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(54) Hull provided with telescopic keel

(57) Present invention relates to a hull (1) having a fixed keel (3), coupled under said hull, **characterized in that** said keel (3) comprises a plurality of elements (6',..., 6^n) telescopically coupled each other, so as to permit varying its length, and a ballast (4) at the end of said keel; and in that it provides lengthening-shortening means (7) for adjustment of length of said keel (3).

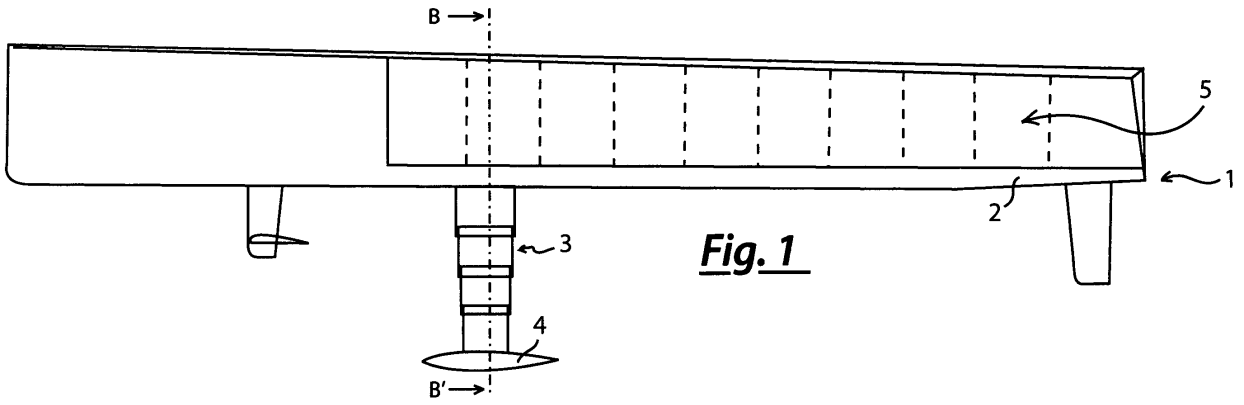

Fig. 1

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Description

[0001] The present invention relates to an improved hull.

[0002] More specifically, the invention relates to a hull, particularly a sail hull, studied and realized in order to permit a navigation always under optimum conditions whichever are the maneuvering or point of sail conditions, so as to improve performances and speed of the same.

[0003] As it is well known to those skilled in nautical field, a sailing boat advances along the set course on the basis of the wind direction, of surface hit by wind and of resistance of the hull to advancing. It is known that in the so called wind points of sail, e.g. in case of close hauled or beam reach, when the hull course aims approaching as more as possible fore to wind direction, both a hull unbalancing (due to the impact of wind on sails, and thus depending both on wind intensity and sail surface toward wind) and a leeway (due to both wind and currents).

[0004] In order to oppose to said phenomenons (which are less important in the so called portanti points of sail, such as reach, broad reach, and running), boats are provided with keel, either a fixed or movable keel (the latter for derive or anyway for small boats). In movable centerboard boats, centerboard is lifted when in the portanti points of sail, just in view of the fact that its work in these points of sail is not necessary, and would hinder advancing of the hull.

[0005] In fixed keel boats, same keel has been studied and designed in the last decades aiming combining maximum fluidodynamic effect for all points of sail, and needing of compensating unbalancing and leeway of the most headed to wind points of sail.

[0006] Many solutions have been developed in this situation providing different appendixes on keels, or solutions permitting keel basculating, in order to try to obtain the best possible result.

[0007] As already said, a well known system for adjusting attitude of sailing boat, permitting limiting the above phenomenon, is that providing a basculating centerboard, permitting modifying centerboard angle with respect to the hull according to the navigation conditions. Movement of said basculating centerboard occurs by two hydraulic pistons provided substantially horizontal and action in contraposition each other.

[0008] The above system really permits improving stability of the hull, even if it does not completely solve the problem. In fact, it is unreliable. Failures frequently occur to the centerboard basculating system and to the two hydraulic pistons. Moreover, it has been observed a remarkable delay in the system response to the different navigation needing.

[0009] In view of the above, it is object of the present invention that of suggesting a hull with technical solutions permitting optimization of stability of a sail boat for every point of sail, suggesting the realization of a keel for a fixed keel hull permitting optimizing the effect for every point of sail, thus being it possible having a very long keel for the close hauled points of sail and a keel with reduced dimensions for the portanti points of sail.

