Nov. 11, 1969 D. L. RICHTER 3,477,752

STRUCTURAL JOINT

Filed Oct. 30, 1968

FIG. 1.

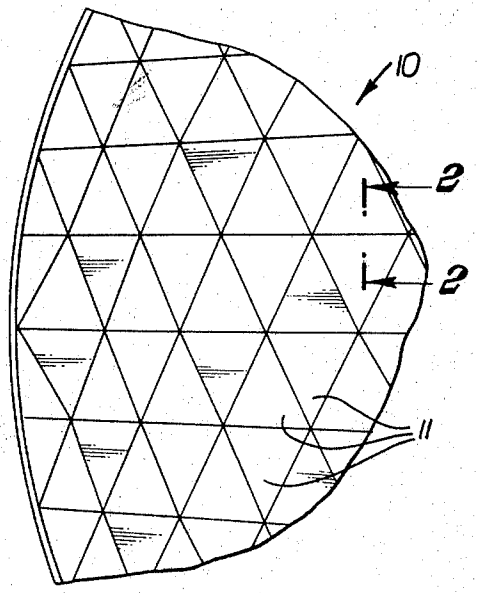


FIG. 3.

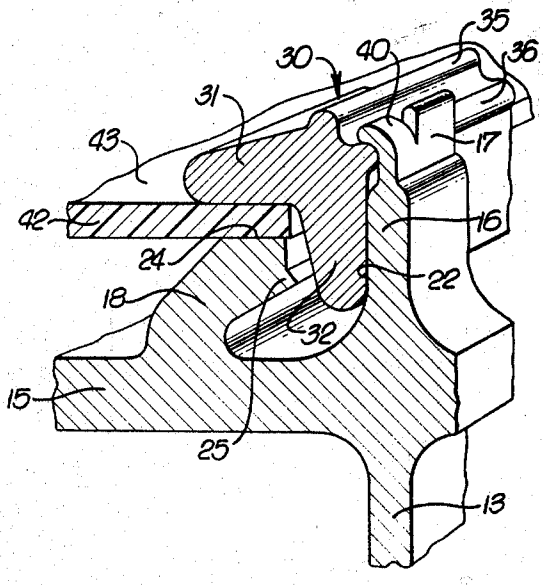


FIG. 2.

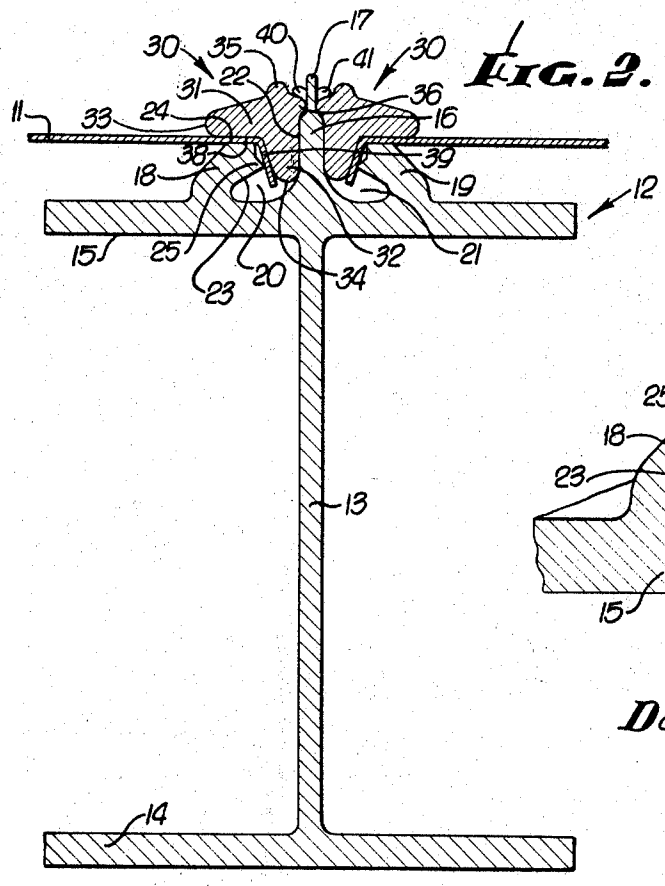
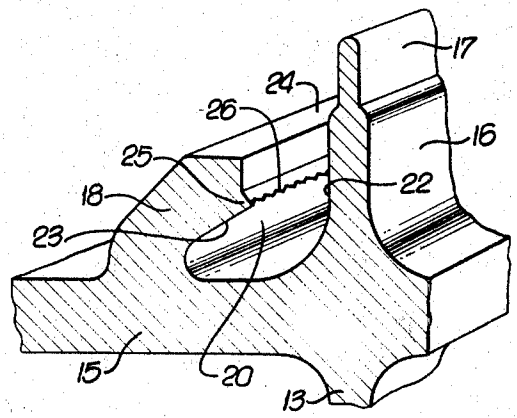


FIG. 4.



