

Dec. 6, 1938.

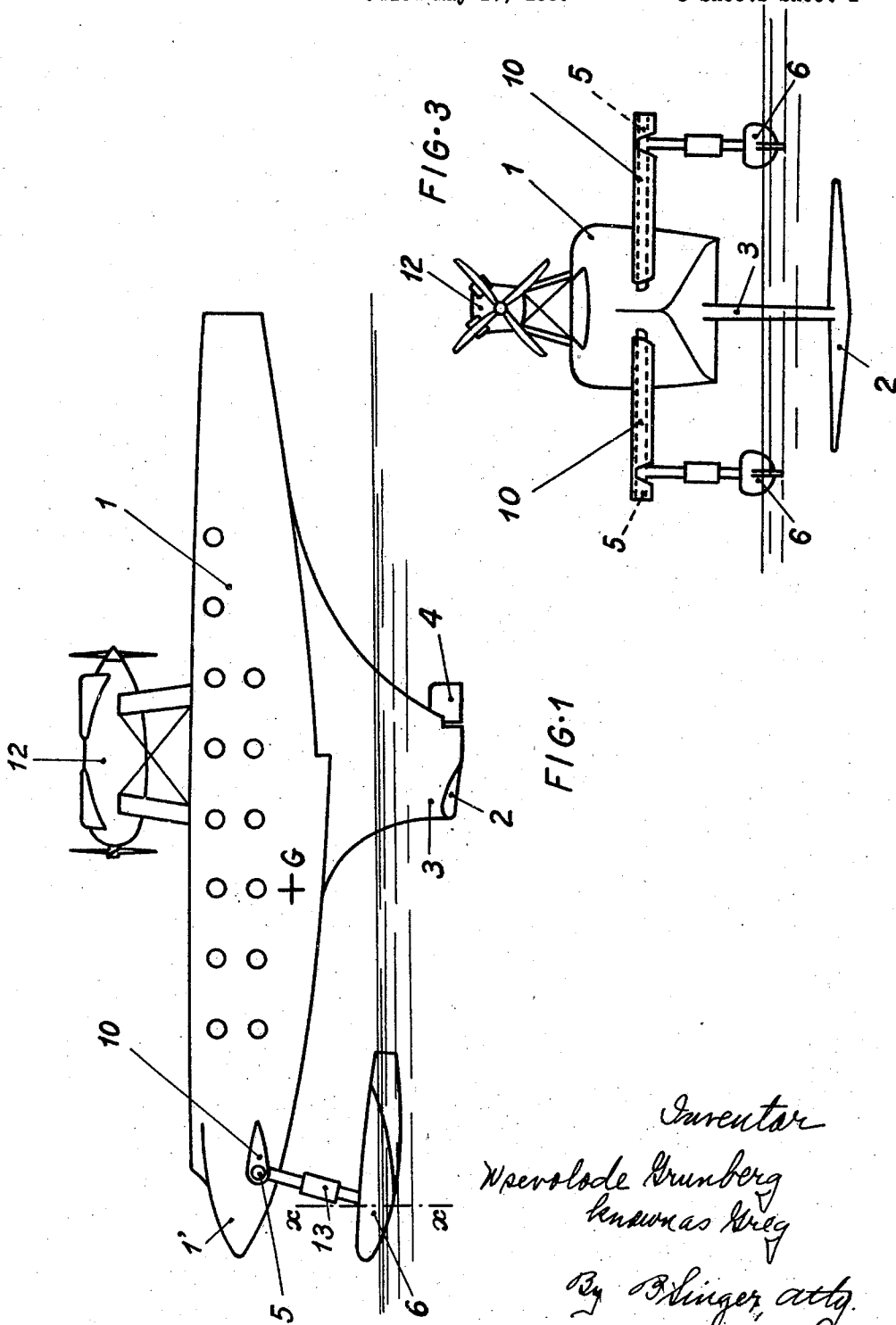
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2,139,303

