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(71) Applicant:
Ravestein Container Pontoon b.v.
6669 MB Dodewaard (NL)

(72) Inventor: **Ravestein, Johannes**
4051 CW Ochten (NL)

(54) Vessel with stiffening construction provided with troughs

(57) The invention relates to a vessel, the hull of which takes an at least partially double-walled form, wherein a stiffening construction is arranged between the double wails (6,8) of the hull (3), characterized in that the stiffening construction comprises a number of troughs (2,9) which are connected fixedly to at least one of the walls (6,8).

The invention also relates to a method for stiffening the hull of a vessel, comprising the following steps of:

- embodying the hull (3) in at least partially double-walled form; and
- arranging a stiffening construction between the double walls (6,8), characterized in that the method further comprises the step of:
- applying troughs (2,9) to manufacture the stiffening construction, wherein the troughs are fixedly connected to at least one of the walls of the hull.

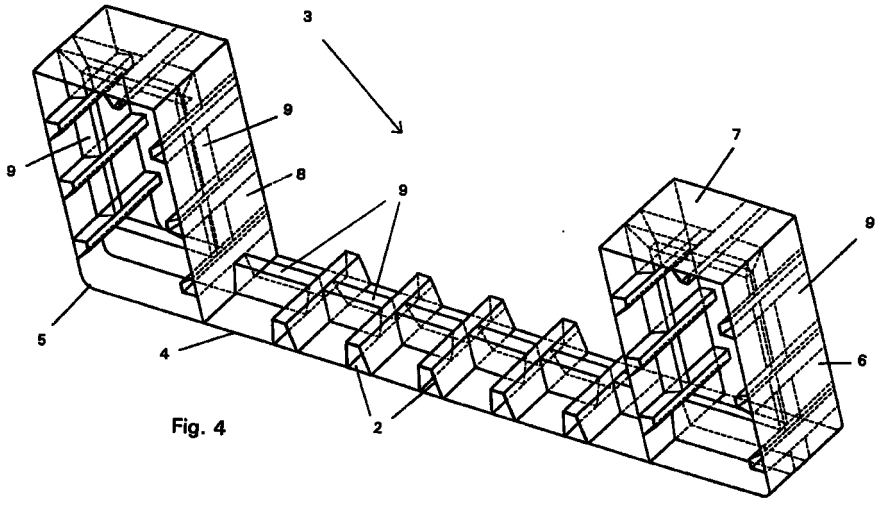

Fig. 4

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Description

[0001] The present invention relates to a vessel, the hull of which takes an at least partially double-walled form, wherein a stiffening construction is arranged between the double walls of the hull.

[0002] Such a vessel is known in the art. The stiffening construction of the known vessel consists largely of angle steels, so-called "Holland profiles" and/or of U.N.P. profiles of steel.

[0003] A large quantity of angle steels and profiles is required for the known stiffening construction, as a result of which the hull of the vessel is heavy.

[0004] The invention has for its object to provide a vessel of the type stated in the preamble with a lighter stiffening construction.

[0005] The vessel according to the preamble has for this purpose the feature that the stiffening construction comprises a number of troughs which are connected fixedly to at least one of the walls.

[0006] Troughs are manufactured from sheet material and are therefore generally lighter than said angle steel and profiles, which in itself will result in a lighter stiffening construction. The vessel according to the invention therefore has a greater cargo capacity or, if the load is the same, can achieve a higher sailing speed with the same engine power than the known vessel.

[0007] It is noted that the use of troughs is per se known in an entirely different field, i.e. the field of bridge building. To applicant's best knowledge, the application of troughs in ship-building is new and has, among others, the stated advantages.

[0008] In a first preferred embodiment the troughs comprise longitudinal troughs which run at some mutual distance parallel to each other in longitudinal direction of the vessel. At least some of the longitudinal troughs are preferably endless. With the use of such longitudinal troughs the vessel acquires a greater strength in longitudinal direction.

[0009] In a practical preferred embodiment one or more of the endless longitudinal troughs a substantially straight middle part which is bent at the position of the stem and/or the stern of the vessel at an angle such that the relevant end of the longitudinal trough makes contact with the middle part. In preference the angle is approximately 270°.

[0010] According to a further preferred embodiment the troughs comprise transverse troughs which run at some mutual distance parallel to each other in transverse direction of the vessel. The vessel according to the invention hereby acquires an improved stiffening in transverse direction.

