



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 870 673 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
14.10.1998 Bulletin 1998/42

(51) Int. Cl.⁶: **B63B 3/56**, B63B 3/68

(21) Application number: **98106100.5**

(22) Date of filing: **03.04.1998**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **09.04.1997 IT GE970031**

(71) Applicant: **INTERMARINE S.p.A.
I-19038 Sarzana (La Spezia) (IT)**

(72) Inventor: **Fantacci, Giafranco
19020 Ceparana, Province of La Spezia (IT)**

(74) Representative:
**Porsia, Attilio, Dr.
c/o Succ. Ing. Fischetti & Weber
Via Caffaro 3/2
16124 Genova (IT)**

(54) "Light ship structure"

(57) A ship structure comprising a hull (1), preferably monocoque, made of composite material, a number of decks (20, 21, 22, 23), a number of transverse bulkheads (3) structurally continuous from the bilge (101) to the forecastle deck (20); the said bulkheads (3) are rigidly connected to the decks (20, 21, 22, 23) and to the planking of the hull from the forecastle deck (20) to the

deck immediately above the bilge (101) of the ship, i.e., the main deck (22), the peripheral edge of said transverse bulkheads (3) being connected to the planking of the hull (1) in the area beneath said main deck (22) by elastic joining means (103).

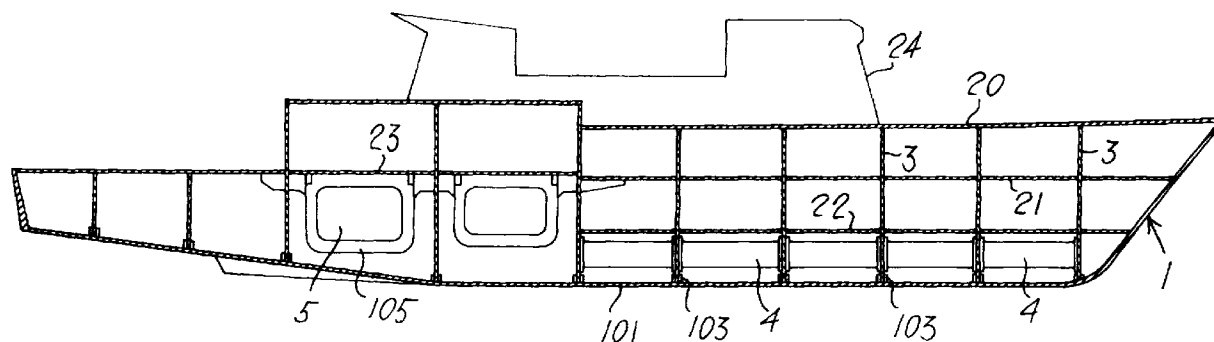


Fig. 1

EP 0 870 673 A1

Description

The present invention relates to ship structures, and in particular relates to light ship structures, such as ships with the hull made of composite material.

When sailing, ships are subject to a large number of stresses, which are generally due to the motion of the waves, the speed of navigation, near submarine blasts, and the uneven distribution of the loads on board the ship. If the hull of the ship were rigid and rigidly connected to the rest of the ship's structure, the vibrations and stresses to which the entire ship would be subjected, above all by pressures of an impulse-like nature, could result in extremely damaging effects. To reduce such effects, the planking of the hull must be free to bend elastically, so as to minimize the transmission of the pressure peaks.

In general, to achieve this result stratified composite materials are used for making the hull of the ship. However, with these materials there exists, as is well known, the problem linked to possible disbonding caused by excessive deflections with respect both to the thickness of the composite material and the length of the part subject to deflection.

In the Italian patent No. 1186843 of the same applicant, the problem is solved by totally eliminating the stiffeners of the hull, except for the transverse watertight bulkheads. The heavier elements with which the ship is equipped, such as tanks and machines, were connected to the aforesaid bulkheads.

In the Italian patent No. 1248252 of the same applicant, the support of the heavier elements with which the ship is equipped was entrusted to cradles made of composite material, directly connected to the deck above the room where the said components were arranged.

Both the solutions described above gave to the ship a high flexibility to stresses. However, the response was efficient with both the systems only as long as the pressures on the planking of the hull, i.e., the submerged part of the hull under the waterline, were of modest degree. But with high pressure peaks, the loads were, nevertheless, transmitted to the rest of the ship's structure, thus subjecting it to stresses even of considerable amount.

