BEAM GRID STRUCTURE FOR SHIPS, AIRPLANES AND THE LIKE

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Fig. 5.

Fig. 6.

Fig. 7.
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Fig. 8.

Fig. 9.
My present invention relates to structures for hulls of ships, airplanes, containers, tanks and the like.

It is an object of my present invention to provide beam structures which are especially well adapted to stiffen the hull of ships, airplanes, containers, tanks and the like.

It is a further object of my present invention to combine the above beam structures with suitably spaced transversal supporting frames, bulkheads or similar means, and to form thus a monolithic spatial body of extraordinary rigidity in transversal, lateral, and also longitudinal direction.

Still a further object of my invention is to provide for the above purposes beam grid structures composed of a series of beam grid panels monolithically secured to each other along their edges and supported partly by adjacent beam grid panels and partly by the above mentioned transversal supporting frame structures.

A further object of my invention is to provide a beam grid structure being particularly well adapted to be used as monolithic stiffening structural frame for concrete ships, barges and other containers for fluid or the like.

Still another object of my present invention consists of hulls for ships, airplanes, containers, tanks and the like, made of steel, light metal or concrete slabs which are stiffened and reinforced by beam grid structures of the type proposed.

With the above objects in view, my present invention mainly consists of a monolithic structural body or hull for ships, airplanes, containers, tanks and the like, comprising a series of a mainly four-sided rectangular beam grid panels, each of which is supported at two opposite edges by transversal frames or bulkheads, and at the other two edges by adjoining beam grid panels inclined to the same; each individual beam grid panel is composed of two groups of parallel beams being arranged diagonally to the panel edges and connected to each other at their intersection points. Furthermore, these beam grid panels are preferably arranged in such a manner that two opposite edges of each panel are parallel and two opposite edges normal to the longitudinal axis of the hull, and that each panel is monolithically connected along these edges to adjacent panels. The longitudinal edges of these panels are supported by adjacent panels, while bulkheads or other cross frames serve as supporting means for the transversal panel edges.

A preferred embodiment of my invention consists of a hull structure having a series of longitudinal rectangular faces contacting each other along ridge-like edges being parallel to the longitudinal hull axis; each of these faces is formed by a series of rectangular beam grid panels of the above described type; the subdivision into panels is achieved by means of bulkheads or other transversal frames, the planes of which are normal to the above mentioned ridge-like edges; along the transversal panel edges formed by these transversal frames, the panels are monolithically secured to adjacent beam grid panels of the same hull face and supported by these transversally arranged frames.

These transversal frames, such as bulkheads or other structures, preferably consist of beam grids which are arranged spaced from each other normal to the longitudinal axis of the hull and secured to the beam grid panels along their transversal edges.

When the new stiffening beam grid structure is used for airplanes, ships or barges, the squares formed by the intersecting beams of the grids are covered with steel, concrete or light-metal slabs forming a coherent hull.

The novel features which I consider as characteristic for my invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in conjunction with the accompanying drawings in which:

Fig. 1 is a side view of a barge designed in accordance with my present invention, partly in section;

Fig. 2 is a top view of the barge shown in Fig. 1;

Fig. 3 is a longitudinal section through a part of the barge along line 1-1 of Fig. 2;

Fig. 4 is a cross section through the barge along line 4-4 of Fig. 3;

Fig. 5 is another cross section along line 5-5 of Fig. 3;

Fig. 6 is a longitudinal section along line 6-6 of Fig. 4;

Fig. 7 is a similar longitudinal section along line 7-7 of Fig. 5; and

Figs. 8 and 9 are two longitudinal sections through a modified beam grid structure corresponding to the sections shown in Figs. 6 and 7.

As shown in Figs. 1 and 2 and indicated by dotted lines, the barge body 11 is composed of a series of compartments 12, the construction of which is identical.

The hull is reinforced and stiffened by the beam grid structure shown in Figs. 3 to 7. The spaces between the beams are covered with slabs 13 forming the hull of the barge. In accordance with the present invention, the beam grid structure is composed of a series of beam grid panels 14; each of these panels consists of two groups 15 and 16 of diagonally arranged beams; these beams are rigidly connected to each other at their points of intersection 17.
As shown in Figs. 4 and 5, the beam grid structure is shaped in such a manner as to form a series of longitudinal rectangular faces, namely, a bottom face 18, a top face 19, and two faces 20 and 21 on each side of the barge.