WATERCRAFT

Filed May 10, 1935

3 Sheets-Sheet 1



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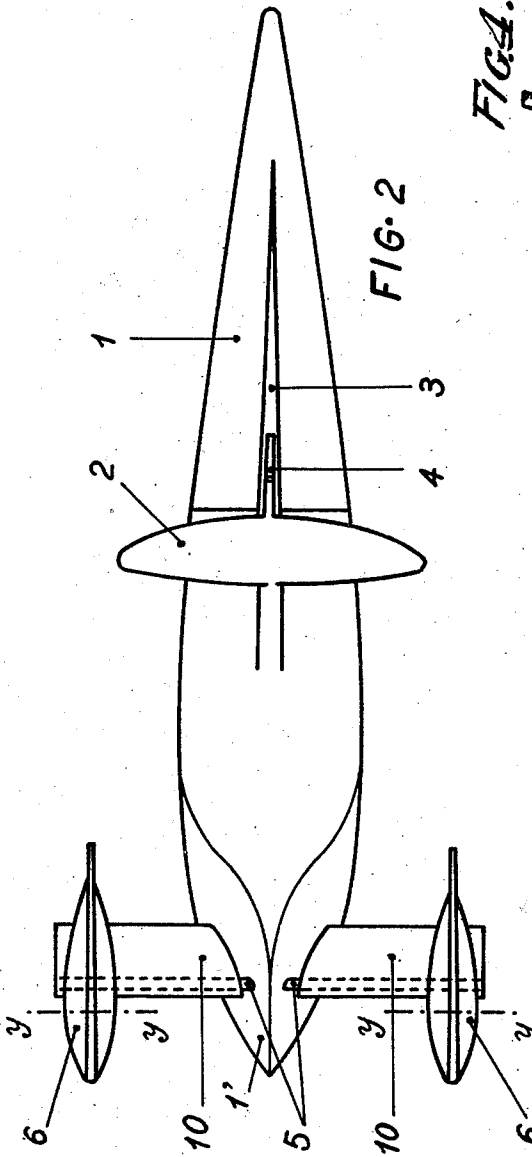