The purpose of the present invention is thus to provide a light ship structure in which the planking of the hull is flexible to the violent stresses of an impulse-like nature.

A further purpose of the present invention is to provide a ship structure in which the load-bearing beam consists of a structure separate from direct contact with the water, and hence also from the stresses induced by the water.

The subject of the present invention is therefore a ship structure comprising a hull, preferably monocoque, made of composite material, a number of decks, a number of transverse bulkheads structurally continuous from the bilge to the forecastle deck, characterized in

that the said bulkheads are rigidly connected to the decks and to the planking of the hull from the forecastle deck to the deck immediately above the bilge of the ship, i.e., the main deck, the peripheral edge of said transverse bulkheads being connected to the planking of the hull in the area beneath said main deck by elastic joining means.

In an embodiment of the invention, in the area comprised between the bilge of the ship and the main deck, one or more longitudinal structural elements are arranged, which are structurally continuous basically throughout the entire length of the hull, and are rigidly connected to the said transverse bulkheads. The said structural elements may advantageously be the ship's main tanks.

Further advantages and characteristics of the present invention will appear evident from the ensuing detailed description of one embodiment of the same, which is made to provide an example and which is not exhaustive of the possibilities; reference is made to the attached drawings, in which:

Fig. 1 is a schematic longitudinal cross section view of a ship structure according to the present invention;

Fig. 2 is a transverse cross section view of a ship structure according to the present invention;

Fig. 3 is a transverse cross section view where the various parts of the ship's structure illustrated in Fig. 1 are broken down into the constituent parts;

Fig. 4 is an enlarged detail of Fig. 2; and

Fig. 5 is a cross section view along the plane indicated by the line V-V of Fig. 4.

Fig. 1 shows a ship structure according to the present invention in which 1 designates the hull of the said structure. Inside the hull are arranged the forecastle deck 20, the intermediate deck 21, and the main deck 22, as well as the deck 23. The decks are traversed by the transverse watertight bulkheads 3, to which they are all rigidly connected; the said bulkheads are connected to the portion of the hull between the main deck 22 and the bilge 101 of the hull 1 by elastic joining means 103. Aft, the elements 5 with which the ship is equipped, for example, the machines, are connected, in a manner which is in itself known, to the deck 23 located above, by means of special cradles 105, preferably made of composite material.

Fig. 2 shows a cross section of the ship's structure according to the invention. The decks 20, 21 and 22 are connected to the hull 1. The forecastle 24 is connected to the forecastle deck 20. The decks are all provided with their respective transverse supporting beams 120, 121 and 122, and longitudinal supporting beams 220, 221 and 222. The watertight transverse bulkhead 3 is fastened with fixing means 201 to the hull from the forecastle deck 20 to the main deck 22. The portion 203 of the bulkhead lying below the said deck is inserted in the

guide 103 having a sinusoidal profile, which is connected to the bilge 101 of the hull. The three main tanks 4 are connected to the bulkhead 3 by means of the flanges 104.

Fig. 3 shows the ship structure of the invention broken down into its basic parts. Like parts are indicated by the same numbers. In Fig. 3 it may be noted that the peripheral edge of the portion 203 of the bulkhead 3 is made in such a way that, as emerges from Fig. 2, it is not in direct contact with the planking of the hull 1. This detail emerges even more evidently from Fig. 4, which illustrates a detail of the connection between the guide 103 and the peripheral edge of the portion 203 of the bulkhead 3. In addition, Fig. 5 illustrates the insertion of the portion 203 of the bulkhead 3 in the guide 103 having a sinusoidal profile. Between the guide 103 and the bulkhead is inserted a filler 113 made of elastomer material or the like.

The operation of the ship structure according to the present invention will appear evident from what follows. As has already been said, in ship structures of a known type, of extreme importance was the problem linked to the absorption of the stresses of an impulse-like nature by the planking of the ship's hull. The ship structure according to the present invention enables, in fact, a greater freedom of flexure for the portion of the hull situated below the main deck 22. In practice, the load-bearing structure of the ship is actually separate from contact with the water, in that the elimination of the rigid connection between the bulkheads and the planking of the hull displaces inwards the so-called "ship's main beam", which is made up, in the longitudinal direction, of the decks and their longitudinal stiffeners, the tanks and the planking of the sides, from the forecastle deck to the main deck, and in the transverse direction, of the decks and their transverse stiffeners and of the bulkheads.

