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(54) Sectional modular multihull watercraft

(57) Described herein is a multihull watercraft (for example a catamaran) comprising two or more hulls 1 assembled together by a number of mutually independent hollow cross brackets 5, each hull 1 comprising at least one "bow" hollow module (2C) and one "stern" hollow module (2A) and, normally, one or more intermediate hollow modules (2B) which make it possible to increase the length of the hull 1 in a modular manner.

The hollow modules 2 are floating ones, are supplied fully equipped, and can be assembled also in water at the place of use by means of reversible connection means 3 (for example, bolts) operated from the inside of the modules 2 without the need for a boatyard, slipway, particular equipment, and/or specialised staff.

The modules 2 and the brackets 5 have dimensions such as to enable them to be transported in containers.

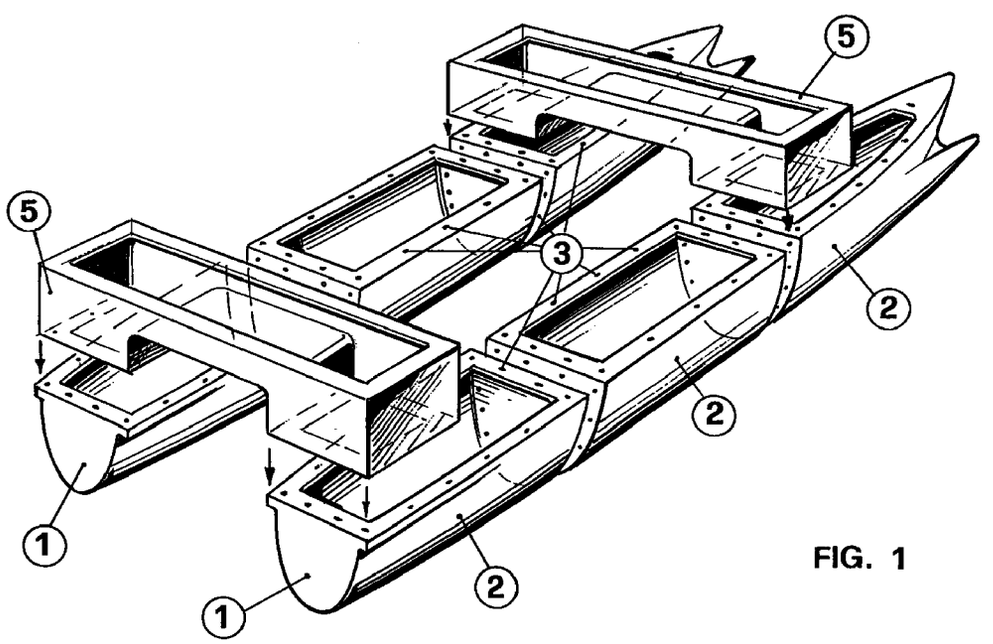

FIG. 1

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Description

SCOPE OF INVENTION

[0001] Described herein is a multihull watercraft (for example a catamaran) comprising two or more hulls assembled together by means of a number of mutually independent hollow cross brackets, each hull comprising at least one "bow" hollow module and one "stern" hollow module and, normally, one or more intermediate hollow modules which make it possible to increase the length of the hull itself in a modular manner.

[0002] The hollow modules are floating ones, are supplied fully equipped, and can be assembled also in water at the place of use through reversible connection means (for example, bolts) operated from the inside of the modules without the need for a boatyard, slipway, particular equipment, and/or specialised staff.

[0003] The modules and the brackets have dimensions such as to enable them to be transported in containers.

PRIOR ART

[0004] Inland waters (rivers and lakes) have always constituted (and still do constitute) very important means of communication for persons and things, which are able to condition even to a considerable extent the economic development of the surrounding regions.

[0005] In vast areas of Africa, Asia and South America, inland waters constitute the only practicable means of communication for heavy machinery and means of transport (large lorries, earth-moving machines, etc.) because the road network is frequently very limited (or practically non-existent), and the few roads (or tracks) that do exist do not allow transit for heavy means of transport, also on account of the lack of upkeep.

[0006] Watercraft suitable for transporting heavy means are normally built in boatyards (even though, frequently at a handicrafts level) and are not able to overcome natural obstacles (waterfalls, non-navigable stretches of rivers, etc.), which considerably limit their range.

[0007] Very frequently it is not even possible to get around such obstacles by transporting over land the parts that make up the watercraft upstream of the obstacle and assembling them, since normally there do not exist *in situ* slipways suitable for "carrying" the watercraft during the assembly phase, nor is the necessary equipment and specialised staff available, and usually it is not possible and/or economically convenient to install a slipway to meet a single, specific need.

[0008] The modular watercraft which is the subject of the present invention enables the above-mentioned limits and problems to be overcome, because the modules that make it up are of reduced dimensions, are supplied fully equipped, are floating, and may be assembled also in the water, without the need for boatyards, slipways, particular equipment (cranes, winches and/or other means of hoisting, welding machines, etc.), and/or specialised staff.

SUMMARY OF INVENTION

[0009] The subject of the present invention is a sectional modular multihull watercraft comprising two or more hulls assembled together by a number of mutually independent hollow brackets set crosswise with respect to the hulls to which are connected by first reversible connection means positioned inside the hulls and the hollow brackets and operated from the inside of at least the hollow brackets, where each hull comprises a number of floating hollow modules assembled together also in water by second reversible connection means positioned inside the hollow modules and operated from the inside of the hollow modules, said second reversible connection means consisting normally of bolts.

