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(54) Boat hull

(57) A boat hull is described comprising at least one rigid structure (10) and one or more tubular members (20) fixable to the rigid structure at the perimeter thereof. The tubular members (20) are sized and shaped such as to only partially cover the hull perimeter.

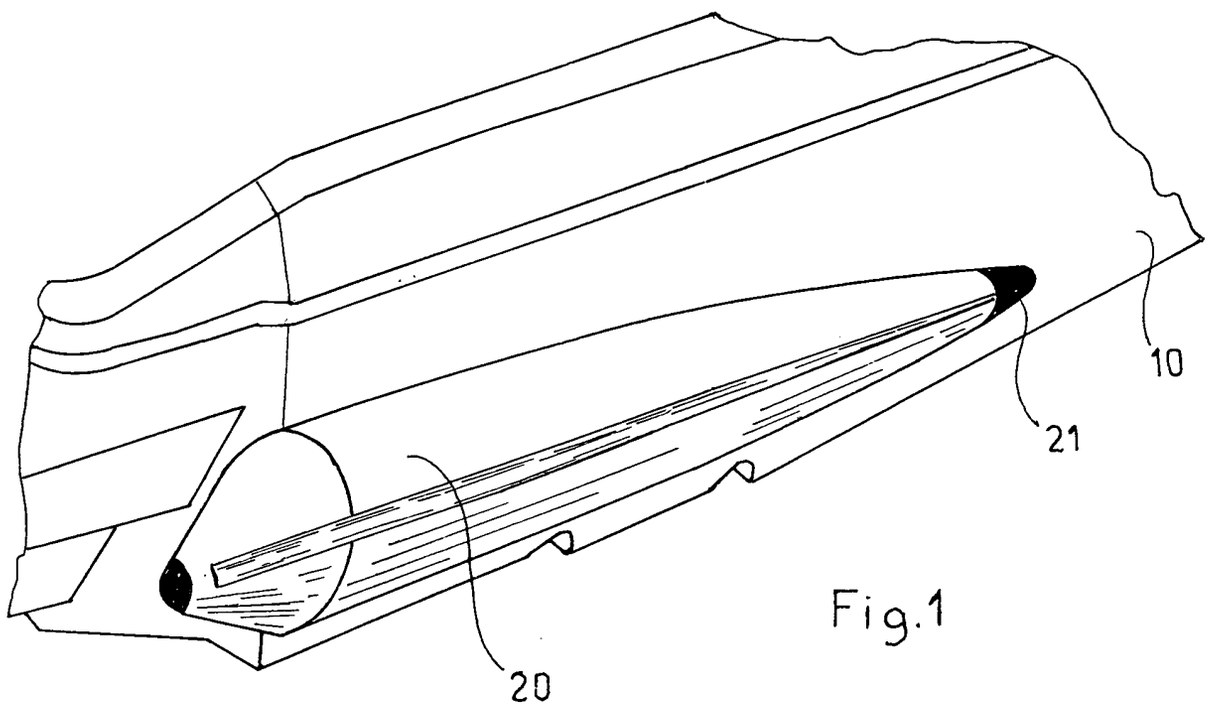

Fig.1

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Description

[0001] The present invention relates to a boat hull and particularly to a hull having improved safety and stability characteristics.

[0002] The currently known boats, particularly the motorboats, can be essentially divided in two typologies, i. e. boats with a rigid structure without any tubular member and boats with a rigid structure provided with a sole tubular member entirely surrounding the perimeter thereof.

[0003] The hulls without tubular elements are properly called "rigid" or however conventional rigid hulls, whereas the rigid hulls provided with tubular members attached along the perimeter of the boat are generally indicated as RIB (Rigid Inflatable Boat). This distinction is required because boats exist which are completely inflatable, or having only the keel, i.e. that part always immersed in the water, as the rigid structure.

[0004] The present invention pertains to the field of the boats having a rigid hull, i.e. boats with conventional rigid hulls and boats with RIB hulls. These types of boats have both advantages and drawbacks, or in other words, they are more suitable for certain uses and less to others.

[0005] For example, a conventional rigid-hull boat is ideal with a flat sea surface, or however with a calm sea, and at the same characteristics of the boat, it allows to reach a higher speed than the boats with a RIB hull. At high speeds, aerodynamic drag becomes a non-negligible contribution to the hydrodynamic drag and with a rigid hull a smaller resistant section is exposed to the air. Furthermore, it should not be overlooked that the boats with a conventional rigid hull generally have a better appearance.

[0006] On the other hand, the boats with a RIB hull are more suitable to sail in rough sea conditions because, at the same width of the rigid hull, the inflatable tubular member surrounding the hull perimeter increase the "support base" in the water and greatly increases the stability and buoyancy of the boat. The latter characteristics are useful, regardless of the conditions of the sea, when the hull is stationary or moving at a low speed, i.e. when the hydrodynamic pressure is poor or negligible.

[0007] However, hulls with tubular members are often preferred for those boats intended for dangerous missions, such as the fight against smuggling or clandestine immigration. As a matter of fact, in RIB boats the tubular members are inflatable and provide the boats with particular characteristics, such as greater reliability in terms of buoyancy in case of collision, greater protection against shocks and better stability under rough sea conditions. However, the boats with tubular members are bulkier than those without, and their greater section is a drawback in terms of air resistance upon forward speed increase.

[0008] Generally, it is an object of the present invention to provide a novel type of boat allowing to combine the advantages of the conventional rigid hulls with the advantages of the RIB hulls, i.e. a boat with improved safety and stability characteristics.

[0009] A particular object of the present invention is to provide a novel type of boat allowing to change the overall width of the hull as desired, while maintaining the size of the rigid hull unchanged.

[0010] Another particular object of the present invention is to provide a novel type of boat provided with a hull to be easily changed into any of the rigid hull boat typologies, as desired.

[0011] These objects are achieved by the present invention, which relates to a boat hull comprising at least one rigid structure and one or more tubular members to be attached to the rigid structure at the perimeter thereof, characterized in that the shape and size of the tubular members are such as to only partially cover the hull perimeter.

[0012] According to a possible embodiment, at least two distinct tubular members are provided which are attached to the respective flanks of the hull. Each of the tubular members has a lower length than the flank length.

[0013] Preferably, the tubular members are assembled at the hull stern portion and have a tapered shape towards the bow.

[0014] The tubular members are removably attached to the hull rigid structure, preferably at respective recessed housings provided in the hull rigid structure.

[0015] Each of the tubular members comprises an inflatable casing made of flexible material and there are preferably provided means to retract the inflatable casing into the corresponding recessed housing when the tubular member is in the deflated condition.

