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(54) **COMPETITION ROW BOAT**

WETTBEWERB RUDERBOOT

BATEAU À RAMES DE COMPÉTITION

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Description

FIELD OF THE INVENTION

[0001] The present invention falls within the field of competition boats, for canoeing or rowing sports, and may be configured as a canoe, a kayak or a boat for Rowing practice. More specifically, the technical field relates to the design and construction of rowing competition boats, thus considering structural/constructive issues of the boat which typically allow it to have the best possible performance.

[0002] Considering that it regards competition row boats, this constructive performance analysis must make use of hydrodynamic and aerodynamic criteria, as well as typical environmental factors, allowing to achieve the highest possible speed and robustness in relation to environmental factors, such as front waves or side wind, etc., and also maintaining the velocity.

PRIOR ART

[0003] The present invention finds its closest antecedents in different types of non-motorized boats for competition, which are found in Canoeing, including canoes and kayaks, as well as Rowing. Examples of kayaks can be seen in EP 1726522 A. In these water sports, boats typically have the so-called traditional or conventional hulls, characterized by a curvature of the keel line in the longitudinal direction, thus presenting a much smaller draft near the ends of the hull than that at the central zone, while the athlete is positioned in this deeper zone.

[0004] These hulls also have a volume distribution such that, above the waterline, the area of the waterlines or horizontal sections of the hull, both at the bow and at the stern, increases from the keel to the deck.

[0005] The competition water sports activity using row boats, with one or more crew members (typically up to four rowers), is regulated by specific rules which define weight, length and width of the boat, but also require that there are no concave sections in the hull, only convex sections [1]. As such, manufacturers seek boats with the best performance, respecting hydrodynamics and aerodynamics related criteria.

[0006] The patent application with publication number EP 1 726 522 A1 presents a kayak for competition with the general typical features of a competition row boat: one deck with an opening for a cockpit to a crew member and a hull, wherein said kayak is based on specific ranges of displaced volume and prismatic coefficient, with these features defining a boat with waterlines of the type of those described above as clearly visible in Fig. 3b of EP1726522 A1, which shows a cross section of this boat, typical of said conventional or traditional boat model.

[0007] The patent application with publication number US 2014 338584 A1 discloses a kayak with double keel, feature which distinguishes this kayak from the on disclosed in patent application cited above, being that, however, it maintains the general structure of a conventional model, i.e., the area of the waterlines in the hull increases up to the deck.

[0008] The hull shown in Fig. 3 of the present application is yet another example of said conventional hull model, relating to a previous model of the present applicant, in which the maximum value of the breadth (or width at the waterline) for any cross-section, from fore body to aft, is essentially close to the deck, wherein the variation of the breadth value for any cross-section is always positive from the keel to the deck.

TECHNICAL PROBLEMS SOLVED

[0009] In the present invention, it was intended to radically change the shape of the boat bow in order to provide a better hydrodynamic and aerodynamic performance, while maintaining compliance with regulatory requirements applied in competition for this type of water sports.

[0010] Thus, it was intended to alter said competition boats from said conventional perspective, enabling: (i) a better capacity in maintaining a route, i.e., to keep the movement of the boat in a straight line, reducing the rower(s) effort; (ii) an increase of the waterline, even when there is a trim variation due to rower(s) movements and to the increase of dynamic lift when the boat velocity increases; (iii) a reduction of the volume of the boat above the waterline at the bow, providing lower air resistance; and (iv) a reduction in the boat rising above the water when facing a front wave.

[0011] Within the present invention, it is also necessary to consider the previously mentioned constructive restrictions for competition boats, including the necessary absence of convex sections or lines in the hull. Thus, it is intended to solve the above problems with this limitation, resulting in the present invention.

SUMMARY OF THE INVENTION

[0012] It is therefore object of the present invention a competition boat (5) with a cockpit zone (3), a bow zone (1) - between the cockpit zone (3) and the fore body (6) - and a stern zone (2) - between the cockpit zone (3) and aft (7) - wherein, in the bow zone (1), the value of the breadth (8) corresponding to any waterline of a vertical section has its maximum value essentially close to the keel (9) and continuously decreases up to the deck (10).

[0013] The present invention thus relates to a competition row boat (5) which transcends the paradigm of said conventional boats, by changing the variation of the breadth corresponding to any waterline in the bow zone (1) from positive (in which the widest breadth is close to the deck) to negative (in which the widest breadth is close to the keel). Consequently, in the competition row boat (5) which is object of the present invention, the volume distribution of the hull in the bow zone (1) is fundamentally the opposite of that of said conventional models, wherein the volume is null at the deck and increases to its maxi-

mum value already below the waterline, and essentially close to the keel line (9).

[0014] It is also an object of the present invention a competition row boat (5) in which, in addition to the above technical features, the fore body (6) is below the design waterline and the stem (11) is projected to aft (7) in the direction to the deck (10).

[0015] This means that, to maintain compliance with the above mentioned competition rules and to obtain the desired best performance of the boat, it is also necessary to reverse the typical stem angle of said conventional boats, wherein the stem (11) is now projecting to aft (7) in the direction of the deck (10), and not in the direction of the fore body as it happens in the conventional type models. Thus, the end of the fore body (6) of the boat is underwater, also having a larger volume at its bottom than at its top. The end of the fore body (6) of the competition row boat (5) is underwater and also has a larger volume in its immersed part than above the design waterline.

[0016] The stern zone (2) of the competition row boat (5) which is object of the present invention keeps the positive variation characteristic of the breadth (8) corresponding to any waterline, in the direction from the keel (9) to the deck (10), which is typical of said conventional type models.

[0017] It is considered that the negative variation of the breadth (8) corresponding to any waterline is unique in the state-of-the-art per se and has, as an additional innovation, its combination with the features which provide the volume distribution, at the bottom of the hull.

DESCRIPTION OF THE DRAWINGS

[0018]

Fig. 1 - Perspective representation of a competition row boat (5) according to present invention. It is visible the bow zone (1), the cockpit zone (3) and the stern zone (2). In the bow zone (1) the stem (11) and the fore body (6) are visible. The aft (7) is visible in the stern zone. The keel (9) and the deck (10) are also presented.

Fig. 2 - Representation of a vertical section of a competition row boat (5) according to the present invention. It represents the breadth (8) corresponding to an arbitrary waterline and the depth (4) - vertical distance between the deck (10) and the hull (9) - of the vertical section.

