April 25, 1933. A. A. KRAMER 1,905,413

REENFORCED METALLIC STRUCTURAL SHEET AND METHOD OF MAKING THE SAME

Filed Jan. 31, 1930

Fig. 1.

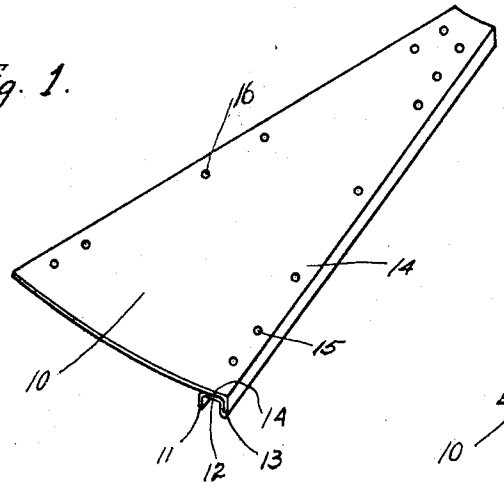


Fig. 2.

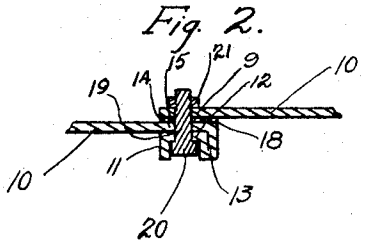


Fig. 3.

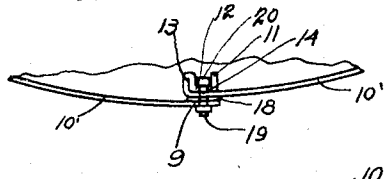


Fig. 4.

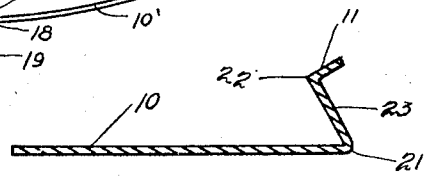


Fig. 5.

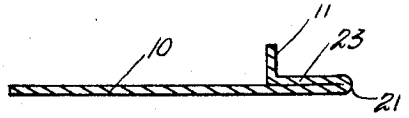


Fig. 6.

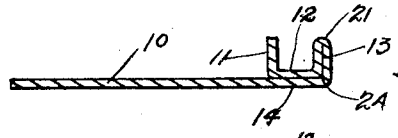


Fig. 7.

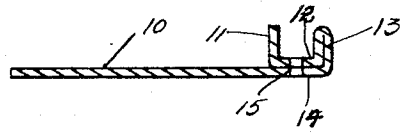
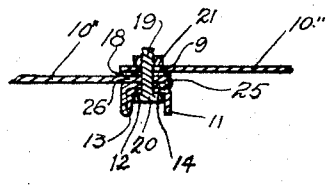


Fig. 8.



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UNITED STATES PATENT OFFICE

ANDREW A. KRAMER, OF KANSAS CITY, MISSOURI

REENFORCED METALLIC STRUCTURAL SHEET AND METHOD OF MAKING THE SAME

Application filed January 31, 1930. Serial No. 424,828.

My invention relates to metallic building units and more particularly to a reenforced metallic structural sheet. It particularly relates to such sheets or units used in the construction of tanks, and roofs for tanks and similar structures.

In the building of tanks and the roofs therefor, it has been customary to use channel members at the overlapped joints between the sheet metal members forming the roof or wall portions thereof to reenforce the sheets at the bolted joints therein and to stiffen the same. These channel members are utilized in place of washers under the heads of the bolts in order to provide a greater bearing surface for the heads and prevent buckling and warping of the sheets, and to keep the square heads of the bolts from turning so they may be tightened up from the outside. As bolted tanks are sold knocked down and are assembled at the point of erection it is very desirable to reduce the number of parts of which the same are constructed, and inasmuch as the channel members referred to reduced the number of parts below that necessary with washers and at the same time additionally reenforced the overlapped joints between the sections, these were more desirable than the washers. There are many disadvantages to the channel members, however, as these require a large amount of handling and also make it necessary to have a man to hold the same on one side of the tank or roof while the bolts are being applied to the nuts on the other side thereof. It is furthermore necessary to cut the channels oversize to assure their being of sufficient length to extend the full length of the joints when the parts are assembled.

It is a purpose of my invention to reduce the cost of fabricating and erecting such bolted tanks and the amount of labor connected therewith by providing integral reenforcing and stiffening means on the units or sheets used in erection of the tanks and fabricated at the factory. Said reenforcing and stiffening means preferably comprise channel shaped portions formed along the edges of the sheets that are to be reenforced, and which are integral therewith and form a part thereof. By providing such integral reenforcing and stiffening means for the sheets or units, a large number of operations both in the making and the erecting of the tanks from the same are avoided and the cost of production of the tanks therefrom is greatly reduced.

