Nov. 1, 1927. 1,647,515

R. E. ELLIS

HULL CONSTRUCTION FOR FLOATING STRUCTURES

Filed Jan. 8, 1926 4 Sheets-Sheet 1

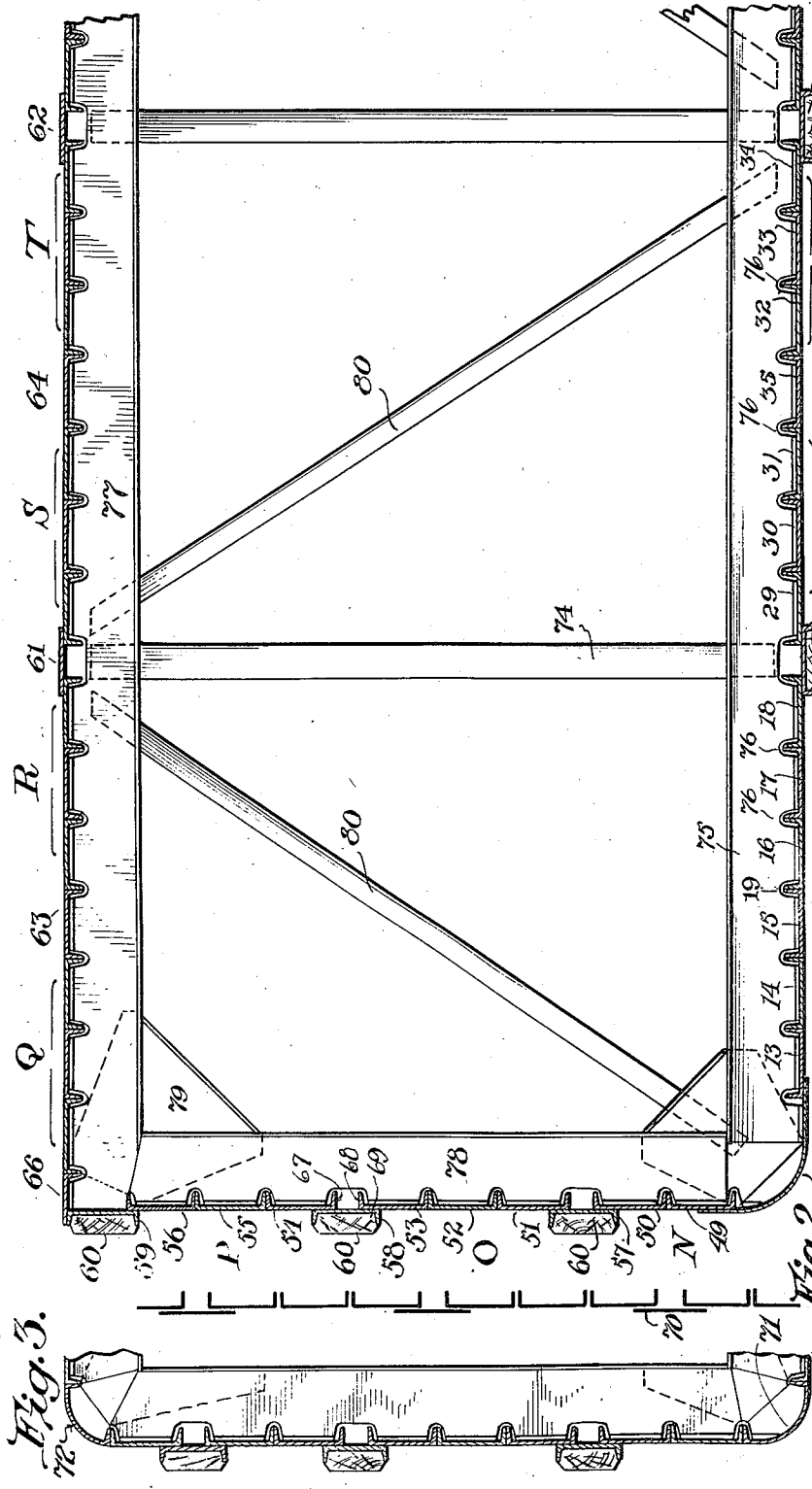


Fig. 1.

Fig. 2.

Fig. 3.

