G. A. CROCCO.

HYDROPLANE BOAT.

APPLICATION FILED APR. 10, 1908.

1,187,268. Patented June 13, 1916.

Fig. 1

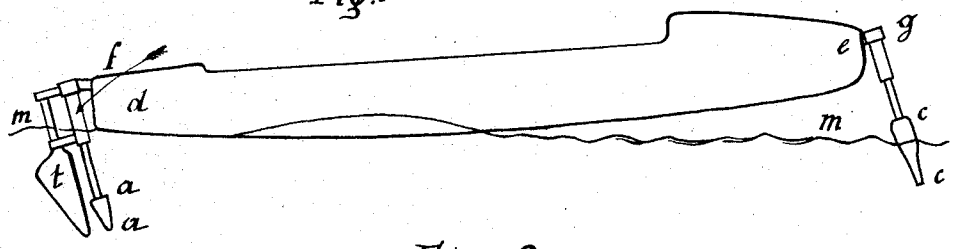

Fig. 2.

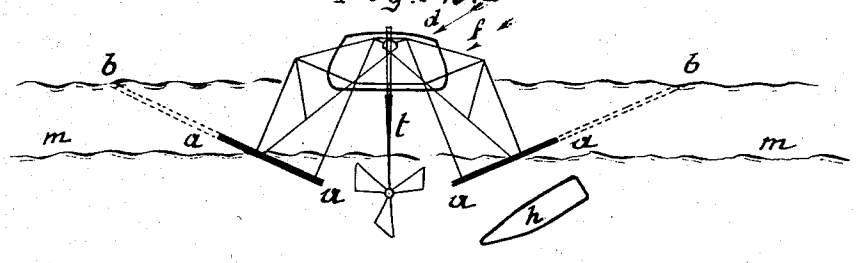

Fig. 3.

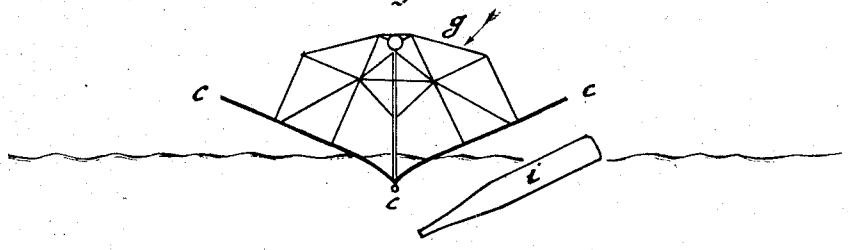

Fig. 4.

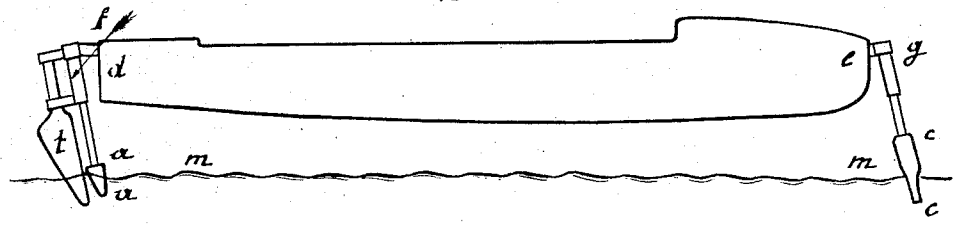

Fig. 5.

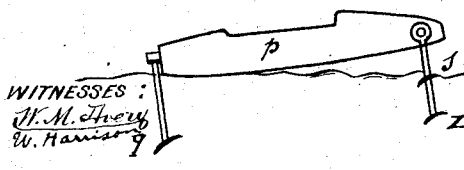

Fig. 6.

WITNESSES:
W. M. Thorp
W. Harrison

INVENTOR
Gaetano Arturo Crocco
BY Munn & Co
ATTORNEYS

UNITED STATES PATENT OFFICE.

GAETANO ARTURO CROCCO, OF ROME, ITALY.

HYDROPLANE-BOAT.

1,187,268. Specification of Letters Patent. Patented June 13, 1916.

Application filed April 10, 1908. Serial No. 426,269.

To all whom it may concern:

Be it known that I, GAETANO ARTURO CROCCO, a subject of the King of Italy, residing at Rome, Italy, have invented a new and useful Improvement in Hydroplane-Boats; and I do hereby declare the following to be a full, clear, and exact description of the same.