[0016] According to a possible embodiment, the hull rigid structure comprises one or more projecting rigid parts at the bow portion. These projecting parts are shaped such as to prevent the bow from sinking in the water under rough sea conditions.

[0017] According to the present invention, the width of the boat can be increased while maintaining the width of the rigid hull unchanged, thereby obtaining a better buoyancy and stability performance than a rigid hull without any tubular member.

[0018] The solution provided by the present invention thus combines the advantages of both hull typologies. The tubular members are more useful mainly aft of the boat, where most of the boat weight is charged when the bow of the hull does not touch the water. In conformity with this load distribution, the tubular member section is thus preferably tapered, i.e. wider aft and narrower fore of the boat.

[0019] The fact of having partial tubular members arranged only fore of the boat further allows a greater freedom in selecting the shape of the remaining part of the hull, particularly fore of the boat.

[0020] For example, the rigid fore portion, optionally

provided with the above projecting rigid parts, can be shaped such as to keep the overall increase in the boat drag within acceptable values, and consequently, not prejudice the boat performance.

[0021] A hull with partial tubular members has a number of advantages compared to one provided with a sole tubular member extending all along the flank thereof because that part of the sole tubular member normally unused is eliminated. Indeed, the working tubular part is aft of the boat, whereas the part fore of the boat increases the overall drag of the boat, both from a hydrodynamic and aerodynamic point of view, by increasing the surface exposed to the wind and waves.

[0022] Generally, both safety and versatility of use of the boat are increased, thus providing a boat that can be easily manufactured and adapted to the various usage situations and sea conditions in the area of operation.

[0023] Further characteristics and advantages of the present invention will be better understood from the description below, which is given by way of a non-limiting example with reference to the annexed drawings, in which:

- Figure 1 is a perspective view of a hull portion according to a possible embodiment of the present invention;
- Figure 2 is a cross-section view showing several details of the means for fixing a tubular member to a hull;
- Figure 3 is a cross-section view of a detail from Figure 2;
- Figure 4 is a partially phantom and section perspective view of a detail of the fixing means located at one end of a tubular member to a hull;
- Figure 5 is a cross-section enlarged view of the fixing means from Figure 4;
- Figure 6 is a longitudinal section enlarged view of a possible embodiment of the front end portion of a tubular member;
- Figure 7A is a schematic section view of a rigid hull of the conventional type, i.e. totally devoid of any tubular member;
- Figure 7B is a schematic section view of a hull with a tubular member of the conventional type, i.e. a hull with a sole tubular member completely surrounding the perimeter of the hull;
- Figure 7C is a schematic section view of a hull according to a possible embodiment of the invention which is formed in a mould;
- Figure 8 schematically represents the inflation and deflation system of the tubular members within a hull according to the present invention;
- Figures 9A and 9C are cross-section views illustrating possible embodiments of the retracting system of a deflated tubular member casing;
- Figures 9B and 9D are cross-section views illustrating the tubular member from Figure 9A and the tubular member from Figure 9C in a deflated condition; and
- Figures 10A-10C illustrate several views of the bow portion of a hull according to a possible embodiment of the present invention.

[0024] Figure 1 illustrates a stern portion of a rigid hull 10 at which a tubular member 20 is fixed to the side flank of the hull. A corresponding tubular member 20 (not shown) is fixed to the opposite flank, such as to provide a system capable of ensuring improved performance in terms of protection and lateral stability. A hull with partial tubular members is thus provided.

[0025] As can be seen in Figure 2, each tubular member 20 is fixed at a recessed housing 11 provided within the rigid structure of the hull 10.

[0026] Preferably, each tubular member 20 is removably fixed to the hull 10 through particular fixing means ensuring a strong retention.

[0027] Particularly, the fixing means comprise one or more longitudinal "sliding rods" 30, such as that represented in greater detail in the view from Figure 3. Each longitudinal sliding rod 30 is formed by a rope 31 made of a textile material, or in a rubber material which is optionally equipped with a metal insert, which is made integral to the tubular member 20 through a coating layer 32 of a material either consistent with or identical to the tubular member 20. The bond between the coating layer 32 and the outer surface of the tubular member 20 is preferably obtained by gluing the mutually contacting surfaces.

[0028] Each sliding rod 30 is fitted within a guide element 12 integral with the hull 10 and provided with a groove 13 having such shape and size as to allow a sliding engagement of the sliding rod 30.

[0029] The guide elements 12 are preferably arranged in the hull 10 in such a position as to allow a same tubular member 20 to be mounted indifferently to the right or left flanks of the hull. Similarly, the tubular members 20 are made such as to be independently mounted to the left or right flanks of the same hull 10, with considerable advantages in terms of cost.

[0030] Further fixing means of the tubular members 20 are described below particularly with reference to Figures 4-6.

[0031] Figure 4 shows the fixing of the front part of the tubular member 20, at which there is provided an end portion 21 fastened to the hull 10 by means of screws 22 and nuts 23 fitted within corresponding through holes 24 drilled in the same end portion 21.

[0032] Referring particularly to the views from Figures 5 and 6, the front locking portion 21 of the tubular member 20 consists of a base element 40 made of rubber for an insert 41 made of metal or rigid plastic material to be incorporated therein. The rigid insert 41 can be either drowned in the rubber of the base element 40 (Figure 5), or fitted therein and covered with a rubber layer (Figure 6) fixed for example by gluing.

[0033] The locking portion 21 provided with the rigid insert 41 enables the fixing to the hull 10 by means of the through screws 22 such that the heads of the screws do not protrude from the upper surface of the flank. The rigid insert 41 allows to support the tightening torque that would be otherwise unloaded to the rubber base element 40 which would collapse. Despite each tubular member 20 is inserted into a corresponding guide element 12 from the bow to the stern to avoid that during normal sailing the tubular member may be released, the locking ensures that each tubular member 20 thus provided may not be inadvertedly released, even in case of boat capsizing.

[0034] Due to the easy fixing system of the tubular members 20, a simple and quick replacement is ensured without requiring particular tools or equipment.

[0035] The present invention also provides particular advantages during manufacture, which advantages are underlined below with reference to Figures 7A-7C.

[0036] In Figure 7A there is schematically illustrated a section of a rigid hull 110 of the conventional type, i. e. without any tubular member, whereas Figure 7B is a schematic section view of a hull 210 with a sole tubular member of the conventional type, i.e. a tubular member 220 totally surrounding the perimeter of the hull. It should be understood that both hulls 110 and 210 cannot be obtained by the same mould.