[0010] It is therefore specific object of the present invention an improved hull having a fixed keel, coupled under said hull, characterized in that said keel comprises a plurality of elements telescopically coupled each other, so as to permit varying its length, and a ballast at the end of said keel; and in that it provides lengthening-shortening means for adjustment of length of said keel.

[0011] Always according to the invention, said lengthening-shortening means can be of the mechanical and/or hydraulic and/or pneumatic and/or electromecanical type.

[0012] Still according to the invention, said lengthening-shortening means can comprise a Worm screw; a ratiomotor, electrically operated for rotating said Worm screw; a toothed wheel, coupled with said Worm screw; a pinion, coaxial with respect to said toothed wheel; and a chain, engaged with said pinion, said chain having a first end and a second end, said first end being coupled with the most inner telescopic element, so that rotation of said toothed wheel by said Worm screw and said ratiomotor determines extraction or withdrawal of said elements for adjusting length of said keel.

[0013] Advantageously, according to the invention, said elements can be comprised of cuprum - nickel in order to prevent formation of vegetation on their surface.

[0014] Preferably, according to the invention, said ballast can be fixed to, or integral with the end of said keel.

[0015] Always according to the invention, said hull can comprise one or more outer lateral tanks, on each bulwarks, said tanks being openable and closable, with their opening upward in correspondence of the hull upperworks, suitable to contain water as ballast.

[0016] Still according to the invention, said lateral tanks can be comprised of rubber and are hinged on each bulwark by hinges.

[0017] Advantageously, according to the invention, said lateral tanks can have every shape, particularly a parallelepiped shape, projecting from bulwarks o sides, maintaining the same features described, and can be comprised of every material, and they can be partially filled in, being independent each other, and they can be selected in number and position along the longitudinal extension of said bulwarks.

[0018] Furthermore according to the invention, said hull can comprise pumping means for partial or total filling in and emptying of all or part of said lateral tanks.

[0019] Always according to the invention, said hull can comprise means for detecting attitude; and a control central unit, operatively connected with said lengthening-shortening means, with said pumping means and with said means for detecting attitude, suitable to activate said lengthening-shortening means and said pumping means for adjustment of hull attitude by adjustment of amount of water contained within said lateral tanks and adjustment of keel length.

[0020] Still according to the invention, said means for

detecting attitude can comprise a first and a second inclinometer, respectively for detection of transverse attitude and of longitudinal attitude of the hull.

[0021] The present invention will be described for illustrative and not limitative purposes according to its preferred embodiments, with particular reference to the figures of the enclosed drawings, wherein:

figure 1 shows a lateral view of a hull embodying the solution according to the present invention;
figure 2 shows a broken away lateral view of a telescopic keel according to the invention;
figure 3 shows a broken away front view of keel of figure 2;
figure 4 shows particular A of keel of figure 3;
figure 5 shows a broken away view taken along line B-B' of keel of figure 1;
figure 6 shows a plan view of keel of figure 1.

[0022] Making reference to figure 1, it is possible observing an improved hull 1. Said hull 1 provides bulwarks 2, a telescopic keel 3 coupled to said hull 1, at the end of which it is provided a ballast 4.

[0023] Said hull 1 comprises a plurality of lateral tanks 5 on said bulwarks 2, said tanks being openable and closable and suitable to contain water in order to ballast the hull 1. Adjusting length of keel 3, and thus depth of relevant ballast 4, along with a suitable choice of amount of water that can be inserted within said lateral tanks 5, it is possible adjusting with high precision attitude of the hull 1, thus reducing leeway and unbalancing, also permitting an increase of performances of the boat thanks to the possibility of exploiting at best hydrodynamic properties of hull 1 under the most critic points of sail.

[0024] Furthermore, lateral tanks 5 of the bulwarks 2 involved, i.e. the one windward, besides being also only partially fillable independently each other, and selected by number and position in the longitudinal direction of said windward bulwarks 2, i.e. the one at the end of the fore and the end of the aft.