Among the operations necessary at the factory where fabrication of the tank takes place with the use of the separate channel members and done away with by my improved units or sheets are the following:—

Unloading the channel iron from the car, checking shipment, storing it away for use when needed, removing it from storage to place where cutting to length takes place, cutting to length, transfer to punch, punching holes for bolts in channel, moving to paint room, painting, baking paint, bundling the punched and painted lengths, checking bundle and loading it in the car. In place of this there are only four additional operations, not carried out with the sheets when used with the channel irons, necessary at the factory when the method to make the units forming the subject matter of this invention is used.

In addition to this there are a large number of operations saved in the field, at the point of erection of the tank, because of doing away with the channel iron reenforcement, and no additional ones are required in erecting my units over those necessary with the old style units. Among the operations saved at the point of erection are:—

Unloading channel iron bundles from car, checking bundles, storing channel iron bundles, loading channel iron on truck, hauling to place of erection, unloading from truck, unbundling channel iron, fitting channel iron to length of joint, holding channel iron in place in alignment with joint while bolts are inserted and nuts applied, and, frequently, the holes in the channels have to be reamed to align them with holes in the sheets.

It is a further purpose of my invention to provide a new and improved method of making sheet metal units for the construction of tanks, and similar members, with integral reenforcing means along an edge thereof, and more particularly, to a method of making a sheet metal structural unit of the character referred to having a channeled reen-

forcement provided along an edge thereof with openings for bolts in the reenforced portion.

Other objects and advantages of my invention will appear as the description of the drawing proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, but that I intend to include as part of my invention, all such obvious changes and modifications as would occur to a person skilled in this art and as would fall within the scope of the claims.

In the drawing:

Fig. 1 is a perspective view of a tank roof or deck sheet made in accordance with my invention.

Fig. 2 is an enlarged fragmentary section through the joint between two adjacent roof sheets.

Fig. 3 is a fragmentary top plan view of a portion of a tank showing my invention as applied to a sheet or unit used in the side wall of the tank.

Fig. 4 is a fragmentary edge view of a sheet showing the first step in forming the reenforcement thereon after the blank has been cut to shape.

Fig. 5 is a view similar to Fig. 4 showing the second step in forming the reenforcement.

Fig. 6 is a view similar to Fig. 4 showing the final step in forming the reenforcement.

Fig. 7 is a fragmentary section of one of the units made in accordance with my invention showing the sheet punched to receive bolts in the reenforced portion thereof, this being the final step in making the unit, and

Fig. 8 is a section similar to Fig. 2 through a joint in which the units are provided with a slightly modified form of integral channelled reenforcement.

Referring in detail to the drawing, my improved structural unit may be utilized for forming any wall portion whether it is a side wall, bottom wall, or top wall, but is shown in the drawing as being applied to the deck or roof portion of a tank and to the side wall of a tank. In the preferred construction shown in Figs. 1 and 2 my improved roof or deck sheet section is shown as comprising a sector shaped body portion 10 which is provided with a reenforced edge portion comprising a channel shaped member having a flange 11 extending substantially at right angles to the body portion, a web or connecting portion 12 which lies adjacent the body portion of the sheet in face to face relation thereto, and a doubled flange portion 13 extending substantially at right angles to the body portion 10 along the edge of the sheet in spaced relation to the flange 11. Thus a channel shaped formation is provided on the sheet which is integral therewith and a two ply portion is thus provided on the edge of the sheet where the channel is formed thereon, the portion 14 of the sheet that overlies the web portion 12 forming one ply and the web portion 12 forming the other ply.

Holes 15, are provided in the reenforced edge portion of the sheet, said holes extending through both plies thereof, and being in alignment. The opposite edge portion of each unit 10 is provided with openings 16 that align with the openings 15 of an adjoining sheet. The sheets or units are arranged in overlapping relation to collectively form the circular deck or roof joint, the joint between two of the sheets being shown in Fig. 2.

It will be noted from Fig. 2 that the overlying portion 9 of the upper sheet 10 is provided with no reenforcement and is substantially flat and flatly engages the gasket 18 provided between the sheets at the joint as does also the upper face of the portion 14 of the lower sheet 10. The adjoining units are connected together by suitable fastening elements such as the bolts 19 which have the heads 20, which may be square or otherwise have flattened faces thereon, and which are provided with the nuts 21 for clamping the overlapping portions of the sheets together and compressing the gasket 18 between said sheets to provide a water tight or gas tight joint. It will be noted that the flat faces of the bolt heads 20 engage the flanges 11 and 13 so as to be held against turning when the nuts are tightened on the bolts.

