FOLDING SWIM FIN

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ABSTRACT
A folding swim fin which comprises a base, arms, an elastic membrane tensioned between the arms and elements for attaching the fin to the swimmer’s feet. Two opposite edges (1 and 2) of the flexible membrane (3) are attached each to one elastic strip (5). The flexible membrane (3) is made of plastic material, preferably reinforced with fibres. A preferred variant of the invention is a membrane woven with durable fibres. The strip (5) is attached to a rigid beam (6) of the base, belonging to a pair of beams connected to each other by a hinge (7) placed at a distance of 0 to $\frac{1}{3}$ of the beam (6) length from the beam end opposite to the place of the strip (5) attachment.
FOLDING SWIM FIN

[0001] The object of the invention is a folding swim fin used for recreational swimming, sport swimming or underwater work.

[0002] Fins have been used for years as a swimming-aiding device, and especially a diving-aiding device. The construction of fins is dictated mainly by their intended use. Fins for underwater work which are used to precisely maintain the underwater position of the diver have a different construction than fins for high-speed swimming or deep diving. However, monolithic structures made of plastic or rubber are predominant. A significant problem in these cases is the weight of the fins, as well as their size, especially when transporting them to the place of use.

[0003] From U.S. Pat. No. 4,250,584, folding, light swim fins are known. The fins consist of a frame stiffened by tension members pivotally connected to a frame. The tension members are used to selectively position and tension or fold the fin. The frame consists of two semi-rigid elements, each of them divided into three distinct elements. The first element located along the foot and intended to attach the fin to the foot, the second element connecting the element attaching to the foot with the third element which is substantially parallel to the edge of the foot. Between the third elements of the frame, a sheet of elastic material, tensioned by means of a folding strut between symmetrical elements of the frame, is located.

[0004] From U.S. Pat. No. 4,952,183, folding fins applied to the legs of a swimmer are known. The fins consist of a frame in the shape of an isosceles triangle, the legs of which are articulated connected with each other at the ends in the heel of the frame and through a folding element which constitutes the third side of the frame triangle. Between side legs of the triangle frame, a fabric is attached, the said fabric being attached to the third side of the frame triangle after its unfolding.

[0005] From U.S. Pat. No. 4,264,994, fins for hands and feet, with their surface variable when swimming, are known. The fins consist of an elastic membrane tensioned between at least two ribs. Strutting ribs are articulated attached to the fin part intended to be attached to the swimmer’s foot. Articulated joints for attaching the ribs are provided with springs. The springs cause the rib to bend when loading the fin on one side while a blockage prevents the surface from changing when moving in the opposite direction.

[0006] The object of the invention is a folding swim fin which comprises a base, arms, an elastic membrane tensioned between the arms and elements for attaching the fin to the swimmer’s feet. Two opposite edges (1 and 2) of the flexible membrane (3) are attached each to one elastic strip (5). The flexible membrane (3) is made of plastic material, preferably reinforced with fibres. A preferred variant of the invention is a membrane woven with durable fibres. The membrane (5) is reinforced with fibres, preferably carbon fibres and/or Kevlar fibres, and/or glass fibres, and/or polyamide fibres, and/or aramid fibres. The strip (5) is attached to a rigid beam (6) of the base, belonging to a pair of beams connected to each other by a hinge (7) placed at a distance of 0 to ½ of the beam (6) length from the beam end opposite to the place of the strip (5) attachment. The hinge (7) may be an articulating hinge. It may also be placed inside the profile of the beam (6) as a uniaxial hinge. Preferably, the base beam (6) has a tubular shape of rectangular or oval section. The base beam (6) is made of plastic or steel, or aluminium, or titanium, or composite of glass, polyamide, Kevlar or aramid fibres bonded with resin.