[0037] Figure 7C illustrates a hull 10 according to the present invention. From the mould 1 for a conventional rigid hull, of the type represented in Figure 7A, it is possible to obtain a hull with partial tubular members by simply providing suitable inserts 2 within the mould. The inserts 2, fixed from outside the mould 1 by removable means (not illustrated), will be extracted from the mould 1 together with the moulded piece and subsequently removed.

[0038] By using or not these inserts 2 it is possible to obtain both hull typologies from the same mould 1, i.e. a rigid hull of the traditional type (Figure 7A) or a hull with partial tubular members 20 according to the present invention. It should be understood that the steps of design, and model- and mould-making for a family of hulls are avoided. Furthermore, it is also possible to obtain a new hull with partial tubular members 20 starting from the design (and the mould) of an already existing conventional hull.

[0039] In other words, the modular mould 1 indifferently allows to obtain a boat with a conventional rigid hull or with a RIB type hull, i.e. a boat prearranged for the fixing of a tubular member 20 or any other removable system (for example, fenders) or not. A mould 1 will be thus obtained which is prearranged for 'normal' laminations (to obtain conventional rigid hulls), or by using the suitable inserts 2, for laminations intended to obtain housings and guide elements which are suitable to allow the mounting of the tubular members 20. Both hull versions for one boat can be thus offered to the customers.

[0040] According to the preferred embodiment, the tubular member 20 comprises an inflatable casing 27 (Figure 6) made of a flexible material. The connection between the casing 27 and the front locking portion 21 can be for example made by gluing at suitable depressions 28 formed on the outer surface of the base element 40 or the corresponding rubber layer coated thereon, such as to make the outer surface of the tubular member 20 smooth, or however without irregularities or steps.

[0041] The tubular member 20 is preferably inflatable or deflatable as desired and the casing 27 is preferably made with one or more separate airtight chambers.

[0042] Figure 8 shows the stern portion according to a possible embodiment of the present invention, in which each of the flexible casings 27 of the tubular members 20 is partitioned into airtight chambers 27a-27d which are separated by suitable partition walls 25.

[0043] The inflation of each tubular member 20 can be carried out by using a single inflating valve 62 connected to a single pipe 60 crossing the partition walls 25 of the airtight chambers 27a-27d. The valve 62 is arranged aft of the respective tubular member 20, in such a position as to not interfere with the hull 10, whereas along the pipe 60 there are present non-return valves 61 (one for each chamber) to pneumatically isolate each chamber from the others. On the other hand, in order to allow the deflation of the casings 27, each chamber 27a-27d is provided with a respective air valve 63.

[0044] This inflation/deflation system allows to separately and independently inflate and deflate each of the tubular members 20 while in motion, without any need to stop.

[0045] There are further advantageously provided means to retract the inflatable casing 27 to the corresponding recessed housing 11 when the casing 27 is in the deflated condition. As a matter of fact, if the tubular member 20 were deflated or damaged, it would hang down the flank of the boat and it is understood that, by sailing in these conditions, the tubular member might be inadvertedly damaged.

[0046] According to a possible embodiment, such as illustrated in greater detail in Figures 9A and 9B, in the inflatable casing 27 of the tubular member 20 there are provided inner elastic tension wires 29 suitable to limit the bulk thereof when it is deflated.

[0047] In this embodiment, the elastic tension wires 29 are arranged with an end thereof which is fastened to each of the sliding rods 30, whereas the other end of each of the elastic tension wires 29 is fastened to a protection profile 26 fixed outside the tubular member 20. The protection profile 26 is preferably made of a material having a greater hardness than the material of the inflatable casing 27, for example a rubber or plastic having a greater hardness than casing 27, and can be fixed to the casing for example by gluing.

[0048] In the inflated condition (Figure 9A) the elastic tension wires 29 are thus tensioned (or loaded) such that, following deflation, the inflatable casing is retracted into the housing 11.

[0049] As illustrated in Figure 9B, the casing 27 in a deflated condition does not droop, thus being instead retracted by the inner elastic tension wires 29 such as to occupy the recessed housing 11 of the flank of hull 10, i.e. the same "natural" housing of the tubular member 20 when in operative conditions. The particular nature of the materials composing the protection profile 26 and the arrangement of the elastic tension wires 29 facilitates the retraction of the casing 27 into the recessed housing 11.

[0050] The arrangement of the elastic tension wires 29 which is indicated in Figures 9A and 9B is given by way of illustration only. For example, such as illustrated in Figures 9C and 9D, the elastic tension wires 29 can also be fixed such as to obtain a sort of three-dimensional web, and thus not being necessarily fastened at the ends thereof to the sliding rods 30 and/or the protection profile 26.

[0051] In this case, the protection profile 26 can also have a smaller sectional size and the retraction efficiency can be essentially delegated only to the geometrical arrangement of the elastic tension wires 29.

[0052] Whatever being the arrangement thereof, the inner elastic tension wires 29 can be inserted within the inflatable casing 27 in an already pre-tensioned condition.

[0053] Alternatively, the retracting means of casing 27 can however be made with a different inner tensioning system, for example by means of pulleys which are connected to one another through rigid or elastic cables.

[0054] It is thus possible to freely use the hull also without tubular members, for example after they have been removed or deflated. The latter case is also valid with a damaged tubular member.

[0055] Due to the provision of partial tubular members according to the present invention, the remaining part of the hull, particularly the bow, being no longer interested by the presence of a sole complete tubular member, can be shaped such as to ensure further safety characteristics. For example, the bow portion can be shaped such as to provide a so-called "anti-sink bow".

[0056] A possible embodiment of the bow portion of a hull 10 according to the present invention is illustrated by way of example in the Figures 10A-10C.

[0057] The anti-sink bow which is represented herein is made by widening the upper part of a conventional pointed bow 51 such that the front end comprises flat surfaces 50, such as shown in the bottom plan view from Figure 10A. Consequently, the deck portion 55 is also widened in order to be joined to the widened surfaces 50.

[0058] From the flattened front ends 50 there develop two corresponding projecting portions 52 provided with hydrodynamically lifting surfaces 53 and 54 which can be seen more in detail in Figures 10B and 10C.

[0059] From a structural point of view, the junction of the bow widened end to the hull flank is provided by a convex surface 53 followed by a concave surface 54. The latter is upwardly joined, i.e. near the deck 55, to the side surface of the projecting portions 52 until the junction of the hull to the deck. All the surfaces described herein are directly obtained from the hull mould during manufacture.

