

April 30, 1946.

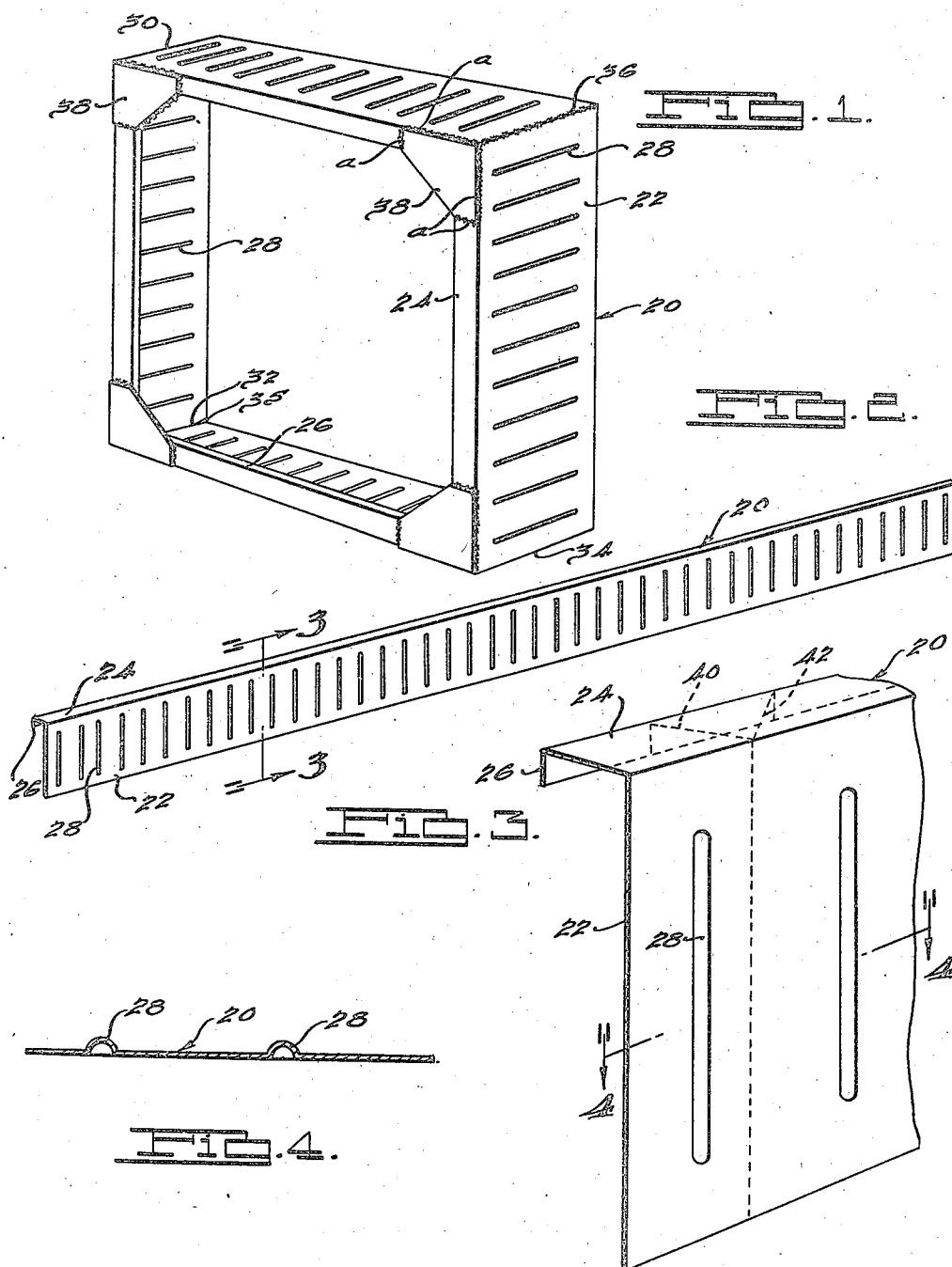
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2,399,202