[0007] Location of the base beams (6) relative to each other is determined by a blockage (8) located near the outer end of the base beams (6), and the other two edges of the membrane (3) remain free. The blockage (8) is also used to adjust tension of the membrane (3). Possibly, between the strips (5), a winding shaft (9) is attached to the hinge (7) for changing the bearing surface of the fin. Preferably, when one of the strips (5), of the pair of strips, is attached to the base beam (6) so as to ensure free rotation of the strip about its longitudinal axis, thereby constituting the winding shaft (9) for changing the bearing surface of the fin. Along the base beam (6), from the side opposite to the side of contact of the fin with the swimmer’s leg, a mounting rail (10) for attaching tools is possibly attached. In the mounting rail (10), tools necessary for underwater work are mounted in a manner that allows them to become disconnected by sliding. Mounted in the mounting rail (10), the tool is protected against accidental sliding out by a latch blockage. The elastic strips (5) are made of plastic or composite of fibres bonded with resin. The fibres of the strip (5) are selected from the group of fibres: glass, polyamide, Kevlar, carbon fibre or aramid fibre.

[0008] Preferably, the strips (5) have a rectangular cross-section. The cross-section of the strip (5) is constant along the longitudinal axis of the strip (5). In another variant of the invention, the cross-section of the strip (5) varies along the longitudinal axis of the strip in such a way that the thickness of the strip is the largest at the place of connection of the strip (5) with the base beam (6), and the smallest at the strip end opposite to the base beam. In a particular case, the membrane (3) has the shape of an isosceles trapezium stretched between the strips (5) of equal length.

[0009] In another variant, the strips (5), of the pair of strips, have different lengths, and the membrane (5) has the shape of a figure with at least two straight sides.

[0010] The strip (5) may be attached to the base beam (6) via a rotary drum (11) with an axis of rotation parallel to the longitudinal axis of the strip (5). The blockage (8) of the operating form of the fin is constituted by a bolt (12) attached articulated with its one end to one of the base beams (6), and with the other end to the other beam (6) through an oval opening (12), and immobilised with a lock (13), preferably a nut or a knob. The fin according to the invention has a low weight, and the articulated connection of the membrane arms allows folding of the fin for the time of transport, especially transport to remote dive sites. The low weight of the fin and the possibility of folding it also help to organise military equipment, especially during marches in military diving applications. The use of identical or different lengths of the strips allows adaptation of the fin to various swimming styles. Appropriate selection of material for the strips, of its cross-section and resilience helps to adjust the parameters of the fin to the intended applications, i.e. whether the fin is to be used for recreational swimming, for underwater work or is to be used for high-speed swimming. Energy from movements of the swimmer’s legs is given to the surrounding water in a manner dependent on the resilience of the fin. The greater the hardness of the fin, the higher the swimming speed. The construction of the fin allows change of the bearing surface and adaptation to tasks performed by the swimmer.

[0011] The object of the invention is presented in embodiments in the drawing, in which FIG. 1 shows a view of a basic
variant of the fin, FIG. 2 shows a variant of the fin with the use of strips 5 of different lengths. FIG. 3 shows a variant of the fin with a membrane windon the strip. FIG. 4 shows a fragmented view of the fin with a distinct membrane windon, FIG. 5 shows a projection of the fin with a rail for attaching tools. FIG. 6 shows a view of the fin with an attached entrenching tool. FIG. 7 shows the fin with an attached saw, and FIG. 8 shows projections of the fin with a uniaxial hinge and with broken beams of the base.

Example 1

[0012] Base beams 6 are made of aluminium profile of square cross-section and are articulately connected to each other by a hinge 7, located in \( \frac{1}{60} \) of the distance from the end of the beams. The hinge 7 is constituted by a rigid pin 14, the ends of which are mounted on axes 15 vertically attached in the base beams 6. Near the end of the beams 6, a blockage 8 of the beams’ position, after unfolding the fin to the usable form, is placed. The blockage is constituted by a bolt 12 articulately attached to the beam 6 and carried through an oval opening 13 in another beam 6. To each beam 6, an elastic strip 5 made of carbon fibre composite and polyester resin is removably attached. The strips 5 have the same length and, along their entire length, a uniform cross-section. To each strip, a leg of the regular trapezium of the membrane 3 is attached. Between the base beams 6, bands 17 for attaching the fin to the swimmer’s leg are stretched. The change of bearing surface of the fin is allowed by replacing the membrane 3. The fin according to Example 6 has a rectangular handle of an entrenching tool 23, inserted into a rail 10.