[0025] Making particularly reference to figures 2 - 4, it is possible observing a preferred embodiment of keel 3, comprised of a plurality of elements 6', .., 6" (in the present case n=5) telescopically coupled each other. Said ballast is fixed to, or integral with, the end of said hull 3, on element 6^n,

[0026] Hull 3 is also provided with keel 3 lengthening-shortening means 7, comprising a ratiomotor 8 permitting rotating a Worm screw 9 engaging on a toothed wheel 10. The latter transmits rotative motion to a pinion 11, which is engaged by a mesh chain 12, having one end 12' fixed to element 6", i.e. to the element fixed to ballast 4 while second end 12" is free.

[0027] Figure 3 shows particular A of telescopic coupling between two consecutive elements 6, comprised by a fixed joint.

[0028] Keel 3 according to the invention is preferably comprised of cuprum-nickel that, as well known, is a copper alloy wherein nickel is main additive element.

[0029] Figures 5 and 6, clearly show lateral tanks 5 of hull 1, comprised of rubber and including wings coupled with bulwarks 2 by hinges 5'.

[0030] By said lateral tanks 5 it is possible navigating according to set points of sail, with ballast necessary, while for other points of sail it is possible navigating without any ballast within hull 1.

[0031] Furthermore, water can be introduced or eliminated within/from said lateral tanks 5 by a suitable pumping system (not shown in the figures). Moreover, when extracting water, also closure of wings is obtained.

[0032] Adjustment of hull 1 according to the present invention can be realized manually operating ratiomotor 8, so as to adjust length of keel 3, and pumping system in order to introduce water within lateral tanks 5 of a side of hull 1.

[0033] Anyway, it is also possible making automatically above adjustments, by a computerized control system (not shown in the figures) comprising a control central unit operatively connected with ratiomotor 8, with the pumping system and with two inclinometers, the latter being suitable to detecting position of sail plane in order to permit adjustment of transverse and longitudinal attitude of hull 1. Suitably dosing water within lateral tanks 5 and adjusting length of keel 3 it is possible making that sail plane is always substantially perpendicular with sea level.

[0034] It can for example taken into consideration that, for example, adjustment of attitude of a boat 1 long 24 m and wide 6 m (without considering movable appendixes for water) and having a sail surface of 380 m^2 and a must tall 34 m. it must be opposed a "7" wind force exerting a pressure on sails of about 14 kg/m^2. Therefore, 14 x 380 = kg 5,320; supposing that between center of buoyancy (CB) and sail centre (SC) a distance of 20 m is present, we will have 20 x 5,320 kg = 106,400 kgm. Since every lateral tank 5 can contain 15.1 l of water at the average distance from bulwarks 2 of 30 cm, therefore km^2 106,400: m 6,30 = 16,889, i.e. exactly the amount of ballast necessary in order to have the hull with the sail plane perpendicular. It follows that, in order to reach perfect balancing, it would be necessary adding kg 1,789, compensated by ballast 4 at the end keel 3, although it could be sufficient increasing amount of liquid in order to obtain perfect balancing.

[0035] An advantage of the present invention is that all systems for adjusting attitude according to the invention do not occupy spaces within the hull, thus not reducing space inside.

[0036] A further advantage of the present invention is that of permitting designing boats with a larger sail surface.

[0037] It is also an advantage of the present invention the fact that retractable keel does not occupy space within the hull, being it possible reaching only 100 cm of length and its fixing does not require holing the hull. Therefore, a perfectly sealing tight structure is obtained.

[0038] The present invention has been described for illustrative but not limitative purposes, according to its preferred embodiments, but it is to be understood that modifications and/or changes can be introduced by those skilled in the art without departing from the relevant scope as defined in the enclosed claims.

Claims

1. Improved hull (1) having a fixed keel (3), coupled under said hull, **characterized in that**
said keel (3) comprises a plurality of elements (6', ..., 6^n) telescopically coupled each other, so as to permit varying its length, and a ballast (4) at the end of said keel; and
in that it provides lengthening-shortening means (7) for adjustment of length of said keel (3).

2. Hull (1) according to claim 1, **characterized in that** said lengthening-shortening means (7) are of the mechanical and/or hydraulic and/or pneumatic and/or electromecanical type.

3. Hull (1) according to one of the preceding claims, **characterized in that** said lengthening-shortening means (7) comprise:

   a Worm screw (9);
   a ratiomotor (8), electrically operated for rotating said Worm screw (9);
   a toothed wheel (10), coupled with said Worm screw (9);
   a pinion (11), coaxial with respect to said toothed wheel (10); and
   a chain (12), engaged with said pinion (11), said chain (12) having a first end (12') and a second end (12"), said first end being coupled with the most inner telescopic element (6^n), so that rotation of said toothed wheel (10) by said Worm screw (9) and said ratiomotor (10) determines extraction or withdrawal of said elements (6',..., 6^n) for adjusting length of said keel (3).