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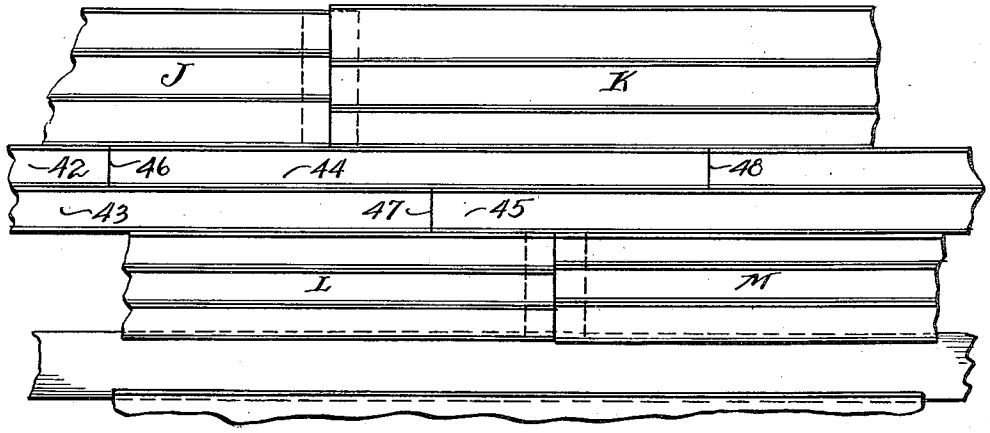
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R. E. ELLIS

HULL CONSTRUCTION FOR FLOATING STRUCTURES

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Fig. 5



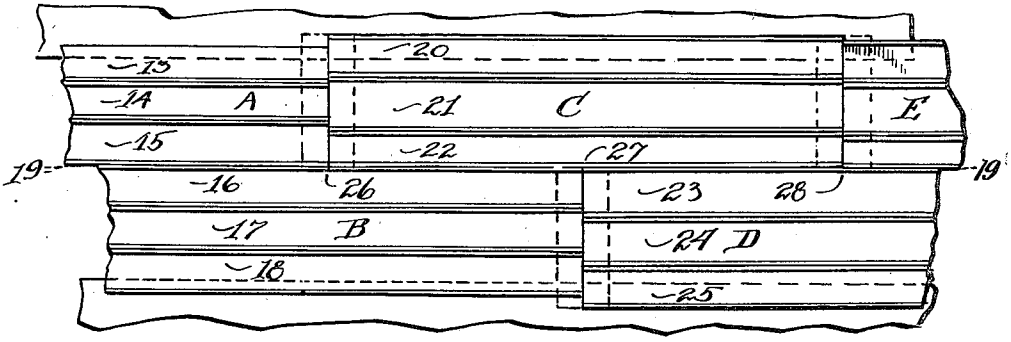


Fig. 4.

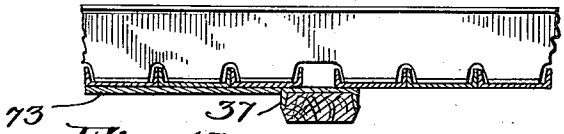


Fig. 13.

Fig. 6.

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HULL CONSTRUCTION FOR FLOATING STRUCTURES

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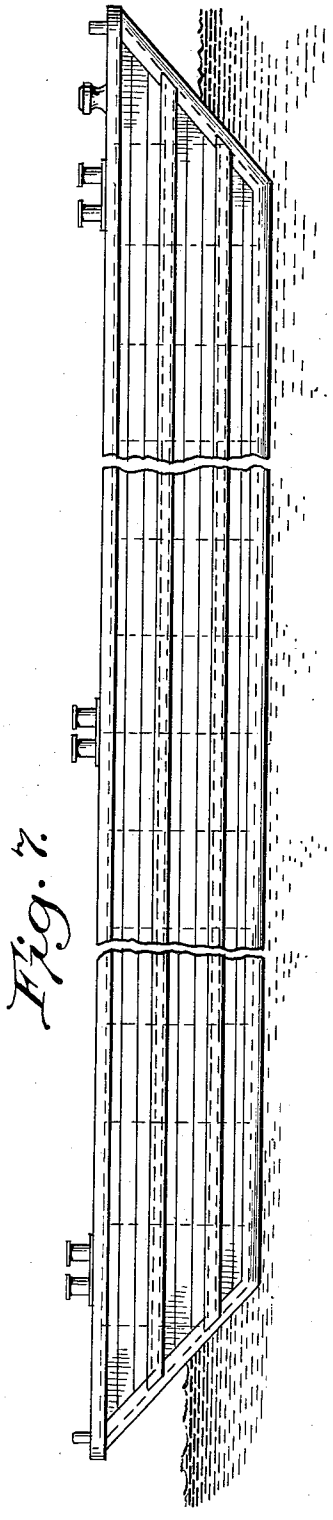


Fig. 7.