[0010] The modules are supplied fully equipped; the modules and the brackets have dimensions such as to enable them to be transported in containers.

List of figures

[0011] The invention will now be more fully described with reference to an example of embodiment, which, however, has no limiting effect, illustrated in the attached figures, where:

- Figure 1 is a schematic representation of an exploded view of a multihull watercraft made according to the invention;
- Figure 2 is a schematic representation of one of the hulls of the watercraft of Figure 1;
- Figure 3 is a schematic representation of the watertight bulkhead of one of the modules of Figure 2;
- Figure 4 is a schematic representation of an exploded view of two adjacent modules, for providing a better illustration of the centring coupling;
- Figure 5 is a schematic representation of a top view of two adjacent modules;
- Figure 6 is a schematic representation of two modules, each of which belonging to one of the hulls of Figure 1, assembled together by means of a bracket;
- Figure 7 is a schematic representation, in sectional view, of a portion of two adjacent modules, assembled according to a preferred embodiment of the means of reversible connection.

[0012] In the attached figures, corresponding items are identified using the same numerical references.

DETAILED DESCRIPTION

[0013] Figure 1 is a schematic representation of an exploded view of a multihull watercraft (a catamaran)

built according to the invention.

[0014] Figure 1 shows the two hulls 1 (better described with reference to Figure 2), each of which comprises a number of floating hollow modules 2, assembled through reversible connection means 3 positioned inside the hollow modules 2 and operated from the inside of the hollow modules 2 (Figure 7).

[0015] The hulls 1 are assembled together by means of hollow cross brackets 5 (as will be more fully described with reference to Figure 6), the number of which and the section of which depend on the amount and nature of the stresses that are expected to have to be withstood by the hollow brackets 5.

[0016] In the example of embodiment illustrated in Figure 1, each of the hulls 1 comprises three hollow modules 2 and two hollow brackets 5, which are independent each other.

[0017] Once the hulls 1 have been assembled by means of the brackets 5, the multihull watercraft according to the invention is completed with the application on the brackets 5 (in a manner of itself known), of limber boards and/or possible superstructures, which are not illustrated herein because they are extraneous to the present invention.

[0018] Figure 2 is a schematic representation of a hull 1 belonging to the multihull watercraft of Figure 1, comprising three hollow modules 2 assembled via reversible connection means 3, not explicitly indicated in Figure 2. A preferred embodiment of the reversible connection means 3 will be illustrated with reference to Figure 7.

[0019] Also shown schematically in Figure 2 (partially "in see-through view") are centring couplings (of the male-female type) located between two adjacent modules 2.

[0020] These centring couplings will be described with reference to Figures from 3 to 5.

[0021] The hull 1 of Figure 2 comprises a "stern" hollow module (2A), an intermediate hollow module (2B) and a "bow" hollow module (2C), but without departing from the scope of the invention, the hull 1 may comprise only one "bow" hollow module (2C) and one "stern" hollow module (2A), or else two or more intermediate hollow modules (2B), which make it possible to increase, in a modular way, the total length of the hull 1. The number of intermediate hollow modules (2B) used each time depends on the specific requirements of the user, taking into account that, to be easily transportable (preferably in a container), it is necessary (or, at least, very desirable) that the length of one hollow module 2 built according to the invention should not exceed approximately 12 metres.

[0022] The "bow" (2C), "stern" (2A) and intermediate (2B) hollow modules differ from one another exclusively in their outer shape.

[0023] All hollow modules 2 are suitable for floating because they are closed at one end at least by the water-tight bulkhead 4 illustrated in Figure 3 (the intermediate hollow modules 2B present a bulkhead 4 at both ends). Consequently, the hollow modules 2 may be "launched" at the place of use and assembled also in water via reversible connection means 3 (preferably, but not necessarily, bolts that engage in nuts, or else threaded bushings fastened to the bulkheads 4 - Figure 7), without the need for a boatyard and/or slipway.

[0024] All the modules 2 are supplied fully equipped (standard or according to the particular requirements of the user), thus simplifying and cutting down to the minimum the operations involved in building an efficient watercraft, without requiring the use of a crane, winches and/or other means of hoisting, or specialised staff. To provide a purely illustrative, i.e., non-limiting example, a "bow" module (2A) may come already equipped with an engine, tail-shaft, solepieces and pintles for the rudder, driving cables for the engine and rudder, etc.; in an intermediate module (2B) and/or in a "bow" module (2A), tanks may be installed for fuel or water, or else in these modules a stowaway may be made (for provisions, implements, etc.), and so on.

[0025] In addition, all the modules 2 and the brackets 5 used for assembling together two hulls 1 are of dimensions compatible with transport by lorry, preferably in a 40-ft standard container, which considerably facilitates transportation to the place of assembly of the various modules 2 and brackets 5 making up the watercraft to be built.

[0026] Preferably, but not necessarily, the dimensions of a module 2 and a bracket 5 do not exceed approximately 2.5 x 2.5 x 12 metres.