FIG. 2

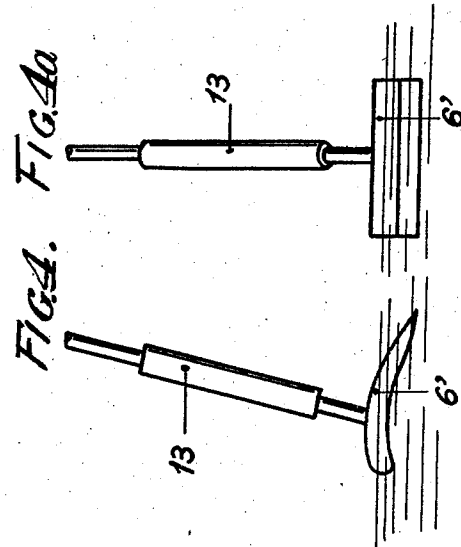


FIG. 4

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3 Sheets-Sheet 3

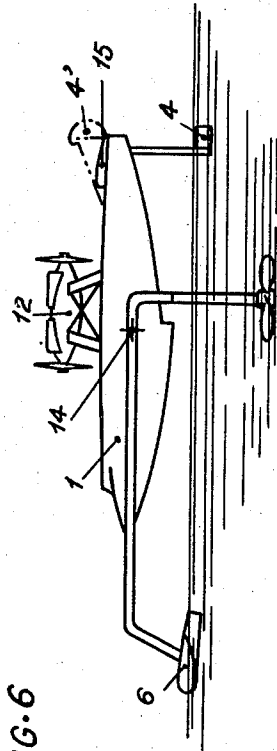
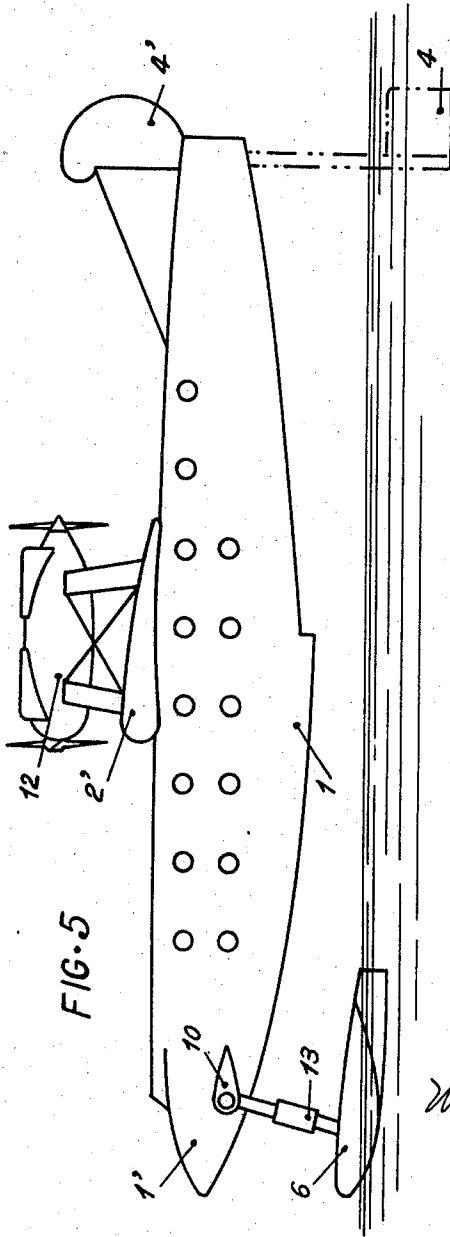


FIG. 6

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UNITED STATES PATENT OFFICE

2,139,303

WATERCRAFT

Wsevolode Grunberg, dit Greg, Paris, France

Application May 10, 1935, Serial No. 20,879
In France May 12, 1934

2 Claims. (Cl. 114—66.5)

The object of the present invention is to create a dynamically supported watercraft whose cockpit or body emerges in its entirety from the water when the craft passes from the position of rest to that of speed, while the elements of dynamic support remain entirely immersed in the sustaining fluid.

Devices of this character have already been proposed, but they present serious drawbacks which make it almost impossible to use them.

Thus, some of these inventions fail to assure the above-mentioned operating conditions, since they do not provide any means for obtaining constant equilibrium between the lift and the other variable forces acting upon the craft (weight, air and water pressure, propeller thrust, etc.).

In other inventions, the means proposed to assure this equilibrium are analogous to those applied in aviation. But in the case of an airplane, whether it is a question of restoring its equilibrium by its own stability or by pilotage, the machine disposes of a margin in which it can leave the strictly horizontal path of travel, while this possibility is lacking in craft that have to function in the immediate vicinity of the surface of the water. Consequently, in the latter case, the means applied in aviation prove inadequate.

Still other inventions involve devices attempting to regulate automatically the lift of the supporting elements, but they are either insufficient or very complicated, and they may even in some cases get out of order to such an extent as to compromise the safety of the vessel.

Finally, there are some prior devices which facilitate the lift by adding hydrovanes or aerial planes to hydro-gliders, without however succeeding in getting the cockpit entirely out of the water. These devices fail to meet the needs of the problem, which demands that the body and the sustaining elements be freed from the influence of the waves.

The present invention is primarily characterized by the fact that, at the two ends of a framework which is rigid longitudinally—the cockpit itself might be incorporated in this framework—there are fixed on the one hand at the rear, elements of dynamic support, and on the other hand at the front, stabilizing members which are sufficiently remote from the cockpit and which rest on the water, serving in this manner as a pivotal axis for the framework, with the result that the incidence of the supporting elements is modified automatically to adapt itself to the conditions of travel (speed, weight, distribution of load, wind, etc.).

The invention herein will be better understood by reference to the annexed drawings which show diagrammatically and by way of example in no way limiting, a boat conforming with the invention. It remains understood that the nature of the stabilizing members can vary, like those of the members for dynamic or static sustentation, propulsion direction, lateral and route stabilization, etc., without exceeding the scope of the present invention.

Fig. 1 is a side view of the structure.