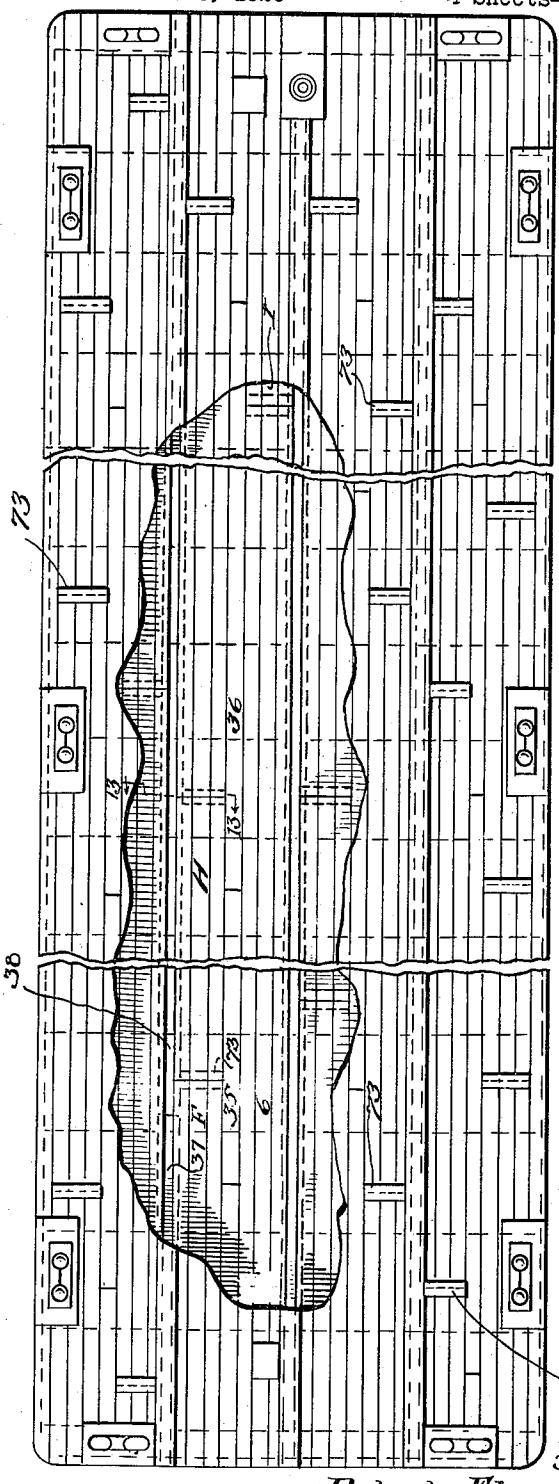


Fig. 8.

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HULL CONSTRUCTION FOR FLOATING STRUCTURES

Filed Jan. 8, 1926 4 Sheets-Sheet 4

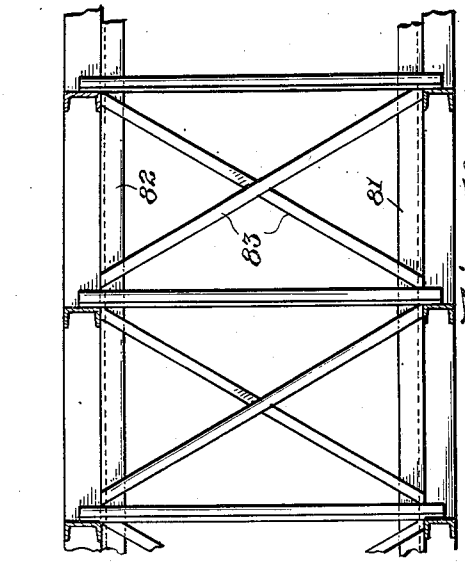


Fig. 10.

