Jan. 3, 1939. J. KJEKSTAD 2,142,945

WELDED CONSTRUCTION

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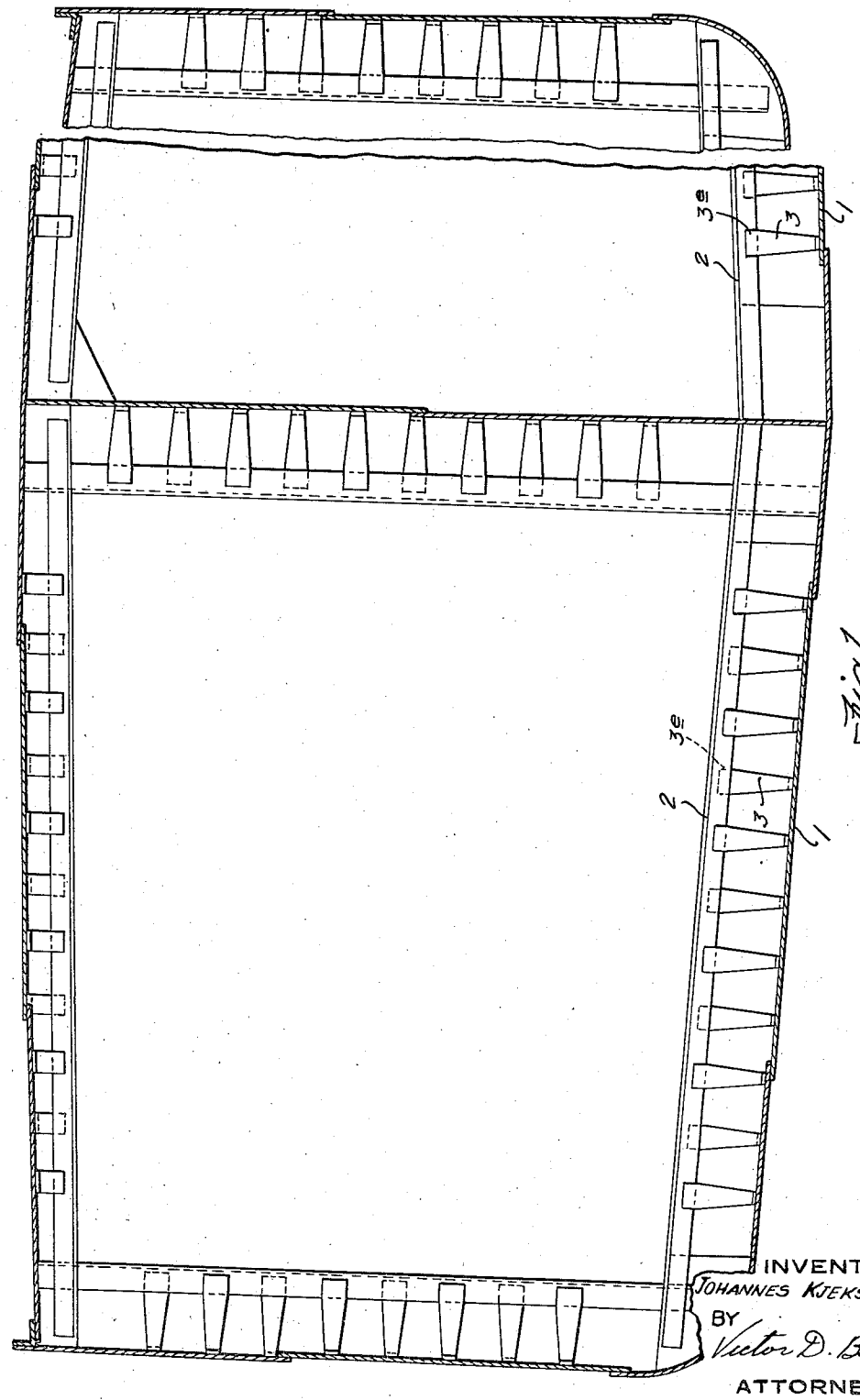

Fig. 1.