The connection between the transverse bulkheads 3 and the bilge 101 of the hull is made by means of the guides 103 shaped with a sinusoidal profile. The type of connection made is an elastic joint, in so far as the peripheral edge of the portion 203 of the bulkhead 3 is inserted in the guide 103 not in contact with the planking and with a certain freedom of movement, guaranteed by the filler 113 made of material of an elastomer kind, which is able to guarantee the watertightness of the bulkhead but is not able to transmit the considerable mechanical stresses resulting from modest deformations of the planking. The sinusoidal shape of the walls of the guide 103 contributes to increasing the flexibility of the joint.

In any case, for deformations of a degree greater than that calculated in the designing phase, owing to the way in which the structure has been devised, the transmission of the stresses would occur always in a very gradual way and without any effects of impact.

In general, in foreseeable situations, the planking of the structure below the main deck is free to bend under the effects of the pressure impulses, from the stem to

the stern, and hence over a very long span. In this way the danger of disbonding of the composite material due to excessive flexure on spans that are too short with respect to the thickness is considerably reduced. The planking may thus be lighter than in known structures, thus decreasing the total weight of the ship.

The stiffness of the "ship's main beam" and the reduced distance between the planking of the hull and the lower part of the tanks enable minimizing of the compressive and tensile stresses induced on the planking itself by the flexure of the ship.

Obviously, the tanks 4 become an integral part of the load-bearing structure of the ship only on account of the fact that it is clearly necessary for them to be advantageously located in a position where their load can be exploited as an element that is able to contribute to the strength of the ship structure in question. In theory, their role could be played in a similar way by similar continuous structural elements.

Claims

1. A ship structure comprising a hull (1), preferably monocoque, made of composite material, a number of decks (20, 21, 22, 23), a number of transverse bulkheads (3) structurally continuous from the bilge (101) to the forecastle deck (20), characterized in that the said bulkheads (3) are rigidly connected to the decks (20, 21, 22, 23) and to the planking of the hull from the forecastle deck (20) to the deck immediately above the bilge (101) of the ship, i.e., the main deck (22), the peripheral edge of said transverse bulkheads (3) being connected to the planking of the hull (1) in the area beneath said main deck (22) by elastic joining means (103).
2. A ship structure according to Claim 1, in which in the area comprised between the bilge (101) of the ship and the main deck (22), one or more longitudinal structural elements (4) are arranged, which are structurally continuous basically throughout the entire length of the hull (1), and are rigidly connected to the said transverse bulkheads (3).
3. A ship structure according to Claim 2, in which the said structural elements are the ship's main tanks (4).
4. A ship structure according to any one of the foregoing Claims from 1 to 3, in which said elastic joining means comprise, for each transverse bulkhead, a guide element (103) set on the inside wall of the hull (1) in the area below the main deck (22), in which is inserted the peripheral edge of said bulkhead (3), a suitable filler (113) made of elastomer material being interposed between said guide (103) and said bulkhead (3).

