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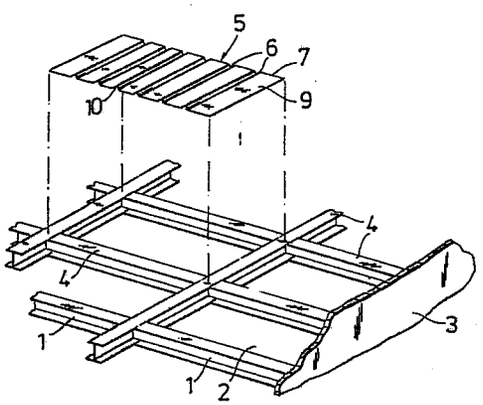
(54) **An interior deck structure for marine vessels.**

(57) An interior deck for marine vessels, comprising beams (1) which are connected to the hull (3) of the vessel and further comprising fluted deck plates (5) which are connected to the beams (1). The deck is characterized in that the beams (1) are firmly connected together and form a grid structure which presents rectangular open frames. Each open frame is covered by a rectangular plate (5) which rests along its four edge-deck parts (7,9) against upper surfaces on the beams (1) defining the open frames, and in that the flutes (6) in the deck plates (5) lie beneath the upper plane of respective deck plates (5) and within the free aperture (2) presented by the frame defined by the beams.

Fig. 1



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Description

An interior deck structure for marine vessels

The present invention relates to an interior deck structure for marine vessels, comprising load-bearing beams which extend respectively in the longitudinal and transverse directions of the vessel and which are connected to the hull of the vessel and to which fluted deck plates are also connected. More specifically, although not exclusively, the invention relates to internal deck structures suitable for ferries and passenger vessels, by internal deck structures being meant decks for supporting cabin structures, amenity furnishings and the like.

Since heavy deck structures reduce the amount of cargo that a vessel can carry and, in view of the considerable height of such vessels, are also liable to cause stability problems, such interior deck structures are required to be light in weight. Such decks shall also be flat, in order to have an aesthetic appearance and also to enable cabins and cabin furnishings etc. to be placed on the decks without needing to make costly accommodating alterations to the existing deck structures. Interior decks shall also be well insulated against sound and shall be capable of being readily manufactured without detracting from the mechanical strength desired.

Conventional interior decks which are constructed from girders or springers, stays and deck plating do not fulfil the aforesaid requirements, and not least the requirements of smoothness and low weight. Irrespective of whether they are smooth or fluted, the deck plates must be welded to stays, support girders, springers, in order to obtain the strength required, and the large number of welds entailed gives rise to welding stresses which result in deformation of the plates. Hitherto, attempts have been made to reduce such deformation to the best possible extent, by using plate thicknesses which are far in excess of those thicknesses necessary from strength aspects. This methodology increases both weight and costs. Unavoidable residual deformation has then been made good, by applying a deck filler to deformed areas and subsequently smoothing out the filler. This methodology again adds to the weight and expense of the deck construction.

Consequently, a main object of the invention is to provide an interior deck structure which will fully satisfy, or at least substantially satisfy the requirements mentioned in the introduction. This object is achieved by means of the invention defined in the following claims.

The invention will now be described in more detail with reference to the accompanying drawings, in which

Figure 1 illustrates a deck construction according to the invention;

Figure 2 illustrates the cross-sectional profile of a deck plate;

Figure 3 illustrates the positioning of deck plates on the frame beams;

Figure 4 illustrates the provision of sound insulating means between deck plates and frame beams;

Figure 5 illustrates an alternative method of connecting deck plates to frame beams;

Figure 6 is an enlarged sectional view taken on the line VI-VI in Figure 5;

Figure 7 illustrates means for positioning the iron rod of the embodiments illustrated in Figures 5 and 6; and

Figure 8 illustrates cover means for sealing-off the open ends of the flutes and a gap located between mutually adjacent plates.