[0060] The bow shaped in this way is called "anti-sink" not because it ensures buoyancy with the damaged boat, either leaking or flooded by the waves, rather because it prevents the bow from sinking with very rough and head sea.

[0061] In other words, the transversal surfaces 53 and 54 ensure the hydrodynamic lift should the bow temporarily sink in the water. When the so shaped bow portion dips into the water, an upward thrust is generated which causes the bow to emerge faster, thereby providing a safer and more stable boat.

Claims

1. A boat hull comprising at least one rigid structure and one or more tubular members fixable to said rigid structure at the perimeter thereof, **characterized in that** said one or more tubular members are shaped and sized such as to only partially cover the hull perimeter.

2. The hull according to claim 1, wherein at least two distinct tubular members fixed to the respective flanks are provided, each of said tubular members having a shorter length than said flanks.

3. The hull according to claim 1, wherein said tubular members are mounted at the stern portion.

4. The hull according to claim 1, wherein said tubular members are tapered towards the bow.

5. The hull according to claim 1, wherein said rigid structure comprises one or more hydrodynamically lifting surfaces at the bow portion.

6. The hull according to claim 1, wherein each of said tubular members is fixed at a recessed housing which is provided in said rigid structure.

7. The hull according to claim 1, wherein means are provided to removably fix said tubular members to said rigid structure.

8. The hull according to claim 7, wherein said means for removably fixing comprise one or more sliding rods arranged on the outer surface of each of said tubular members.

9. The hull according to claim 1, wherein each of said tubular members comprises an inflatable casing made of a flexible material.

10. The hull according to claim 9, wherein said inflatable casing comprises one or more separate airtight chambers.

11. The hull according to claim 10, wherein each of said separate airtight chambers comprises at least one deflating valve.

12. The hull according to any of claims 9 to 11, wherein one single inflation duct is provided for said separate airtight chambers.

13. The hull according to any of the preceding claims, wherein means are provided to retract said inflatable casing into the corresponding recessed housing when said casing is in a deflated condition.