Example 3

[0014] Base beams 6 of the fin, made of titanium profile of square cross-section, are articulately connected to each other by a hinge 7, located in \( \frac{1}{60} \) of the distance from the end of the beams. The hinge 7 is constituted by a rigid pin 15, the ends of which are mounted on axes 16 vertically attached in the base beams 6. Near the end of the beams 6, a blockage 8 of the beams’ position, after unfolding the fin to the usable form, is placed. The blockage is constituted by a bolt 12 articulately attached to the beam 6 and carried through an oval opening 13 in another beam 6. One of the strips 5, of the pair of strips, is attached to the base beam 6 so as to ensure free rotation of the strip about its longitudinal axis and constitutes a winding shaft 9 of a membrane 3, and the base beam 6 is provided, on the extension of the titanium profile, with a seating 19 for placing a rotation shaft 11 located in the front wall of the bracket 20 of the strip 5. The rotation shaft 11 is provided, around its circumference, with latch elements 18 for positioning the strip 5. The strips 5 have the same length. The thickness of the strips 5 decreases along their longitudinal axis. To each strip, a leg of the regular trapezium of the membrane 3 is attached. Between the base beams 6, bands 17 for attaching the fin to the swimmer’s leg are stretched. The change of bearing surface of the fin is allowed by the rotation of the strip 5 on the shaft 11. The blockage 8, in the usable position of the fin, allows tension of the membrane 3.

Example 4

[0015] The fin with a distinct membrane winder. Base beams 6 are made of titanium profile of square cross-section and are articulately connected to each other by a hinge 7, located in \( \frac{1}{60} \) of the distance from the end of the beams. The hinge 7 is constituted by a rigid pin 15, the ends of which are mounted on axes 16 vertically attached in the base beams 6. Near the end of the beams 6, a blockage 8 of the beams’ position, after unfolding the fin to the usable form, is placed. To each beam 6, an elastic strip 5 made of glass fibre composite and polyester resin is attached. Perpendicularly to the pin 15, an axle 21 of a winding shaft 9 is attached. To each strip, a leg of the regular trapezium of the membrane 3 is attached. Between the base beams 6, bands 17 for attaching the fin to the swimmer’s leg are stretched. The change of bearing surface of the fin is allowed by the rotation of the winding shaft 9 on the axle 21. The blockage 8, in the usable position of the fin, allows tension of the membrane 3.

Example 5

[0016] The fin, according to any one of the preceding Examples, has a rail 10 of tubular shape of rectangular section attached to a beam 6 from a side opposite to the attachment of the fin to the swimmer’s foot. The rail 10, on its outer surface, is covered with a fluting 22 which constitutes a surface making it easier to tread particularly on slippery ground.

Example 6

[0017] The fin according to Example 6 has a rectangular handle of an entrenching tool 23, inserted into a rail 10.
Example 7

[0018] The fin according to Example 6 has a rectangular handle of a saw 24, inserted into a rail 10.

Example 8

[0019] Base beams 6 are made of aluminium profile of square cross-section and are connected to each other by a broken hinge 7, located on the edge of the beams. The hinge has one axis of rotation. To each beam 6, an elastic strip 5 made of carbon fibre composite and polyester resin is removably attached. The strips 5 have the same length and, along their entire length, a uniform cross-section. To each strip, a leg of the regular trapezium of the membrane 3 is attached.