[0011] In an elegant embodiment, at least a number of the transverse troughs mutually connect at least some of the longitudinal troughs. The transverse troughs preferably connect the longitudinal troughs in pairwise manner. If desired, a number of the transverse troughs is endless. With this elegant construction the stiffening construction according to the invention provides with a smaller volume of material a similar or even improved stiffening of the vessel compared to the known stiffening construction.

[0012] The troughs preferably comprise a light and strong steel type, preferably of the type also designated "Grade A" in the field.

[0013] The invention also relates to a method for stiffening the hull of a vessel, comprising the following steps of:

- embodying the hull in at least partially double-walled form; and
- arranging a stiffening construction between the double walls, characterized in that the method further comprises the step of:
- applying troughs to manufacture the stiffening construction, wherein the troughs are fixedly connected to at least one of the walls of the hull.

[0014] The invention will now be discussed in more detail with reference to the drawings, in which:

Figure 1 shows a longitudinal section through the hull of a vessel according to the invention;
Figure 2 shows a cross-section, for instance approximately midships, through the vessel of figure 1;
Figure 3 is a schematic view, partly in cross-section, along the line A-A' in figure 1;
Figure 4 is a schematic view, partly in cross-section, for instance approximately midships, through the vessel of figure 1;
Figure 5A shows a schematic top view of the connection of two longitudinal troughs by a transverse trough;
Figure 5B is a schematic cross-sectional view in more detail of a trough of the foregoing figures; and
Figure 5C shows a part of figure 5B in more detail.

[0015] Figure 1 shows a longitudinal section through the hull of a vessel 1 according to the invention. Figure 1 shows a longitudinal trough 2 which runs fore to aft over the whole length of vessel 1.

[0016] Figure 2 shows a cross-section through the hull 3 of the vessel of figure 1. Hull 3 takes a double-walled form. Each wall has its own designation depending on the location on the vessel. The lower bottom wall or surface 4 transposes on both sides via the chine 5 into the outer wall or skin 6. This skin runs via the deck 7 into the inner wall or bin wall 8. The surface 4, chine 5, skin 6, deck 7 and bin walls 8 form the hull 3 of the vessel.

[0017] In the hull 3 is arranged a stiffening construction which according to the invention comprises a number of troughs. These troughs comprise both longitudinal troughs 2 and transverse troughs 9 (see figure 4).

[0018] Longitudinal troughs 2 run substantially parallel to each other in longitudinal direction of vessel 1. A certain mutual distance is maintained between the longitudinal troughs. As shown in figure 1, at least a number of the longitudinal troughs is endless. This is also shown in figure 3, in which a schematic view, partly in cross-section, is shown along the line A-A' in figure 1.

[0019] Each of these endless longitudinal troughs consists of a middle part 10 running substantially parallel to surface 4. At the position of the stem and/or the stern of vessel 1 the longitudinal trough is bent at an angle such that the outer end 11 of the longitudinal trough makes contact with the middle part 10 thereof. In order to achieve this the longitudinal trough can for instance consist of a plurality of parts, as in the shown preferred embodiment. Longitudinal trough 2 in figure 1 consists of a middle part 10 which is provided on both sides with two upward curving ends and a substantially horizontal second part 12 which runs parallel thereto and which is connected to part 10 by means of a third, substantially vertical part 13. For the sake of simplification only this connection is shown instead of the whole endless trough. The angle between part 13 and part 10 is approximately 270°.

[0020] The trough parts are preferably welded to each other using known welding techniques. Application of such endless longitudinal troughs considerably increases the strength of the vessel in longitudinal direction.

[0021] It is noted that transverse partitions 14 are placed with some regularity in longitudinal direction of the vessel, thereby achieving a sub-division into compartments. At the position of each transverse partition 14 a watertight partition 15 is also placed in the longitudinal troughs. This avoids the possibility in particular circumstances of the longitudinal troughs completely filling with water.

[0022] Figure 4 shows a schematic view, partly in cross-section, of a part of the hull of vessel 1. Transverse troughs 9 are shown here which run substantially parallel to each other at some mutual distance in transverse direction of the vessel. Longitudinal troughs 2 are connected in pairs by means of transverse troughs 9. The connection between longitudinal troughs and transverse troughs is preferably also effected by means of known welding techniques. At least a number of the transverse troughs runs endlessly through the hull as according to the preferred embodiment shown in figure 4.