4. Hull (1) according to one of the preceding claims, **characterized in that** said elements (6', ..., 6^n) are comprised of cuprum - nickel.

5. Hull (1) according to one of the preceding claims, **characterized in that** said ballast (4) is fixed to the end of said keel (3).

6. Hull (1) according to one of the preceding claims, **characterized in that** said ballast (4) is integral with the end of said keel (3).

7. Hull (1) according to one of the preceding claims, **characterized in that** it comprises one or more outer lateral tanks (5), on each bulwarks (2), said tanks (5) being openable and closable, with their opening upward in correspondence of the hull (1) upperworks, suitable to contain water as ballast.

8. Hull (1) according to claim 7, **characterized in that** said lateral tanks (5) are comprised of rubber and are hinged on each bulwarks (2) by hinges (5').

9. Hull (1) according to claim 7 or 8, **characterized in that** said lateral tanks (5) have every shape, particularly a parallelepiped shape, projecting from bulwarks or sides, maintaining the same features described, and can be comprised of every material, and they can be partially filled in, being independent each other, and they can be selected in number and position along the longitudinal extension of said bulwarks (2).

10. Hull (1) according to one of the preceding claims 7 - 9, **characterized in that** it comprises pumping means for partial or total filling in and emptying of all or part of said lateral tanks (5).

11. Hull (1) according to claim 10, **characterized in that** it comprises means for detecting attitude; and
a control central unit, operatively connected with said lengthening-shortening means (7), with said pumping means and with said means for detecting attitude, suitable to activate said lengthening-shortening means (7) and said pumping means for adjustment of hull (1) attitude by adjustment of amount of water contained within said lateral tanks (5) and adjustment of keel (3) length.

12. Hull (1) according to claim 11, **characterized in that** said means for detecting attitude can comprise a first and a second inclinometer, respectively for detection of transverse attitude and of longitudinal attitude of the hull (1).

13. Improved hull (1), **characterized in that** it comprises one or more outer lateral tanks (5), on each bulwarks (2), said tanks (5) being openable and closable, with their opening upward in correspondence of the hull (1) upperworks, suitable to contain water as ballast.

14. Hull (1) according to claim 13, **characterized in that** said lateral tanks (5) are comprised of rubber and are hinged on each bulwarks (2) by hinges (5').

15. Hull (1) according to claim 13 or 14, **characterized in that** said lateral tanks (5) have every shape, particularly a parallelepiped shape, projecting from bulwarks or sides, maintaining the same features described, and can be comprised of every material, and they can be partially filled in, being independent each other, and they can be selected in number and po-

sition along the longitudinal extension of said bulwarks (2).

16. Hull (1) according to one of the preceding claims 13 - 14, **characterized in that** it comprises pumping means for partial or total filling in and emptying of all or part of said lateral tanks (5).

17. Hull (1) according to each one of claims 13 - 16, **characterized in that** it comprises a keel (3) providing a plurality of elements (6', ..., 6^n), telescopically coupled each other, so as to permit variation of its length, and a ballast (4) at the end of said keel (3); and lengthening - shortening means (7) for adjustment of length of said keel (3).