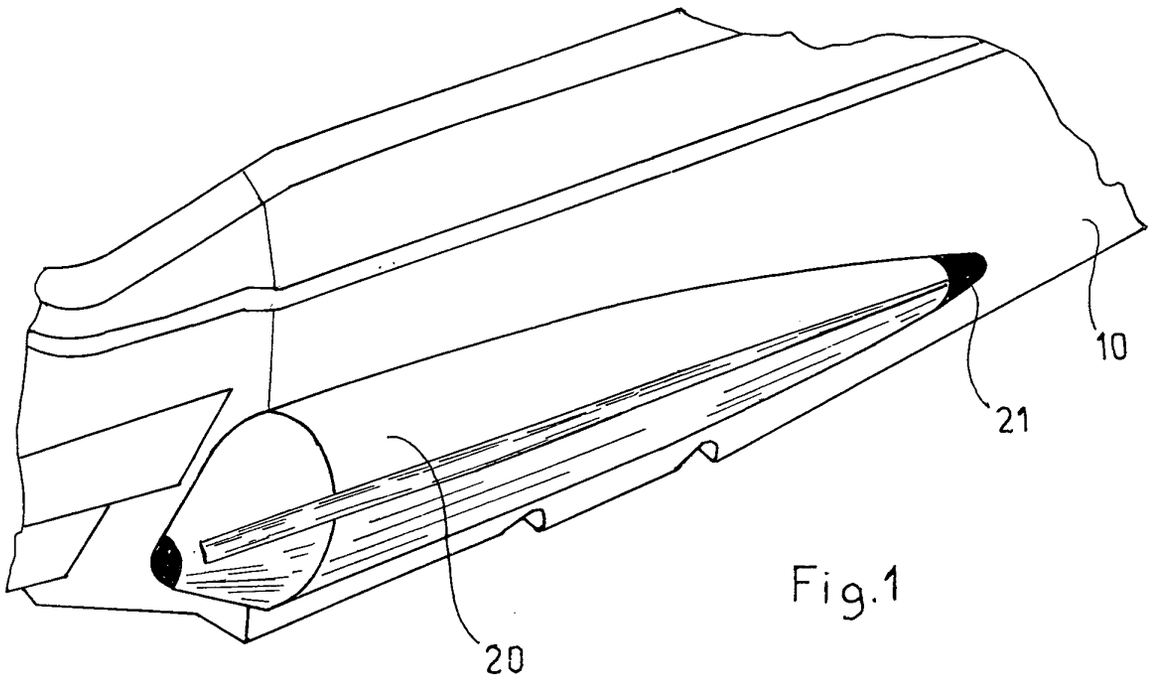


Fig.1

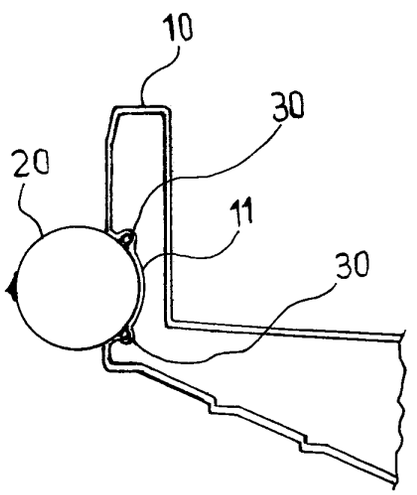


Fig.2

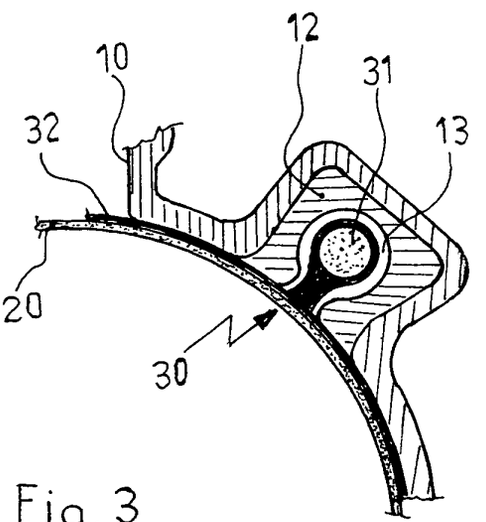


Fig.3

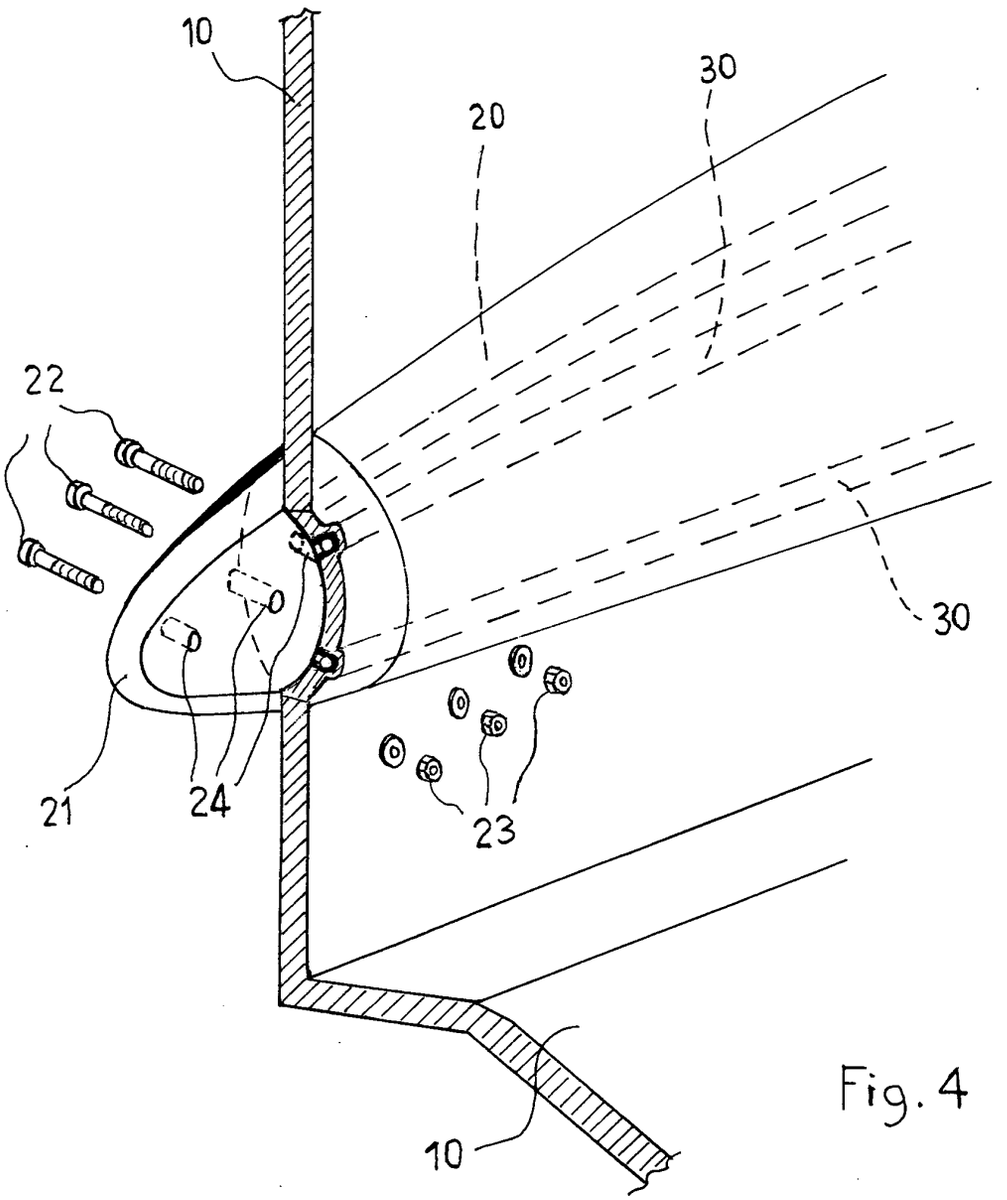


Fig. 4