METAL STRUCTURE

Filed April 7, 1942

4 Sheets-Sheet 1



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METAL STRUCTURE

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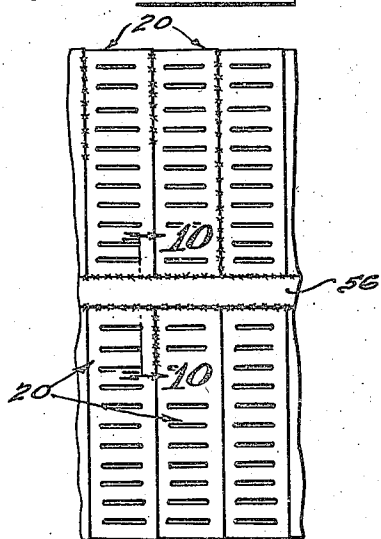
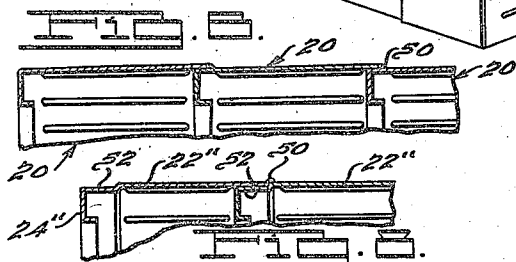
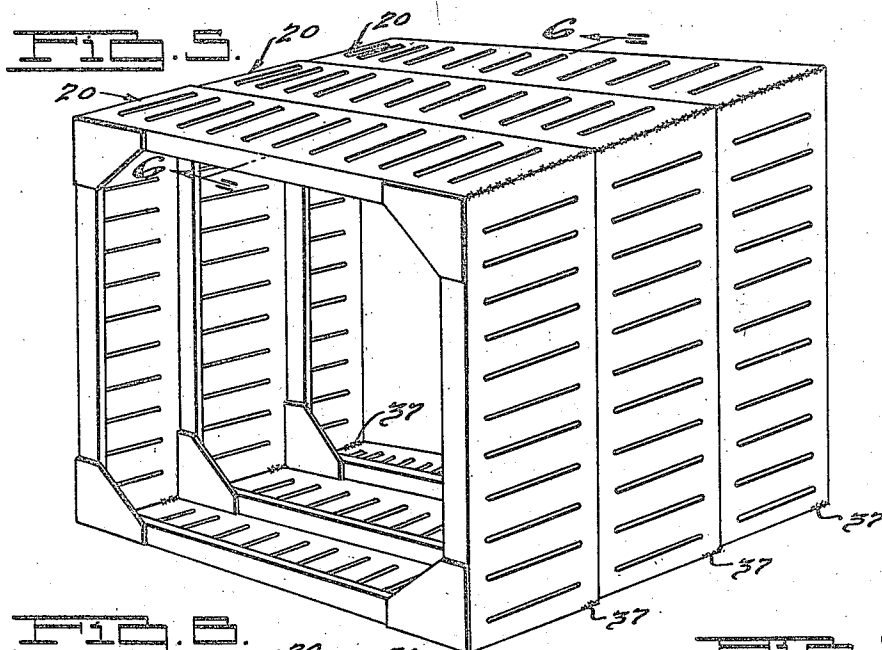


FIG. 8.

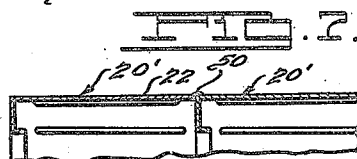
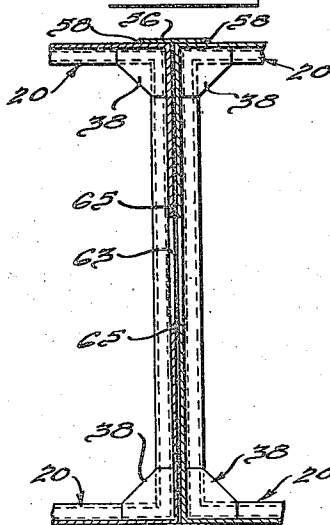


FIG. 10.