[0027] A further advantageous characteristic of a watercraft according to the invention is represented in the fact that all the hollow elements (modules 2 and brackets 5) that make it up consist (preferably but not necessarily) of monolithic bodies made of composite material obtained by moulding.

[0028] Figure 3 is a schematic representation of the bulkhead 4 of one of the hollow modules 2 of Figure 2. Figure 3 shows a number of holes 6 made along the perimeter of the bulkhead 4 (in this figure only one of such holes is identified, with the reference "6") suitable for accepting the reversible connection means 3 (Figure 7), a set of holes 7 located along the top edges of the module 2 (in Figure 3, only one of these holes is identified, with the reference "7"), in which are engaged bolts (or other functionally equivalent means of connection) which connect the module 2 to at least one of the brackets 5 (Figure 6), and the male element 9 of the centring coupling of the male-female type (Figure 2), located on the bulkhead 4, which engages in a corresponding female element 9' having a complementary shape, located on the bulkhead 4 of the adjacent hollow module 2.

[0029] The elements (9, 9') that make up a centring coupling made according to the invention are more easily visible in the exploded view of Figure 4, where there are also schematically indicated the holes 6 located along the perimeter of the bulkheads 4 of the modules 2

and the holes 7 located along the top edges of the modules 2.

[0030] The centring coupling (9, 9') enables easy alignment and proper reciprocal positioning of two **hollow** modules 2 to be assembled and, for this purpose, the surfaces of its elements (male and female) are inclined with respect to the perpendicular to the corresponding bulkhead 4. In addition, the male element 9 absorbs at least part of the torsional stresses that, in operation, occur between two assembled modules 2, thus reducing the shearing stresses to which the means of reversible connection 3 are subjected.

[0031] To obtain an efficient centring action and an adequate mechanical resistance to the stresses, the angle of inclination of the surfaces of the elements (9, 9') of the centring coupling is preferably, but not necessarily, between 5° and 40°.

[0032] Preferably, but not necessarily, integral with the male element 9 of the centring coupling is a threaded pin 16, which is inserted in a hole 17 present in the corresponding female element 9' of the centring coupling and "pulled" by means of a threaded handwheel 18 (or other functionally equivalent means of tightening) acting on the threaded pin 17, assembling together the male and female elements (9 , 9') of the centring coupling.

[0033] Figure 5 is a schematic representation of a top view of two hollow modules 2. In this figure, the male element 9 of the centring coupling and, in see-through view, the corresponding female element 9' are present.

[0034] Figure 6 is a schematic representation of two hollow modules 2, each of which belonging to one hull 1, assembled together by means of a cross hollow bracket 5 connected in a reversible manner to the hollow modules 2 by means of bolts (or other functionally equivalent means), which are not explicitly indicated in Figure 6 for reasons of simplicity of graphical representation, inserted in the holes located along the bottom edges of the bracket 5 and in corresponding holes 7 located along the top edges of the hollow module 2, where they are fastened in a manner of itself khown, for example, by means of nuts embedded in the top edges of the modules 2 at the holes 7, or else located inside the modules 2 at the holes 7.

[0035] Figure 7 is a schematic sectional view of a portion of two adjacent hollow modules 2, assembled according to a preferred embodiment of the reversible connection means 3, which makes it possible to assemble conveniently the hollow modules 2, at the same time guaranteeing water-tightness of the modules themselves up to the moment of assembly.

[0036] The reversible connection means 3 comprise, in combination, a smooth bushing 10 fixed to the bulkhead 4 of a module 2 at one of the holes 6 and closed by a first seal element 11; a threaded body 12 (consisting, for example, of a threaded bushing) fixed to the bulkhead 4 of the other module 2 at one of the holes 6 and closed by a second seal element 13; and one bolt 14, which, at the moment of assembly of the modules 2, is inserted in the smooth bushing 10 and screwed into the threaded body 12.

[0037] Before assembly of the hollow modules 2, the holes 6 are occluded by the seal elements (11, 13), which prevent water from penetrating inside the hollow modules 2. When the two hollow modules 2 are assembled, they are brought up one against the other, the bolt 14 is inserted in the bushing 10, an axial pressure is exerted on the bolt 14 to eject the seal element 11 from the bushing 10 and to bring the thread of the bolt 14 to engage with the thread of the threaded body 12, and the bolt 14 is screwed into the threaded body 12 until it is fully tightened; the two hollow modules 2 are thus assembled.

[0038] If the shank of the bolt 14 is sufficiently long, the bolt 14, when fully tightened, will expel the seal elements 11 and 13 from the threaded body 12.

[0039] Without departing from the scope of the invention, the threaded body 12 may consist of a second smooth bushing fixed to the bulkhead 4 at one of the through holes 6 and closed by the second seal element 13 and by a threaded nut. When the two hollow modules 2 are assembled, they are brought up one against the other, the bolt 14 is inserted in the bushing 10, an axial pressure is exerted on the bolt 14 to eject the seal elements 11 and 13 from the bushing 10, respectively from the second smooth bushing, and the bolt 14 is screwed into the nut until it is fully tightened; the two modules 2 are thus assembled.

[0040] In Figure 7 there is also visible a seal 15 inserted (preferably but not necessarily) into a groove made in the bulkhead 4 of at least one of the modules 2. The seal 15 and the corresponding groove are not indicated in Figures 3 and 4 for reasons of simplicity of graphical representation and may be omitted without departing from the scope of the invention.