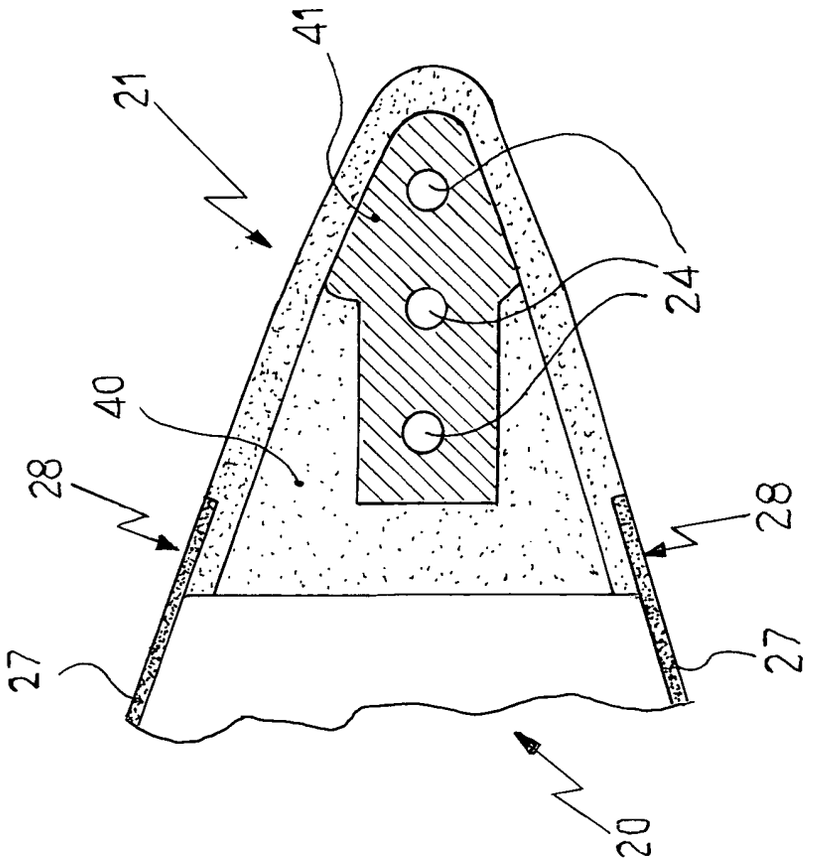


Fig.6

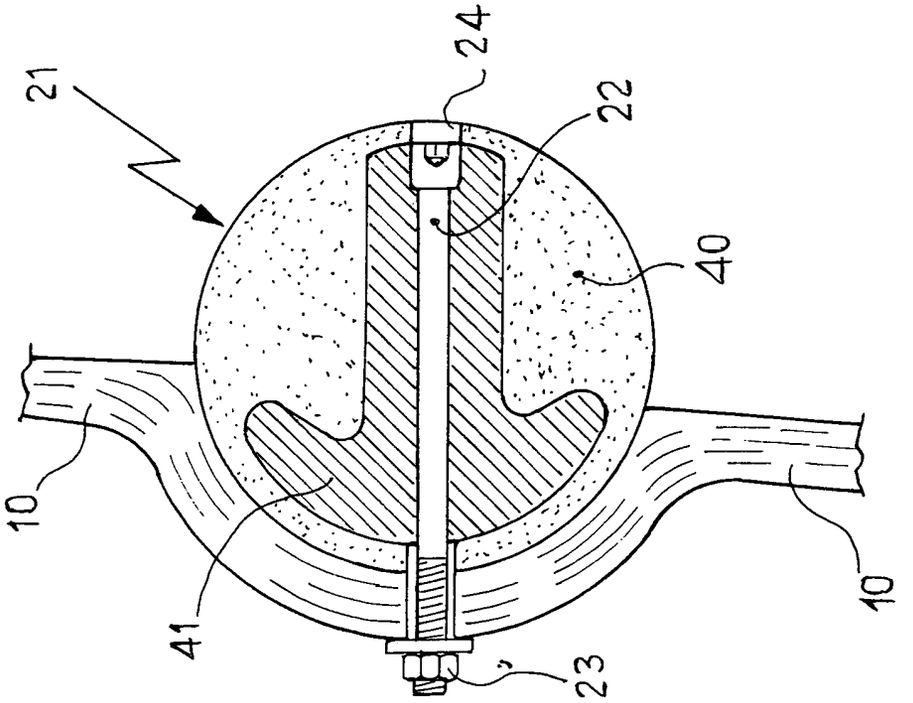


Fig.5

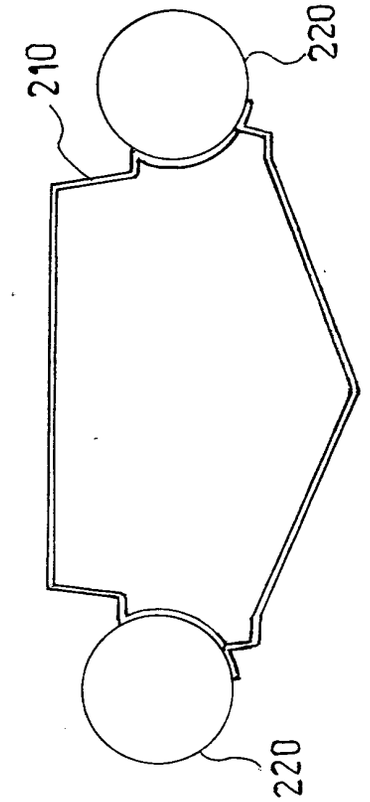


Fig. 7B

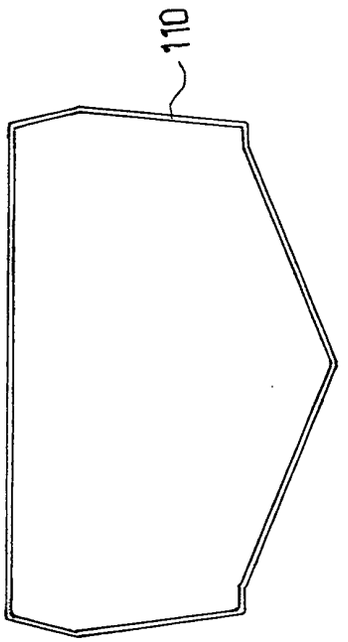


Fig. 7A

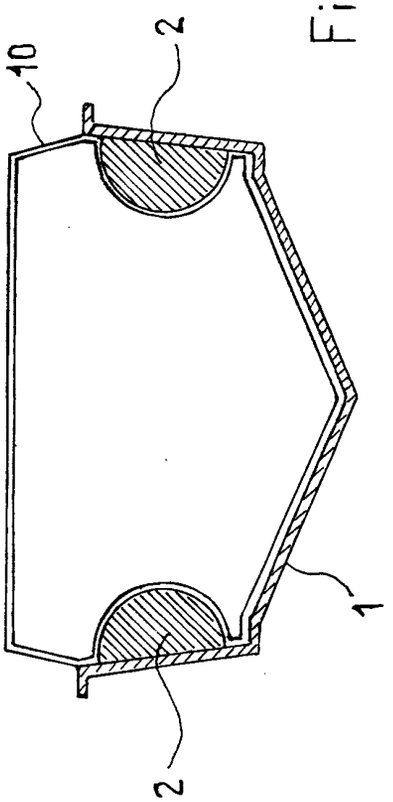