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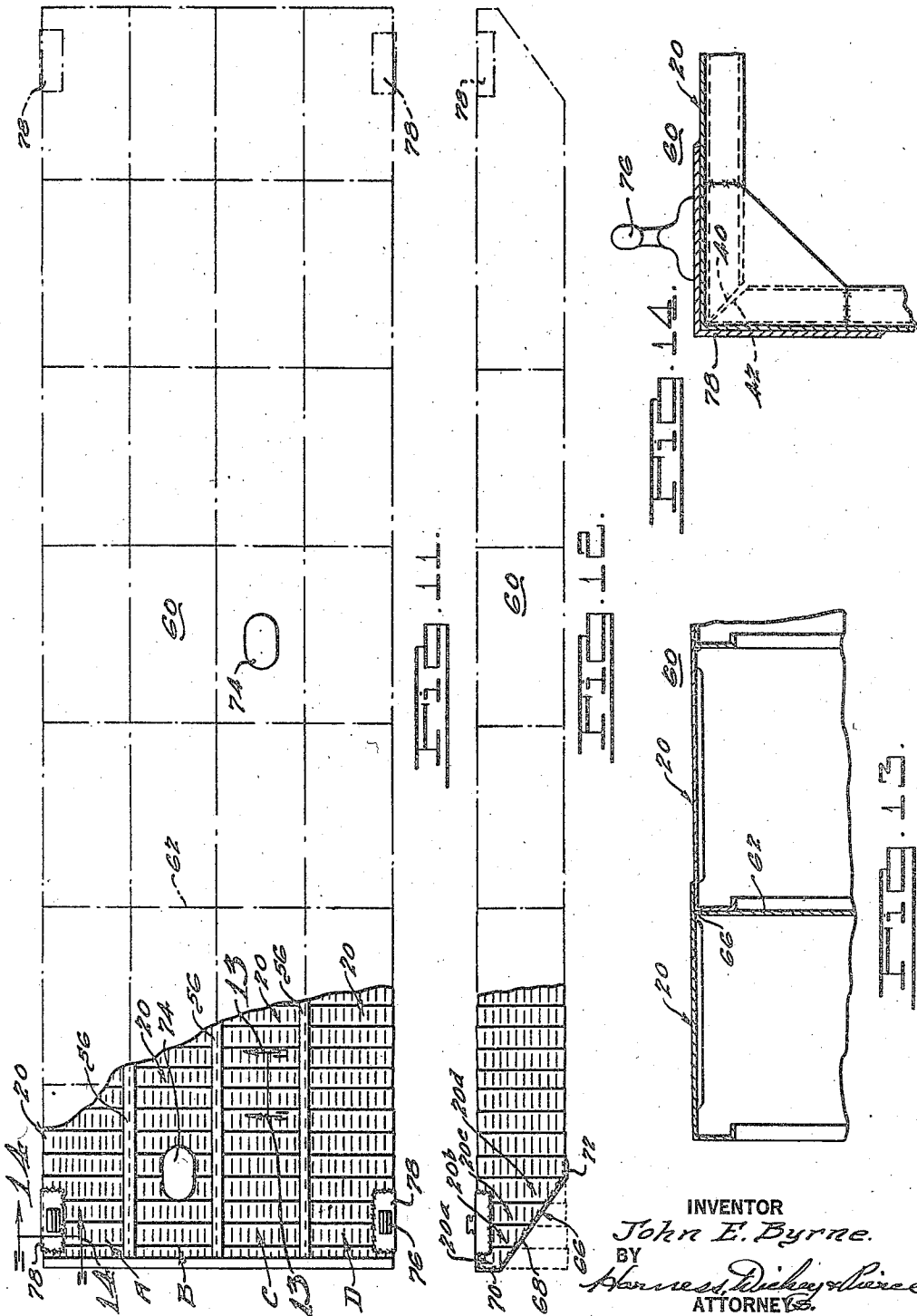
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FIG. 15.