As will be seen from Figure 1, the interior deck structure according to the invention principally comprises a plurality of beams 1 which are welded together to form an open grid structure with rectangular open frames incorporating apertures 2, this grid structure being connected to the hull 3 of the vessel in a conventional manner. The beams of the illustrated embodiment are I-beams, although there may be used T-beams or box-beams having upper flanges 4 which lie in a common, or at least substantially common plane A (Figure 2). Each aperture 2 is covered with a deck plate 5, which has flutes 6 formed therein so as to stiffen the plate, these flutes preferably extending in the direction of the shortest span. The stiffening flutes 6 of the otherwise flat plates lie beneath the upper surface B of respective plates 5 and are cut obliquely, as shown at 8 in Figure 3, such as to form at the ends of respective flutes a free support lip 7. As will be understood, the support lips 7 terminate at the location of their associated obliquely cut flutes 6, as indicated at 10 in Figures 1 and 8. Extending parallel with the flutes 6 are two support flanges 9, as shown in Figure 2, and the lips 7 and flanges 9 together form a planar frame structure which is intended to rest on the flanges 4 of respective load-bearing beams 1 forming the aforesaid grid structure. The flutes 6 of respective plates 5 will thus lie within a respective rectangular aperture defined by beams 1 and will depend essentially to beneath the support surfaces of respective beam flanges. The plates 5 are so dimensioned in relation to the apertures 2 and the beam flanges 4 that the four frame edges, e.g. the edges 7', define therebetween a gap 11 which enables the plates to be welded to the beam flanges 4, by means of weld beads or spot welding 12. This form of attachment of the relatively thin plates 5 to the flanges 4 does not result in any appreciable deformation of the plates along their edge regions. The gaps are filled with some suitable smoothable filler, such as to provide a completely smooth deck surface.

Figure 4 illustrates an interior deck according to the invention in which vibration damping and/or sound insulating sheets of a resiliently springy material 13, e.g. wood, rubber etc., are fitted between the support lips 7 of the deck plates 5 and the support flanges 4 of the beams 1, said sheets being bonded to respective flanges 4 and to respective support lips and support flanges 7 and 9

with the aid of glue or the like.

Figures 5-7 illustrate an alternative method of securing respective deck plates 5. According to this alternative embodiment, a springy resilient material 13 is placed between the lip-frame 7 of respective plates 5 and the flanges 4 of respective beams 1, and a steel rod 14 is inserted into one or more of the flutes 6 of the plates, such that one end portion of the rod rests against elastically resilient material 15 located at the bottom of the flute 6. The other end portion of the rod is then forced into abutment with the undersurface of the respective flange 5 and welded thereto. The steel rod, or bar, 14 has a planar upper surface 16 so as to lie flat against the flat undersurface of the flange 4, and preferably a part-cylindrical bottom surface 17 which fits into the bottom of the flute. When the flutes 6 have, for instance, trapezium-shaped profile, the rod is shaped correspondingly. Naturally, the rod 14 must be dimensioned so that it is held tightly between the flange and the bottom of the flute when the rod is fastened to the beam in the position illustrated in Figure 5.

Figure 7 illustrates a suitable tool for forcing the rod 14 up into its welding position and for holding the rod in this position while it is being welded. It is assumed here that the springy resilient material 15 of the Figure 7 embodiment is fitted onto the rod or bar 14, although the material may, of course, be placed initially in respective flutes 6. The tool comprises a support 16′ which is secured to the bottom flange of the illustrated I-beam 1 and which has pivotally mounted thereon a lever 17′, one end of which is pivotally connected to one end of a press-rod 18. The other end of the press-rod engages, through a fork portion or the like, the end of the rod 14 that protrudes from the flute 6. When the lever 17′ is pressed down, the press-rod 18 is moved vertically upwards and urges the rod 14 into contact with the upper flange 4 of the beam and also with the bottom of the flute 6, whereafter the rod 14 can be welded to the undersurface of said upper flange 4.

Figure 8 illustrates part of the deck plate 5, seen from beneath. As beforementioned, the end part of the illustrated flute 6 is cut obliquely so as to form a free opening 10 in the lip part 7 of the plate. This opening 10 and the open end parts of the flutes are covered with folded metal sheet 19, which is preferably spot welded at edge parts 20 to the plate 5 and along the oblique end edge 8 of the flute 6. In addition to covering each end of the respective flutes there is also obtained an equalization of the stress concentrations which may occur at the corners of the plate, e.g. the corner 21.

The flutes of a finished deck structure are preferably filled with pre-fabricated shaped sections of light material, e.g. plastic foam, cork or wood. One such profiled section is shown by broken line 23 in Figure 2.

Claims

1. An interior deck structure for a marine vessel, comprising load-carrying beams (1) which extend in the longitudinal and transverse directions of the vessel and which are joined to the hull (3) of said vessel and firmly secured to fluted deck plates (5), characterized in that the beams (1) are rigidly connected together and form a grid structure comprising rectangular open frames and presenting upper support surfaces (4) all of which lie in an at least substantially common frame (A); in that each open frame is covered with a rectangular plate (5) having four edge deck-portions (7,9) which rest against the upper surfaces of the beams (1) which form said open frames; and in that the flutes (6) of respective deck plates (5) lie beneath the upper surface of said plates and within the free aperture (2) defined in the frames formed by said beams.

