The invention relates to hull construction and while not limited thereto is particularly directed to an improved hull for barges or scows and to the method of building such vessels. The invention provides a hull structure made up of a multiplicity of flanged structural rolled sections united to one another by fused metal seams.

Hitherto the building of steel vessels wherein the outer shell and decks of the vessel are made of riveted members, an enormous amount of time and expense is involved in drafting and engineering detail. Drawings must be carefully prepared detailing each individual piece. Molds of full size must be prepared with considerable care to insure proper laying out of the work in the fabricating shop. Work in the fabricating shop consisting of laying-out, punching and shaping material must be carefully and accurately done to insure proper alignment of parts in erection. Though the work may be perfect when the fabricated material reaches the ship, extreme care and accuracy is required in erection to insure proper fit between the various members. A slight error in any of the preceding operations may and frequently does result in parts of the material being scrapped.

This results not only in the loss of material but also in the loss of time and the waste of labor cost. The labor required in drafting, fabricating and erecting is supplied by highly skilled engineers and mechanics earning the highest wages paid to shipyard labor. Much of this labor is expended primarily in the locating and punching of holes in material which is later to accommodate rivets or bolts. In the completed vessels heretofore made using riveted joints, the rivets are a source of danger and expense. Damages resulting from collision, grounding, and docking while not of themselves serious enough to cause rupture of the vessel plating will frequently, however, cause leakage around the rivets requiring that rivets be replaced, this work frequently requiring sending the vessel to a drydock at great expense.

My improved barge and method of building the same eliminates riveting with its attendant expense and overcomes many of the objections to the prior practice briefly referred to above.

The invention will be fully understood from the following specification when read in connection with the accompanying drawings and will be defined with particularity in the appended claims. In the drawings—

Fig. 1 is a side elevation on a small scale diagrammatically illustrating a scow built in accordance with my improved method and embodying the invention;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is a transverse half-section on an enlarged scale taken on line 2—2 of Fig. 1;

Fig. 4 is a detail view illustrating a preliminary step in building a hull in accordance with my novel method;

Fig. 5 is a similar view illustrating a further step in the method;

Fig. 6 is a view illustrating a further step in the method;

Fig. 7 is a detail showing the double welded seam uniting the adjacent sections of which the hull is composed;

Fig. 8 is a detail showing the double seam connections between the bottom and side portions of the hull embodying my invention;

Fig. 9 is a detail showing a modified form of joint between the bottom side of the hull;

Fig. 10 illustrates a further modification of Fig. 9;

Fig. 11 is a view showing a step in the method and showing the reinforcing plate introduced at knuckle or corner formed by bending the channels.

Referring in detail to the drawings, the invention is illustrated in Figs. 1 to 8 inclusive as embodied in a barge or scow including a bottom indicated as a whole by numeral 10 which is made up of a multiplicity of rolled steel channel sections 12 united to one another by seams to be hereinafter described; sides 14 made up of similar rolled steel sections 16 united by similar seams and a deck 18 formed of a multiplicity of similarly united channels 20.

At suitable intervals along the sides of the hull, side frames 22 are welded to the sections 16. The side frames 22 are welded.
at the top as indicated, for example, at 24 to deck beams 26 and at the bottom as indicated at 28 to bottom frames 30. At suitable points additional bracing members 32 and 34 are secured as shown.

Extending longitudinally along the center line of the hull is a keelson plate 36 preferably seated in a groove between two adjacent sections 12 and welded as hereinafter described. A longitudinally extending upper girder plate 38 is also provided and this is connected at intervals with the keelson plate 36 by means of bracing members 40. Longitudinally extending angles 41 are welded to vertical plates also to ends of pieces 26 and 30.

According to my improved method of building the hull, I first lay the bottom channels 12 alongside one another on suitable skids, the toes 12b of the channel flanges 12b extending upwardly as in Fig. 4. Between the flanges 12b of the adjacent channels, I insert flat bars 42, these being of less depth than the depth of the flanges 12b. Suitable cleats not shown are provided to hold the bars 42 above the lower surface 44 of the channel sections 12. Thus, in the preliminary step of building the hull, open ended slots 46 and 48 are left between the edges of the bars 42 and the outermost edges of the channel flanges 12b.