Fig. 7C

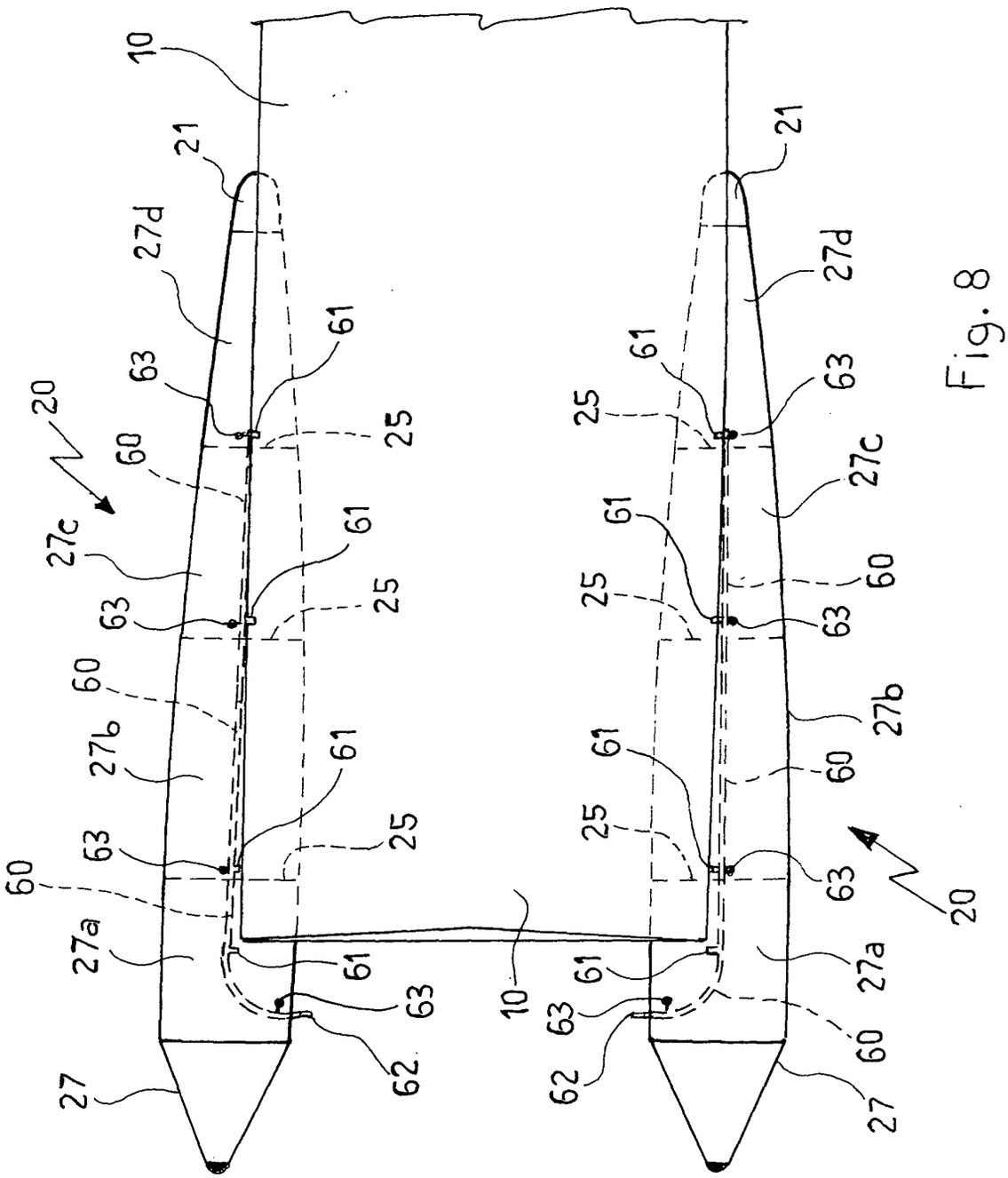


Fig. 8

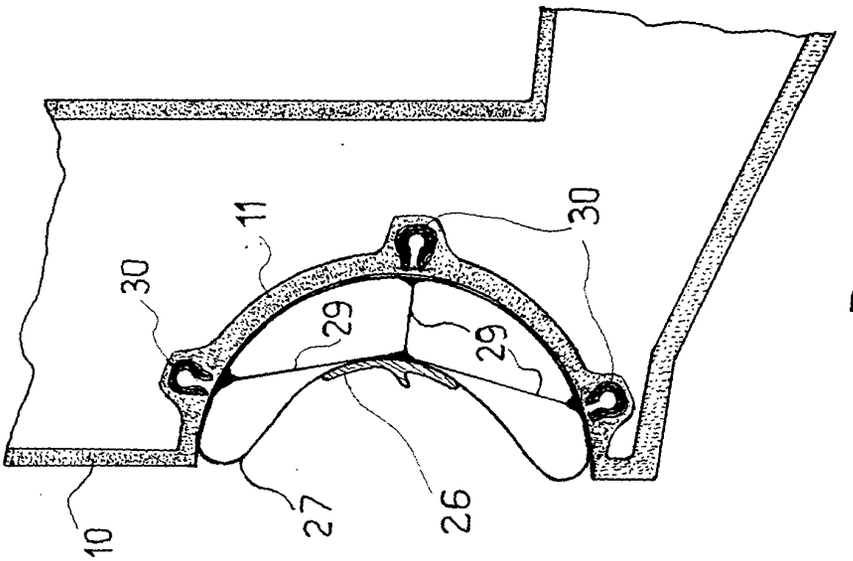


Fig. 9B

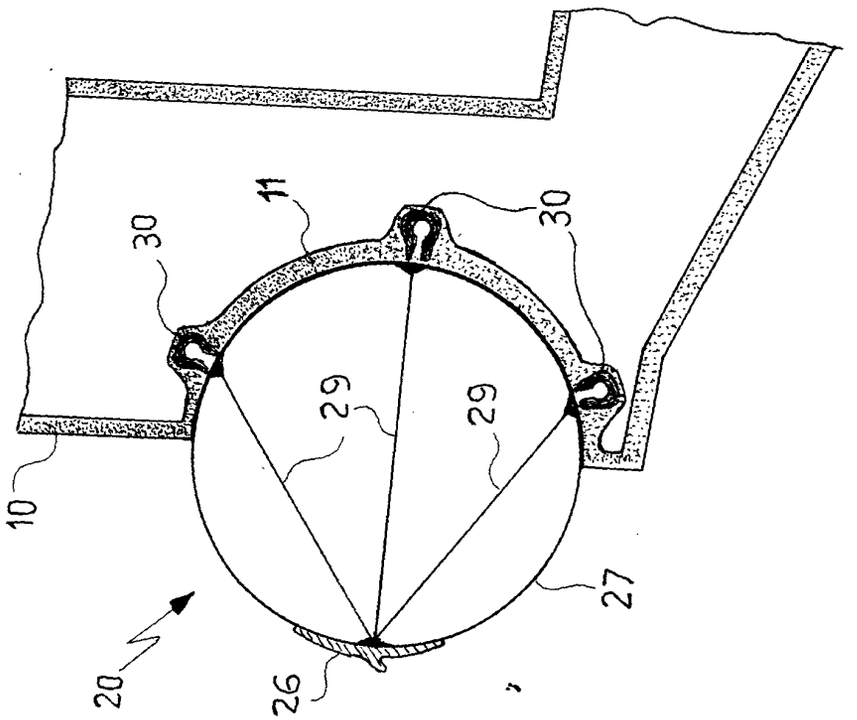


Fig. 9A

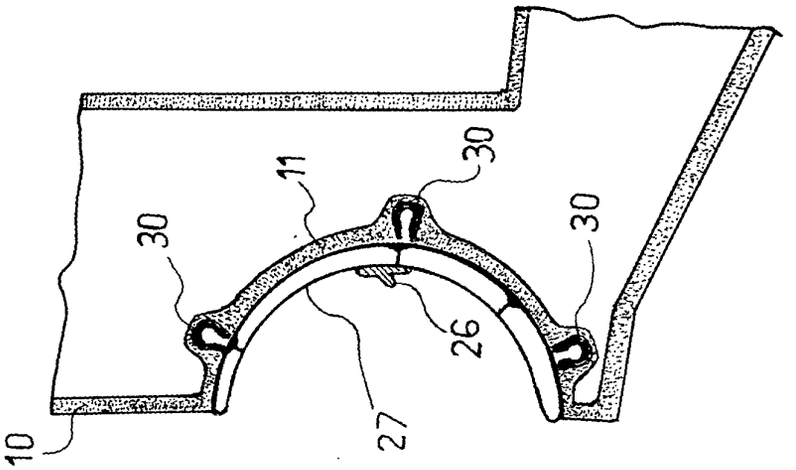