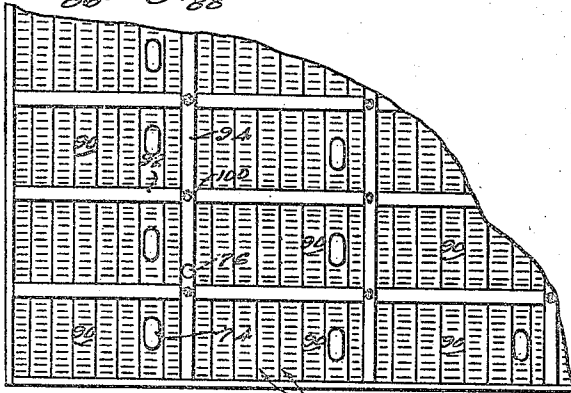
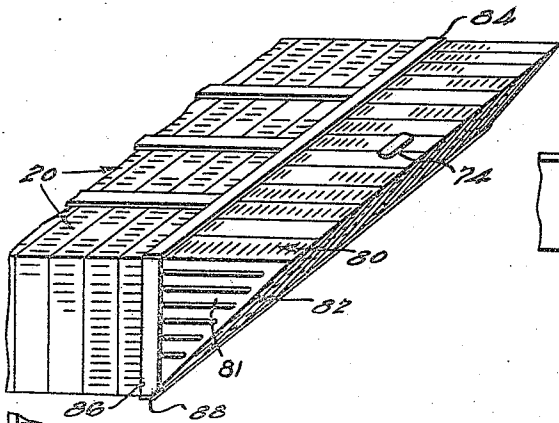


FIG. 16.

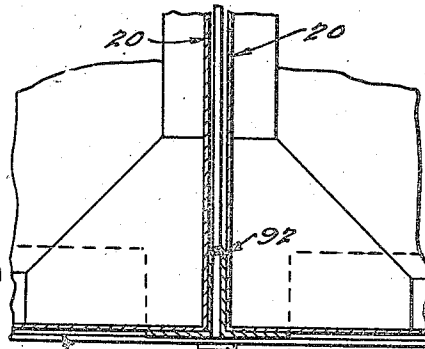
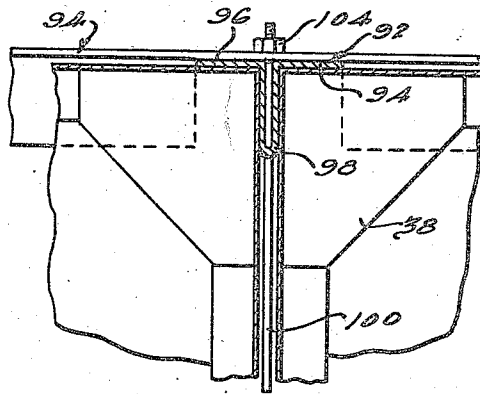


FIG. 18.

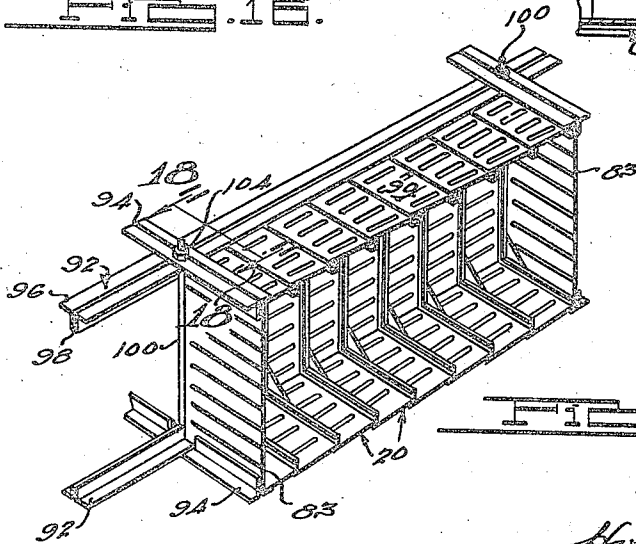


FIG. 17.

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METAL STRUCTURE

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Application April 7, 1942, Serial No. 438,051

2 Claims. (Cl. 114—77)

The present invention relates to metal structures and methods of erecting the same, and more particularly provides improved structures primarily built up from a plurality of preferably identical units or sections.