The adjacent channels 12 are welded or united to one another, also to the interposed flat bars 42 by means of fused metal seams 50 along the toes of the flanges 12b and by similar fused metal seams 52 along the backs of the flanges. The welded seams 50—52 may be made either by oxyacetylene or by an electric welding machine, or by electric welding, hand operated. In practice, electric welding is preferred. In electrically welding the adjacent sections, the welding machine such as indicated diagrammatically at 54 is moved longitudinally along the work, this machine being arranged either for fusing a welding wire 56 within the groove 46, thus forming a homogeneous bond between the two adjacent flanges 12b and the interposed flat spacer bar 42 or by the use of a metallic electrode. After a suitable number of channels 12 have been welded along the toes of the flanges 12b, the work will be inverted as indicated in Fig. 6 and the welding machine will be moved along the work so as to form the fused metal seams 52. When working on this comparatively flat surface, the grooves 48 between adjacent channels 12 are utilized to guide the welding machine in a straight line. For example, the machine may be provided with a supporting wheel 58 having a flange 60 which rides in the groove 48 adjacent to the similar groove in which the electrode 62 of the machine is operated to form the welded seam. The opposite wheel 64 of the machine may be of simple cylindrical form merely riding on the flat backs of the channels 12.

In laying out the channel sections 12 for the bottom of the hull, enough length of channel is placed down to form the ends of the hull. As indicated in Fig. 11, the flanges 12b are coped out to permit the extreme ends 65 of the channels to be bent upwardly as indicated in dotted lines. An angle plate 69 is substituted for the bar 42 at the corner to reinforce the structure as shown. The several channels thus bent collectively form one end 70 (Fig. 1) of the hull. Similarly, the other ends of the channels are bent upwardly to form the rear inclined end of the scow as indicated at 72 (Fig. 1). The sides of the hull are laid out on a flat surface in a manner similar to that above described for forming of the bottom and several channel sections 12 are united to one another by fused metal joints similar to those indicated at 50 and 52 in Fig. 7. On completion of the welding of the multiplicity of sections which go to make up the sides, each side is welded to the bottom unit by a double welded seam as indicated at 74 and 76. As shown in Fig. 8, the outermost section is in the form of a channel having one of its flanges cut off. Or, if desired, a rolled angle section may be used. The member 78 may be either considered as such an angle section or a channel with one flange cut away. Fig. 9 illustrates a slight modification of Fig. 8 in which the outermost section 78 is secured to the lowest channel 16 of the side unit by means of a curved member 80, this member being united to the member 78 by means of the welded seams 82 and 84 and similarly united to the channel 16 by the welded seams 86 and 88. The member 80 is adapted to be formed either of the bent plate or a section of pipe.

Fig. 10 shows a slight modification of Fig. 9 in which the curved member 80 overlaps the back or web of the outermost channel 12 of the bottom unit, the same being secured by welded joints 90—92. After the several bottom channels have been united to form the bottom unit, the inside transverse members 39 and uprights 22 may be erected and subsequently the side units may be united to the bottom unit by the formation of joints shown, for example, in Figs. 8 to 10 inclusive. However, I am not limited to any sequence of steps as regards the erecting or welding of the hull sections or other members as variations will be made as deemed expedient by those skilled in the art.

The deck channels 18 may be welded in place in their proper position. When the assembly of the sides and bottom units has been completed, the keelson plate 36 will be put in place and welded. The keelson plate is conveniently seated in one of the grooves 46.
between the adjacent flanges of the pair of centrally disposed channels.

From the foregoing it is apparent that the invention is an improvement over prior practice. The cost of construction of a barge hull by my method is considerably less than any other method of which I am aware. All riveted joints are eliminated thus saving much drafting room labor and eliminating much shop fabrication work. The channels or other structural sections forming the bottom sides, deck or bulkheads can be ordered from the steel mills at random lengths without any marking, thus ensuring the lowest possible price for the steel. These channels may be delivered direct to the shipbuilding skids without sorting or any shop work whatever.

In view of the tolerance allowed by the manufacturers of rolled steel sections, there are appreciable variations in the dimensions of sections of a given listed size. For example, channels listed as having a depth of say 12 inches may vary in size from a quarter of an inch more than 12 inches to a size slightly less than 12 inches. Also in practice the angle which the back of the web of the channel makes with the top of the flange may vary from an angle of slightly less than 90 degrees to an angle of slightly more than 90 degrees. These variations due to mill tolerances and wear on the rolls used in producing roll sections give rise to considerable trouble and expense in the assembly and construction of vessels having bolted or riveted connections as in the prior constructions. In my improved construction the use of the flat spacer bars 42 permits of readily compensating for variations in the width of the rolled channel sections, it only being necessary to use flat bars of sufficient thickness to secure the desired overall width. The use of spacer bars between the channel flanges which are of less depth than the depth of the channel flanges provides grooves for the reception of the welding wire or electrode and greatly expedites the welding operation whether the joint be made by an electric weld or by an oxyacetylene weld. Moreover, as above pointed out, the spacer bar serves to define a groove between adjacent sections which groove serves to guide the welding machine without special attention on the part of the workman. The welded method of hull construction eliminates a great deal of drafting room and engineering work and eliminates all shop fabrication. With the exception of the welders, the labor on the shipways need only be semi-skilled or unskilled.