Fig. 2 is an underside view thereof.

Fig. 3 is a front view.

Figures 4 and 4a show respectively a side elevation and a front elevation of a modification of the stabilizer.

Figs. 5 and 6 are side views of modifications of the structure.

The body or hull is indicated by the number 1 and may be of any approved construction.

The carrying member consists of the surface 2 of suitably chosen profile, shape and dimensions.

The surface 2 is connected to the hull by means of the connecting beam 3. This beam which may have various aspects, is shown in the shape of a profiled body prolonged towards the rear to form a keel and to serve as a fin. It carries the pivot for the rudder 4.

The surface 2 and beam 3 constitute a dynamic supporting means for the body 1.

The prow supports a cross strut 5, which itself serves to receive the connections of the lateral floats or buoys 6, is disposed, consequently, on either side and forward of the centre of gravity G of the boat.

The essential purpose of these floats is to maintain the surface 2 under water with a suitable incidence. On the other hand the floats ensure lateral stability of the boat.

The boat is centered forwardly which signifies that its centre of gravity G is forward of the centre of thrust, account being taken not only of the thrust which is hydro-dynamically applied at the surface but also aerodynamic thrusts which take place on the complete structure as well as of the traction of the screws. The sustaining power of the floats only, not their weight, is excluded from this balance of forces.

Thus, the boat will always have a tendency to nose-dive until the partial immersion of the floats creates a lifting moment equal to the nose-diving moment. With a surface 2 which has been appropriately calculated to provide in travel and in the immersed state, the necessary support,

there is obtained a device which is in stable dynamic equilibrium.

In fact, suppose the boat has left its state of equilibrium for some unforeseen reason and for instance nose-dived: the supporting force of the floats then increases, that of the surface 2 diminishes and there is created a straightening moment which immediately brings back the boat to its normal position. It is the same, with opposite action, if the prow lifts.

Variations in weight, speed—within defined limits and which may be very large—load distribution and so on create each time a new state of stable equilibrium and the structure passes thereto automatically. Thus, for example, if the speed has decreased this surface 2 sinks more than the floats (because the carrying force has diminished behind the centre of gravity and not forward thereof), and the sustaining force increases by variation of the angle of incidence, until the state of equilibrium is reached again.

It is, therefore, by pivoting about a transverse axis passing through the floats, that the boat adapts its angle of incidence to the requirements of the moment. The angle of incidence can thus attain without inconvenience, two extreme values which correspond the one to the position of the plane 2 at water level and the other at the landing of the hull on the water. Conditions of use will lead the constructor to the choice of these extreme values between which is situated the range of utilizable angles: maximum angle insuring travelling at full load and reduced speed, the minimum angle corresponding to the opposite, to the maximum speed of the unloaded boat.

To ensure lateral stability to the structure, the floats 6 are disposed on either side of the centre of gravity and act as floats on the wings of hydroplanes.

The floats can be articulated about a more or less vertical axis xx and situated forward of their "centre of lateral pressure" or "lee-way centre". In this manner the floats will exert no objectionable action on the route stability of the boat. The rotation of the floats about this axis can likewise be controlled. In this case they serve as rudder and brake means.

The facultative articulation of the floats about a transverse horizontal axis yy passing near their centre of gravity will give greater suppleness to their action, whilst at the same time protecting them against the waves. Nevertheless, it is useful to provide shock absorbing means to oppose any movements of the floats which is too disordered.

By providing a resilient connection between the floats and the hull in a manner such as for the suspension of the landing wheels of an airplane, the transmission of the shocks received by the floats will be reduced. On the accompanying drawings 13 shows this shock absorbing system in its cover.

It is possible to use the floats as reservoirs for fuel or as other recipients or even to install therein the motors which is of interest if it is desired to use marine screws.

It should be noted that the carrying force of the float or floats 6 can be, and generally is negligible in relation to the carrying power of surface 2 because the purpose of the floats is not to assist in the general supporting but to insure the stability of the boat by the creation of straightening moments and by the selection of suitable angles of incidence.