[0023] Figure 5A finally shows a schematic top view of the connection of two longitudinal troughs by a transverse trough. Figure 5B shows a trough 2 or 9 of the foregoing figures in more detail. In principle the longitudinal troughs and transverse troughs have the same construction. A suitable trough consists of sheet material which is rolled into the desired form. Particularly suitable is steel. The steel preferably has quality designation "grade A", which is a common material in the ship-building field. This material has the advantage of being sufficiently light and strong for the stated application. In addition, the choice for this steel type has the practical advantage that because of the common use thereof it is usually available. The time involved in the construction, maintenance and repair of the vessel according to the invention is hereby shortened considerably. This steel type with a yield stress of approximately 235 N/mm^2 is particularly suitable. Trough 2, 9 has three closed sides 16, 17 and 18 and is open on one side, the bottom side. The angle formed by pairs of closed sides is of course greater than 90°. The radius of this angle preferably lies in the range between 20 and 30. The radius is more preferably 25. The trough is welded with the open side onto the relevant wall, for instance surface 4, of hull 3. The trough is provided for this purpose with chamfered edges on sides 16 and 18. This is shown in more detail in figure 5C. The welded seam 19 is here arranged at the position of such a chamfered edge. For mutual connection of the troughs, the troughs are provided where necessary with further chamfered edges. Each of the troughs is in principle formed integrally.

[0024] By means of strength calculations the stiffening construction according to the invention can be adapted to any type of vessel. The following parameters are among those which must be calculated to size:

- the mutual distance between the longitudinal troughs;
- the mutual distance between the transverse troughs;
- the type of sheet material;
- the thickness of the sheet material;
- the angles between the sides of each trough;
- the dimensions of the troughs.

[0025] All types of vessel can be stiffened by means of the stiffening construction according to the invention. Seagoing ships and floating structures such as pontoons as well as inland navigation vessels can be envisaged here.

[0026] The invention is therefore expressly not limited to the shown and described embodiment but extends generally to any embodiment which falls within the scope of the appended claims as seen in the light of the foregoing description and drawings.

Claims

1. Vessel, the hull of which takes an at least partially double-walled form, wherein a stiffening construction is arranged between the double walls of the hull, **characterized in that** the stiffening construction comprises a number of troughs which are connected fixedly to at least one of the walls.

2. Vessel as claimed in claim 1, wherein the troughs

comprise longitudinal troughs which run at some mutual distance parallel to each other in longitudinal direction of the vessel.

3. Vessel as claimed in claim 2, wherein at least some of the longitudinal troughs are endless.

4. Vessel as claimed in claim 2 or 3, wherein one or more of the longitudinal troughs has a substantially straight middle part and is bent at the position of the stem and/or the stern of the vessel at an angle such that the relevant end of the longitudinal trough makes contact with the middle part.

5. Vessel as claimed in claim 4, wherein the angle is approximately 270°.

6. Vessel as claimed in any of the foregoing claims, wherein the troughs comprise transverse troughs which run at some mutual distance parallel to each other in transverse direction of the vessel.

7. Vessel as claimed in claim 6, with reference to any of the foregoing claims 2-5, wherein at least a number of the transverse troughs mutually connect at least some of the longitudinal troughs.