In Figs. 1 and 2 the sheet that is shown is sector shaped, being a unit for a roof or deck and said units collectively forming a substantially circular member. In Fig. 3 the same kind of a joint is shown between the curved sheets or units collectively forming the side wall of a tank, and it will be obvious that the same reenforcement can be applied to other units or sections of other portions of tanks or other sheet metal structures in a similar manner to that shown in the applications of the invention illustrated. In Fig. 3 the units 10′ have the same channeled reenforcements provided thereon as described above and the same numerals are applied thereto, as in Figs. 1 and 2.

In making the sheet metal structural units described above a substantially sector shaped blank is cut from sheet metal and this blank is first bent along the edge portion thereof that is to be reenforced as shown in Fig. 4. This may be done by means of rolls or dies, either by a rolling or breaking process. Preferably this is done by simultaneously bending the sheet metal blank at 21 and 22 to provide the flange 11 and the partly closed fold 23 thereon.

The portion 23 is next bent down into face to face relation to the body portion of the sheet to provide a doubled or two ply portion on the sheet between the flange 11 and

the bend 21, the flange 11 now extending perpendicular to the face of the sheet, as shown in Fig. 5. The doubled portion of the sheet is next bent at right angles to the body portion of the sheet at 24, or at such a point between the bend 21 and the flange 11 that the doubled flange 13 thus formed is of substantially the same height as the flange 11, a two ply portion having the plies 14 and 12 resulting between the flanges, whereby an integral channeled reenforcement is formed on the sheet adjacent one edge thereof. The sheet, after this step of the process has been carried out, is shown in Fig. 6.

After this has been done the holes 15 are punched through the plies 14 and 12 the punch going through both sheets to thus accurately align the holes in the plies as shown in Fig. 7. The holes 16 are then also, of course, punched along the opposite edge of the sheet.

Inasmuch as the various other operations such as handling and painting of the units are the same with the units made in accordance with my invention as with the ordinary units previously used, and as the only additional steps necessary in the process to produce my improved units are those shown in Figs. 4, 5 and 6, the amount of labor saved in making the same over that used in making the previously used units and the separate reenforcing channels is very great and the cost of the reenforced units made according to my method is greatly reduced over that of making the units and separate reenforcements.

While the channeled reenforcement shown in Figs. 1 to 3 inclusive is preferred, the reenforcement shown in Fig. 8 may be used for lighter gauge metal than that for which the reenforcement shown in Figs. 1 to 3 is preferred. This reenforcement is formed in the same way as previously described, except that after the sheet has been bent into the form shown in Fig. 6, the body portion is bent back on itself at 25 to provide an additional ply 26 lying adjacent the ply 14, thus making a three ply portion between the flanges 11 and 13, on the unit 10'' shown in Fig. 8, and placing the single flange 11 at the outer edge of the sheet and the doubled flange 13 spaced inwardly from said edge. The holes 15' are then punched through all three plies as shown in Fig. 8. The bolts 19, having the heads 20 and the nuts 21 thereon, have the same relationship to the flanges 11 and 13, and clamp the gasket 18 between the faces of the overlapped portions of the sheets 10'' in the same manner, as previously described.

In any of the forms of reenforcements shown, the flanges thereon serve to hold the bolts from turning when the nuts are tightened thereon, and the worker can push all the bolts through the holes in the sheets and the holes in the gaskets and these will remain in place, due to the frictional engagement between the walls of the holes in the sheets and in the gaskets and the bolts, until the same, or some other, worker is ready to place and tighten the nuts on the same from the opposite side thereof, at which time the flanges will operate to hold the bolts from turning.

Having thus described my invention, what I claim and desire to secure by United States Letters Patent is:

1. In a device of the character described, a sheet metal body portion having a doubled flange substantially perpendicular to said body portion along one edge thereof, and a portion lying in face to face relation to said body bracing portion narrower than said body portion adjacent said flange, said body portion and said last mentioned portion having aligning openings therein.

2. In a device of the character described, a sheet metal body portion having a doubled back integral flange substantially perpendicular to said body portion along one edge thereof, an integral bracing portion much narrower than said body portion extending from said flange over said body portion adjacent said doubled flange to overlie the same in face to face relation and an integral flange on said bracing portion adjacent said edge of said body portion extending substantially parallel to said first mentioned flange and in spaced relation thereto, said body portion and said overlying bracing portion having aligning openings therein.