Fig. 3 - Representation of two views, top and side, of a prior art art model of said conventional type technique. In Fig. 3, letters **A** through **P** correspond to different vertical sections of the boat which are depicted in Fig. 4. Fig. 3 also shows the design waterline, which illustrates that in this model the stem (11) is projecting to the fore body (6).

The boat shown in Figs. 3 and 4 has the same length as the boat shown in Figs. 5 and 6, being that the sections represented by the reference signs **A** through **P** are at the same length for all the figures.

Fig. 4 - Representation of vertical sections of a prior art model of said conventional type technique. It is visible that, despite all the vertical sections having a shape of an isosceles trapeze with rounded corners and convex sides, the pattern with a maximum breadth value corresponding to any waterline close to the deck is maintained. This corresponds to the fact that, in said similarity to an isosceles trapeze, the shorter side is the keel. In Fig. 4, the letters **A** through **P** identify the different vertical sections of the boat corresponding to those shown in Fig. 3.
In all the sections, the keel (9) is on the left side and the deck (10) on the right.

Fig. 5 - Representation of two views, top and side, of a competition row boat (5) according to the object of the present invention. In Fig. 5, the letters **A** through **P** again correspond to different vertical sections of the competition row boat (5), which are depicted in Fig. 6. Fig. 5 also shows the design waterline, which illustrates that in this model the stem (11) is projecting to aft (6).

Fig. 6 - Representation of vertical sections of a competition row boat (5) according to the present invention object. In the competition row boat (5) shown in Fig. 6, it is visible that only part of the vertical sections have the shape of an isosceles trapeze with rounded corners and convex sides, namely only those in the bow zone (1).
In Fig. 6, the letters **A** through **P** identify the different vertical sections of the competition row boat (5) corresponding to those shown in Fig. 5.
In all the sections, the keel (9) is on the left side and the deck (10) on the right.

Fig. 7 - Representation of a longitudinal side view of a competition row boat (5) according to the present invention. Reference signs **5A** through **5E** correspond to different horizontal sections of the competition row boat (5), which are in turn depicted in Fig. 8. As in Fig. 5 it is again visible the stem (11) projecting to aft (6). In Fig. 7, the reference signs **5A** through **5E** correspond to different horizontal sections of a competition row boat (5) according to the present invention.

Fig. 8 - Representation of horizontal sections of a competition row boat (5) according to the object of the present invention. In Fig. 8, the reference signs **5A** to **5E** identify the different horizontal sections of the competition row boat (5) corresponding to those shown in Fig. 7. It is clearly visible that the horizontal

sections of the bow zone (1) close to the keel (9) are wider than the horizontal sections of the bow zone (1) close to the deck (10).

Fig. 9 - The graph compares a prior boat, in said conventional model, with a competition row boat (5) according to the object of the present invention. This graph presents on its abscissa axis the length of the boat, with the bow on the left side and the stern on the right side, while in the ordinate axis it is represented the area of each section divided by the maximum value of each boat, with normalization purposes, so that the largest section has the value 1.

[0019] In the abscissa axis, the reference signs **S1** through **S25** represent different lengths, wherein the spacing between adjacent dots is always the same.

[0020] The solid curve represents a competition row boat (5) according to the present invention, while the dashed curve represents the prior art boat shown in Figs. 3 and 4, according to said conventional model.

[0021] Regarding the variation of the vertical position of the volume, it is easily visible in the vertical sections of the previous Figs., so that Fig. 9 illustrates which changes were made to obtain the new shape.

[0022] According to the graph, it is clear that a longitudinal redistribution of volume has taken place, which has been moved from the center to the ends (bow and stern), and also a displacement of the volume center to the boat aft.

[0023] The integration of these curves results in the total volume of each boat, which should be the same for both curves. That is to say, keeping the total weight of the boat there was a shift in volume along the length in order to compensate the new shape.

DETAILED DESCRIPTION OF THE INVENTION

[0024] The present invention enables, due to the bow shape, an increase in the waterline length. As noted above, the waterline length remains always in its maximum value even when there is variation in the trim.

[0025] Considering that in this hull shape there is a larger submerged volume at the bow - when compared with said conventional models -, as soon as there is a tendency for the bow to stay out of water the immersed volume variation is larger, causing a negative moment which forces the bow to return to the ideal position, maintaining the shape of the waterline. The conservation of the waterline length has direct implications in keeping the velocity, since when reducing the length there is a direct increase in wave resistance (when comparing similar hulls, one with a shorter waterline length has higher wave resistance than one with longer waterline length).

[0026] This is provided by the fact that, in the bow zone (1), the value of the breadth (8) corresponding to any waterline of a vertical section has its maximum value essentially close to the keel (9) and continuously decreases up to the deck (10). This means that the bow zone (1) has an inverse configuration with respect to said conventional boat models and, in addition to the fact that the maximum value of the breadth (8) for any vertical section of the bow zone (1) is located essentially close to the keel (9), the value of the breadth (8) reduces from its maximum value as it approaches the deck (10). This is clearly visible in the vertical sections **A, B, C, D, E** and **F** of Fig. 6, all of them belonging to the bow zone (1). This is no longer true for the remaining vertical sections, as these belong to the cockpit zone (3) and stern zone (2), as is visible from the correspondence with Fig. 5.

[0027] It is considered that, as the value of the breadth (8) is the most influent parameter on the boat stability and since the position of the gravity center varies little and is particularly dependent on the height of the rower, the vertical sections are approximated to a semicircular shape in order to minimize the area of the hull surface and so contribute to the reduction of frictional resistance against water.

[0028] Additionally, it is considered that the value of the breadth (8) corresponding to any waterline having its maximum value substantially close to the keel (9) means that, in the absence of any curvature discontinuity in the cross section between the keel (9) and this point - which would result in a vertex - there is a real need for a curvature between the lower point, the keel (9), and the point of maximum breadth (8). While keeping the restriction for the bow zone (1) to comprise only convex sections, this allows reaching the best performance of the boat.

[0029] On the other hand, the reduction of keel's longitudinal curvature, also known as rocker, promotes a greater ability to maintain a given route with less effort of the athlete, who can devote more to the propulsion in the direction of motion, enabling him/her to accelerate more rapidly till reaching full speed.