5. A ship structure according to Claim 4, in which the walls of the said guide (103) present a sinusoidal profile.

5

10

15

20

25

30

35

40

45

50

55

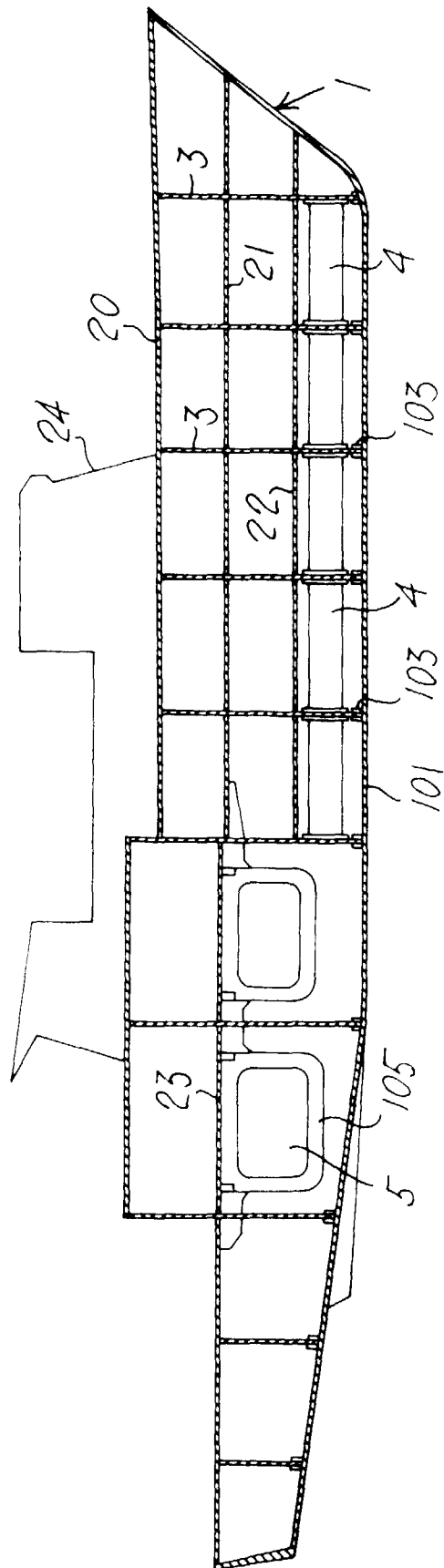
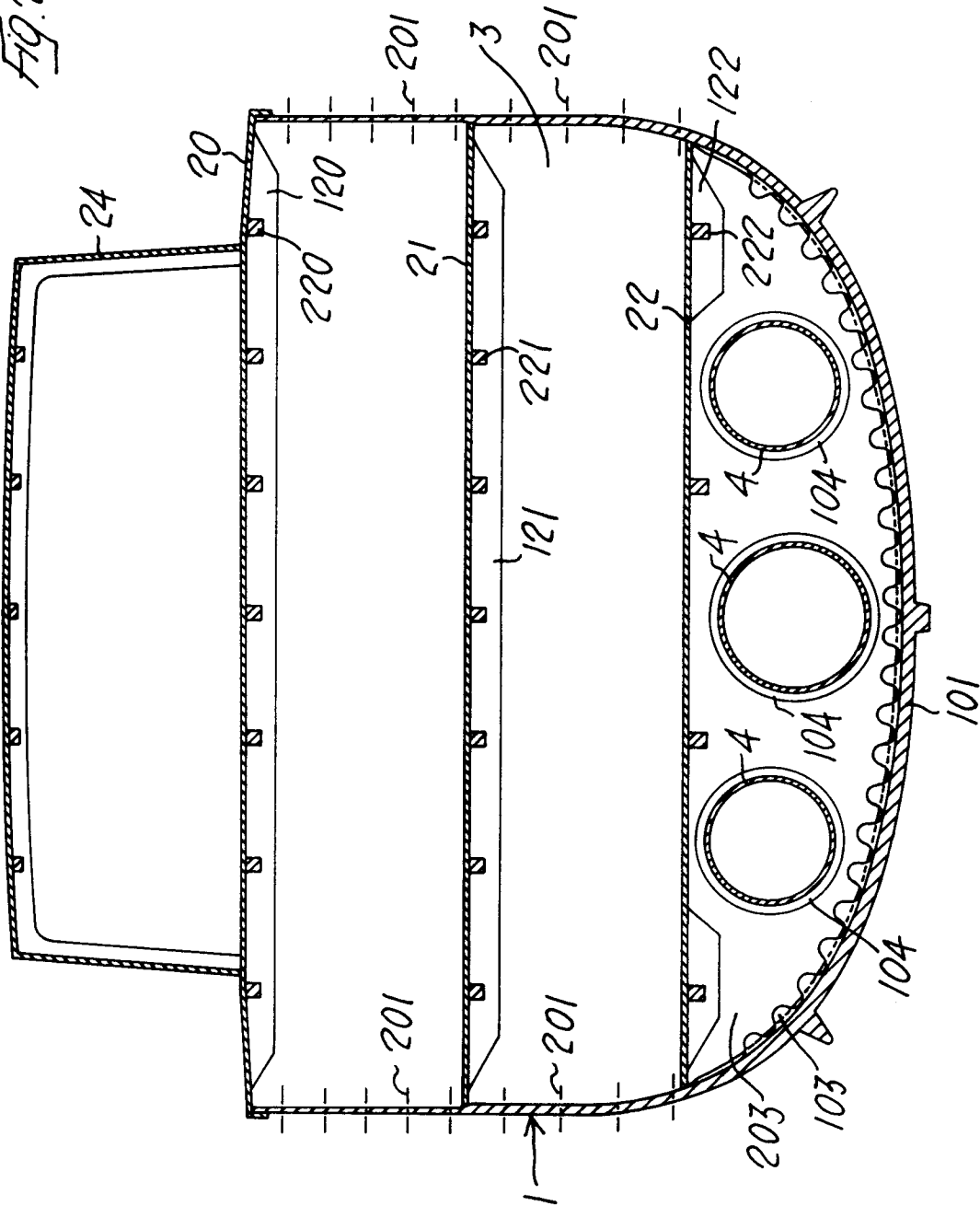
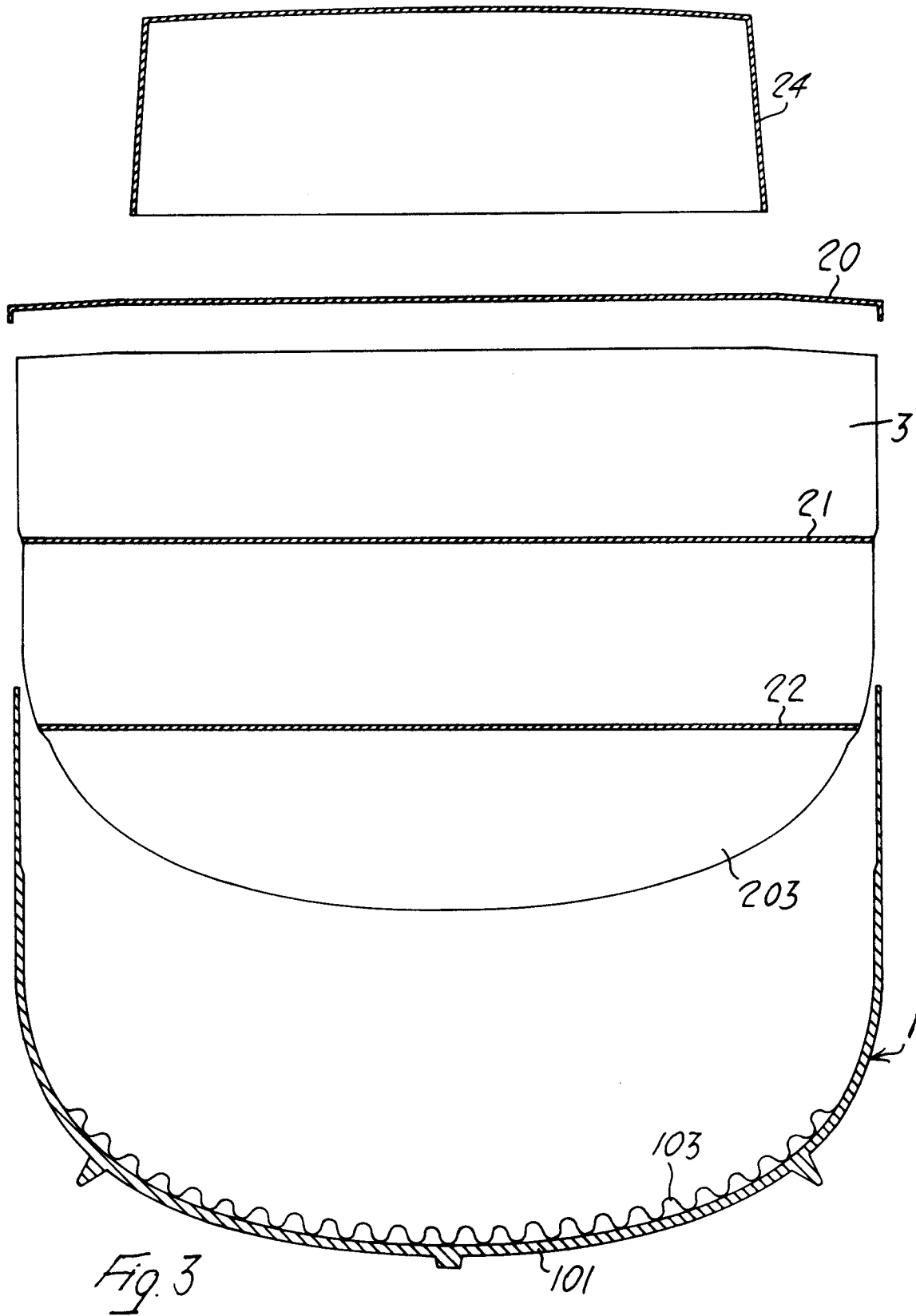