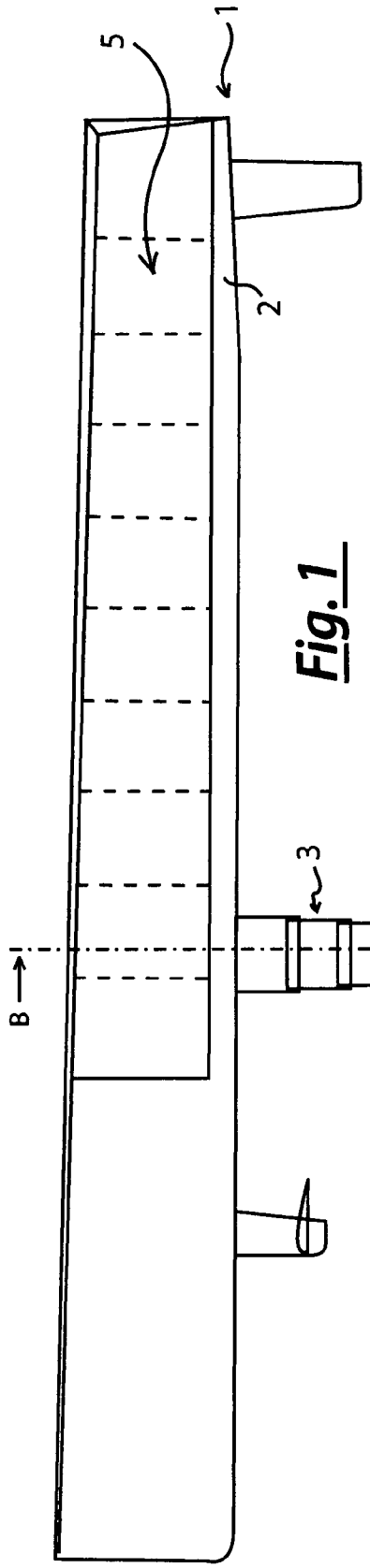

Fig.1

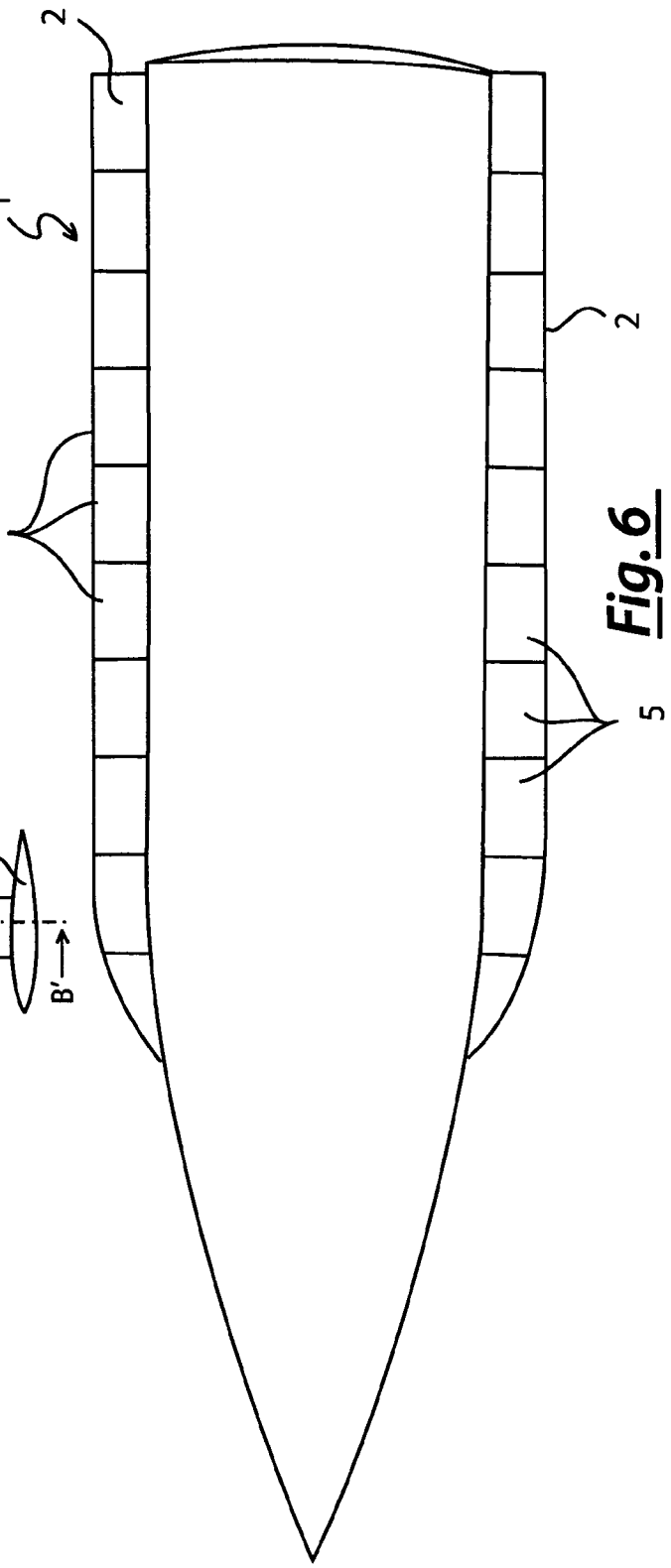