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Fig. 2.

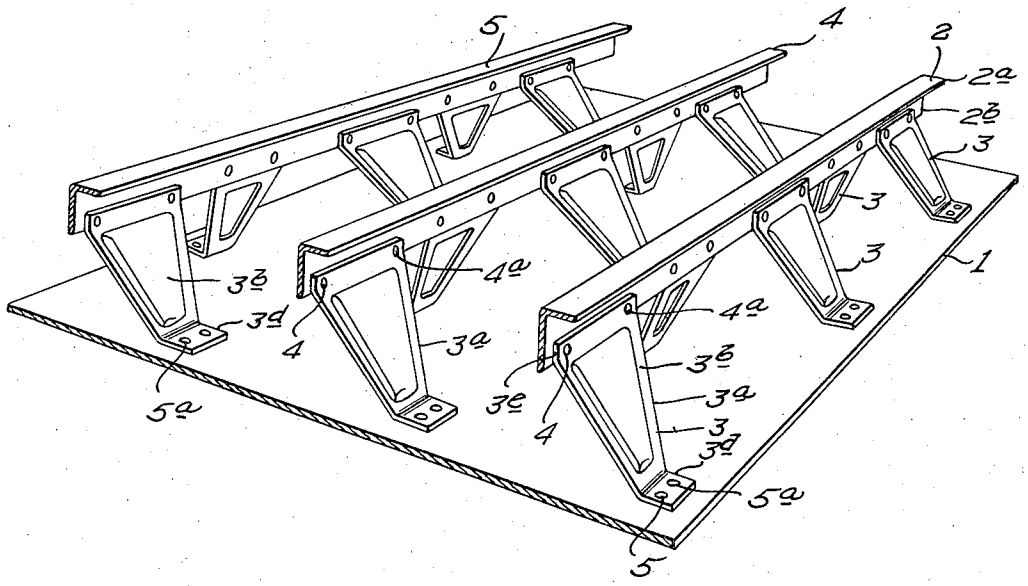
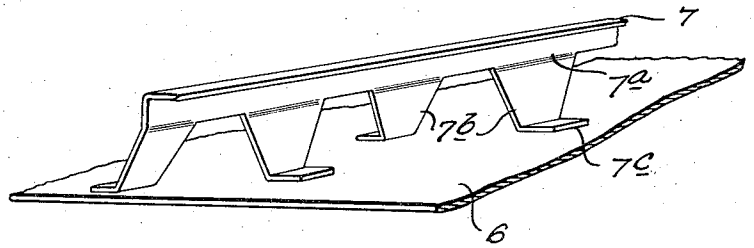


Fig. 3.



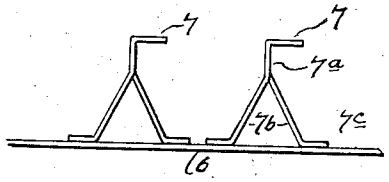


Fig. 4.

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WELDED CONSTRUCTION

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7 Claims. (Cl. 114—79)

The invention herein disclosed relates to the construction of vessels and in particular constitutes an improvement upon the welded construction, known as the open frame construction, disclosed in my prior Patent No. 2,082,836, issued June 8, 1937.

Primarily, the function of the frame of a ship is to hold the shell plating in place and in line, to resist compressive stresses imposed axially thereon; to hold the shell plating in place against pressure exerted normally thereto; to resist local deformation caused by collision, grounding, etc.; and to contribute rigidity to the general structure due to its beam action. Originally the riveted frame was nearly self-sufficient to resist all stresses and the shell was principally a watertight envelope. With the development of the welded frame and particularly the open frame construction, the shell plating is utilized as a source of strength and forms a part of the beam section of the frame. In this construction in which the bracing is secured along a line, only a limited portion of the plating on either side of the connection of the bracing enters into the beam action of the frame.