[0041] The above description of the multihull watercraft which forms the subject of the present invention is given as an example, which, however, has no limiting effect, with reference to a catamaran, but, without departing from the scope of the invention, it is possible to build a trimaran by assembling one of the side hulls 1 to the central hull 1 by means of a first set of hollow brackets 5 fastened along one edge of the central hull 1, and the other side hull 1 to the central hull 1 by means of a second set of hollow brackets 5 fastened along the other edge of the central hull 1.

[0042] Again without departing from the scope of the invention, it is possible for a person skilled in the art to build a watercraft which comprises four or more hulls 1, without having to make any inventive step.

[0043] Without departing from the scope of the invention, it is moreover possible for a person skilled in the art to make to such a sectional modular multihull watercraft, which is the subject of the present description, all the modifications and improvements suggested by normal experience and by the natural evolution of techniques.

Claims

1. Sectional modular multihull watercraft, characterised in that it comprises at least two hulls (1) assembled together by a number of mutually independent hollow brackets (5) set transversely with respect to the hulls (1) to which are connected by first reversible connection means positioned inside the hulls (1) and the hollow brackets (5) and operated from the inside of at least the hollow brackets (5), each hull (1) comprising a number of floating hollow modules (2) assembled together by second reversible connection means (3) positioned inside the hollow modules (2) and operated from the inside of the hollow modules (2).

2. Watercraft according to Claim 1, characterised in that the hollow modules (2) are suitable to be assembled in water by the second reversible connection means (3).

3. Watercraft according to Claim 1, characterised in that each hull (1) comprises at least one "bow" hollow module (2C) and at least one "stern" hollow module (2A).

4. Watercraft according to Claim 3, characterised in that each hull (1) further comprises at least one intermediate hollow module (2B).

5. Watercraft according to Claim 1, characterised in that each hollow module (2) is supplied fully equipped.

6. Watercraft according to Claim 1, characterised in that the hollow modules (2) and the hollow brackets (5) may be transported in containers.

7. Watercraft according to Claim 6, characterised in that the hollow modules (2) and the hollow brackets (5) have a length not exceeding approximately 12 metres.

8. Watercraft according to Claim 6, characterised in that the dimensions of the hollow modules (2) and hollow brackets (5) do not exceed approximately 2.5 x 2.5 x 12 metres.

9. Watercraft according to Claim 1, characterised in that the hollow modules (2) and the hollow brackets (5) consist of monolithic bodies made of composite material obtained by moulding.

10. Watercraft according to Claim 1, characterised in that at least one end of each hollow module (2) is closed by a watertight bulkhead (4).

11. Watercraft according to Claim 10, characterised in that a number of holes (6) suitable for accepting the second reversible connection means (3) are present along the perimeter of the watertight bulkhead (4).

12. Watercraft according to Claim 10, characterised in that the bulkheads (4) of two adjacent hollow modules (2) carry the male element (9), respectively the female element (9'), of a centring coupling of the "male-female" type, the female element (9') having a shape complementary to the shape of the male element (9).

13. Watercraft according to Claim 12, characterised in that the surfaces of the male (9) and female (9') elements of the centring coupling are inclined at an angle of between 5° and 40° with respect to the perpendicular to the corresponding bulkhead (4) by which said elements are carried.

14. Watercraft according to Claim 12, characterised in that the male element (9) of the centring coupling is integral with a threaded pin (16) suitable for being inserted in a hole (17) present in the corresponding female element (9') of the centring coupling, the male (9) and female (9') elements of the centring coupling being assembled together by tightening means (18) acting on the threaded pin (16).

15. Watercraft according to Claim 1, characterised in that along the top edges of each of the hollow modules (2) there is present a set of holes (7), in which are engaged the first connection means suitable for connecting the hollow module (2) to at least one of the hollow brackets (5).

16. Watercraft according to Claim 11, characterised in that the second reversible connection means (3) comprise, in combination, a smooth bushing (10), fixed to the bulkhead (4) of one of the hollow modules (2), to be assembled at one of the holes (6) that are present on the bulkhead (4) itself, and closed by a first seal element (11); a threaded body (12), fixed to the bulkhead (4) of the other hollow module (2), to be assembled at one of the holes (6) present on the bulkhead (4) itself, and closed by a second seal element (13); and one bolt (14) which, upon assembly of the hollow modules (2), is inserted in the smooth bushing (10) and screwed into the threaded body (12).

17. Watercraft according to Claim 16, characterised in that the threaded body (12) consists of a threaded bushing.

18. Watercraft according to Claim 16, characterised in that the threaded body (12) comprises a second smooth bushing fixed to the bulkhead (4) of the

other hollow module (2), to be assembled at one of the holes (6) present on the bulkhead itself, and closed by the second seal element (13) and by a threaded nut, into which the bolt (14) is screwed.

19. Watercraft according to Claim 18, characterised in that, when the hollow modules (2) are assembled, the bolt (14) ejects the seal elements (11, 13) from the smooth bushing (10), respectively from the threaded body (12).

20. Watercraft according to Claim 10, characterised in that it moreover comprises a seal (15) inserted into a groove made in the bulkhead (4) of at least one of the hollow modules (2).