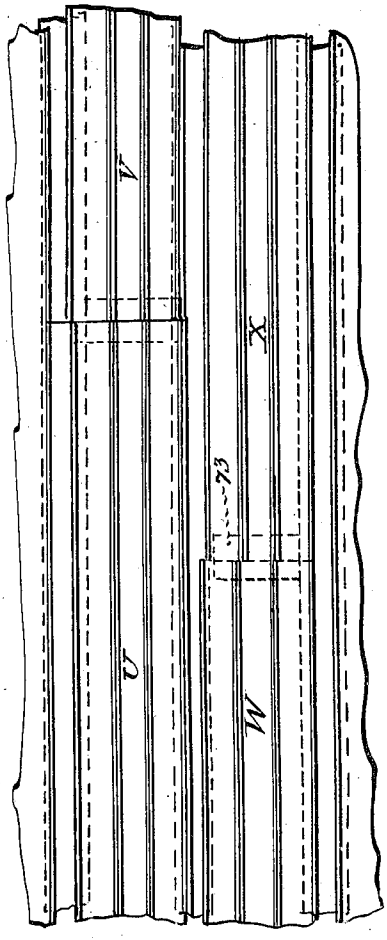


Fig. 11.

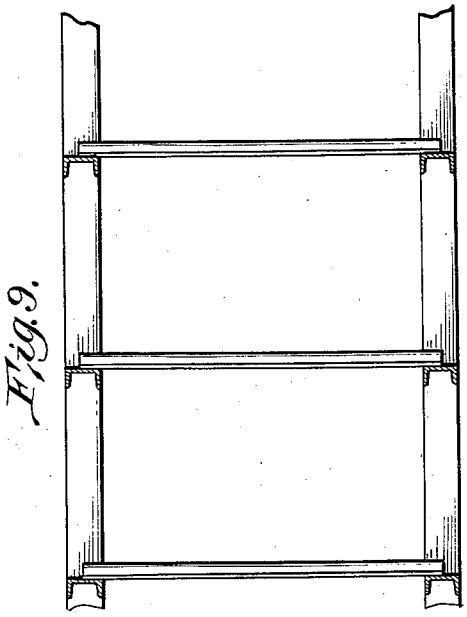


Fig. 9.

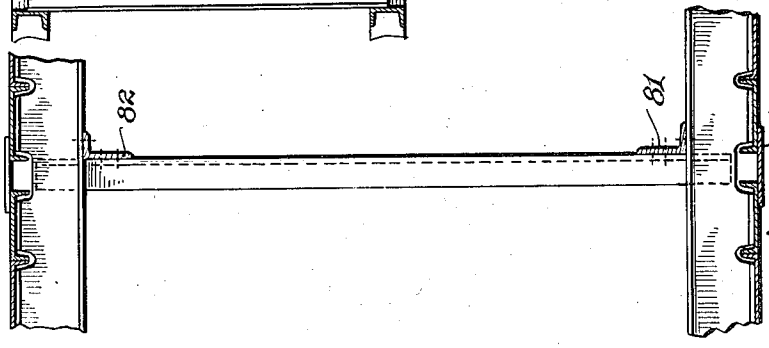


Fig. 12.

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Patented Nov. 1, 1927. 1,647,515

UNITED STATES PATENT OFFICE.

ROBERT ELWOOD ELLIS, OF SEATTLE, WASHINGTON.

HULL CONSTRUCTION FOR FLOATING STRUCTURES.

Application filed January 8, 1926. Serial No. 80,019.

My invention relates to a hull construction for floating structures, more particularly to hull construction of channel shapes.

My invention will be set forth as embodied in a scow or barge. However, its scope is not to be limited to any such specific application but is coextensive with all floating structures, such as ships, drydocks, etc., embodying like conditions or problems in whole or in part.

The particular type of a ship known as a scow is peculiarly subject to great strains due to its extreme shallowness in comparison to its breadth and length, and also due to the lack of uniformity in disposition of the load. In loading a ship, great care is taken to load the same uniformly, so that the weight is balanced and the vessel is kept in trim, thereby placing no undue strains upon the hull. The exact opposite condition obtains for a scow. A scow may be placed under a chute for loading, and one side or end may be heavily loaded, with the result that the vessel may be disposed at a big angle to the surface of the water, or she may trim by bow or stern,—all of which produces abnormal strains on the structure. A further complicating factor is that the structure must sustain the towing strains while supporting the load,—a condition which, of course, is not ordinary in the case of a ship.

