprising an aerial supporting surface, and a hydroplane structure connected therewith, said structure having its hydroplaning surface provided with a multiple number of steps arranged longitudinally on the arc of a circle having its center approximately in the longitudinal vertical plane and approximately in vertical alinement with the center of gravity of the machine as a whole.

In testimony whereof we affix our signatures.

GLENN H. CURTISS.
JOHN P. TARBOX.