21. Watercraft according to at least one of the previous claims, characterised in that it comprises at least three hulls (1) assembled together by means of at least two sets of independent hollow brackets (5) set transversely with respect to the said hulls (1) to which are connected by the first reversible connection means; further characterised in that each one of the intermediate hulls (1) is assembled to one of the adjacent hulls (1) by means of a first set of hollow brackets (5) fastened along one of the edges of the said intermediate hull (1) and to the other adjacent hull (1) by means of a second set of hollow brackets (5) fastened along the other edge of the said intermediate hull (1).

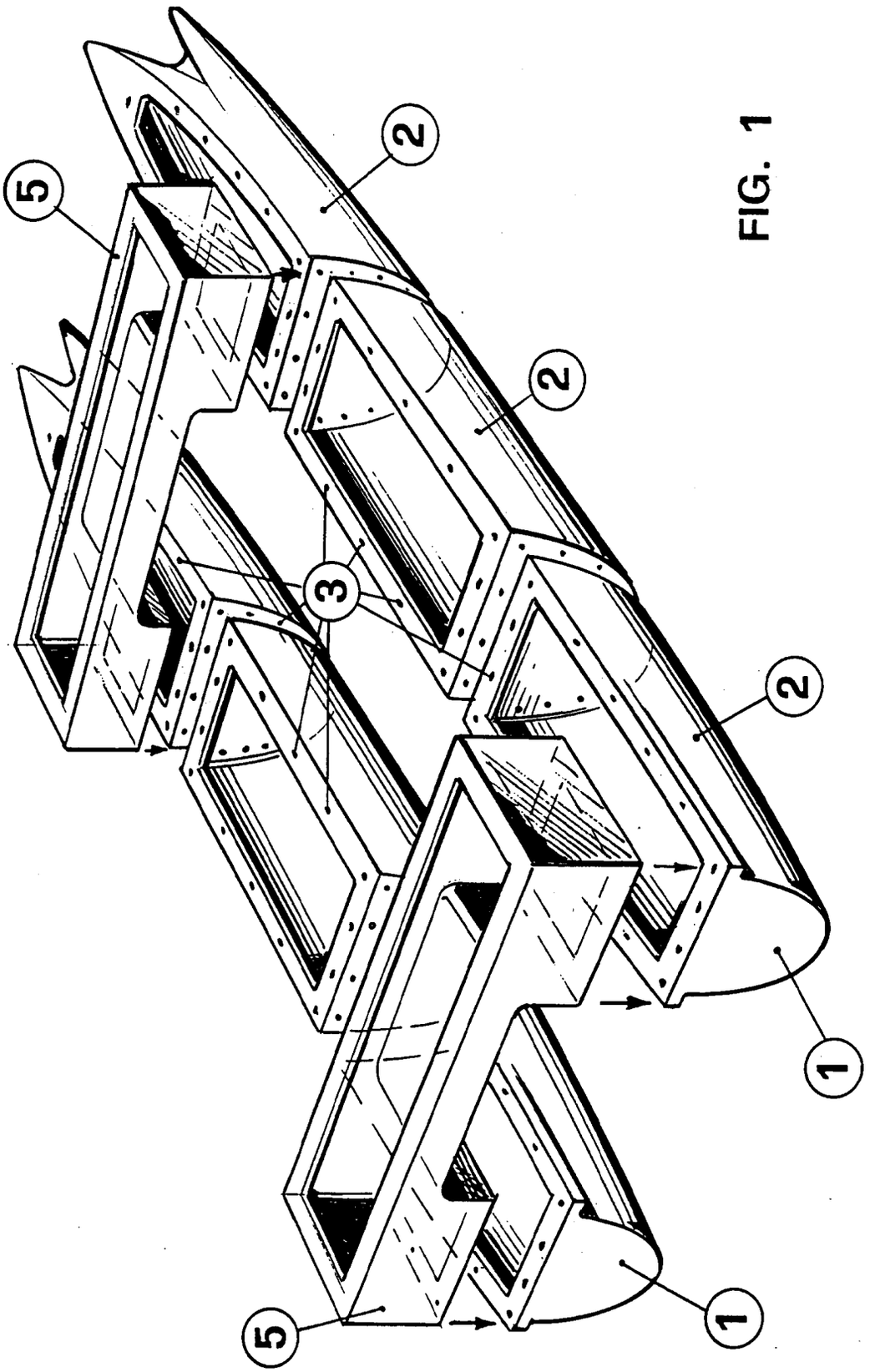

FIG. 1

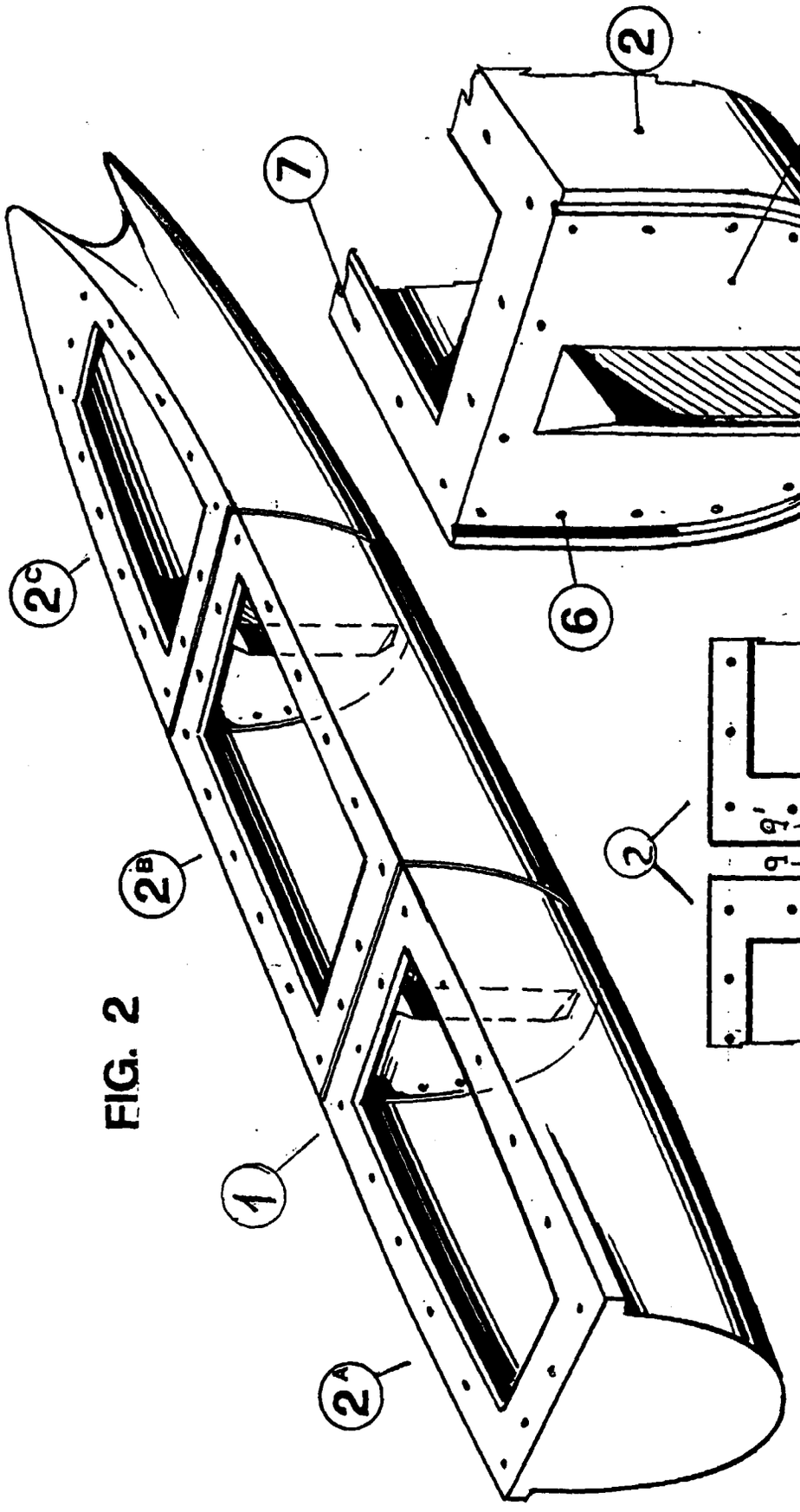

FIG. 2

FIG. 3

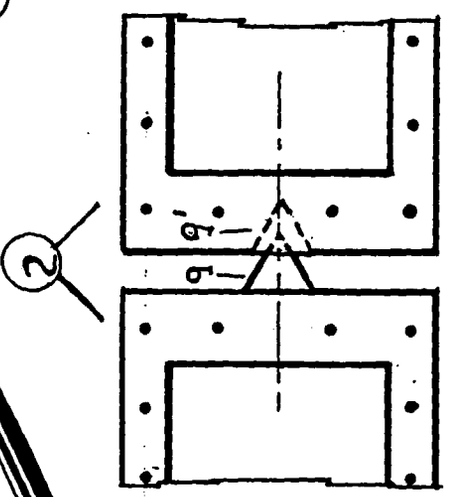

FIG.5

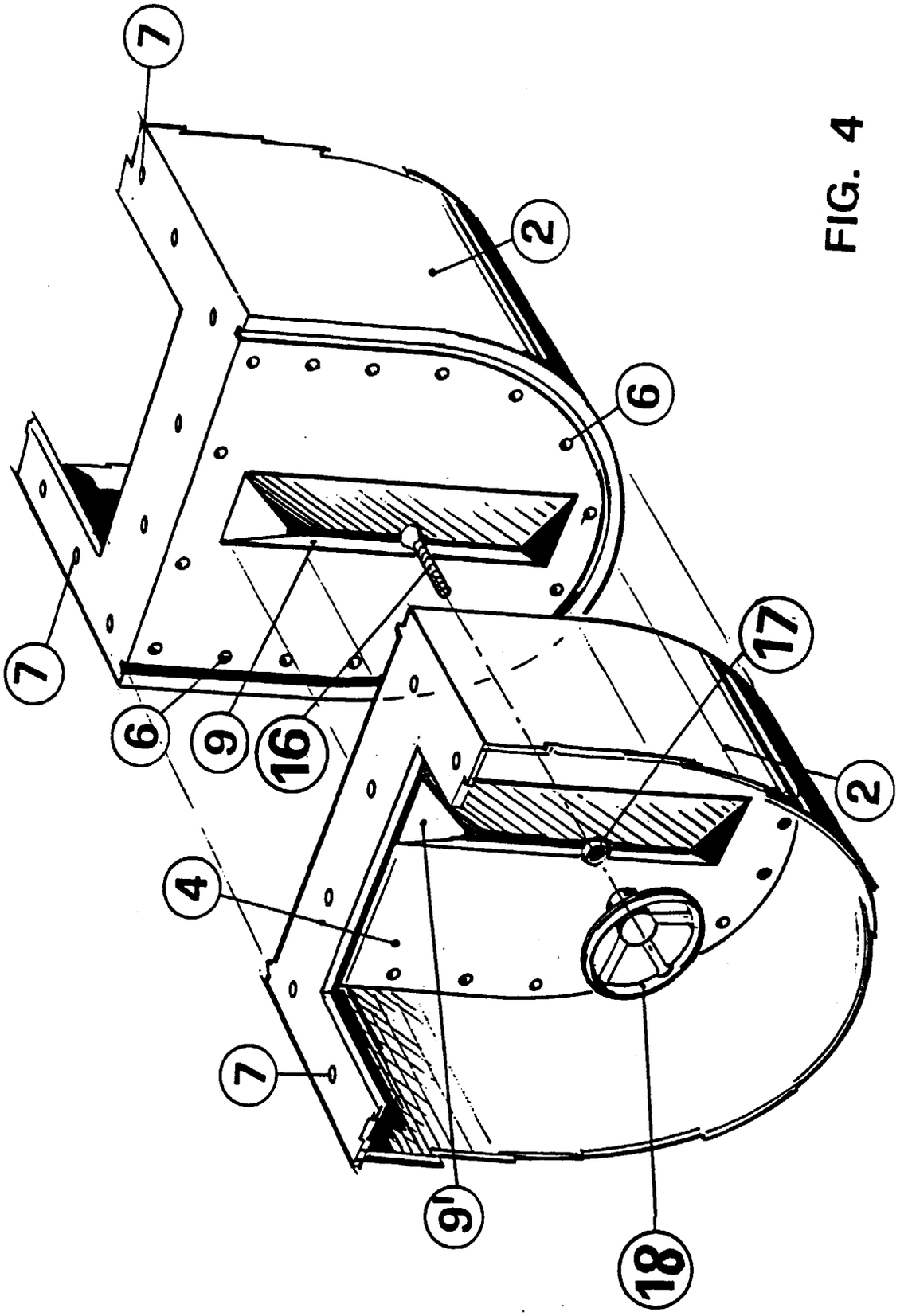

FIG. 4