Furthermore, a scow is subject to particularly severe shocks rising when the tugs which tow or push the scow from one place to another strike or ram into the scow hull to shove it sidewise, or endwise. In all these ways, as well as others, a scow hull is subject to especially rough usage.

Ordinarily a scow must be of shallow draft and economical in construction, as well as of great strength. According to present practice and design, scows are generally constructed of wood. Serious objection obtains to wooden construction in that the same gradually becomes water-soaked, so that it is customary to allow a high percentage or reduction in their carrying capacity depending upon the age of the structure. This must be considered when the scow is dispatched to receive a load and constitutes a large element in calculating its depreciation and loss in efficiency. While a scow made of metal, such as iron or steel, overcomes this objection, nevertheless, the great cost of steel construction heretofore has proven such a handicap that the more general construction for scows has been wooden. Therefore, a primary object of my invention is to provide a metal hull construction which will overcome this objection and be light so as to be of shallow draft and yet of such strength as to meet the severe requirements imposed by the conditions of scow operation.

The particular metal construction unit known as a channel shape is desirable for some reasons, particularly since they may be secured together along their flanges which may be disposed inwardly of the hull and the riveting which may be employed in holding the same together may thus be kept from being exposed to the water for the most part. Said flanges also constitute stiffening ribs which permit of providing the necessary strength and at the same time eliminate much, both by weight as well as by number, of the frame members, so that lightness of construction is obtained which ordinarily should characterize a scow so that it may operate in shallow water and carry its maximum load. Channel shapes are a market article which may be employed throughout an entire hull of one width, so that the great cost of handling and assorting and scarfing incident to such a great extent in flat plate construction, is avoided; or, at least, the sizes of the channel shapes may be so limited in number for a given hull that little or no difficulty or objection arises by reason of handling and assorting. Scarfing is eliminated altogether.

However, serious objection has obtained to the employment of said channel shapes due to their varying width, and so serious has this objection been that the adoption of channel shapes as a construction unit has been postponed so far as their use is concerned in hull construction. The obvious manner of overcoming this objection, namely, by using liners, so greatly increases the cost that little advantage would remain in adopting such units of construction. The variation in width of the channel shapes arises by reason of the fact that the temperature of the rollers at the rolling mill vary. A primary object of my invention is to overcome this objection occasioned by the variation in widths of the channel shapes and eliminate the use of liners.

Moreover, it is customary to stagger all joints in hull construction to provide maximum strength and a primary object of my

invention herein is to provide for staggering the joints of channel shapes, while at the same time providing for the variation in widths of the channel shapes. Furthermore, in connection with this staggering feature, it is important and it is my purpose to provide for as great a number of staggered joints as a given hull may require to meet the specified strength.

Again it is my purpose to provide connector means for the units composing a hull embodying my invention, which will also be the housing for the fenders of the hull and at the same time provide for an especially strong mounting of said fenders, due to the grouping of the flanges.

Finally, a primary object of my invention is to provide a hull constructed of channel shapes which overcomes difficulties in repairing which otherwise are serious, owing to the variation in width of the channel shapes, and it is also my purpose to provide a hull structure formed of channels which does not require the lines of the hull, transversely considered, to be rectilinear.

The above mentioned general objects of my invention, together with others inherent in the same, are attained by the device illustrated in the following drawings, the same being merely preferred exemplary forms of embodiment of my invention, throughout which drawings like reference numerals indicate like parts:

Fig. 1 is a view in cross section from amidship to the side of a hull structure embodying my invention;

Fig. 2 is a view in cross section of a modified form of a hull side embodying my invention;

Fig. 3 is a view in cross section of another modified form of said hull side;

Fig. 4 is a plan view of panels bearing on a line type of base;

Fig. 5 is a plan view of panels bearing on a base formed of two channels of selected width;

Fig. 6 is a diagrammatical view of one-half of a hull structure wherein the lines of a hull transversely considered are not rectilinear; that is, of a "shaped" hull;

Fig. 7 is a view in elevation of a hull structure embodying my invention;

Fig. 8 is a plan view of said hull structure with a portion broken away to show a plan view of the bottom panels;

Fig. 9 is a view in longitudinal section of said hull structure;

Fig. 10 is a longitudinal view in modified form of hull structure embodying my invention having longitudinally directed frame members or trusses;

Fig. 11 is a plan view of the arrangement of the channel shapes in the sides;

Fig. 12 is a cross sectional view of a modified form of connector plate; and

Fig. 13 is a view in cross section on dotted line 13, 13 of Fig. 8.