At the present time there is an urgent need for methods by which a variety of special structures may be produced rapidly, economically, in large quantities, utilizing readily available structural material, and by the use of manufacturing or assembly equipment which is of a readily available type. Illustrative such structures include barges for the transportation of oil and other materials, pontoons, docks, and tanks for the storage of water and other materials. The improvements of the present invention are well suited to these requirements, but may also be used to advantage in a wide variety of other structures. Briefly stated, the present invention contemplates utilization in a complete structure of a plurality of individual sections which may be and preferably are identical in construction. In accordance with the present invention, each individual section may be built up from a single length of stock or from a plurality of such lengths. The stock may be, for example, hot rolled strip steel formed into desired shape by cold forming processes. The erection of each individual section, as well as the assembling together of a group of sections, may be effected simply and with great rapidity. Also, if desired, the same basic section may be used in producing a number of different structures, thus reducing to a minimum the number of types and sizes of sections which are required.

With the foregoing general considerations in view, the principal objects of the present invention are to provide structures which may be readily, rapidly and economically assembled, and to also provide improved methods of assembling such structures; to provide such arrangements wherein the individual structures are primarily built up from a plurality of improved readily manufactured basic units or sections; to provide such arrangements wherein the individual sections may each be formed from one or more lengths of stock, bent or otherwise formed into desired shape; and to provide improved methods of securing a plurality of the sections or units together.

With the above as well as other objects in view, which appear in the following description and in the appended claims, preferred but illustrative embodiments of the invention are shown in the accompanying drawings, throughout the several

views of which corresponding reference characters are used to designate corresponding parts and in which:

Figure 1 is an isometric view of a section constructed in accordance with the present invention;

Figure 2 is an isometric view illustrating a flanged strip which may be used in erecting the section of Fig. 1;

Figure 3 is a view in section, taken along the line 3—3 of Fig. 2;

Figure 4 is a view in section, taken along the line 4—4 of Fig. 3;

Figure 5 is an isometric view illustrating one method of securing a plurality of sections together in edgewise relation;

Figure 6 is a fragmentary sectional view, taken along the line 6—6 of Fig. 5;

Figure 7 is a view illustrating a modified arrangement for securing a plurality of sections together in edgewise relation;

Figure 8 is a view illustrating a further method of securing a plurality of sections together in edgewise relation;

Figure 9 is a plan view illustrating a preferred method of securing a plurality of sections together in side-by-side relation;

Figure 10 is a sectional view taken along the line 10—10 of Fig. 9;

Figure 11 is a plan view of a barge embodying the invention;

Figure 12 is a view in side elevation of the structure of Fig. 11;

Figure 13 is a fragmentary view, taken along the line 13—13 of Fig. 11, illustrating a preferred method of partitioning a structure of the type shown in Figs. 11 and 12;

Figure 14 is a fragmentary view, taken along the line 14—14 of Fig. 11, illustrating a preferred method of securing auxiliary parts, such as a bit, to a structure as is shown in Figs. 11 and 12;

Figure 15 is a fragmentary view illustrating a modified stern or bow construction;

Figure 16 is a fragmentary view illustrating a modified barge construction;

Figure 17 is a fragmentary isometric view illustrating a preferred method of securing together the pontoons of Fig. 16; and

Figure 18 is a view in vertical section, taken along the line 18—18 of Fig. 17.

It will be appreciated from a complete understanding of the invention that the improvements thereof may be embodied in a wide variety of different structures, certain of which are mentioned in an illustrative sense in the foregoing

parts of this specification, and certain of which are illustrated in the drawings. In the preferred practice of the invention, each unit or section of the structure is, as aforesaid, built up from one or more lengths of stock or members, each having a web and a reinforcing or rib-like portion which projects from the web. Preferably, this reinforcing portion is in the form of a flange which extends along one edge of the web. Preferably, also, the just-mentioned flange is provided with a terminal flange portion which extends generally parallel to the plane of the web. It is further preferred to introduce a plurality of stiffening ribs into the web to further reinforce the structure.

In further accordance with the preferred practice of the invention, the just-mentioned members are further processed by bending the webs thereof along lines which extend transversely to the length of the member so as to bring them into desired form. To form a closed shape from a single member, the web is bent to such an extent as to enable the two ends of the member to be secured together. The form of each individual unit or section may also be varied in accordance with the use to which it is to be put. For example, in constructing barges such as are shown in Figs. 11 through 18, rectangular sections are preferably employed.