1. A folding swim fin comprising a base, arms, an elastic membrane tensioned between the arms and elements for attaching the fin to the swimmer’s feet, characterised in that two opposite edges (1 and 2) of the flexible membrane (3) are attached to one elastic strip (5), wherein the strip (5) is attached to a rigid beam (6) of the base, belonging to a pair of beams connected to each other by a hinge (7) placed at a distance of 0 to ½ of the beam (6) length from the beam end opposite to the place of the strip (5) attachment, and the location of the base beams (6) relative to each other is determined by a blockage (8) located near the outer end of the base beams (6), and the other two edges of the membrane (3) remain free.

2. The fin according to claim 1, characterised in that the hinge (7) is placed inside the base beam (6).

3. The fin according to claim 1, characterised in that the hinge (7) is an articulating hinge.

4. The fin according to claim 1, characterised in that the hinge (7) is a uniaxial hinge.

5. The fin according to claim 1, characterised in that the blockage (8) constitutes a tension control for the membrane (3).

6. The fin according to claim 1, characterised in that the fin is provided with a winding shaft (9) of the membrane (3) for changing the bearing surface of the fin.

7. The fin according to claim 6, characterised in that one of the strips (5), of the pair of strips, is attached to the base beam (6) so as to ensure free rotation of the strip about its longitudinal axis and constitutes the winding shaft (9) of the membrane (3).

8. The fin according to claim 6, characterised in that the winding shaft (9) is attached to the hinge (7).

9. The fin according to claim 1, characterised in that a mounting rail (10) for attaching tools is attached to the beam (6).

10. The fin according to claim 9, characterised in that the outer surface of the mounting rail (10) has a rough surface which constitutes a non-slip element when walking.

11. The fin according to claim 1, characterised in that the flexible membrane (3) is made of plastic material, preferably reinforced with fibres.

12. The fin according to claim 11, characterised in that the fibres reinforcing the membrane (3) are selected from the group of fibres: glass, polyamide, Kevlar, carbon fibre, aramid fibre.

13. The fin according to claim 1, characterised in that the membrane (3) is made of woven fibres.

14. The fin according to claim 1, characterised in that the elastic strips (5) are made of plastic material.

15. The fin according to claim 14, characterised in that the elastic strips (5) are made of composite of fibres bonded with resin.

16. The fin according to claim 15, characterised in that the fibres of the strip (5) are selected from the group of fibres: glass, polyamide, Kevlar, carbon fibre, aramid fibre.

17. The fin according to claim 1, characterised in that the strips (5) have a rectangular cross-section.

18. The fin according to claim 17, characterised in that the cross-section of the strip (5) varies along the longitudinal axis of the strip in such a way that the thickness of the strip is the largest at the place of connection of the strip (5) with the base beam (6), and the smallest at the strip end opposite to the base beam.

19. The fin according to claim 1, characterised in that the membrane (3) has the shape of an isosceles trapezium.

20. The fin according to claim 1, characterised in that the strips (5), of the pair of strips of one fin, have the same length.

21. The fin according to claim 1, characterised in that the strips (5), of the pair of strips, have different lengths.

22. The fin according to claim 1, characterised in that the strip (5) of greater length is attached to the base beam (6) via a shaft (11) with an axis of rotation parallel to the longitudinal axis of the strip (5).

23. The fin according to claim 1, characterised in that in the mounting rail (10), tools necessary for underwater work are mounted in a manner that allows them to become disconnected by sliding.

24. The fin according to claim 1, characterised in that, mounted in the mounting rail (10), the tool is protected against accidental sliding out by a latching blockage.

25. The fin according to claim 1, characterised in that the blockage (8) is constituted by a bolt (12) attached articulately with its one end to one of the base beams (6), and with the other end to the other beam (6) through an oval openings (13), and immobilised with a lock (14), preferably a nut or a knab.

26. The fin according to claim 1, characterised in that the base beam (6) has a tubular shape of rectangular section.

27. The fin according to claim 1, characterised in that the base beam (6) has a tubular shape of oval-like section.

28. The fin according to claim 26 or claim 27, characterised in that the base beam (6) is made of a plastic material selected from the group consisting of: steel, aluminium, titanium, carbon-resin composite, ABS.