Fig.6

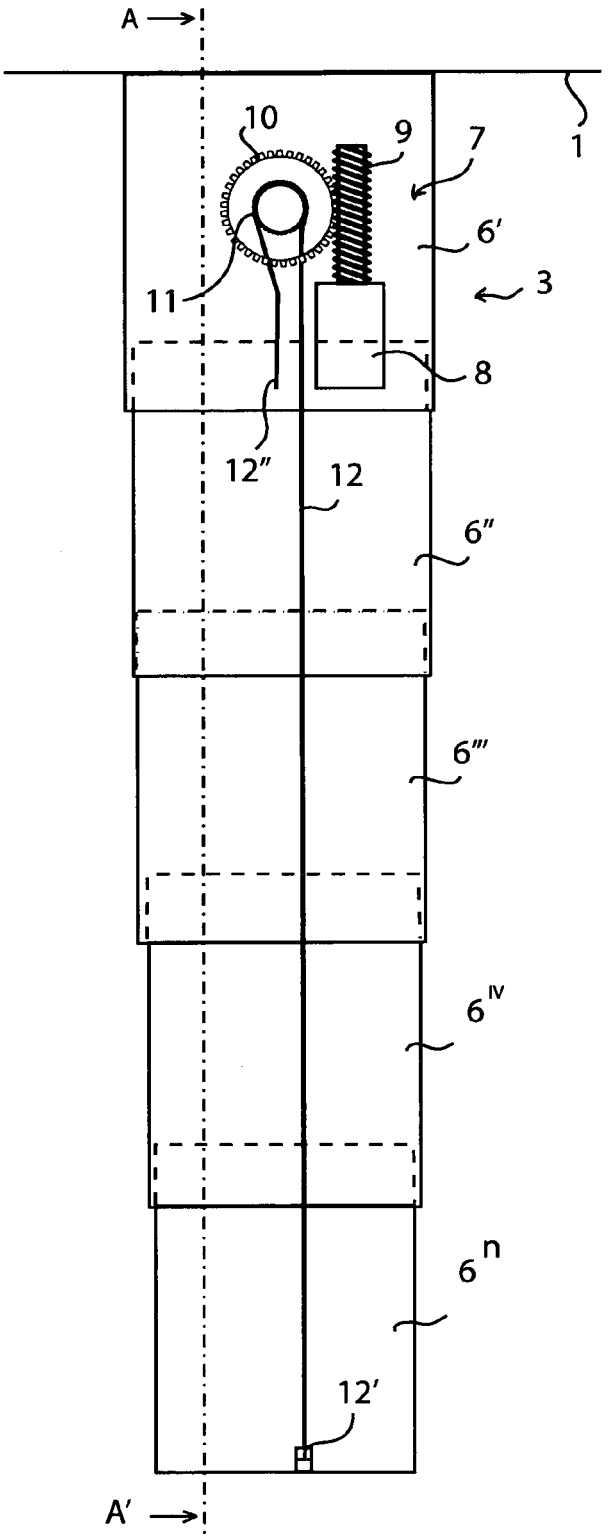

Fig. 2

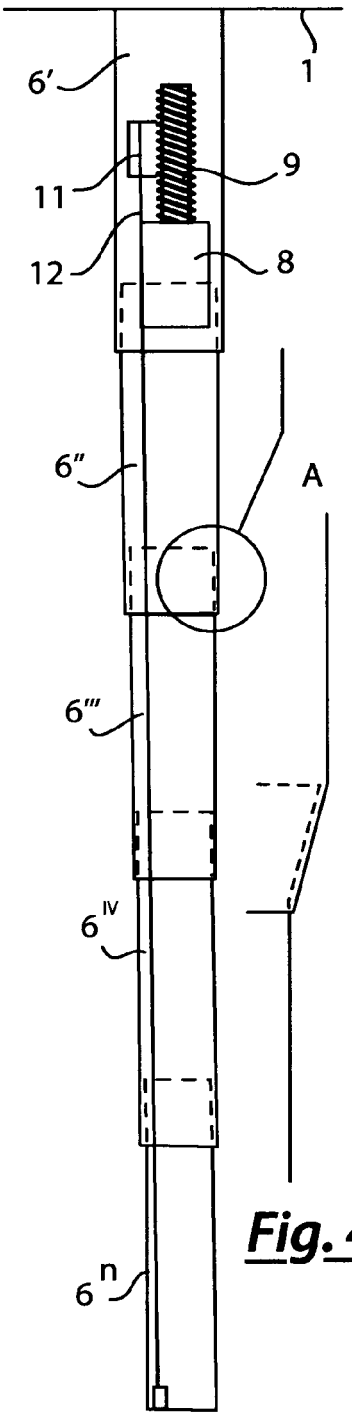