8. Vessel as claimed in claim 7, wherein the transverse troughs connect the longitudinal troughs in pairwise manner.

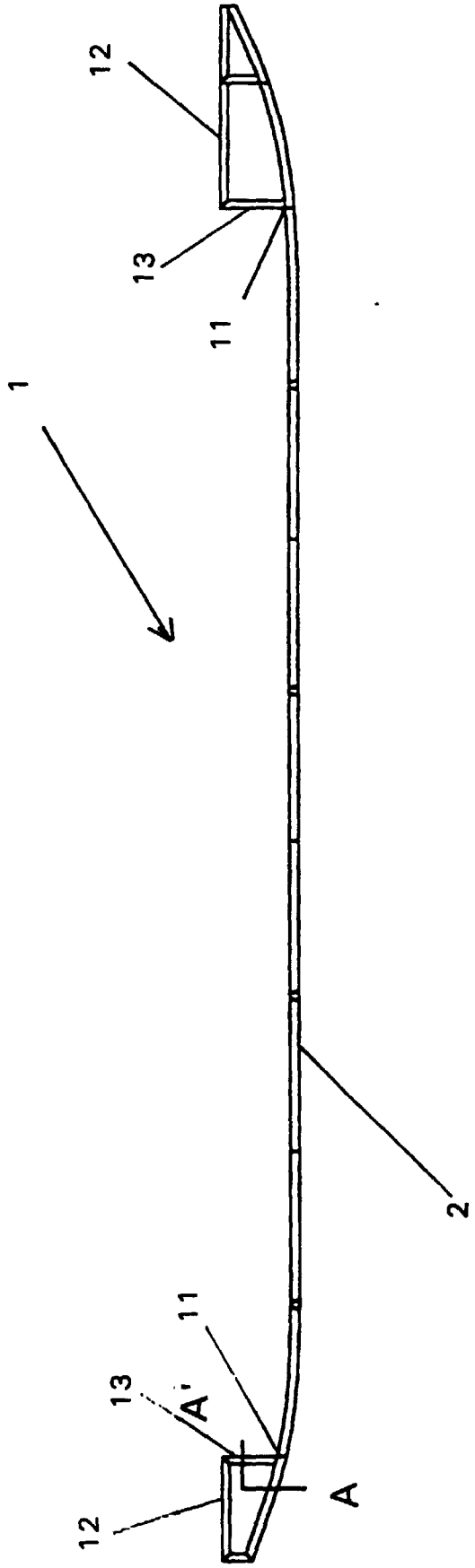
9. Vessel as claimed in claim 6, 7 or 8, wherein a number of the transverse troughs is endless.

10. Vessel as claimed in any of the foregoing claims, wherein the troughs comprise steel of the "Grade A" type.

11. Method for stiffening the hull of a vessel, comprising the following steps of:

- embodying the hull in at least partially double-walled form; and
- arranging a stiffening construction between the double walls, **characterized in that** the method further comprises the step of:
- applying troughs to manufacture the stiffening construction, wherein the troughs are fixedly connected to at least one of the walls of the hull.