Fig. 1

Fig. 2





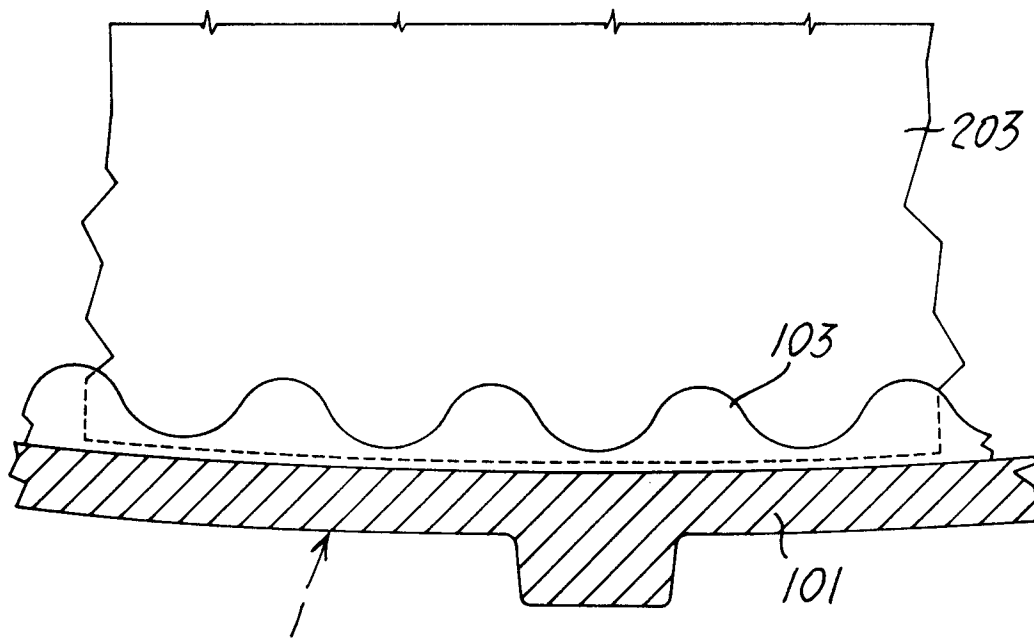


Fig. 4

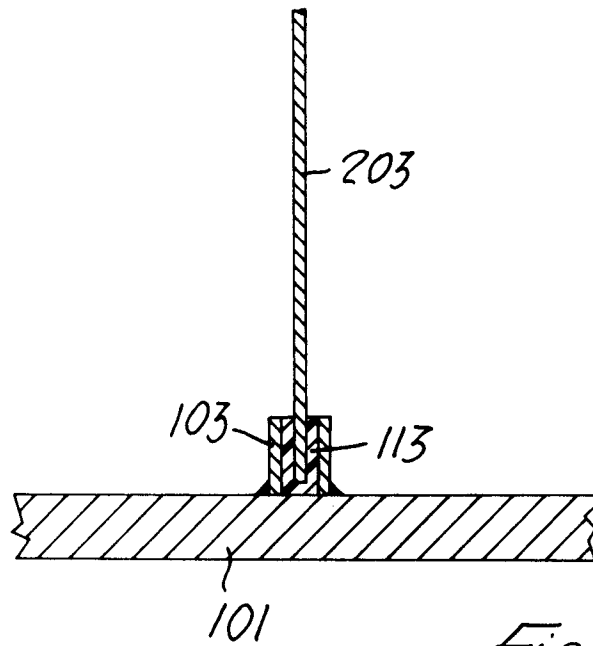


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 10 6100

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)
A	US 3 760 757 A (PIENING) 25 September 1973 * column 2, line 57 - line 68; figures 2,3 * ---	1,4	B63B3/56 B63B3/68
A	US 2 333 289 A (BOHNSACK) 2 November 1943 * page 3, left-hand column, line 66 - right-hand column, line 8; figure 7 * ---	1,4	
A	US 2 560 269 A (BERNER) 10 July 1951 * figure 1 * -----	1,2	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B63B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 June 1998	Examiner DE SENA, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03 82 (P04C01)