Now the present invention relates to certain improvements in the arrangement of the fins or blades of the hydroplane boats, the object of which is to secure a greater stability in the first phase of the run, viz: when the body of the boat is gradually emerging from the water, at the same time considerably reducing the number of the fins as well as their size.

In the annexed drawings which show how said invention can be carried into practice: Figure 1 shows a hydroplane boat in the first phase of the run, the stem of which has emerged from the water, while the bottom at the stern still remains in contact with the water. Figs. 2 and 3 are two transverse sections of the same boat and to each of them the form of the blade is added. Fig. 4 shows the same boat while in motion, when the body has emerged from the water. Figs. 5 and 6 are both side elevations of another form of hydroplane boat according to the present invention, in two different phases of the run.

In all the hydroplane boats heretofore known it is necessary, in order to insure a sufficient stability, to reduce gradually the surface of the supporting fins while the speed is increasing, in order to keep the stability always constant. In order to insure a perfect stability it is necessary in all the hydroplane boats, as soon as the vertical thrust of the fins has reached the value of the weight of the boat, to keep said thrust constant irrespective of any further variation of the speed above the normal limit. Heretofore this result has been secured; either by altering the angle of incidence of the water on the fins, that is by providing some contrivance for controlling the position of the fins in accordance with the speed of the boat; or by fitting the boat with sets of superposed fins at various heights arranged in such a manner that the total surface of the plunger fins grows smaller as the speed becomes higher and the vertical thrust remains constant. Both arrangements are objectionable; the arrangement of the movable fins because it introduces hinges and other articulations which are liable to give trouble and get out of order; the arrangement of the superposed fins because the construction of the boat becomes much more complicated. Apparently those hydroplane boats having V-shaped fins should be free from said objection, because the supporting surface of the fins diminishes automatically as the boat is raised and by conveniently shaping the fins a perfect regulation should be obtained. This automatical regulation by means of V-shaped fins is prevented in practice by serious structural difficulties. Fig. 2 shows clearly where the difficulty lies; the undulated line *b* indicates the level of the water when the hydroplane is at rest, and the line —*m*— the same level when the hydroplane is running at its normal speed. The reference character —*a*— indicates the fins and the portion in full lines corresponds to the fins of a hydroplane boat in accordance with the present invention, while said portion in full lines together with the portion shown in dotted lines shows the size which the fins had to attain if the diminution of the supporting surface should begin directly with the lifting of the boat. It will be understood that many difficulties had to be overcome for stiffening conveniently fins having such a considerable length and the weight of the boat would be also increased and more room would be required in performing any movement.

The object of the present invention is a novel arrangement of the fins, permitting an easy lifting of the boat above the water, keeping at the same time a perfect stability without using superposed fins or in the case of V-shaped fins, without giving them an excessive length. This result is obtained by a particular distribution of the supporting surfaces of the fins, which distribution is a departure from the practice hitherto in general use for this class of boats.

Heretofore the supporting surfaces have been arranged in such a manner that the resultant of the vertical thrusts on the various groups of fins coincided with the vertical line passing through the center of gravity of the boat, and therefore the boat was lifted while keeping same on an even keel or nearly so. Now in accordance with the present invention the supporting surfaces are distributed in such a manner that the resultant of the vertical thrusts on the various groups of

fins lies forward of the vertical line passing through the center of gravity when the boat is at rest or when the hull has not all emerged from the water. It ensues that the boat is lifted in this case in two successive steps, that is in a first period the bow rises and the transversal stability, until the fore fins reach the surface, is secured by the bottom of the boat skimming above the water at the stern; in a second period the stern portion of the boat rises gradually and is lifted clear from the water. At this moment the boat increases her speed to the maximum and both the groups of fins or only a group, if desired, help to the stability of the boat.

The practical execution of this arrangement requires firstly a boat very stable astern and for this purpose the usual racing boats having a finely cut and deep bow and flat bottomed stern are well suited. The same results can be secured, however, also by means of boats of the old pattern providing same with steadying surfaces astern. The flat bottomed boats have the further advantage of helping with their bottom in lifting the stern during the second period.

Secondly it should be remarked that the fins at the end of the first period have an inclination with respect to the direction of the movement, differing from the inclination they have at the beginning of the period, because the axis of the boat takes an inclined position. This particular movement is of the greatest importance, because it allows the reduction of the supporting surfaces and further renders possible to arrange same in such a manner that while at the beginning of the run the lifting of the stern follows the lifting of the bow, at the end of the run it is the lowering of the stern that precedes the lowering of the bow. This condition is indispensable for the safety and stability of the system.