The material used in the hull construction is not weakened by rivet holes and the double steel weld described provides double insurance against leakage.

In case of the hull being damaged by grounding or collision, the structure may be distorted but it is not so nearly liable to rupture as in the case of hulls using riveted or similarly mechanically coupled or bolted joints. The welded seam being of the same material as the other parts of the barge and being homogeneous with such parts, the seam will follow the distortion in almost all cases without rupture. In exceptional cases, such as collision or the like where rupture actually occurs, it is a comparatively simple matter to remove the damaged part by fusing the seams and replacing the same with new material, the replaced part being readily welded in place.

While I have described quite specifically the embodiment of the invention illustrated, and certain steps in the method of building the hull, it is not to be construed that I am limited thereto since various modifications may be made by those skilled in the art without departing from the invention as defined in the appended claims.

What I claim is:

1. The method of building a vessel which comprises placing a multiplicity of stock size flanged sections of non-uniform width alongside one another with spacing members between them of different thicknesses to compensate for the lack of uniformity of said sections and forming fused metal seams to close the spaces between the adjacent sections.

2. The method of building a vessel which comprises placing a multiplicity of flanged sections alongside one another with spacing members between all of them and forming fused metal seams to close the spaces between all the adjacent sections and thus form a water-tight bottom portion of the vessel, bending the bottom portion at an angle to form an integral end of the vessel, placing other flanged sections alongside one another with spacing members between them, uniting the latter sections by fused metal seams to form side portions of the vessel and joining each side portion to said bottom portion by a welded seam.

3. The method of building a vessel which comprises placing a multiplicity of rolled channel sections alongside one another in separate groups, one group being adapted to form the bottom and ends of the vessel and other groups being adapted to form the sides thereof, inserting spacer bars between all of the adjacent channels of each group, welding the adjacent sections and the corresponding interposed spacer bars to one another to form water-tight seams, bending the sections of the bottom group to form the ends of the vessel and joining the united side groups to the thus formed bottom group by welded seams.

4. The method of building a vessel which comprises placing a multiplicity of stock size rolled channel sections alongside one another,
with a compensating spacer bar between each and every one of them adapted to leave a groove for the reception of a welding wire electrode and guiding a welding machine in one of said grooves while fusing such a wire electrode with the spacer bar and the adjacent channel sections.

5. The method of building a vessel which comprises placing a multiplicity of rolled channel sections alongside one another, each with a spacer bar between them adapted to leave a groove for the reception of a welding wire electrode and fusing such a wire with the spacer bar and the adjacent channel sections, inverting the channel sections and fusing another wire to the opposite edge of said spacer bar and the adjacent sections during the welding operations the welding machine being guided by engagement with the work.

6. The method of building a vessel which comprises placing a multiplicity of rolled channel sections alongside one another, each with a spacer bar between them adapted to leave a groove for the reception of a welding wire, moving a welding machine along the work to fuse such wire with the spacer bar and the adjacent channel sections, and guiding the welding machine during the welding operation by engagement with a groove between certain of said sections.

7. The method of building a vessel which comprises placing a multiplicity of rolled channel sections alongside one another, each with a spacer bar between them adapted to leave a groove, guiding a welding machine along the work by coaction with one of the grooves and at the same time welding one of said bars to the adjacent channel sections.

8. The method of building a vessel which comprises placing a multiplicity of stock sized rolled flange sections alongside one another with a spacer bar between them adapted to leave a groove, guiding a welding machine by coaction with said groove and uniting adjacent flanges with said spacer bar while moving said machine along work.

9. A vessel having a hull comprising a multiplicity of run-of-the-mill rolled steel sections having slightly varying widths, said sections being arranged alongside one another with spacing members of varying thicknesses between them and fused metal seams closing the spaces between said sections.

10. A vessel having a hull comprising a multiplicity of solid rolled flanged structural sections arranged alongside one another with flat bars between the sections, each bar being of less depth than the depth of the flanges of said sections and a welded seam uniting each bar to the two adjacent flanges and closing the space between them.

11. A vessel having a hull comprising a multiplicity of longitudinally extending stock size rolled steel channels of slightly varying widths arranged alongside one another with relatively thin metal bars of varying thicknesses between the flanges of adjacent sections and welded seams uniting said bars to the adjacent channels.

12. A vessel having a hull comprising a multiplicity of run-of-the-mill flanged structural sections of non-uniform width extending longitudinally thereof and arranged alongside one another, bars of less depth than the depth of the flanges of said sections located between said flanges, and welded seams the major portions of which lie within the extremities of said flanges, said seams uniting the opposite edges of each bar to the adjacent sections and forming longitudinally extending double water-tight seals between each adjacent pair of said longitudinally extending sections.

In witness whereof, I have hereunto signed my name.

GORDON G. HOLBROOK.