Three channel shapes 13, 14, 15 are disposed in a panel A (see Figs. 1 and 4) and similarly channel shapes 16, 17, 18 are arranged to form panel B, said panels being jointed on a base line 19, 19, that is, the center of the rib formed by the joined flanges of adjacent channel shapes 15 and 16 of panels A and B. This base line preferably extends from end to end of the vessel but may be of less extent, if desired. Since channel shapes vary in width, that is, if channels of twelve inches in width are ordered, the delivered product may vary from one-sixteenth to one-half inches or more, due to variations in the temperature of the rollers during their manufacture, it may result that channel shapes 20, 21 and 22 which make up a panel C which abuts upon panel A will cause panel C to be wider than A; for example, three-fourths of an inch or more or less. Likewise, channels 23, 24 and 25 which make up panel D may cause panel D to be narrower than C. Therefore, I bring the abutting panels A and C to line up as respects one lateral edge, that is, to coincide with or rest upon the base line 19, 19. Likewise abutting panels B and D are caused to line up as respects one edge, that is, they are caused to rest upon base line 19, 19. This disposition of the channels adds together all the discrepancies in their width upon one side of the panel, which they form,—that is, upon the side opposite the base 19, 19. Similarly all abutting panels as E which lie in line longitudinally of the hull with panels A and C are brought to bear upon the base 19, 19 as respects one lateral edge of said panels, and so with one lateral edge of panels which lie in line longitudinally with the hull with panels B and D,—each being brought to bear upon the base line 19, 19. Obviously this arrangement permits, and is preferable, these panels to be disposed with their butts 26, 27, 28 in staggered relation, thereby assuring greater strength to the structure. Channels 29 and 31 are secured together as respects their flanges to form panel F and channel shapes 32, 33 and 34 are secured together to form panel G. These panels may have as abutting panels (see Fig. 8) H and I, respectively. In this instance, however, the panels F and H have one lateral edge abutting upon channel 35 which we will assume is exactly twelve inches in width. Likewise channel 36 which abuts upon channel 35 is exactly twelve inches in width, and all channels in line longitudinally of the hull with said channels 35 and 36 are selected of exactly twelve inches in width, and all these channels are disposed with their flanges in line so that instead of the base in this case being a single line as 19, 19, the base consists of the chan-

nel 35 and its aligned channels. Upon this "channel base" panels F and H are caused to bear as respects one lateral edge, while panels G and I are likewise caused to bear as respects one lateral edge upon said base. The lateral edge portions of panels B and F are connected longitudinally by means of channels 37 and 38, and their longitudinally alined channels which are mounted with their flanges outwardly disposed. Since these channels 37, 38, etc., overlap the lateral edge portions of adjacent (but ordinarily non-contacting) panels as B and F, the uneven line of the flanges of abutting channels makes no difference for the reason that a sufficient overlapping is provided in these "take-up connector" channels 37 to constitute a completely covered joint throughout the length of the hull or so far as the same is caused to extend. A filler 39, which may be of wood, is preferably inserted in the "take-up connector" channels 37, 38, etc., which prevents the rivets from being exposed to the water and affords a bumper on the bottom. Similarly, a "take-up connector" channel 40 and its aligned channels is caused to connect the lateral edge portions of panels disposed on each side amidship.

Such is the construction of the bottom. A modified form of such "take-up connector" means is shown in Fig. 12, where a plate 41 is disposed to so function. Obviously, instead of the panels above described being made up of three channel shapes, two or four or other desired number might be so grouped. Also instead of having the base consist of one channel width, as channel 35, it might be two or more (see Fig. 5 for this modified arrangement) such as channels 42 and 43 and their abutting channels 44 and 45, respectively. The channels in line forming such a base must be selected of the same width and their butts 46, 47 and 48 are preferably disposed in staggered relation. Upon this base, panels J, K, L and M may be mounted as illustrated. Manifestly this arrangement of the panels and bases provides for any desired width and desired degree of staggered butts. Relative the sides of the hull: the channels 49, 50, 51, 52, 53, 54, 55, and 56 may be disposed in panels N, O and P with "take-up connector" channels 57, 58 and 59, which may be filled with wood and may serve as fenders 60 and cover the rivets thereunder.