Referring first to Fig. 1, a basic unit or section of rectangular form is illustrated. This unit is built up from a single length of stock 20, having a web 22, a laterally turned flange 24, and an inwardly turned flange 26. The web 22 is preferably provided with a uniformly distributed series of reinforcing ribs 28. The member 20 is bent along the lines 30, 32 and 34 to define three of its corners. The fourth corner is constituted by the junction between the ends of the member 20 and, as shown, is completed by effecting a seam weld 36, which extends throughout the entire width of the web 22. Further reinforcement for the section may be and preferably is provided by gusset plates 38, one of which is shown at each corner of the section. The individual gusset plates are preferably welded to the adjacent flanges 26 along the lines designated "a." It is believed that no description is needed of the conventional forming operations which may be utilized to form the flanges 24 and 26 and the reinforcing ribs 28. Preparatory to the bending operations, which form the corners 30, 32 and 34, the flanges 24 and 26 may be notched, as indicated in dotted lines in Fig. 4, to define the surfaces 40 and 42.

In building up structures utilizing the basic units or sections 20, these sections may be connected together in various edgewise and side-by-side combinations. As shown in Figs. 5 and 6, the successive sections may be telescoped together. In this instance, the unflanged edge of the web of one section is fitted over the flanged edge of the web of the adjacent section. With this method of assembly, it will be appreciated that the individual sections may be formed to have a slightly truncated form, so that the inside dimension at the unflanged edge of each section is equal to the outside dimension of the flanged edge thereof. In view of the reinforced character of the present sections, it is possible to use material of relatively light gauge. These factors make it readily possible to give each section its necessary truncated form and still form the same, as aforesaid, from straight strip stock. Alternatively, the corners 30, 32 and 34 may be slit back

a short distance from the free edge of the web, as indicated at 35 in Fig. 1, enabling a rectangular section to be telescoped onto the adjoining section, after which the slitted edges may be welded, as indicated at 37 in Fig. 5. In Fig. 7, a plurality of the sections 20' are directly abutted against each other in edgewise relation with the unflanged edge of the web 22 of one section directly abutting the outer face of the flange 24 of the immediately adjacent section.

In the further modified arrangement, shown in Fig. 8, the webs 22'' of the individual sections are provided with depressed seats 52 adjacent the flanges 24'' thereof, which seats receive the edge of the web 22'' of the next adjacent section. This arrangement enables the several sections to be telescopically secured together and at the same time enables the individual sections to be of rectangular form.

Various means may be utilized to secure the individual sections of Figs. 5 through 8 together, but it is preferred to effect a continuous seam weld, which extends entirely around the junction between each pair of adjacent sections, and which joins the just-mentioned unflanged edge of the web of one such section to the web 22 or to the flange 24 of the immediately adjacent section. Such a continuous seam is designated 50 in Figs. 6, 7 and 8.

Certain structures may comprise merely a series of sections, such as 20, arranged in edgewise relation. Other structures may utilize a single series of sections arranged in side-by-side relation, or may utilize a plurality of groups of sections (each comprising a plurality of edgewise connected sections) arranged in side-by-side relation. Illustrative side-by-side connections are shown in Figs. 9 and 10, in which figures a pair of sections 20, connected in edgewise relation, as described in connection with Figs. 5 and 6, are connected in side-by-side relation to a corresponding pair of sections 20. The side-by-side connection is completed by securing a strip of metal 56 over the joints between the sides of adjacent sections, one such strip 56 being shown at the top in Fig. 10 and another such strip being shown at the bottom. The strips 56 may be and preferably are welded to the sections 20 by seam welds 58, which may extend continuously throughout the length of the corresponding strip.

In Figs. 11 and 12, an illustrative barge 60 is built up of four columns A, B, C and D, arranged in side-by-side relation. The columns each comprise a series of identical sections 20, arranged in edgewise relation. The edgewise connections between the sections may be and preferably are made as described in connection with Figs. 5 and 6, although the connections described with reference to Figs. 7 and 8 may be used. The side-by-side connections may be and preferably are made as described in connection with Figs. 9 and 10.