2. A deck structure according to Claim 1, characterized in that vibration damping and/or noise insulating material (13) is placed between the edge parts (7,9) of respective deck plates (5) and the upper surfaces of associated beams (5).

3. A deck structure according to Claim 2, characterized in that the vibration damping and/or noise insulating material is in sheet form and is glued to the edge part (7,9) of the deck plates (5) and to associated beams (1).

4. A deck structure according to any of Claims 1-3, characterized in that each deck plate (5) is firmly secured to its respective beam (1) by means of firmly mounted rods (14), each of which rests at one end part thereof against the bottom of a flute (6), and which end part is firmly connected to said bottom.

5. A deck structure according to Claim 4, characterized in that a layer of vibration damping and/or noise insulating material (15) is placed between said end parts of respective rods (14) and the flutes (6) connecting with said end parts.

6. A deck structure according to any of Claims 1-5, characterized in that each flute (6) is filled to the level of said upper surface or plane of the deck plate with a prefabricated profiled element (23).

Fig. 1

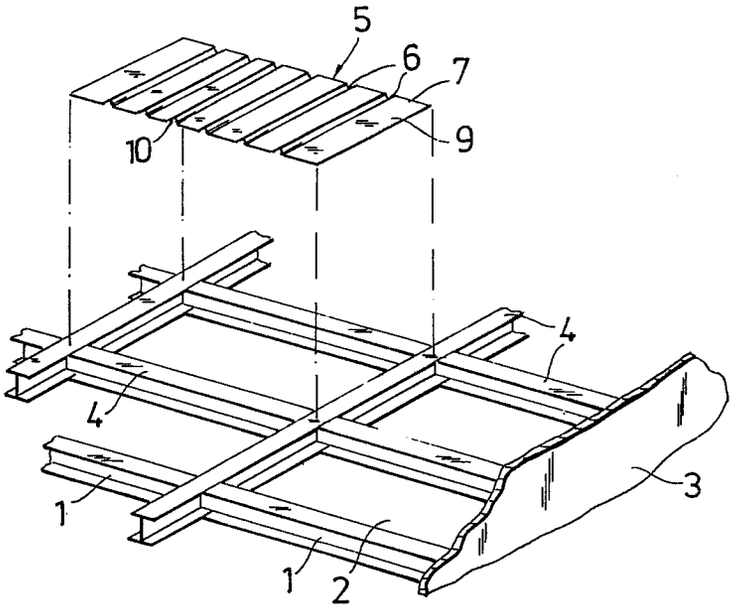


Fig. 2

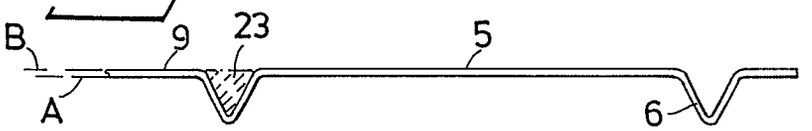


Fig. 3

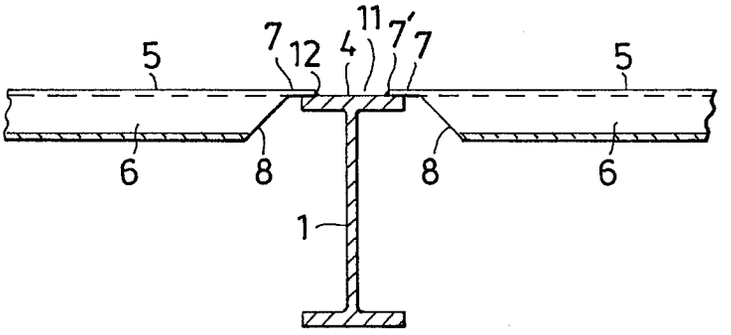


Fig. 4

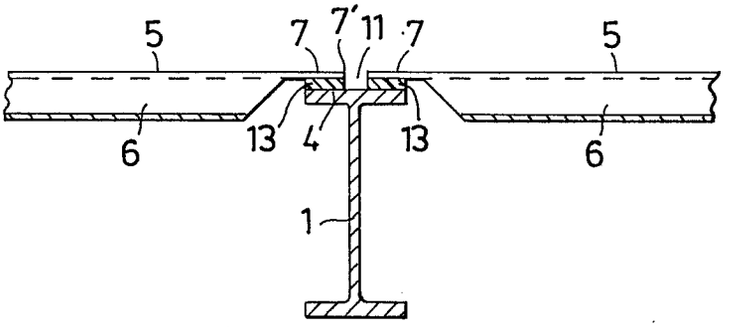


Fig. 5

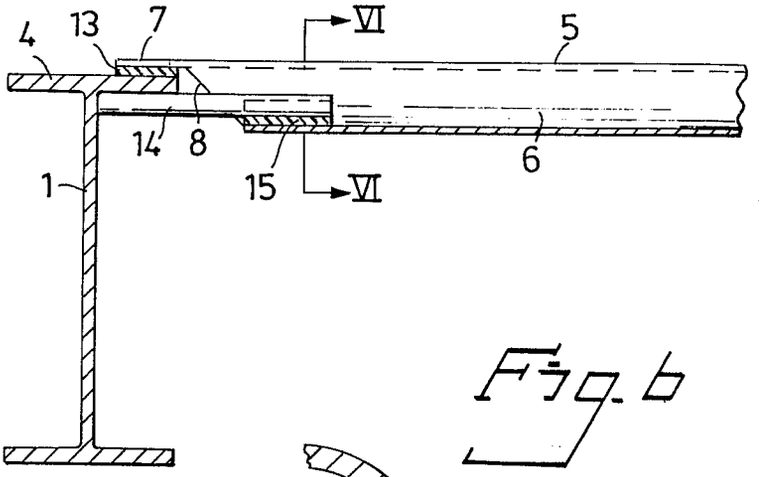


Fig. 6

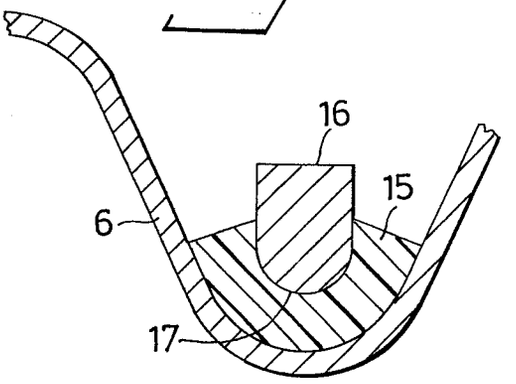


Fig. 7

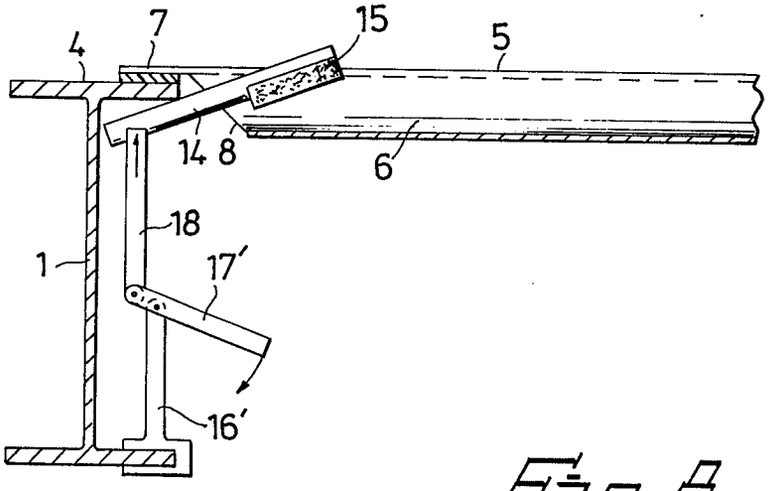
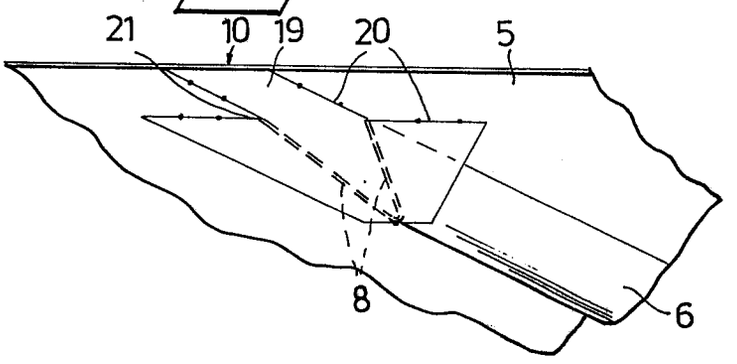


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number

EP 87 85 0293

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.4)
A	GB-A-1 119 842 (GREGSON & CO., LTD) * Page 2, lines 18-39; figures 1,4 *	1	B 63 B 3/48
A	FR-A- 884 234 (R. GUILLOTON) * Page 3, lines 88-102; page 4 *	1	
A	GB-A-2 135 248 (BLOHM & VOSS) * Abstract; page 5, lines 56-66; figures 1,5a *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 63 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-01-1988	VISENTIN, M.

CATEGORY OF CITED DOCUMENTS

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