The float or floats is or are therefore comparable to the horizontal stabilizer plane of an airplane with still wider stabilizing functions. Now the stabilizer is in no way intended to sustain the airplane and has even, more often than not, a negative lift.

This purpose applied to the floats in the invention differentiates them entirely from floats proposed by certain inventors to which reference has been made at the beginning of the present description.

It has been seen that the displacement of the floats is not large in relation to the weight of the whole of the boat. Consequently, the resistance which they offer to forward movement does not considerably influence the speed of the vessel. Nevertheless, in certain cases and more particularly in that of speedcraft, it would be possible to substitute for the floats, dynamic supporting members, in a state of partial immersion, for instance, bearing surfaces level with the water.

The two projections shown in Figure 4 represent one of these surfaces 6' with its means of fixation containing in a casing 13 a shock absorbing means similar to the shock absorbers of an airplane.

On the condition that these auxiliary surfaces are suitably established, their action will be the same as that of the floats and will exert themselves by a practically analogous mechanism.

To facilitate turning or banking and the taking off operations as well as to permit the vessel to retain its most favourable angle of incidence (for example the economic angle) in the varied conditions of weight, speed and load distribution it can be provided with auxiliary members represented by the ailerons 10 having variable incidence and which are supported by the beam 5.

An equal and simultaneous action on the two ailerons, by increasing or decreasing their leading angle, brings about the modification required in the centering; a differential action allowing of inclining the vessel.

It is necessary however to bear in mind the advanced position of the ailerons. Owing to this position, they have the risk of exerting an unbalancing action. Their dimensions must therefore be adjusted according to the effect of stabilization of the floats unless the ailerons are withdrawn behind the centre of gravity.

The apparatus represented in Figures 1 to 3 is provided with a motor installation 12 actuating air screws.

It is obvious that all the means hereabove described by way of example, can be replaced by other members:

For the bearing surfaces themselves there might be substituted other supporting means of dynamic nature: for example a supporting screw 2'' (Fig. 6). And, although it may seem preferable because of a smaller encumbrance and more concentrated load distribution, that the supporting members should be plunged into the water rather than into the air, the scope of the invention will not be exceeded by having recourse to this last solution (Fig. 5).

Finally the longitudinal stability can likewise be obtained by other means than those described.

An example of automatically controlled stability can be found, in the following arrangement (Fig. 6): if instead of being directly connected to the hull 1, the assembly-supporting surface-floats, was connected to it by means of an articulation 14 the variations in incidence of the sur-

face 2 will not involve similar modifications in that of the hull. It is then possible to consider the float 6, as constituting the automatic driving means of an apparatus provided with a surface of variable incidence. In this modification, it would be advisable to provide the hull with a horizontal feathering plane 15.

What I claim is:

1. In a dynamically supported watercraft with body rising entirely clear of the water, means for maintaining the sustentation, said means consisting of integral elements and comprising, on the one hand, at least one stabilizer bearing upon the water, spaced from the craft and arranged forward of the center of gravity, and, on the other hand, at least one dynamic sustainer located behind the center of gravity, said stabilizer being made sufficiently large so that the pressure of the water forces it in operation to rest upon the surface and prevents it from sinking entirely, while said sustainer is, on the other hand, entirely immersed in the sustaining fluid, said sustainer comprising a hydrovane.

2. In a dynamically supported water craft with body rising entirely clear of the water, means for maintaining the sustentation, said means consisting of integral elements and comprising, on the one hand, at least one stabilizer bearing upon the water, spaced from the craft and arranged forward of the center of gravity, and, on the other hand, a dynamic sustainer located behind the center of gravity, said stabilizer being made sufficiently large so that the pressure of the water forces it in operation to rest upon the surface and prevents it from sinking entirely, while said sustainer, on the one hand, is entirely immersed in the sustaining fluid, said sustainer comprising vanes extending laterally, one on each side of the longitudinal plane of symmetry of the craft, said vanes being mounted under a sufficient incidence to lift the hull of the water craft entirely from the water, without the entire water craft, however, being able at any time to rise in the air.

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