[0030] Such advantage is achieved through the second technical feature considered as innovative, and which consists of the fact that the fore body (6) is below the design waterline, with the stem (11) projecting to aft (7) in the direction of the deck (10).

[0031] Here again this is an inversion with respect to said conventional state-of-the-art models. The stem (11) has an angle which is reverse with respect to conventional state-of-the-art models, i.e., the end of the fore body (6) of the competition row boat (5) is underwater and also has more volume in its immersed part than above the waterline.

[0032] Additionally, the combination of the volume distribution - larger volume at the ends - and the rocker reduction implies an increase of the prismatic coefficient. It is known by experience [2] that, operating at high Froude numbers, the increase in this coefficient is beneficial thus achieving a reduction of the wave resistance. Roughly, Froude number is a dimensionless velocity parameter and measures how fast a ship travels in relation to its length [3]. The Froude number is important because, at higher speeds, the resistance due to wave formation

assumes greater importance.

[0033] Considering that: (i) in this type of boats, the prismatic coefficient is typically between 0.56 and 0.61; (ii) the prior art boat model shown in Figs. 3 and 4 has a prismatic coefficient of 0.57; and (iii) the prismatic coefficient of a competition row boat (5) according to the present invention is in the range of 0.55 to 0.62, one can verify that a substantial improvement is obtained over the prior art.

[0034] Also as additional advantage, the combination of the volume distribution, larger volume at the ends, and the rocker reduction provides: (i) less air resistance, especially with headwind or crosswind, (ii) lower tendency to scend ("caturrar") (pitch or surge movements "cabeceio"), because an immersion of the bow does not cause such a strong impulse reaction as in a boat of said conventional model, due to volume distribution, and (iii) the reduction of movements improves the hull performance and improves the rower's ability in concentrating the effort in propulsion and not in controlling the boat.

[0035] In short, the relationship between the technical features considered as innovative and the technological advantages and technical problems they solve is as follows:

- the reduction of the emerged volume creates less air resistance, reduces the boat subjection to crosswind, and creates less vertical impulse when facing a wave, which reduces the pitch or surge movements. This shape is combined with a non-concave hull surface, so that the boat can comply with the current rules applicable to competition [1]. As mentioned above, is a question of knowing how to get the best performance while avoiding deleterious effects on the boat displacement and considering the constraint of not having any concave sections in the bow zone (1).

[0036] In a preferred embodiment of the present invention, there is a breadth (8) corresponding to a maximum waterline related to an upper waterline and a lower waterline whose breadths have a value lower than that of the maximum waterline.

[0037] On the other hand, each end of said breadth (8) corresponding to a waterline with maximum value, belonging to opposite sides of the boat surface, is connected to the keel line (9) by a convexly curved line.

[0038] In any embodiment of the present invention, the waterline with maximum breadth (8) will always lie between 1% and 30% of the depth (4), which is the height of a certain vertical section measured from the keel (9) to the deck (11) perpendicular to the waterline.

[0039] Regarding the stern zone (2), the configuration of said conventional model remains, i.e., the value of the breadth (8) corresponding to any waterline of a vertical section has its maximum value essentially close to the deck (10) and continuously decreasing in the direction of the keel (9).

[0040] However, and as an additional feature of the innovation of the present invention, the increasing of lift in the bow and the reduction of the longitudinal curvature of the keel (9) have created the need to increase the volume at aft (7) in order to maintain longitudinal balance and its final floating position design. This increase in volume has already been mentioned and is represented in Fig. 9.

[0041] Preferably, the competition row boat (5) object of the present invention consists of a single piece in which all the sections identified - bow zone (1), stern zone (2) and cockpit zone (3) - form a single piece made through the mold manufacturing process with polymeric materials - such as plastics or fiber material, for instance fiberglass or carbon fiber, or with natural materials such as mahogany. However, it is considered that the distinction in this invention does not relate to the material used, and that any material known in the state-of-the-art is suited for the manufacture of competition row boats.

[0042] In an alternative embodiment of the present invention, not preferred, the competition row boat (5) consists of two pieces: a deck part and a hull part which are longitudinally connected.

[0043] Regarding the cockpit zone (3), this is the area where the competition row boat (5) contains one or more apertures, so called cockpits, for accommodating the crew member (s) and separating the bow zone (1) from the stern zone (2). Thus, the cockpit zone (3) contains at least one cockpit.

[0044] The technical features of the present invention, in their several combinations, are suitable for canoeing and Rowing practice. Thus, the competition row boat (5) of the present invention may consist of a kayak, a canoe or a boat for Rowing competition.

EMBODIMENTS

[0045] In one embodiment of the object of the present invention, any vertical section of the bow zone (1) of the competition row boat (5) corresponds to a trapeze with all its sides convex and rounded vertices, wherein the smallest base corresponds to the deck (10) and the largest base corresponds to the keel (9).

[0046] In another embodiment of the present invention object, any vertical section of the bow zone (1) of the competition row boat (5) corresponds to an isosceles triangle with rounded corners and all its sides convex, wherein the smallest side is the keel (9).

[0047] In one embodiment of the object of the present invention, any vertical section area of the stern zone (2) of the competition row boat (5) corresponds to a trapeze with all its sides convex and rounded vertices, wherein the smallest base corresponds to the keel (9) and the largest base corresponds to the deck (10).

[0048] In another embodiment of the object of the present invention, any vertical section of the stern zone (2) of the competition row boat (5) corresponds to an isosceles triangle with rounded corners and all its sides

convex, wherein the largest side is the deck (10).

[0049] In one embodiment of the present invention object, the fore body (6) comprises a section perpendicular to any waterline. In addition, the stem (11) comprises three sections, joined as follows:

- a first convex section projecting to the fore body (6) in the direction of the deck (10);
- a straight section perpendicular to any waterline;
- a second convex section projecting to aft (7) in the direction of the deck (10);

wherein the first convex section is the smallest of these sections.

[0050] In a more detailed embodiment of the present invention object, the prismatic coefficient of the competition row boat (5) is 0.5816.

[0051] In eight alternative embodiments of the present invention object, the cockpit zone (3) contains one, two, three, four, five, six, seven or eight cockpits suitable for one, two, three, four, five, six seven or eight rowers, respectively.

[0052] As will be apparent to one skilled in the art, the invention should not be limited to the embodiments described herein and various modifications which remain within the scope of the present invention are possible.