The deck may be formed of panels Q and R and their aligned panels with preferably "take-up" means in the form of plates 61 and 62. Channels 63 and 64 and their longitudinally aligned channels may function as bases upon which said panels may bear. A bilge plate 65 may join the lateral edges of panels A and N and a channel 66 with one flange removed may serve to connect panels Q and P through "take-up connector" channel 59. Therefore, ample "take-up connector" means is provided for the sides inasmuch as discrepancies may be absorbed both by the plates 65 and 59, as well as the intermediate "take-up connector" panels 57 and 58.

This ample take-up provision for the sides is important because it is the sides of the scow especially that are particularly subject to injury arising by reason of ramming by the tugs which serve to move the scows about, or by being jammed against the wharves by waves. Provision is thus made for their ready repair in that the damage panels may be quickly removed and a new panel easily fitted in place, owing to the "take-up" latitude provided on both sides of the said panels. Fig. 11 shows in plan such a disposition of panels such as U, V, W and X (U and W corresponding respectively to P and O panels of Fig. 1) which have take-up means on both lateral edges. Thus is overcome one of the very positively urged and frequently presented objections to the use of the channel shapes, namely, the difficulty incident to repairing a damaged hull formed of said channel shapes.

Moreover, such replacement channels secured together in panels may be stocked and hence the time required for such repair may be made relatively very short at the time of such repairing. Since the number of channels from which selection may be made to obtain a specific width of panel, may be very limited as contrasted with the situation at the time of construction, the provision for wide latitude in the take-up means is important and eliminate the necessity of such exact selection. Repair shops or yards in ports distant from the home port, that is, repair shops generally, may be employed to make the repairs. In other words, my invention in employing channel shapes does not involve a hull construction which will require especially equipped shops to make repairs, but I cause my channel hull construction to be of a character to meet practical requirements and operating conditions. One of the great advantages of a steel or metal constructed scow as contrasted with a wooden constructed scow is the small upkeep charge, and therefore it is necessary in providing a hull structure formed of channels to have the same economically repaired if this advantage of steel or metal construction is to be retained.

Not only do the channels 57, 58 and 59 function as "take-up connector" means, and as fender housings but in making provision for the fenders, special local strength is provided. This is important because the fender is designed to receive the blows incident to operation. This local strength is afforded herein by grouping the flanges, four in number, 88, 67, 68 and 69, to oppose any blows

sustained by the fenders and to distribute the same over a considerable portion of the hull whereby great local strength obtains throughout the length of the fender. In Fig. 2 a modified form of side construction is illustrated, wherein plates 70 function as "take-up connector" means. In Fig. 3 another modified form of side construction is illustrated wherein the bilge plate 71 consists of a curved channel and likewise the plate 72 which connects the side and deck may be a curved channel. This form of bilge is made possible by reason of the intermediate "take-up connector" means disposed between the side deck and bottom panels. Butt straps 73 may be the means to join the end portions of abutting panels or channels and the relation of said straps to the "take-up connector" means is shown in Fig. 13. The end of the strap 73 stops short of the said connector means 37.

Upright braces 74 may be secured at their end portions to transverse framing members 77 and 75. Transverse framing or truss members may be provided as by plates 75 notched at 76, if desired, to receive the inwardly directed flanges of the channel shapes in the bottom, and similarly disposed plates 77 and 78 in the sides and under the deck may further constitute said transverse framing means. Corner plates 79 serve to unite these plates at their end portions. Diagonal braces 80 are preferably provided to strengthen the transverse framing. The plates 75, 77 and 78 may be angle or channel shapes. Figs. 10 and 12 are modified forms illustrating how longitudinal framing or truss members may be provided at such points athwartship as may be desired. Longitudinal framing members 81 and 82, which may be angle members, may be disposed along the bottom and deck, respectively, and these joined by diagonal braces 83.