3. The method of making a sheet metal construction unit, comprising cutting a blank out of sheet metal, forming a flange along one edge of said blank, doubling back the edge portion of said blank having the flange thereon to provide a two ply portion adjacent said flange and bending up said two ply portion between said flange and the outer edge thereof in substantial parallelism to said first flange to provide an integral channel on said unit.

4. The method of making a sheet metal construction unit, comprising cutting a blank out of sheet metal, forming a flange along one edge thereof, folding back the edge portion of said blank having the flange thereon against the body portion thereof to provide a doubled portion along said edge adjacent said flange, bending up said doubled portion between said flange and the outer doubled edge of said blank in substantial parallelism to said first flange to provide an integral channel on said unit and punching holes through both plies of said two ply portion between said flanges to provide aligning openings in said plies.

5. The method of making a sheet metal construction unit of the character described, comprising cutting a blank of sheet metal, forming a pair of oppositely directed bends therein along one edge thereof to provide a

substantially right angular flange and a partially open fold along said edge of said blank, closing down said fold against the body portion of said blank to provide a doubled edge portion with a projecting flange thereon and bending up a flange on said doubled portion in spaced relation to said first mentioned flange.

6. In the method of making a sheet metal construction unit of the character described, the steps of cutting a blank of sheet metal, simultaneously bending a substantially right angular flange and a partially open fold in opposite directions along one edge of said blank, and closing down said fold against said body portion to provide a doubled edge portion with a projecting flange thereon.

7. In a tank, a plurality of sheet metal units arranged in overlapping arrangement, said units each comprising a body portion of sheet metal having a doubled portion along an edge thereof, the adjoining unit overlapping said doubled portion and a stiffening flange along the edge of said body portion and a stiffening flange spaced therefrom at said doubled portion, said doubled portion of each unit having a row of holes therein and the overlapping portion of the adjoining unit having aligning holes therein, and headed fastening elements extending through said openings to secure the overlapping portions of adjoining units together, said flanges engaging said heads of said fastening elements to hold the same against turning.

8. In a tank, a plurality of sheet metal units arranged in overlapping arrangement, said units having doubled edge portions overlapped by the edge portions of adjoining units, said doubled edge portions and said overlapping edge portions having aligning openings therein, fastening elements extending through said openings and holding said units together, and a pair of spaced stiffening flanges projecting outwardly along opposite edges of said doubled portions of said units, said fastening elements having heads lying between said flanges and engaging the same.

9. A construction unit comprising a sheet metal body portion of smooth unbroken contour, except for integral bracing means formed along one edge thereof comprising a channel projecting from one face of said body portion and having the flanges of said channel extending substantially perpendicular to said body portion, the face of said body portion opposite that having the channel projecting therefrom being of smooth unbroken contour.

10. In a device of the character described, a sheet metal unit having a body portion having rows of openings along a pair of edges thereof, one of said edges of said pair having spaced integral flanges projecting substantially at right angles to one face of said body portion to provide a channel on said face along said edge integral with said body portion, the other face of said edge portion being of unbroken contour, and the other of said pair of edges having the face thereof, corresponding to said channeled face, of unbroken contour, whereby a pair of said units may be overlapped at said edges in face to face relation with said openings aligning to provide a flat seam joint between said units.

11. A construction unit comprising a tapering sheet metal body portion having the longitudinal edges thereof extending at an oblique angle to each other, said unit having rows of openings therein extending substantially parallel to said oblique longitudinal edges, said unit having flat opposite faces adjacent one of said edges and having a channel integrally formed adjacent the other of said edges on one face thereof, the opposite face of said unit adjacent said other edge being flat, said channel providing a pair of spaced flanges on opposite sides of one of said rows of openings extending substantially at right angles to said body portion.

12. A construction unit comprising a curved sheet metal body portion having a pair of opposite edges thereof provided with rows of openings therein extending substantially parallel to said edges, said unit having opposite faces having the same curvature as said body portion adjacent one of said edges and having a channel integrally formed adjacent the other of said edges on one face thereof, the opposite face of said unit adjacent said other edge being of substantially the same curvature as said body portion, said channel providing a pair of spaced flanges on opposite sides of one of said rows of openings extending substantially at right angles to said body portion.

In testimony whereof, I hereunto subscribe my name this 4th day of January, 1930.

ANDREW A. KRAMER.

CERTIFICATE OF CORRECTION.

Patent No. 1,905,413. April 25, 1933.

ANDREW A. KRAMER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, lines 80 and 81, claim 1, strike out the words "portion lying in face to face relation to said body bracing portion narrower than" and insert instead "bracing portion narrower than said body portion lying in face to face relation to", and line 83, for the words "last mentioned" read "bracing"; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of June, A. D. 1933.

M. J. Moore.

Acting Commissioner of Patents.

(Seal)