By the present invention, there is provided a welded construction of bracing for a vessel of the open frame type in which practically all of the plating may be made to form a part of the beam section of the bracing or framing. This is accomplished, in accordance with the invention, by providing a bracing that includes a member spaced from and extending parallel to the plating. The member is connected to the plating by a series of transversals spaced longitudinally thereof and extending from the member to the plating at an angle to the plating, forming what may be termed an open, spread frame construction. Successive transversals are welded to the plating on opposite sides of a plane perpendicular to the plating and including the member. Adjacent braces of this type are arranged so that their transversals are secured to the plating alternately and in line.

This open, spread frame construction has several advantages among which are the fact that the transversals have flanged ends that may be spot welded to the plating, thus avoiding the possibility of locked-in stresses encountered in continuous welds, and the fact that the plating is more securely braced against lateral pressure.

Such a construction is illustrated, in two forms, in the accompanying drawings in which:

Fig. 1 is a transverse section of a hull of a vessel with the bracing of this invention;

Fig. 2 is a perspective of a section of the plate of a vessel with one form of the bracing applied;

Fig. 3 is a perspective of a section of the plate of a vessel with another form of the bracing applied thereto; and

Fig. 4 is an end elevation of the bracing shown shown in Fig. 2.

The open, spread frame construction of this invention has been illustrated in the drawings in connection with the hull of a vessel. It is shown as bracing the outer shell or plates 1 and a bulkhead 2. In Fig. 2 of the drawings there is shown a section of the plate 1 of a vessel. This plate is braced by an angle iron 2 that is spaced from the plating 1 but which extends parallel thereto. In the bracing as illustrated in Fig. 2, one flange 2*a* of the angle iron extends parallel to the plating 1 and the other flange 2*b* extends laterally to the plating 1. The angle iron 2 is secured to and maintained in spaced relation with respect to the plating 1 by a series of transversals 3 that extend at an angle to the plane of the plating 1.

Each transversal is constructed as shown and includes a central straight section 3*a* having a bulge 3*b* formed therein to increase the strength of the section and flanged ends 3*c* and 3*d* on each end of the straight section 3*a*. The straight section 3*a* has diverging side edges and the flange 3*c* is secured to the flange 2*b* of the angle iron 2 by spot welding as at 4 and 4*a*. The flange 3*d* is secured to the plate 1 by spot welding as at 5 and 5*a*. It will be seen that successive transversals 3 extend to the plating, from the flange 2*b* of the angle iron 2 on opposite sides of a plane lateral to the plating and including the flange 2*b* of the angle iron 2. Similar bracings 4 and 5 are also shown connected to the plating at spaced intervals transversely thereof. It will be noted that the transversals on the several bracings are in line so that the transversals of one bracing come between the transversals of an adjacent bracing. In consequence, a minimum area of plating is obtained between transversals of the bracings for any given number of transversals.

It will be seen that with the bracing shown in Fig. 1, and as described above, there is an open frame construction for the hull of vessels in which a maximum amount of plating is caused to enter into the beam action of the bracing. Likewise, the plating is given greater strength against lateral forces acting upon the bracing either due to the pressure of the water or collision. By virtue of these advantages, the bracing may be made of much lighter weight material and the vessel can have a greater carrying capacity.

In Figs. 3 and 4 there is shown an alternative

form of bracing. In these figures, the plating is indicated by the numeral 6. The plating is braced by an angle iron 7 which has one flange 7a serrated. The transversals 7b formed by the serrating of the flange are bent so as to extend at an angle to the plane of the flange, successive transversals being bent to extend on opposite sides of the plane of the flange. Each of the transversals has formed on the end thereof a flange 7c which is secured to the plating by spot welding. The difference between this construction and that shown in Fig. 1 is the fact that the bracing is an integral piece. This however has all of the advantages of the bracing shown in Fig. 1 and when several bracings are set up, the bracings are related in the manner illustrated in Fig. 1.