The modified form of hull contour shown in Fig. 8 illustrates how rectilinear lines in the contour of the hull transversely considered are not necessary, the "take-up connector" means 84, 85 and 86 making it possible to provide a "shaped" or curved hull. The "take-up connector" means 85 is preferably of a channel type to provide a mounting for a bilge keel 87.

In view of the explanation of the operation of the hull structure embodying my invention having been set forth in the above description of its construction, no further detailed statement will be made. Summarily, let it be noted that the panel construction herein set forth provides for adding together the discrepancies in width of the individual channel shapes composing the panel and disposing this accumulated discrepancy along one lateral edge of the panel, the other panel edge bearing upon a base which may be either a line or a channel, the "take-up connector" plates rendering the discrepancies immaterial as explained herein above. This obviates the use of liners or fillers between the channel flanges. Since riveting is only possible where the flanges are caused to contact squarely against each other or where liners are employed to fill in all openings, it is manifest, that a great assortment of liners varying greatly in thickness would be required in a hull construction of channel shapes taken as they come from the mill, since the variation in width of the channels may vary from one-sixteenth to one-half inch or more. My panel construction, however, herein set forth overcomes the difficulty without liners and provides for economical construction, as well as large scale production.

Manifestly the panels in the deck and bottom may be caused to extend transversely of the hull, if so desired, and in the sides they may extend vertically; or longitudinally in the deck and bottom and vertically in the sides. Such is the latitude provided by my invention for hull construction of panels, that this is a matter of choice. The preferred forms for a scow structure are herein illustrated.

Furthermore, the great advantage in repairing afforded by my panel construction overcomes one of the great objections to the use of channel shapes, because obviously the securing of channels of exactly the right width to fit into a damaged section would involve keeping a large stock of channels of different width and carefully assorting these, all of which expensive handling and selecting is precisely what characterizes the use of flat plates in hull construction and constitutes a large cost item in flat plate construction. Economy of construction and use is one of the primary reasons and requisites for adopting channel shapes as the construction unit. The flanges of the channels may be secured together in any desired manner, riveting, bolting or welding. Finally, my invention provides for the arranging of the butts in staggered relation, which construction is preferred to provide strength.

Obviously changes may be made in the forms, dimensions and arrangements of the parts of my invention without departing from the principle thereof, the above setting forth only preferred forms of embodiment.

I claim:

1. A hull structure formed of channel shapes, said shapes in part at least being assembled in panels of varying widths due to variations in the widths of the channels themselves, and connector means between adjacent panels covering the space incident to such variation in widths.

2. A hull structure, the exterior wall of which is formed of channel shapes assem-

bled in part at least in panels of varying width, said panels being disposed in staggered relation, and connector means for the lateral edge portions of adjacent panels as respects one side of said panels.

3. A hull structure, the exterior wall of which is formed of channel shapes assembled in part at least in panels of varying width, said panels being disposed in staggered relation, and connector means for the lateral edge portions of adjacent panels as respects one side of said panels, the other edge portions of said adjacent panels each being disposed in coincidence with a base line extending throughout the ship's length.

4. A hull structure, the exterior wall of which is formed of channel shapes assembled in part at least in panels of varying width, said panels being disposed in staggered relation; connector means for the lateral edge portions of adjacent panels in the bottom as respects one side of said panel; channel connector means for the lateral edge portions of adjacent panels in the hull sides as respects one side of said panels; and fenders mounted in said channel connector means.

5. A hull structure having the hull exterior walls, bottom and sides, formed of channel shapes assembled in part at least in panels of varying width, said panels being disposed in staggered relation, said sides and bottom being in spaced relation; a bilge plate extending from bow to stern connecting said sides and bottom; and connector means for the lateral edge portions of adjacent panels as respects one side of said panels.

6. A hull structure having the hull exterior walls, bottom and sides, formed of channel shapes assembled in part at least in panels of varying width, said panels being disposed in staggered relation, said sides and bottom being in spaced relation; a bilge plate extending from bow to stern connecting said sides and bottom; and connector means for the lateral edge portions of adjacent panels as respects one side of said panels, the other edge portions of said adjacent panels both in bottom and sides being each disposed in coincidence with a base line extending throughout the ship's length.

In witness whereof, I hereunto subscribe my name this 7th day of January A. D., 1926.

ROBERT ELWOOD ELLIS.