As thus far described, it will be appreciated that the barge 60 is divided into four longitudinally extending compartments, each of which extends from one end of the barge to the other. In the event it is desired to divide the just-mentioned four compartments into a series of compartments extending lengthwise of the barge, a plurality of partitions, such as 62, may be introduced. A preferred method of providing these additional compartments is shown in Fig. 13. Referring to Fig. 13, a rectangular plate 62 is secured to the flange 24 of an associated section 20. The connection between the plate 62 and the flange 24 is preferably effected, as before, by a seam weld 66, which

extends completely around the junction between these members. It will be obvious that as many of the partitions 62 as desired may be introduced into the barge structure and these partitions may readily be applied to the individual sections prior to the step of securing the several sections together. It will further be understood that the partitions or plates 62 additionally reinforce the structure as a whole, and that, if desired, certain of the plates 62 may be apertured so that they function only as reinforcing members. Also, if desired, the juxtaposed side walls of the sections in adjacent columns A, B, etc., may be provided with registering apertures so as to afford communication between the compartments in one column and the compartments in the laterally adjacent column. The marginal edges of such registering apertures may be joined together so that such apertures afford communication only between the sections and do not afford communication between the exterior and interior of such sections. Such registering apertures are designated 63 in Fig. 10, the margins whereof are joined by a weld 65 which extends continuously therearound.

In a generic sense, the front and rear ends of the barge 60 may be variously constructed, it being suitable in certain instances to simply apply closure plates over the vertical stern and bow ends of the structure so as to seal these ends. In other cases, it may be preferred to provide the angularly disposed arrangement shown in Fig. 12. In these instances, the end sections 20a, 20b, 20c and 20d may be formed, as previously described. Thereafter these end sections may be cut along an angled line, after which the end connection may be completed by applying a rectangular plate 68 to the angled faces of the end sections. The plate 68 may be provided with angularly directed flanges 70 and 72, which overlie the back of the section 20d and the bottom of the barge, respectively. The plate 68 may be welded in place, as aforesaid, it being preferred to use a continuous seam weld which extends completely around the marginal edge of each plate.

Alternatively, as shown in Fig. 15, a vertically ended barge structure, comprising, for example, one or more columns of sections 20, may be provided with triangularly formed bow and stern structures, such as 80. The stern or bow structure 80 is built up from a plurality of edgewise connected units or sections 82. Each unit or section 82 is constituted by a single length of stock or member, similar to the previously described members 22, the web whereof is bent at two points along its length so as to form a triangular shape, the free ends of the member being brought together, as described above, to define the third corner of the structure. The individual units or sections 82 may be connected together, as described in connection with any of Figs. 5, 6, 7, or 8, so as to produce the structure 80 having a length equal to the width of the barge. The ends of the structure 80 may be sealed off by closure plates 81, welded or otherwise secured to the outer faces of the end sections 82. The structure 80 may be secured to the extreme end sections 20 of the barge proper in any suitable manner. For example, connecting plates 84, 86 and 88 may be secured to the top, sides and the bottom of the junction between the barge proper and the structure 80.

Access to the individual sections or compartments of the barge may be afforded in any suitable way, it being preferred to provide the upper surface of the barge with a plurality of openings,

which may be provided with closures 74. Moreover, such auxiliary structure as may be desired may be applied to the barge structure by simple welding or other operations. For example, as shown in Fig. 14, towing bits 76 may be secured to angle plates 78, which may in turn be welded to the cooperating structures.

In the construction illustrated in Figs. 11 through 15, it is assumed that all of the compartments are utilized for cargo storage, but, if desired, certain of the compartments may be utilized to house motives means for the structure, so as to enable self propulsion thereof.

It will be appreciated that the several columns A, B, etc., connected together in side-by-side relation, and having the ends closed, as aforesaid, cooperate together to form the entire hull and cargo receiving elements of the barge, and that the barge so constructed may be divided into as many or as few longitudinally and transversely distributed compartments as may be desired. It will be appreciated that material of various gauges and sizes may be employed, depending upon the character of the structure. By way of illustration but not of limitation, it has been found that eleven gauge material having a web 22 and flanges 24 and 26 of, respectively, approximately 20 inches, 3½ inches and 1½ inches and built into sections of approximately 6 feet on a side may be satisfactorily built into barges up to 24 feet in width and 84 feet in over-all length, which barges may be used for the transportation of various commodities, such as oil.