[0053] Of course, the preferred embodiments presented above can be combined in different possible ways, although herein the repetition of all such combinations is avoided.

REFERENCES

[0054]

[1] "ICF Canoe Sprint Competition Rules 2015", International Canoe Federation, 2015.

[2] Lewis, E., "Principles of Naval Architecture", Volume II, Chapter 5, Section 8, Society of Naval Architects and Marine Engineers, 1988.

[3] Ridley, J.; Patterson, C., "Reeds Vol 13: Ship Stability, Powering and Resistance", p. 328, A&C Black, 2014.

Claims

1. Competition row boat (5) with a cockpit zone (3), a bow zone (1) - between the cockpit zone (3) and the fore body (6) - and a stern zone (2) - between the cockpit zone (3) and aft (7) -, wherein in the stern zone (2), the value of the breadth (8) corresponding to any waterline of a vertical section has its maximum value essentially close to the deck (10) and continuously decreasing in the direction of the keel (9), **characterized in that,** in the bow zone (1), the value of the breadth (8) corresponding to any waterline of a vertical section has its maximum value essentially close to the keel (9) and continuously decreases up to the deck (10).

2. Competition row boat (5) according to the preceding claim **characterized in that** the fore body (6) is below the design waterline, wherein the stem (11) is projected to the aft (7), in the direction of the deck (10).

3. Competition row boat (5) according to claim 2 **characterized in that** any vertical section of the bow zone (1) corresponds to a trapeze with all its sides convex and rounded vertices, wherein the smallest base corresponds to the deck (10) and the largest base corresponds to the keel (9).

4. Competition row boat (5) according to claim 2 **characterized in that** any vertical section of the bow zone (1) corresponds to an isosceles triangle with rounded corners and all sides convex, wherein the lower side is the keel (9).

5. Competition row boat (5) according to any of the preceding claims **characterized in that** it has a prismatic coefficient between 0.55 and 0.62.

6. Competition row boat (5) according to the previous claim **characterized in that** it has a prismatic coefficient of 0.5816.

7. Competition row boat (5) according to any of the preceding claims **characterized in that** any vertical section of the stern zone (2) corresponds to a trapeze with all its sides convex and rounded vertices, wherein the largest base corresponds to the deck (10) and the smallest base corresponds to the keel (9).

8. Competition row boat (5) according to any of the preceding claims **characterized in that** the fore body (6) comprises a section perpendicular to any waterline.

9. Competition row boat (5) according to any of the preceding claims **characterized in that** the stem (11) comprises three sections, joined in the following way:

   - a first convex section projecting to the fore body (6), in the direction of the deck (10);
   - a straight section perpendicular to any waterline;
   - a second convex section projected to the aft (7), in the direction of the deck (10);

   wherein the first convex section is the smallest of these sections.

10. Competition row boat (5) according to any of the preceding claims **characterized in that** it consists of a

single piece.

11. Competition row boat (5) according to claim 9 **characterized in that** it consists of two pieces longitudinally connected: a deck part and a hull part.

12. Competition row boat (5) according to any one of the preceding claims **characterized in that** the cockpit zone (3) contains at least one cockpit.

13. Competition row boat (5) according to the previous claim **characterized in that** the cockpit zone (3) contains one, two, three, four, five, six, seven or eight cockpits suitable for one, two, three, four, five, six, seven or eight rowers, respectively.

14. Competition row boat (5) according to any of the preceding claims **characterized in that** it consists of a kayak, a canoe or a boat for Rowing competition.

Patentansprüche

1. Wettbewerbsruderboot (5) mit einem Cockpitbereich (3), einem Bugbereich (1) - zwischen dem Cockpitbereich (3) und dem Vorderteil (6) - und einem hinteren Bereich (2) - zwischen dem Cockpitbereich (3) und dem Heck (7) -, worin beim hinteren Bereich (2) die Größe der Breite (8) jeder Wasserlinie eines senkrechten Abschnitts entspricht, dessen größte Breite in der Nähe des Decks (10) ist und diese kontinuierlich in Richtung des Kiels (9) abnimmt, **dadurch gekennzeichnet, dass** in dem Bugbereich (1) die Größe der Breite (8) jeder Wasserlinie eines senkrechten Abschnitts entspricht, dessen größte Breite in der Nähe des Kiels (9) wesentlich ist und diese kontinuierlich in Richtung des Decks (10) abnimmt.

2. Wettbewerbsruderboot (5), nach dem vorhergehigen Anspruch, **dadurch gekennzeichnet, dass** das Vorderteil (6) unter der Konstruktionswasserlinie liegt, worin der Steven (11) zum Heck (7), in Richtung des Decks (10), projiziert ist.

3. Wettbewerbsruderboot (5), nach Anspruch 2, **dadurch gekennzeichnet, dass** jeder senkrechte Abschnitt des Bugbereichs (1) einem Trapez entspricht, dessen Seiten alle konvex und Eckpunkte abgerundet sind, worin die kleinste Basis dem Deck (10) und die größte Basis dem Kiel (9) entspricht.

4. Wettbewerbsruderboot (5), nach Anspruch 2, **dadurch gekennzeichnet, dass** jeder senkrechte Abschnitt des Bugbereichs (1) einem gleichschenkligen Dreieck mit abgerundeten Kanten und, bei dem alle Seiten konvex sind, entspricht, worin der untere Teil das Kiel (9) ist.

5. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** es ein prismatischen Koeffizienten zwischen 0.55 und 0.62 hat.

6. Wettbewerbsruderboot (5), nach dem vorhergehigen Anspruch, **dadurch gekennzeichnet, dass** es ein prismatischen Koeffizienten von 0.5816 hat.

7. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** jeder senkrechte Abschnitt des hinteren Bereichs (2) einem Trapez entspricht, dessen Seiten alle konvex und die Eckpunkte abgerundet sind, worin die größte Basis dem Deck (10) und die kleinste Basis dem Kiel (9) entspricht.

8. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** der Vorderteil (6) einen senkrechten Abschnitt zu jeder Wasserlinie umfasst.

9. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** der Steven (11) drei Abschnitte umfasst, diese sind wie folgt vereinigt:

- ein erster konvexer Abschnitt, in Richtung Vorderteil (6), zum Deck (10) hin, projiziert;
- ein gerader Abschnitt, der zu jeder Wasserlinie senkrecht ist;
- ein zweiter konvexer Abschnitt in Richtung des Hecks (7), zum Deck (10) hin, projiziert;

worin der erste konvexe Abschnitt der kleinste dieser Abschnitte ist.

10. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** es aus einem einzigen Teil besteht.

11. Wettbewerbsruderboot (5), nach Anspruch 9, **dadurch gekennzeichnet, dass** es aus zwei Teilen besteht, die longitudinal verbunden sind: ein Deckteil und ein Rumpfteil.

12. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** der Cockpitbereich (3) mindestens einen Cockpit enthält.

13. Wettbewerbsruderboot (5), nach dem vorhergehigen Anspruch, **dadurch gekennzeichnet, dass** der Cockpitbereich (3) einen, zwei, drei, vier, fünf, sechs, sieben oder acht Cockpits enthält, diese sind für jeweils einen, zwei, drei, vier, fünf, sechs, sieben oder acht Ruderer geeignet.

14. Wettbewerbsruderboot (5), nach jedem der vorhergehigen Ansprüche, **dadurch gekennzeichnet, dass** es ein Kajak, ein Kanu oder ein Boot für Ruderwettkämpfe ist.

Revendications

1. Bateau à rames de compétition (5) avec une zone de cockpit (3), une zone de proue (1) - entre la zone de cockpit (3) et le corps avant (6) - et une zone de poupe (2) - entre la zone de cockpit (3) et l'arrière (7) - dans lequel, dans la zone de poupe (2), la valeur de la largeur (8) correspondant à toute ligne de flottaison d'une section verticale a sa valeur maximale essentiellement proche du pont (10) et diminue continuellement dans la direction de la quille (9), **caractérisé en ce que**, dans la zone de proue (1), la valeur de la largeur (8) correspondant à toute ligne de flottaison d'une section verticale a sa valeur maximale essentiellement proche de la quille (9) et diminue continuellement jusqu'au pont.

2. Bateau à rames de compétition (5) selon la revendication précédente, **caractérisé en ce que** le corps avant (6) est en dessous de la ligne de flottaison de conception, où l'étrave (11) fait saillie vers l'arrière (7), dans la direction du pont (10).

3. Bateau à rames de compétition (5) selon la revendication 2, **caractérisé en ce que** toute section verticale de la zone de proue (1) correspond à un trapèze dont tous les côtés sont convexes et les sommets sont arrondis, où la base la plus petite correspond au pont (10) et la base la plus grande correspond à la quille (9).

4. Bateau à rames de compétition (5) selon la revendication 2, **caractérisé en ce que** toute section verticale de la zone de proue (1) correspond à un triangle isocèle dont les sommets sont arrondis et tous les côtés sont convexes, où le côté inférieur est la quille (9).

5. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il a un coefficient prismatique entre 0,55 et 0,62.

6. Bateau à rames de compétition (5) selon la revendication précédente, **caractérisé en ce qu'**il a un coefficient prismatique de 0,5816.

7. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** toute section verticale de la zone de poupe (2) correspond à un trapèze dont tous les côtés sont convexes et les sommets sont arrondis, où la base la plus grande correspond au pont (10) et la base la plus petite correspond à la quille (9).

8. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le corps avant (6) comprend une section perpendiculaire à toute ligne de flottaison.

9. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'étrave (11) comprend trois sections jointes de la manière suivante :

- une première section convexe faisant saillie au corps avant (6), dans la direction du pont (10) ;
- une section droite perpendiculaire à toute ligne de flottaison ;
- une deuxième section convexe faisant saillie à l'arrière (7), dans la direction du pont (10) ;

où la première section convexe est la plus petite de ces sections.

10. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il consiste en une seule pièce.

11. Bateau à rames de compétition (5) selon la revendication 9, **caractérisé en ce qu'**il consiste en deux pièces reliées longitudinalement : une partie pont et une partie coque.

12. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la zone de cockpit (3) contient au moins un cockpit.

13. Bateau à rames de compétition (5) selon la revendication précédente, **caractérisé en ce que** la zone de cockpit (3) contient un, deux, trois, quatre, cinq, six, sept ou huit cockpits appropriés pour un, deux, trois, quatre, cinq, six, sept ou huit rameurs, respectivement.

14. Bateau à rames de compétition (5) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**il consiste en un kayak, un canoë ou un bateau pour les compétitions d'aviron.