Fig. 4

Fig. 3

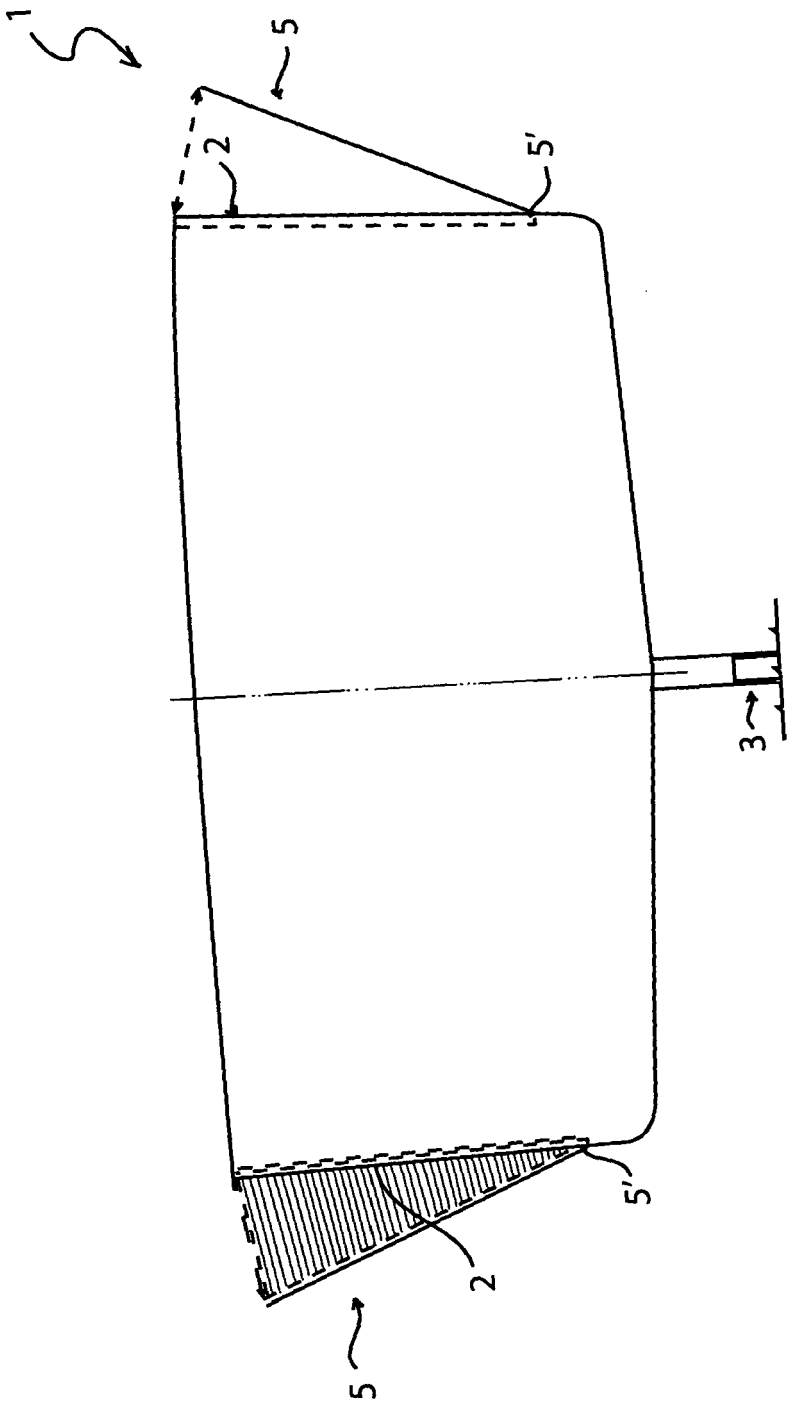

Fig.5