Referring to Figs. 16, 17 and 18, the invention further comprehends the building up of barge structures from a plurality of separate compartments or pontoons in such a way that the complete barge may readily be assembled or disassembled. This arrangement provides great flexibility in the handling and transportation of materials. For example, the individual pontoons or compartments may be separately hauled or floated between primary terminals and the consumption or loading centers, and may be assembled into barge formation for water transportation between the primary terminals. Other advantages of this separable relation between the individual pontoons or compartments will be obvious. In Figs. 16, 17 and 18, the individual compartments or pontoons are designated 90. Each pontoon 90 may be assembled from a plurality of sections 20, in the same manner that the columns A, B, etc., of Fig. 11 are assembled, and may be provided with end closures to seal off the ends thereof, also as described above. Each pontoon 90 may also, if desired, be broken down into a series of smaller compartments or subdivisions by the use of partitions such as are described in connection with Fig. 13. Each pontoon thus constitutes a unitary structure which may individually be used for storage or transportation purposes.

The assembling together of the individual pontoons is accomplished, in the illustrated arrangement, by the use of a separable framework comprising longitudinal members 92 and cross members 94, which extend, respectively, longitudinally and transversely of the barge as a whole. The members 92 and 94 may be and preferably are of T-section, formed from initially flat stock to define flanges 96 and a double web 98. The two legs of the web 98 are secured together, slightly spaced apart, so as to define a tie receiving slot therebetween. This tie receiving slot receives tie rods, such as 100, which are passed through the upper and lower members 92 and 94 at the

junction therebetween, so as to define a compartmented box-like framework within each of which compartments one pontoon 90 is received. Any suitable means may be utilized to releasably retain the tie rods 100 in place. As shown in Fig. 18, the tie rods 100 are provided with enlarged heads 102, and are provided, adjacent their upper ends, with threads which receive holding nuts 104.

It will be understood that the lateral and vertical spacing between longitudinal members 92 is so proportioned as to enable a pontoon 90 to be snugly received between the webs of the corresponding members. Similar comments apply to the longitudinal and vertical spacings between the members 94. It is noted that at each junction between a member 92 and a member 94, the web of the member 94 is notched out so as to enable the flanges of the member 94 to freely seat upon the flanges of the adjoining member 92.

It is believed that it will be apparent from the foregoing description of certain embodiments of the invention that the improvements thereof may be embodied in an exceedingly wide variety of different structures, and that the resultant structures are characterized as being extremely economical to manufacture and assemble. Such structures are also of particular advantage because of the fact that the component parts may be constructed of readily available materials, and by the use of readily available manufacturing and erecting equipment. The disclosure herein of only several specific embodiments of the invention is to be taken in an illustrative and not in a limiting sense.

What is claimed is:

1. A separable barge structure including a plurality of structurally separate individually float-

able pontoons having upper and lower surfaces and sides, a plurality of skeleton framing members for securing the pontoons in assembled side-by-side relation, said members including a pair of upper and lower members positioned between a pair of said pontoons, each upper member having a portion which overlies a portion of the upper surfaces of said pair of pontoons and each lower member having a portion which underlies a portion of the lower surfaces of said pair of pontoons, each said member having a portion which lies between the juxtaposed sides of said pair of pontoons, and means for securing the members together against vertical displacement relative to each other and for retaining said pair of pontoons in engaged relation to said upper and lower members.

2. A structure comprising a column made up of a plurality of units, each said unit comprising a single length of metallic stock having a web one edge whereof is unflanged and the other edge whereof is provided with a flange, said web being bent at a plurality of points along its length and the ends of the web being secured together in angularly related relation to define a said unit of polygonal shape, one corner whereof is defined by said joined ends, each such point constituting another corner of such unit and said web constituting the bounding surface of such unit, said units being secured together in edgewise relation with the unflanged edges thereof secured to the flanged edges of the adjacent units, and plate-like members secured to the ends of the column to enclose the same and provide a floatable pontoon.

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