Each of these faces 16, 19, 20, and 21 is composed of a series of consecutive beam grid panels 14 of the type described above. It must be noted that in all beam grid panels the distance between the single beams has to be equal; this makes it possible to connect the beams of the beam groups 15 and 16 at their ends 22 with the ends 23 of corresponding beams of adjacent beam grid panels. The thus connected beams form two groups of helical beam structures extending, as shown in Fig. 1, coaxially with the axis of the ship structure over the entire length of the ship hull.

I have found that in most cases it is preferable to provide besides the above described beam grid structure additional supporting structures normal to the axis of the hull; this supporting structure preferably consists of a supporting beam grid 24, preferably secured to the edges 26, i.e., to those edges of the beam grid panels which are normal to the ridge-like structure edges 25. These supporting structures are also provided with concrete slabs 27 forming thereby compartments, i.e., bulk heads in the interior of the ship or barge.

In some cases, it is advantageous to arrange along the edges of the beam grid panels edge beams 28 and 29 secured to the diagonal beams 15 and 16 of the panels. In this event the edge beams 28 are forming the ridge-like structure edges 26, and the edge beams 29, form the panel edges 26 which are normal to the structure edges 25.

It should be noted that all beam grid panels 14 forming one of the faces 18, 19, 20, and 21, must be of equal length in direction normal to the structure edges 25, i.e., the length of the edges 26 of these panels must be equal. Furthermore, it is also of importance to stress the fact that the length of all beam grid panels 14 arranged between two consecutive supporting beam grids 24 must be identical, too; only in this case is it possible to arrange these supporting beam grids in the required manner and to form bulk heads in the interior of the barge.

The modified structure shown in Figs. 8 and 9 differs only slightly from the above described one: In the above described embodiment the distribution of the intersecting points between diagonal and edge beams is symmetrical only along the structure edges 25, and asymmetrical along the edges 26, whereas in the embodiment shown in Figs. 8 and 9 the distribution of intersecting points is entirely symmetrical, i.e., the intersecting points are arranged along opposite edges in the same way. In the latter case, diagonal beams of four adjacent beam grid panels are meeting in each corner of the panels and are therefore connected to each other.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of beam grid structures for ships, airplanes and the like differing from the types described above.

While I have illustrated and described the invention as shown in beam grid structures for ships, airplanes and the like, I do not intend to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of my invention.

Without further analysis, the foregoing will so fully reveal the gist of my invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalency of the following claims.

What I claim as new and desire to secure by Letters Patent is:

1. Longitudinal stiffening structure for hulls of ships, airplanes, containers, tanks and the like, comprising a series of rectangular beam grid panels having four straight panel edges two of which extend in longitudinal direction parallel to the longitudinal axis of said hull and two of which extend in transversal direction normal to said axis, each of said rectangular beam grid panels being composed of two groups of parallel beams in such a manner that all beams are diagonal to said straight panel edges and that the beams of one beam group intersect the beams of the other beam group and are connected to these beams at their points of intersection, and a series of transversal polygonal supports arranged normally to the longitudinal axis of said hull, each of said panels being monolithically connected to neighboring panels along said four straight panel edges and supported by said transversal polygonal supports along said transversal panel edges which are normal to the longitudinal axis of said hull.

2. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks and the like, comprising a series of rectangular beam grid panels having each four straight panel edges, each of said rectangular beam grid panels being composed of two groups of parallel beams arranged diagonal to said straight edges of said panels and connected to each other at a series of intersection points, each of said beam grid panels arranged with two parallel straight opposite edges parallel and two parallel straight opposite edges normal to the longitudinal axis of said hull.

3. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks and the like, comprising a series of rectangular beam grid panels having each four straight panel edges, each of said rectangular beam grid panels being composed of two groups of parallel beams arranged diagonal to the edges of said panel and connected to each other at a series of intersection points, each of said beam grid panels being arranged with two opposite parallel straight edges parallel and two opposite parallel straight edges normal to the longitudinal axis of said hull and being connected along said four straight panel edges to the adjacent beam grid panels.

4. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks and the like, comprising a series of plane rectangular beam grid panels, each of which is composed of two groups of straight and parallel beams arranged diagonal to the edges of said panel and connected to each other at a series of points of intersection, each of said beam grid panels being arranged with two edges parallel and two edges normal to the longitudinal axis of said hull and being monolithically connected along these edges to the adjacent beam grid panels, and a series of transversal supporting structures arranged normal to the longitudinal axis of said hull and secured to said beam grid panels along their transversal edges.
2,352,296 edges which are extending normal to the hull axis.

3. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks and the like, comprising a series of plane rectangular beam grid panels, each of which is composed of two groups of straight and parallel beams arranged diagonal to the edges of said panel and connected to each other at their points of intersection, each of said beam grid panels arranged with two edges parallel and two edges normal to the longitudinal axis of said panel in such a manner that the edges of adjacent beam grid panels form a series of straight ridge-like continuous edges in longitudinal direction of the hull parallel to each other and to the hull axis, and a series of polygonal transversal edges all around this hull in planes being normal to the axis of the same.

6. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks, and the like comprising a series of plane rectangular beam grid panels, each of which is composed of two groups of straight and parallel beams arranged diagonal to the edges of said panel and connected to each other at their points of intersection, each of said beam grid panels being arranged with two edges parallel and two edges normal to the longitudinal axis of said panel and being monolithically connected along these edges to the adjacent beam grid panels in such a manner that the connected edges of adjacent and consecutive beam grid panels form a series of straight ridge-like continuous edges in longitudinal direction of the hull parallel to each other and the hull axis, and a series of continuous polygonal transversal edges all around this hull in planes being normal to the hull axis.

7. A stiffening structure for longitudinal hulls of ships, airplanes, containers, tanks and the like, comprising a series of plane rectangular beam grid panels, each of which is composed of two groups of straight and parallel beams arranged diagonal to the edges of said panel and connected to each other at their points of intersection, each of said beam grid panels being arranged with two edges parallel and two edges normal to the longitudinal axis of said panel and being monolithically connected along these edges to the adjacent beam grid panels in such a manner that, the connected edges of adjacent beam grid panels form a series of straight ridge-like continuous edges in longitudinal direction of the hull parallel to each other and the hull axis, and a series of continuous polygonal transversal edges all around this hull in planes being normal to the hull axis, and a series of supporting transversal structures being arranged normal to the longitudinal axis of said panel in such a manner that, the connected edges of adjacent beam grid panels being arranged normal to the longitudinal axis of said panel and being monolithically secured along these edges to the adjacent beam grid panels in such a manner that, these panels being monolithically secured along their edges to each other, and a series of transversal supporting beam structures having each an outline equal to the cross-section of said longitudinal stiffening structure, said transversal supporting structures being arranged normal to the axis of said longitudinal stiffening structure and secured to said beam grid panels along those edges which are extending normal to the axis of said stiffening structure.

9. A longitudinal ship hull consisting of a series of longitudinal faces contacting each other along ridge-like hull edges being parallel to the longitudinal axis of said ship hull, each of said faces being formed by concrete slabs reinforced by a series of rectangular beam grid panels, each of which consists of two groups of parallel beams arranged diagonal to the edges of said panel and connected to each other at their points of intersection, said beam grid panels being secured to each other at their transversal edges which are normal to said ridge-like structure edges and being secured at their longitudinal edges forming said ridge-like hull-edges to the beam grid panels of the adjacent longitudinal faces of the ship hull.

10. A longitudinal ship hull consisting of a series of longitudinal faces contacting each other along ridge-like hull edges being parallel to the longitudinal axis of said ship hull, each of said faces being formed by concrete slabs reinforced by a series of rectangular beam grid panels, each of which consists of two groups of parallel beams arranged diagonal to the edges of said panel and connected to each other at their points of intersection, said beam grid panels being secured to each other at their transversal edges which are normal to said ridge-like structure edges and being secured along the longitudinal edges which form said ridge-like hull edges to the beam grid panels of the adjacent longitudinal faces of the ship hull, and a series of polygonal supporting beam structures having each an outline equal to the cross-section of said ship hull, said supporting beam structures being arranged transversal to the longitudinal axis of said ship hull and secured to said beam grid panels along their transversal edges which are extending normal to said ridge-like hull edges.

11. In a longitudinal ship hull of the type claimed in claim 9, concrete transversal partition walls supported by said polygonal supporting beam structures, said partition walls forming bulkheads inside of said ship hull.

12. In a longitudinal hull stiffening structure of the type claimed in claim 8, each of said beam grid panels comprising besides said diagonally arranged beams also edge beams monolithically connected to each other at the corners of said beam grid panels.

13. In a longitudinal hull stiffening structure of the type claimed in claim 8, all beam grid panels of one longitudinal structure face being of equal length in direction normal to said ridge-like structure edges.

14. In a longitudinal hull stiffening structure of the type claimed in claim 8, all beam grid panels arranged between consecutive polygonal transversal supporting beam structures being of equal length in direction of said ridge-like structure edges.

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