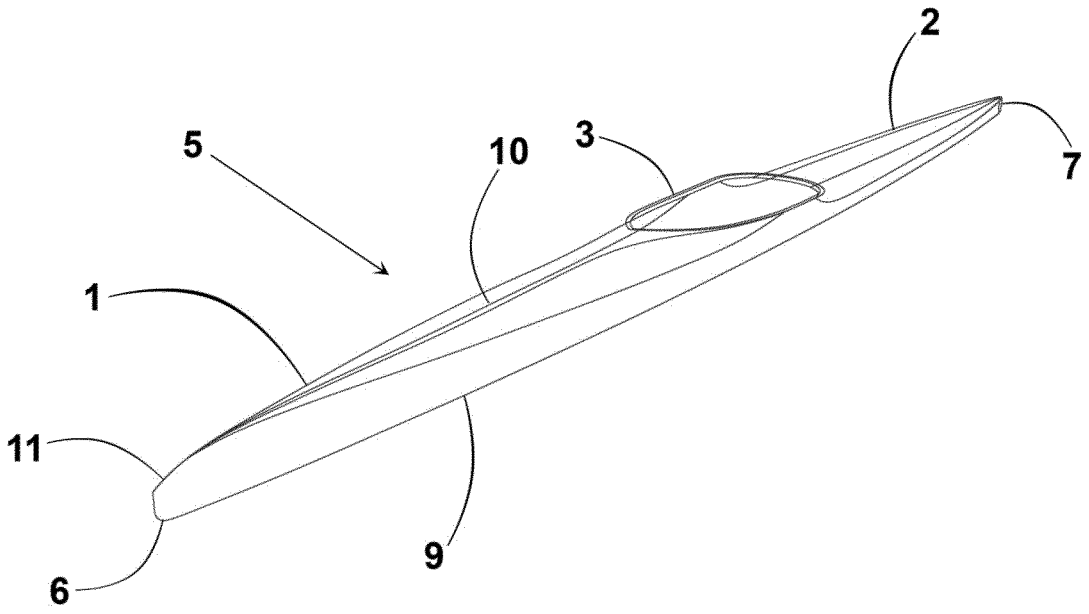

Fig. 1

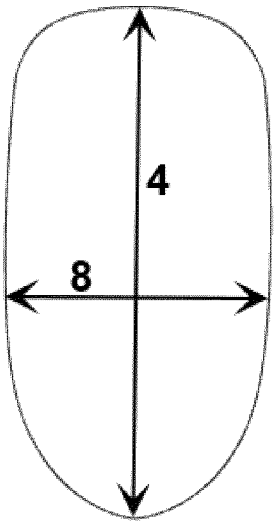

Fig. 2

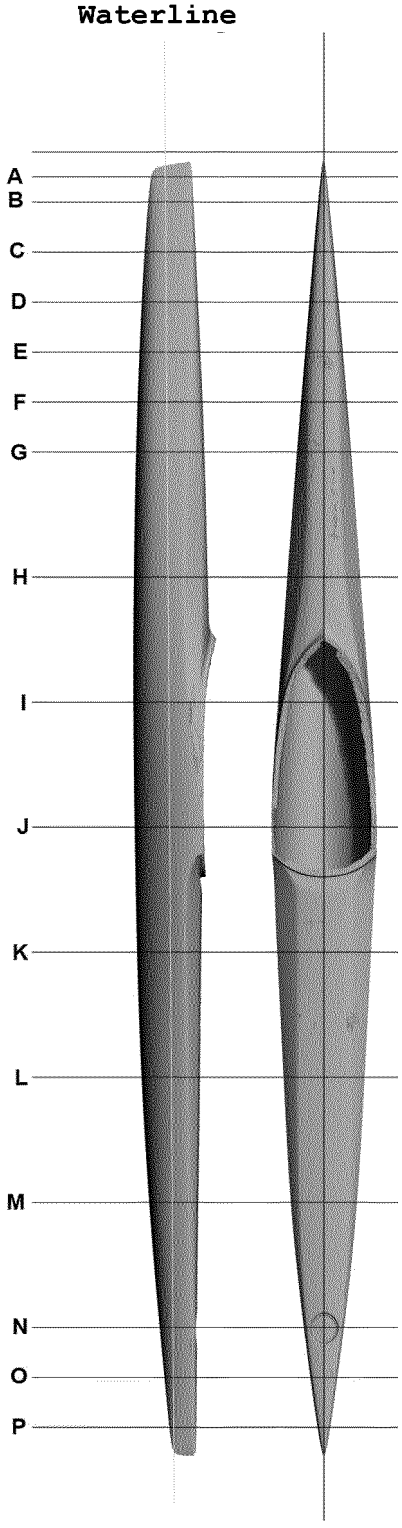

Fig. 3

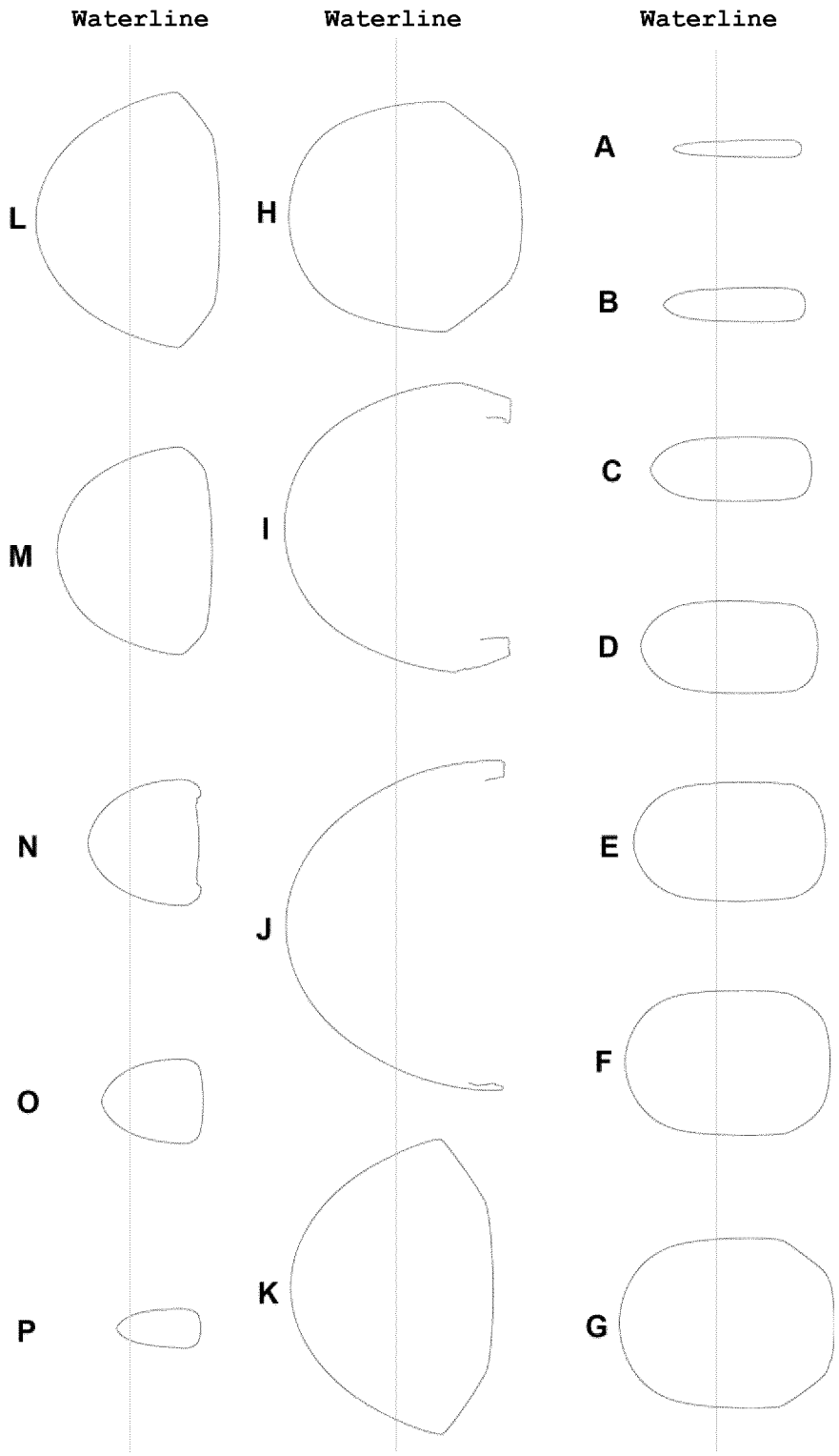

Fig. 4