This open, spread frame construction described above has many advantages over those heretofore used. It greatly increases the critical pressure which a plate of a given thickness will stand before buckling, for the frame spacing, for the same amount of framing, is materially lesssened and the critical pressure at which a plate of a given thickness will buckle is increased inversely as the square of the frame spacing. Thus, the flat surface of the plate supported by rigid bracing at points spaced one-half the distance apart as similar parallel line bracing has much greater strength. This spread frame also places material along the line of action of local impact and its diagonal supports or braces are extremely effective in resisting failure by "tripping" or folding over upon local impact.

The foregoing advantages are obtained in addition to the fact that spot welding or localized arc welding is utilized in the attachment of the struts. Extensive experiments show conclusively that attachments of toe-down single line frames to plating by means of continuous or intermittent arc welding inevitably caused shrinkage of the plate at right angles to the line of frames, and that furthermore this shrinkage was not uniform or predictable in amount. If this shrinkage be resisted it will produce internal stresses, if it can produce movement it will cause distortion of the plating. Since, however, the open, spread frame avoids line attachment and permits adjustment of strain in all directions (not resisting along the line of frame) there cannot be any locked up stresses or distortion. Due to the feet or flanges on the struts it is possible to spot-weld them to shell or frame by resistance welding and the chances for stress concentration and distortion are even further lessened and the cost of attachment greatly reduced. This open, spread frame is of particular value in cases of very thin shell plating, as for example, destroyers, submarines and airships, where a smart appearance and smooth surface are desired. Present examples of welded destroyers show decided hollows between frames even in new vessels and the fairness of shell does not compare favorably with previous riveted designs.

It will be obvious that various changes may be made by those skilled in the art in the details of the embodiments of the invention illustrated in the drawings and described in detail above within the principle and scope of the invention as expressed in the appended claims.

I claim:

1. In a vessel, the combination comprising a wall consisting of steel plating and a brace for the wall including a member spaced from and extending parallel to the plating, and a series of transversals of substantial length spaced longitudinally of the member and extending from the member, the several transversals extending at an acute angle to the plating and on opposite sides of a plane perpendicular thereto and being welded thereto.

2. In a vessel, the combination comprising a wall consisting of steel plating and a brace for the wall including a member spaced from and extending parallel to the plating, and a series of transversals of substantial length extending from the member on opposite sides of the plane perpendicular to the plating and including the member, the several transversals extending to the plating and being welded thereto.

3. In a vessel, the combination comprising a wall consisting of steel plating and a brace for the wall including a member spaced from and extending parallel to the plating, and a series of transversals of substantial length extending from the member to the plating and being welded thereto, successive transversals being on opposite sides of a plane perpendicular to the plating and including the member and the several transversals extending at an angle to the plating.

4. In a vessel, the combination comprising a wall consisting of steel plating and a brace for the wall including a member spaced from and extending parallel to the plating, and a series of transversals of substantial length extending from the member and having flanged ends welded to the plating, successive transversals being on opposite sides of a plane perpendicular to the plating and including the member and the several transversals extending at an angle to the plating.

5. In a vessel, the combination comprising a wall consisting of steel plating and bracing therefor including a plurality of parallelly disposed members spaced from the plating and parallel thereto, and a series of transversals of substantial length extending from each member to the plating and having flanged ends welded to the plating, the successive transversals extending from each member being on opposite sides of a plane perpendicular to the plating and including the member and the transversals on one side of one member being positioned intermediate successive adjacent transversals of the adjacent member.

6. In a vessel, the combination comprising a wall consisting of steel plating and a brace therefor including an angle iron spaced from the plating and having one flange extending parallel to the plating, and a series of transversals of substantial length secured to the other flange and extending to the plating at an angle thereto, the successive transversals extending to the plating on opposite sides of the plane of the flange of the angle iron.

7. In a vessel, the combination comprising a wall consisting of steel plating and a brace therefor including an angle iron having one flange spaced from the plating and parallel thereto and the other flange serrated forming a series of transversals of substantial length extending at an angle to the plating and including flanged ends welded to the plating.

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