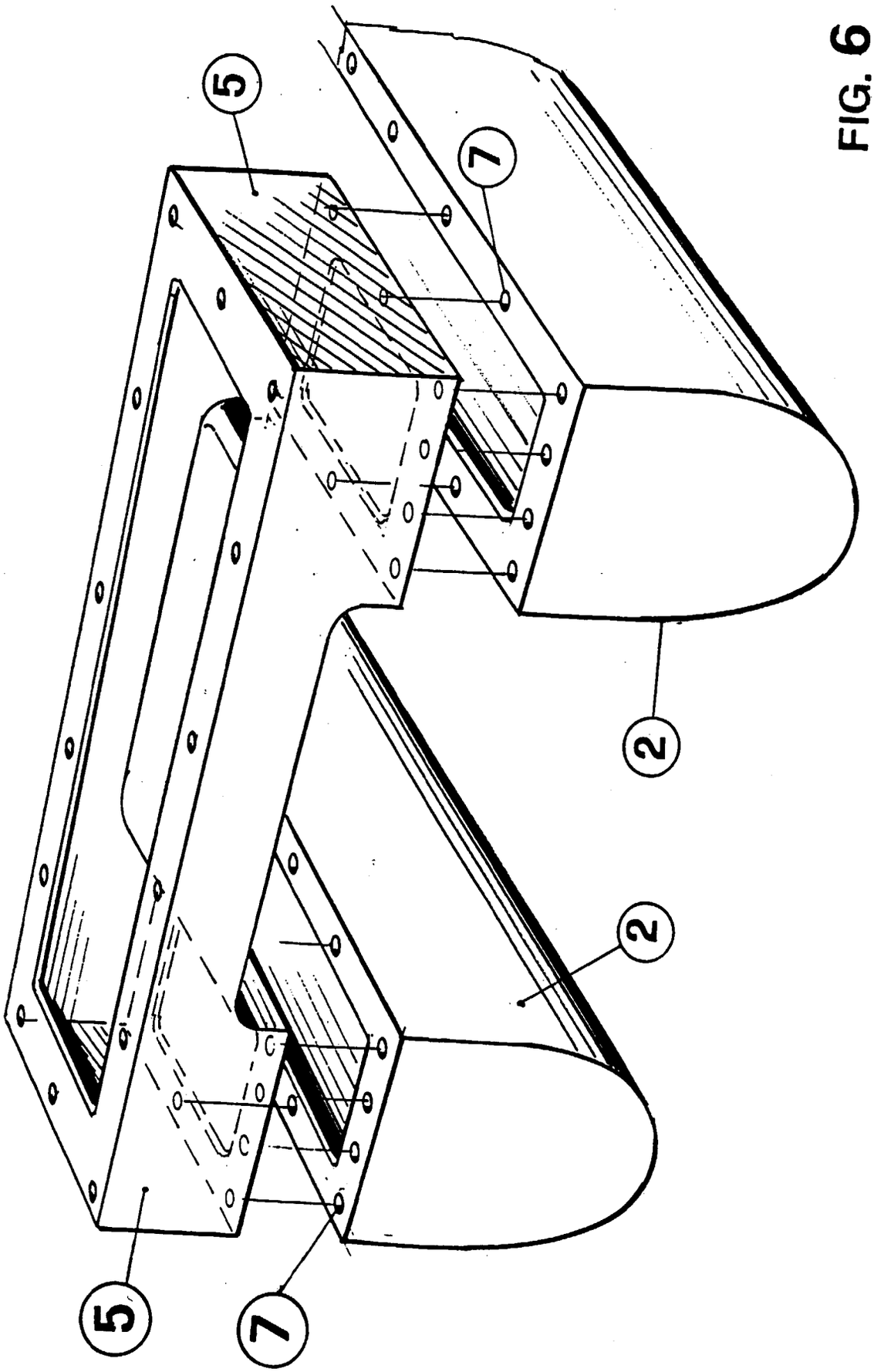

FIG. 6

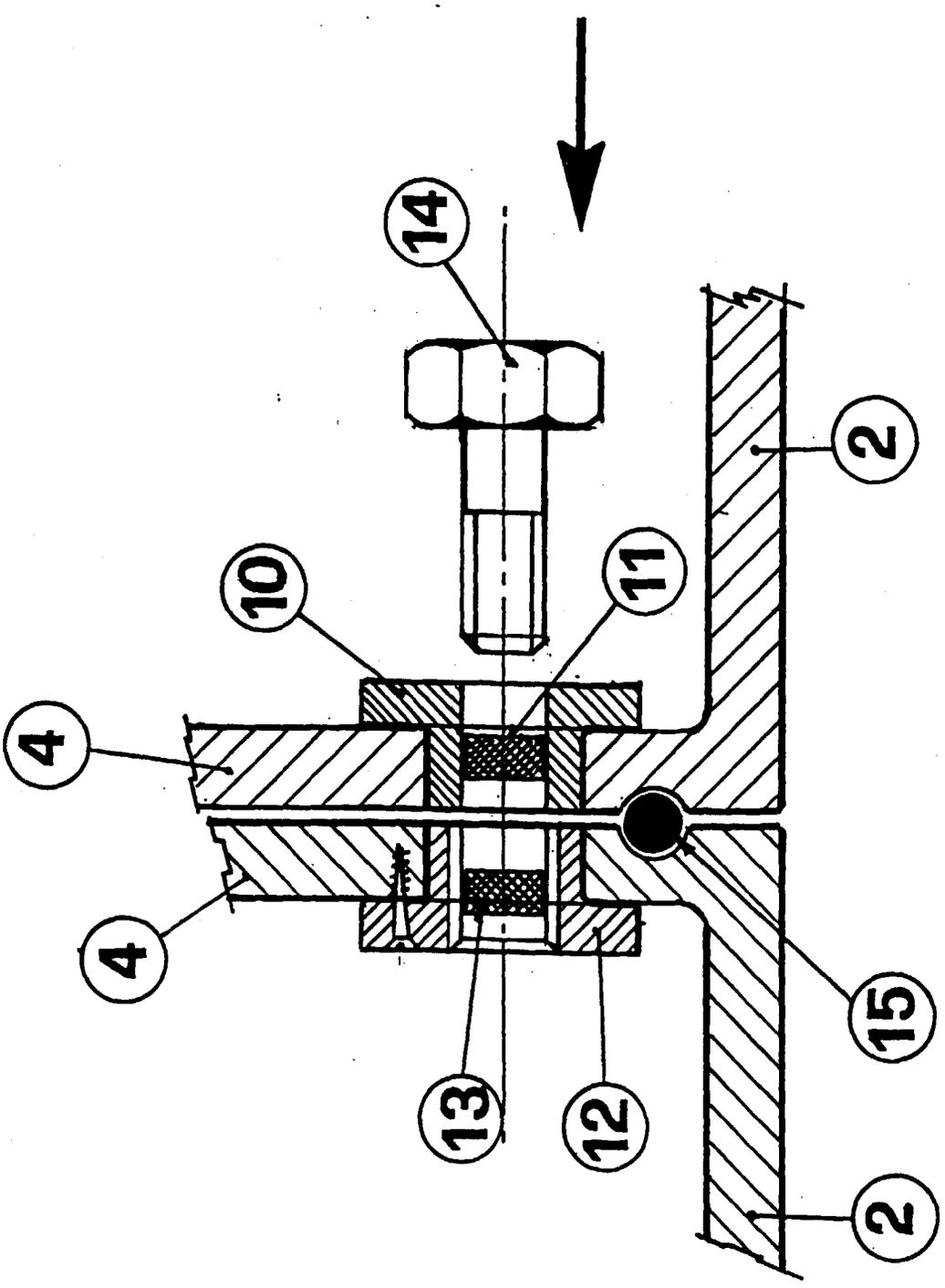

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 99 10 5828

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 June 1999	DE SENA, A

CATEGORY OF CITED DOCUMENTS

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