Thirdly the surface of the fins ought to be distributed in such a manner that the fore fins support for a given angle corresponding to the horizontal position of the boat their share of load at a lower speed than that required by the fins at the stern.

In the practical form of execution shown in the drawings —*d*— (Figs. 1 and 4) designates the stern, —*e*— the bow of the boat having a flat bottom stern as shown in Fig. 2. The fins *a*—*a*—*c*—*c*— are secured to the boat by means of braced struts —*f*—*g*—. The aft fins —*a*—*a*— Fig. 2, in the form of boat illustrated are arranged in the shape of a V without vertex, while the fore fins —*c*—*c*— (Fig. 3) are in the shape of a complete V. This arrangement has given in practice excellent results, but nothing prevents adopting for the fore fins the same shape as for the fins at the stern. It is also possible to adopt for both groups of fins the form shown in Fig. 3, but in this case, when the boat is going at full speed it is lifted clear above the water and rests upon the portion of the fins near the vertex, the stability resulting would be insufficient.

In Figs. 2 and 3 a top view of the preferred forms of fins —*h*—, —*i*— are shown, but any other convenient shape may also be adopted. Further instead of straight fins, as shown in the drawing, bent fins can be adopted, formed for instance by two portions of the same circle either severed or connected together or bent to form any other convenient curve.

It should be remarked that by having at the stern the fins in the shape of a V without vertex, there remains between the lower ends of the fins a free space in which can be placed the rudder —*t*— and propeller *w*, Fig. 2. The form of construction hereinbefore described shows only a particular instance of the mode of carrying the invention into practice, because the system of raising the boat in two different times can be advantageously employed not only in the hydroplane boats with V-shaped fins, but also in the hydroplane boats with horizontal fins (in the transverse direction) of either the simple or of the multiple type. In this case the method forming the object of the present invention allows the reduction of the number of fins and makes it possible to arrange them at a great depth under the hull, without impairing the stability of the boat.

Figs. 5 and 6 show by way of example the invention as applied to a boat with horizontal fins. To the hull —*p*— the fins —*q*—*z*—*s* are secured by means of suitable supports. Fig. 5 represents the boat at the end of the first time: Fig. 6 the boat at the end of the second time lifted clear above the water surface —*m*—. It will be seen that the fins are arranged at the stern in a single plane and at bow at two different heights. However fins all at the same height or at various heights, even more than two, may be adopted also on the bow; and at the stern also a multiple system of fins.

I claim:

1. In hydroplane boats the combination of a boat with a flat bottomed stern, a group of V-shaped fins at the bow and a group of fins in the shape of an incomplete V at the stern, as shown and for the purposes set forth.

2. In hydroplane boats the combination of a group of fins at the bow having the shape of a complete V, a group at the stern having the shape of a V with the vertex cut off, a rudder and a propeller placed in the free space inclosed between the two fins at the stern or in the direction of same.

3. In hydroplane boats of the class in which the extension of the submerged supporting surface is progressively reduced

while the boat is progressively emerging from the water, supporting fins arranged at the bow and at the stern of the boat, the extension of which fins under the horizontal plane containing the water line of the boat floating at rest being such that the product of the distance between the center of gravity of the boat and the resultant of the vertical thrust of the bow fins, by the submerged surface of said bow fins multiplied by their mean unitary thrust is greater than the product of the distance between the center of gravity of the boat and the resultant of the vertical thrust of the stern, by the submerged surface of said stern fins multiplied by their mean unitary vertical thrust, for the purpose set forth.

4. In hydroplane boats of the class in which the extension of the submerged supporting surfaces is progressively reduced while the boat is progressively emerging from the water, supporting fins provided at the bow and at the stern of the boat, arranged in such a manner that in any position of the boat from the position she takes before she has reached the normal run above the water to the position with her bottom skimming astern at the surface of the water and the bow raised above the water in the position it takes in the normal run the product of the distance between the center of gravity of the boat and the resultant of the vertical thrust of the submerged portion of the bow fins, by the surface of said submerged portion of the bow fins multiplied by their mean unitary vertical thrust, is smaller than the product of the distance between the center of gravity of the boat and the resultant of the vertical thrust of the submerged portion of the stern fins, by the surface of said submerged portion of the stern fins multiplied by their mean vertical unitary thrust, for the purposes set forth.

In testimony whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

GAETANO ARTURO CROCCO.

Witnesses:

A. ROGGI,

LETTERNO GABSCEETTO.