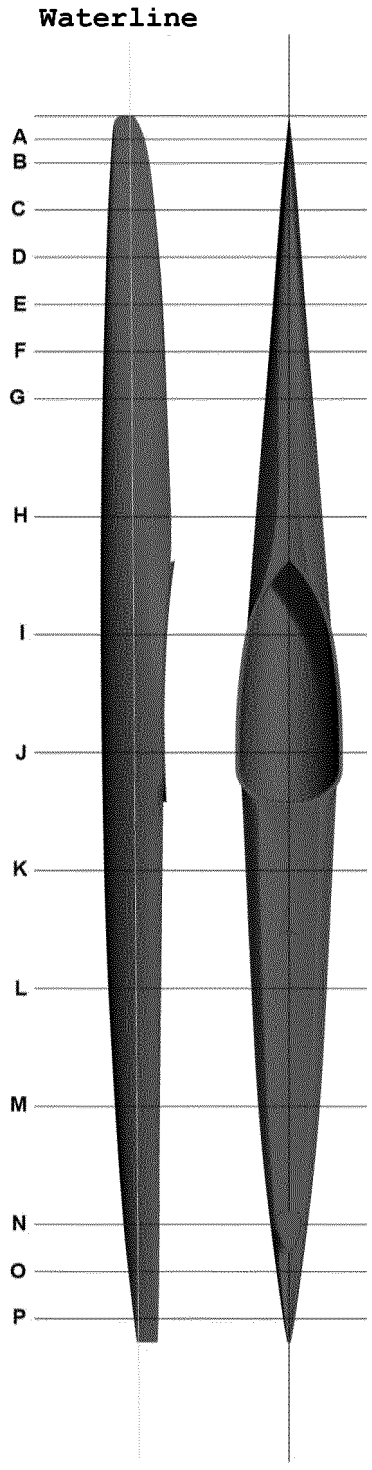

Fig. 5

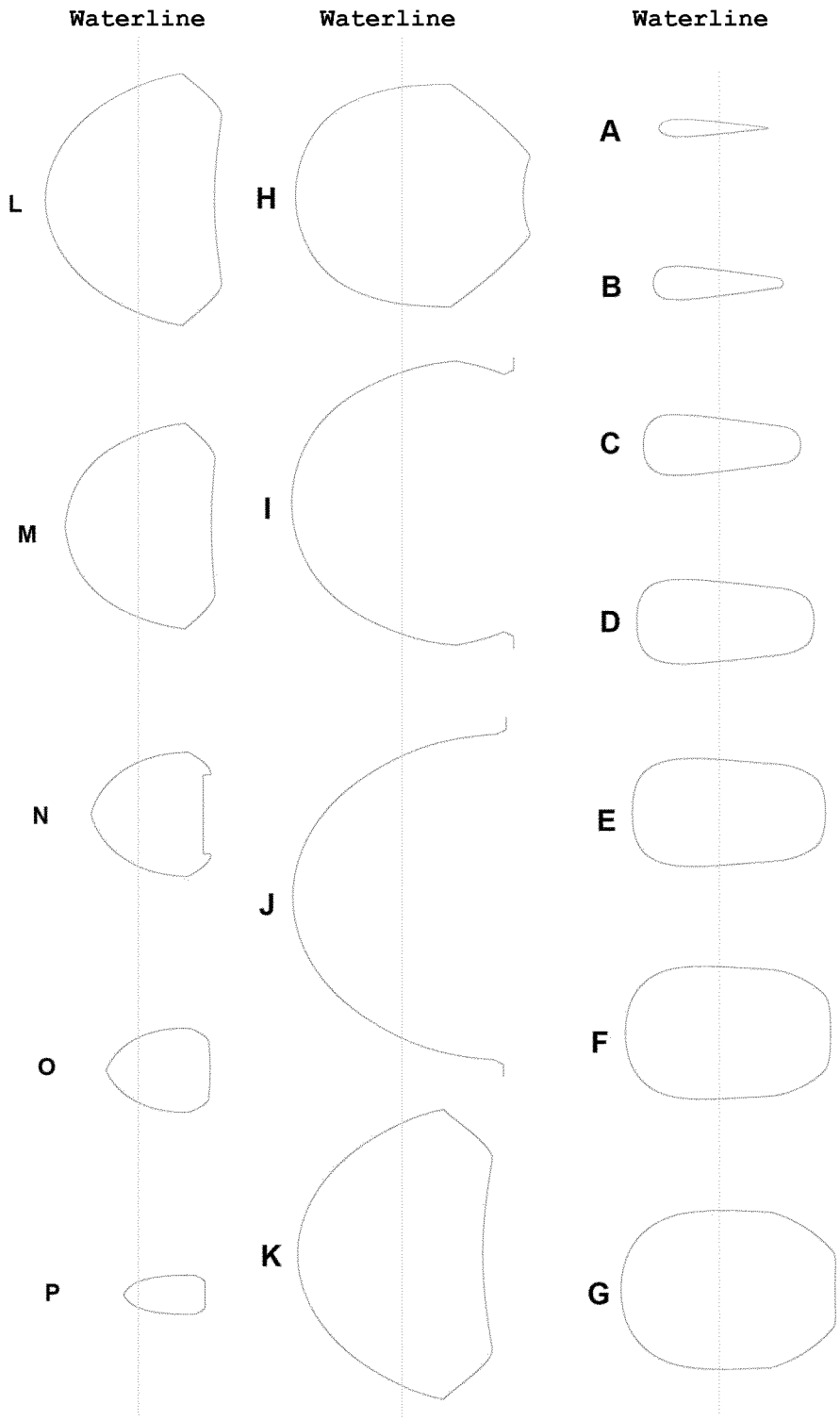

Fig. 6

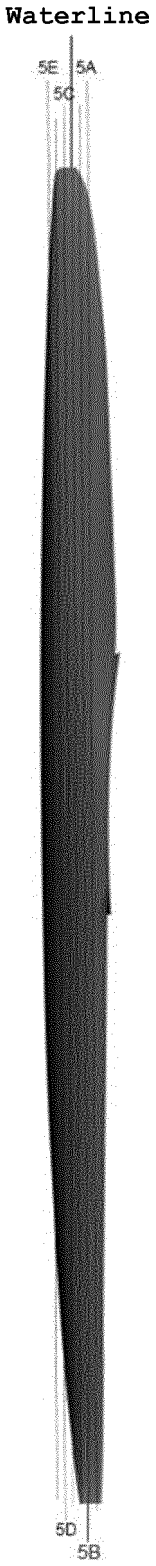

Fig. 7

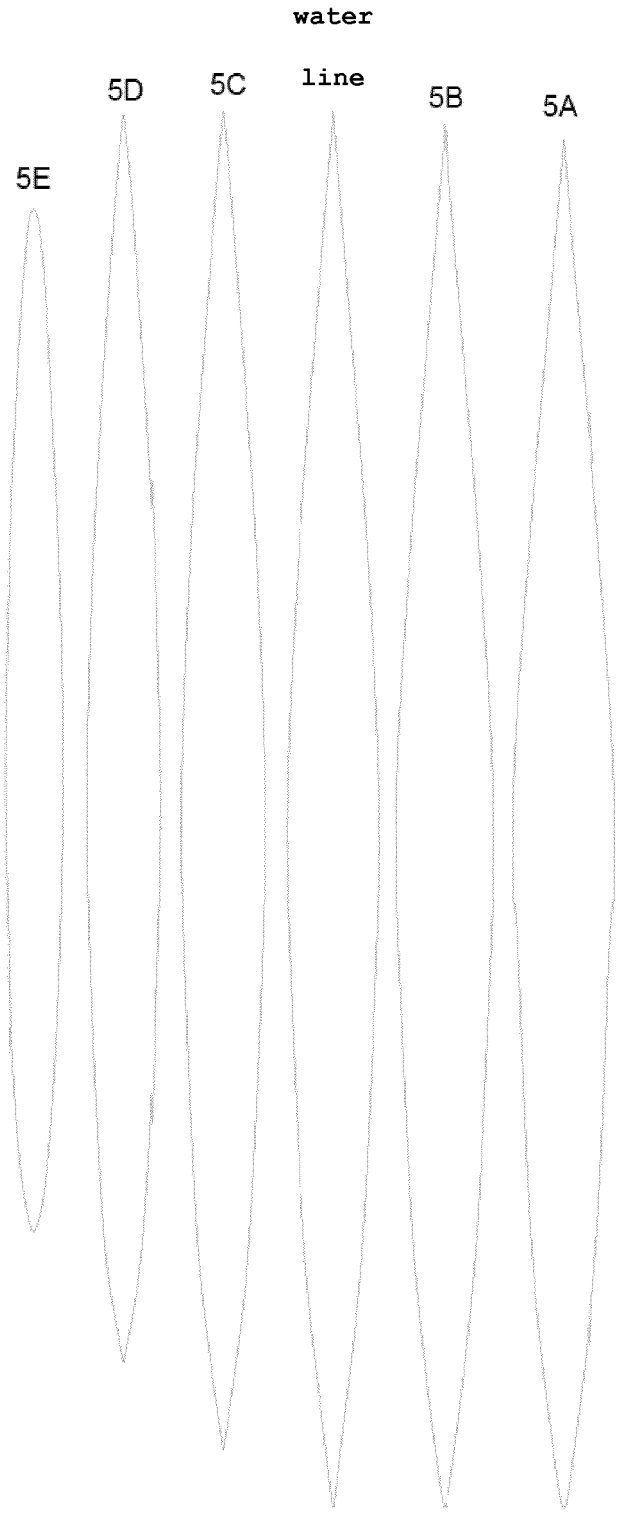

Fig. 8

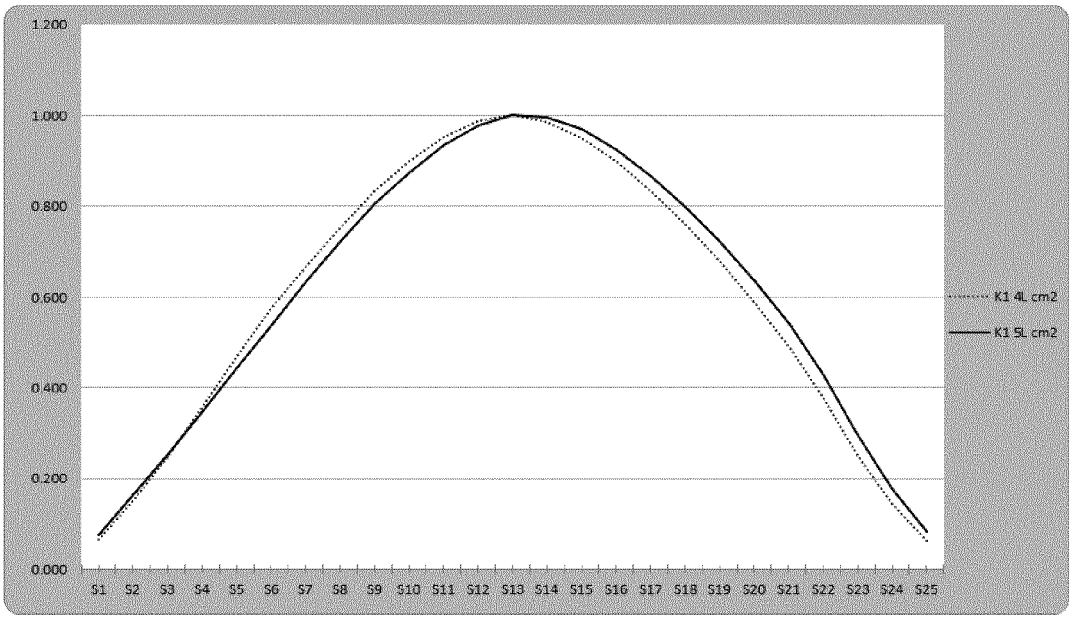
1.200
1.000
0.800
0.600
0.400
0.200
0.000
S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24 S25
K1 4L cm2
K1 5L cm2

Fig. 1

REFERENCES CITED IN THE DESCRIPTION

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