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STRUCTURAL JOINT

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ABSTRACT OF THE DISCLOSURE

A structural joint for holding sheet material which consists of laterally spaced ribs forming a pocket between them into which a marginal flange of the sheet material extends. A wedge shaped leg of a locking member is forced into the pocket pressing the flange against a knife edge while another leg of the locking member presses the margin of the sheet material against the top of the leg. A thin web or extension of the higher rib has sections broken from it and bent over the locking member to hold it in position.

Where large panels of sheet material need to be held on a structural frame work in a rigid and preferably water-tight manner, a problem encountered is one of providing for firmly holding the sheet material in place and also sealing the joint, inasmuch as the sheet material in panels often serves as the roof of a building. Typical of the structures wherein this circumstance is encountered is a structure commonly referred to as a geodesic dome. Such domes are constructed of a lattice of structural members erected in a substantially dome shape and wherein portions between the lattice are covered over by some appropriate sheet material, such for example as sheet aluminum. In some instances the spaces are triangular but they can also be of other multi-sided geometric shapes. Although the strength of such domes lies in the lattice-like construction, the sheet material, although serving as the cover, also provides a stiffening effect. In the past elaborate connections of sundry kinds have been devised to serve such a multiple purpose. To a large degree these have been expensive and difficult to install. Over an arcuate area such as domes present, the many-sided geometric patterns have posed special problems where the numerous marginal edges on each piece of sheet material must be properly mounted with respect to the next piece of sheet material, as well as being joined to the lattice structure itself. In addition to presenting difficulties in installation, sealing problems for the multitude of marginal edges have been substantial and those seals resorted to have not been dependable.

It is therefore among the objects of the invention to provide a new and improved structural joint for the mounting of sheet material upon a structural element the parts of which are inexpensive to manufacture and the structure of which is easy and quick to install.

Another object of the invention is to provide a new and improved structural joint for mounting sheet material upon a structural element which is relatively simple and inexpensive and which requires a substantially minimum number of separate parts.

Still another object of the invention is to provide a new and improved structural joint for mounting sheet material which is equally capable of holding flanged sheets and plain sheets whether they be plastic or metal, and which, once in place, provides a reinforced rigid and substantially waterproof joint.

Still further among the objects of the invention is to provide a new and improved structural joint for mounting sheet material wherein extra fastening elements such as bolts, rivets, and the like are entirely dispensed with

and the fastening accomplished merely by deforming certain basic portions of the structure.

With these and other objects in view, the invention consists in the construction, arrangement, and combination of the various parts of the device, whereby the objects contemplated are attained, as hereinafter set forth, pointed out in the appended claims and illustrated in the accompanying drawings.

In the drawings:

FIGURE 1 is a fragmentary plan view of a typical domed surface comprising one of the structures with which the joint is adapted to operate.

FIGURE 2 is a cross-sectional view of a structural joint taken on the line 2—2 of FIGURE 1.

FIGURE 3 is an end perspective view of one side of the joint showing a sheet of material which is not provided with a flange held in place by the same joint members.

FIGURE 4 is an end perspective view of the structural member upon which one of the joint parts is formed.

In an embodiment of the invention chosen for the purpose of illustration, there is shown a building structure **10**, the covering of which is a multiplicity of sheets **11** here, by way of example, having the form of triangles wherein all sides of each triangle are joined by complementary sides of adjoining triangles, such for example that there must be a joint on each side of every sheet. Details of the lattice structure are not shown inasmuch as they form no portion of the present invention. Structural elements, however, are significant and in the embodiment chosen consist of H-beams **12** of somewhat special construction consisting of a web **13**, a lower leg **14** and an upper leg **15**, the upper and lower legs being somewhat thicker in section than the web.

Extending above the upper leg **15** is a central relatively high rib **16** along the upper or outer edge of which is an extension **17** of relatively less breadth than the rib **16**. On relatively opposite sides of the high rib **16** are oppositely facing, but relatively identical low ribs **18** and **19**. The low ribs in each instance are laterally spaced from the high rib forming respective pockets **20** and **21**. The pocket **20**, for example, is formed between a wall **22** of the high rib **16** and a wall **23** of the low rib **18**. At the top or outer edge of the low rib **18** is an end face **24** which is substantially perpendicular to the side wall **22** of the high rib **16**.

Extending along the wall **23** is a projection **25**, which in the example of FIGURE 2, is substantially a knife edge and which in the example of FIGURE 4, is a serrated edge **26**. Other forms of roughness may also be provided.

An elongated locking member indicated generally by the reference character **30** consists mainly of two divergently disposed legs **31** and **32** which are substantially wedge shaped, having rounded outer ends **33** and **34**, the thickness at the outer end being relatively less than at the inner end and increasing progressively in thickness from the outside end inwardly. Inwardly facing portions of the legs **31** and **32** subtend an angle which is slightly greater than 90 degrees.