Fig. 1



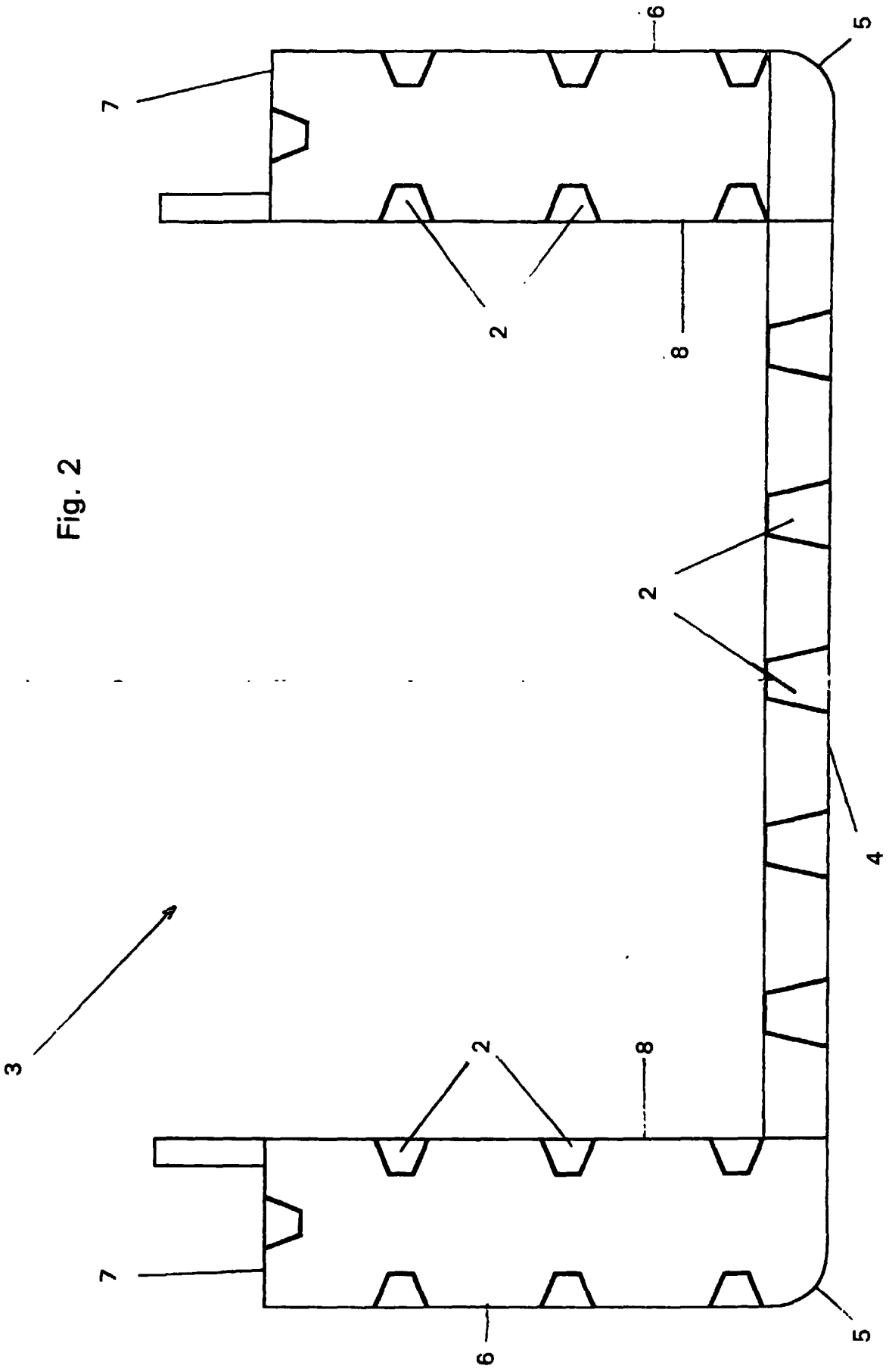


Fig. 2

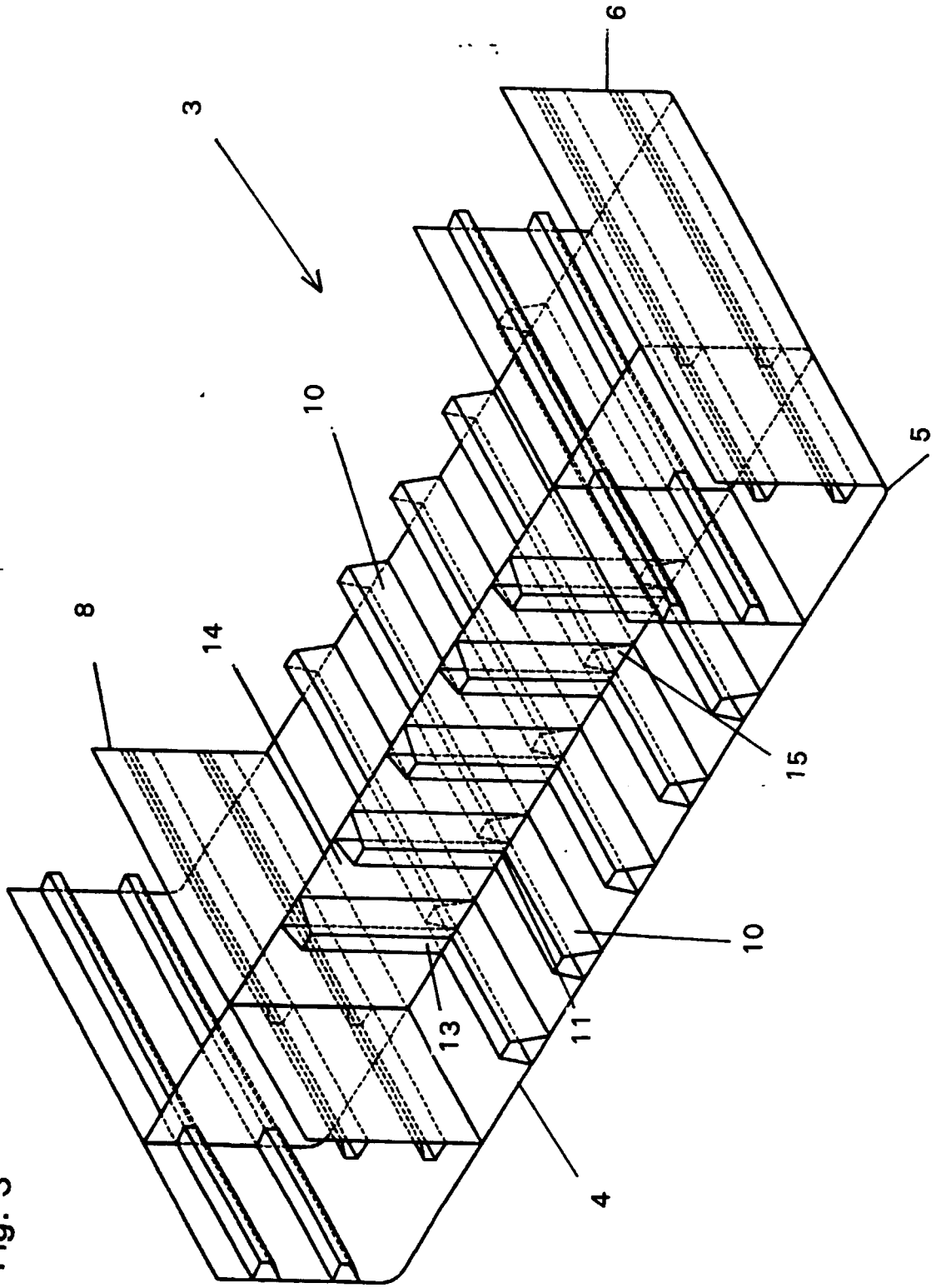


Fig. 3

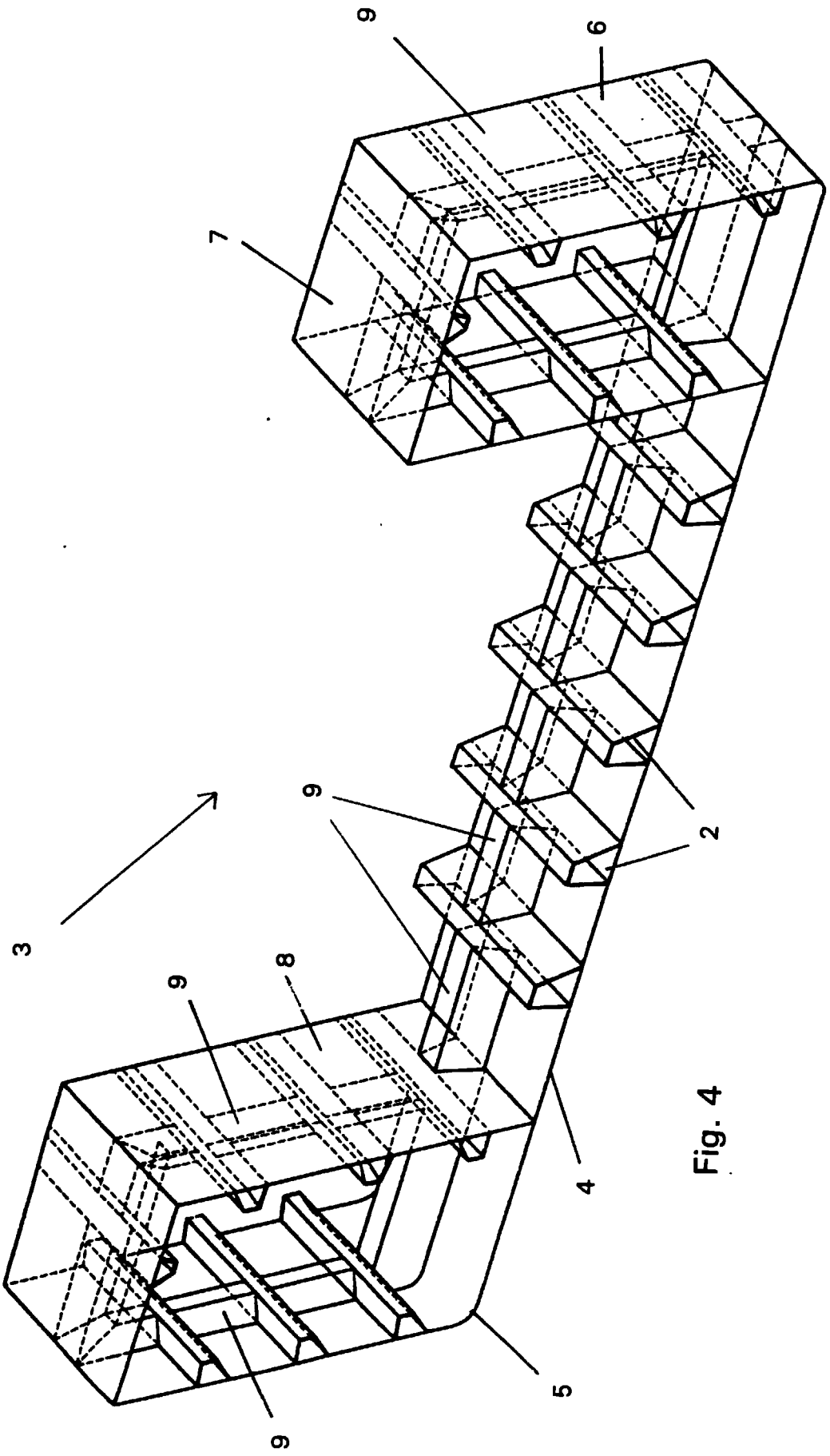


Fig. 4

Fig. 5A

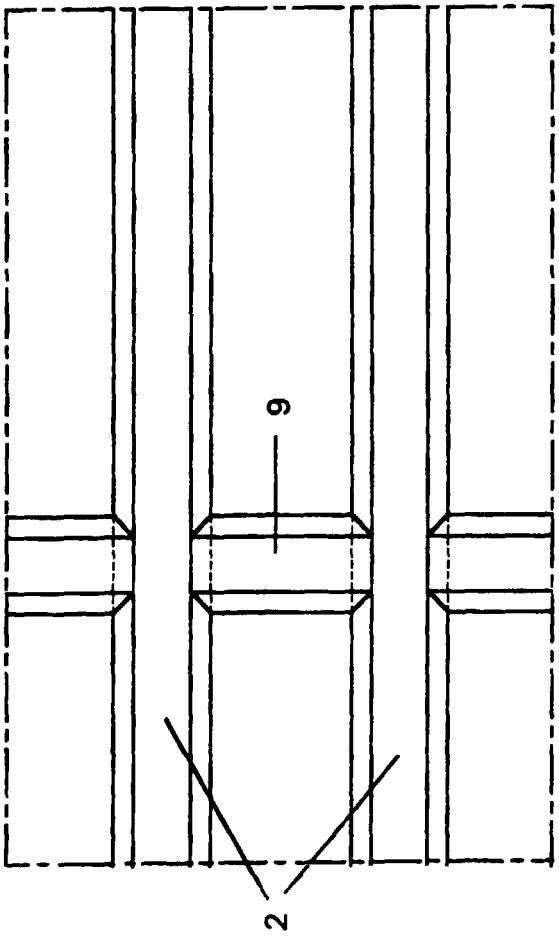


Fig. 5B

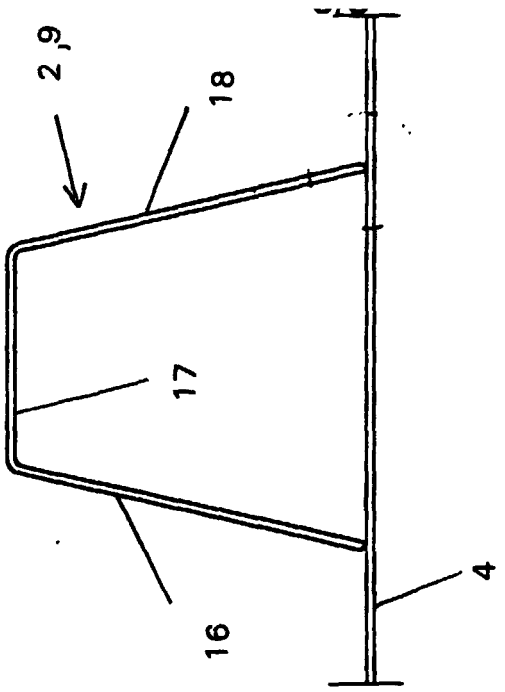
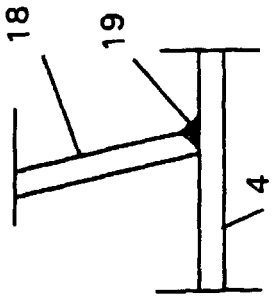


Fig. 5C



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EUROPEAN SEARCH REPORT

Application Number
EP 00 20 2671

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	"EINFÜHRUNG IN DIE DIN-NORMEN" 1961 , B.G. TEUBNER VERLAGGESELLSCHAFT , STUTTGART XP002133699 * page 155; table 155.2 *	10	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 November 2000	DE SENA HERNAND.., A

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