Fig.9D

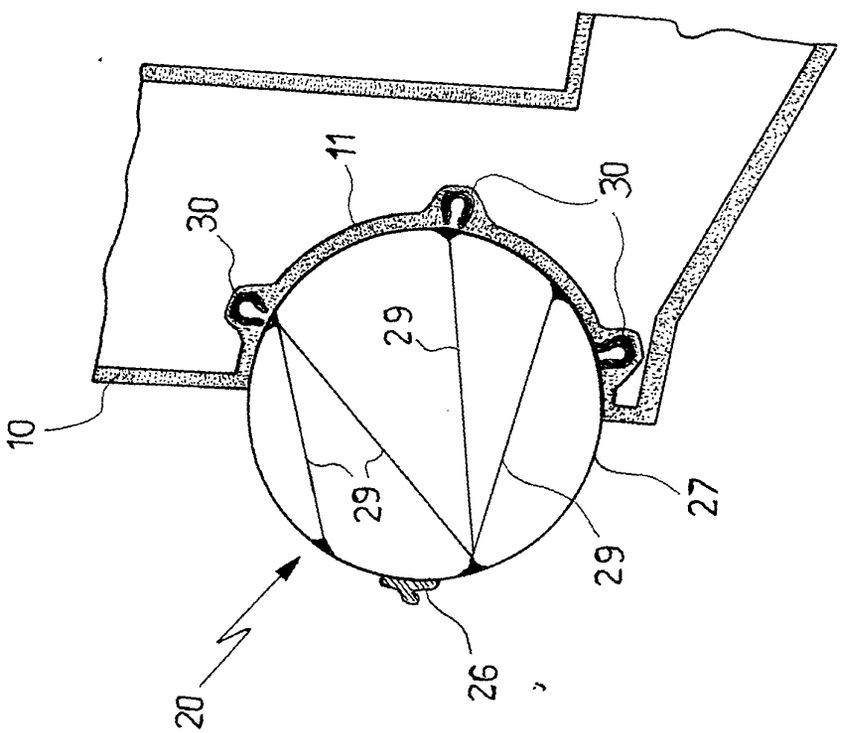
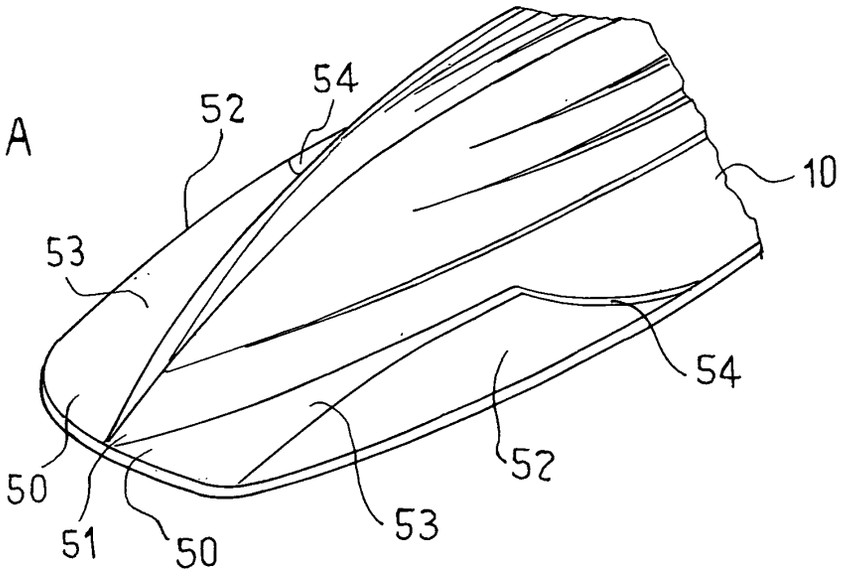


Fig.9C

Fig. 10A



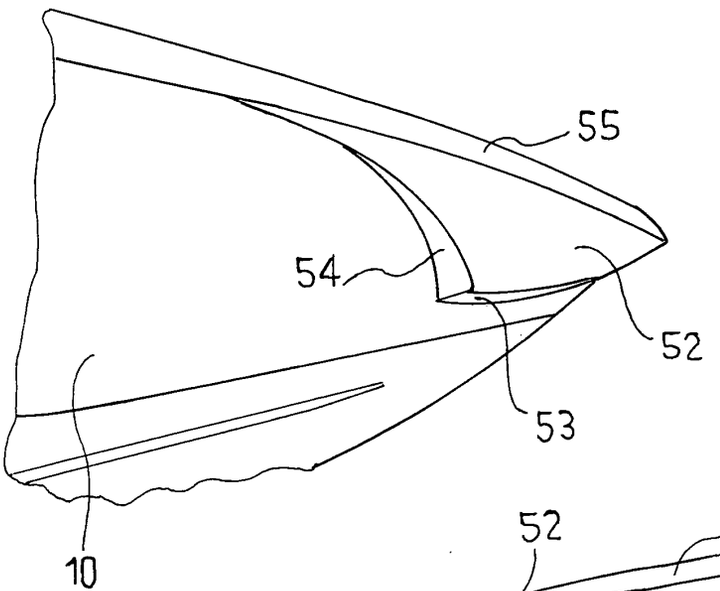


Fig. 10B

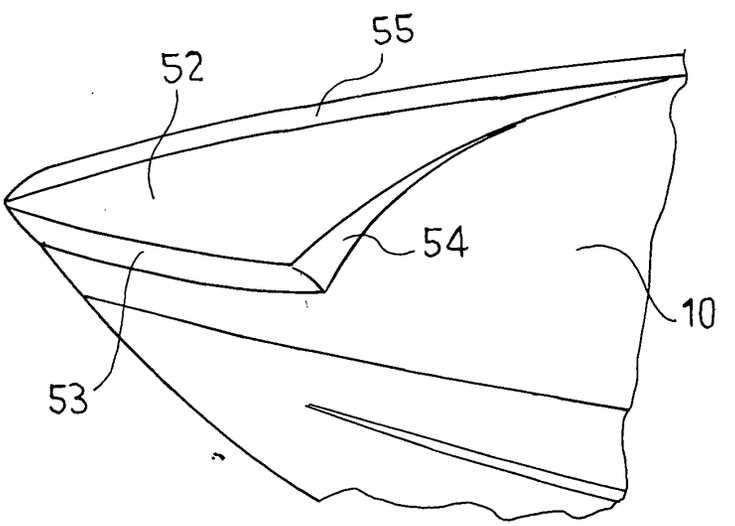


Fig. 10C