On the portion of the locking member **30** opposite from the subtended angle are a pair of laterally spaced fastening ribs **35** and **36** with a shallow, rounded valley between them.

In the form of invention of FIGURE 2 there is shown one of the sheets **11** which has on its marginal portion **38** a flange **39** bent to an angle substantially equal to the subtended angle between the legs **31** and **32**. This angular direction, however, is not critical in that the flange will ultimately be forced to assume the same angular direction in the subtended angle, when the joint is made up. To assemble the structural joint, the sheet **11** is laid upon

the face **24** and, in the embodiment of FIGURE 1 by way of example, each of the three marginal edges will overlie a corresponding face **24** of each of three H-beam members. If the sheets were pentagons, there would of course be five marginal edges and five H-beams. Other geometric shapes would have corresponding numbers of marginal edges and H-beams. After the flange has been laid in the pocket **20**, the locking member **30** is laid in place with one leg **32** projecting into the pocket. The locking member **30** is then driven into the pocket to wedge the leg **32** in place forcing the flange **39** against the projection **25**. Once driven securely in wedged position the locking member is held in that position by breaking sections **40** with an appropriate conventional tool from the extension **17** at the top of the high rib **16** and bending the sections into engagement with the adjacent fastening rib **36**, thereby to hold the locking member in the wedged position.

The locking member **30** on the right side as distinguished from the left side of FIGURE 2 is driven into position in the same fashion and held in place by sections **41** broken from the extension **17** in the opposite direction.

In the form of invention of FIGURE 3, where a sheet **42** is to be held, which is not provided with flanges as previously described, the same structural joint members are employed. In such instances the sheet may, for exple, be a plastic material and to be securely held in position it should be relatively thick, namely thick enough to support itself over a large span as much as 10 feet without bowing. With a relatively stiff sheet **42** the flange can be dispensed with and the locking member **30** driven into wedged position between the projection **25** and the wall **22** of the high rib **16** to secure and lock the locking member in position. At the same time, the leg **31** is pressed against an upper surface **43** of the sheet **42** forcing it in face-to-face engagement with the face **24** of the low rib **18**. As previously described, the locking member **30** is securely anchored in place by making use of sections **40** broken from the extension **17** of the high rib **16**.

The form of invention shown in FIGURE 4 possessed of serrated edges **26** is used in the same fashion as has already been described.

On those occasions where there should be greater assurance of a water-tight joint, plastic sealing material may be placed initially in the bottoms of the pockets **20** and **21** before the joint is made up, whereafter the locking member **30** has its leg **32** forced into the pocket and the sealing material therein, thereby to compact it into sealed relationship with other portions of the joint which are forced into face-to-face position.

While the invention has herein been shown and described in what is conceived to be a practical and effective embodiment, it is recognized that departures may be made therefrom within the scope of the invention;

Having described the invention, what is claimed as new in support of Letters Patent is:

1. A structural joint for mounting sheet material comprising:

an elongated structural base piece having an outwardly disposed supporting member, an outwardly extending high rib and an outwardly extending low rib in laterally spaced relationship on said supporting member and forming a pocket therebetween, said high rib having a side wall adjacent said pocket, said low rib having a face substantially normal to the side wall of said high rib adapted to have marginal portions of said sheet material mounted thereon, a side wall of said low rib facing the side wall of said high rib and a locking shoulder on the side wall of said low rib, an elongated locking member comprising legs extending in divergent directions, each said leg having a thickness increasing progressively from an outside end inwardly, the thickness of the outside end being less and the thickness inwardly of the outside end being greater than the initial breadth of said pocket, one of said legs being adapted to be wedged between the walls of said pocket when the other leg is in engagement with said marginal portion of the sheet, an extension on an outer edge of said high rib and sections of said extension being separated from the rest of said extension and forced against said locking member to hold it in place.

2. A structural joint as in claim **1** wherein there is an elongated projection extending from the side wall of the low rib inwardly into the pocket.

3. A structural joint as in claim **1** wherein there is a flange on said marginal portion of the sheet extending into the pocket between the side wall of the low rib and the respective leg of the locking member.

4. A structural joint as in claim **2** wherein there is an irregular gripping configuration on said elongated projection.

5. A structural joint as in claim **1** wherein said locking member has a fastening rib located on a corner thereof opposite free ends of said legs adapted to be engaged by portions of the extension of said high rib.

6. A structural joint as in claim **5** wherein there is a fastening rib for each leg spaced laterally from the other fastening rib.

7. A structural joint as in claim **1** wherein the inside end of said pocket has a greater breadth than the outside end.

8. A structural joint as in claim **1** wherein said extension on the high rib is initially continuous and said portions of the extension are broken from the extension when in fastening engagement with said locking member.

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