United States Patent [19]

Konig

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[54] **STRUCTURAL ASSEMBLY**

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[30] **Foreign Application Priority Data**

Jan. 23, 1970 Germany ..... P 20 03 010.8

[52] **U.S. Cl.** ..... **52/758 D,** 52/285

[51] **Int. Cl.** **F16b 5/00**

[58] **Field of Search** ..... 287/189.36 C, 189.36 D, 287/20.92 C, 20.92 D, 20.92 J, 20.92 W, 20.92 D; 52/277, 281, 282, 285, 471, 472, 570, 584, 284

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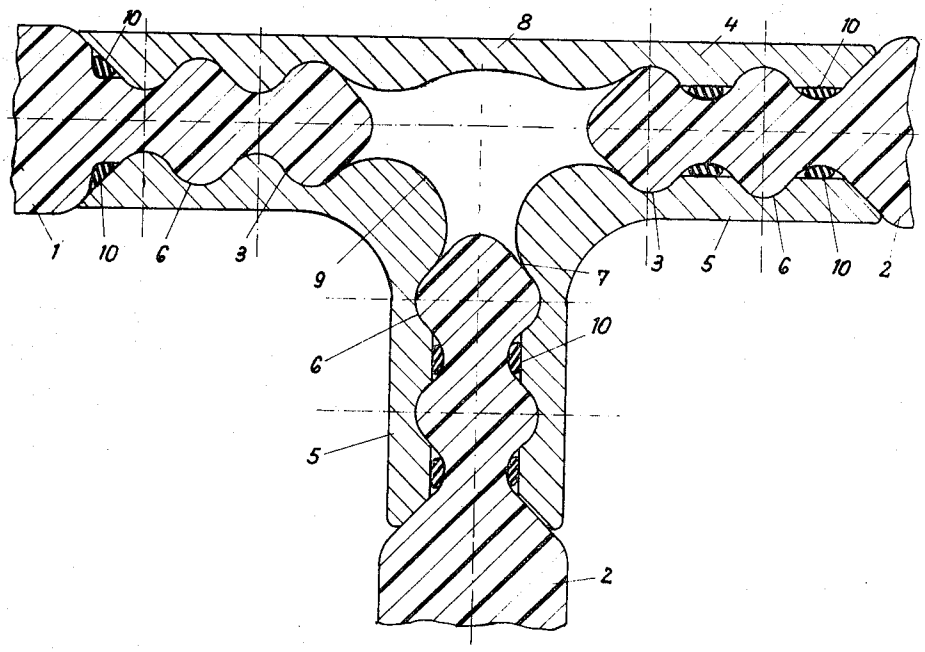
[57] **ABSTRACT**

Each of a plurality of platelike elements comprises at least one undulated edge portion, which is undulated on opposite sides and is connected by connecting elements comprising a plurality of undulated connecting portions which are complementary to and mate with undulated edge portions of respective ones of the platelike elements on opposite sides thereof, interconnecting portions connecting the undulated connecting portions, and fastening elements holding the undulated connecting portions in mating engagement with the undulated edge portions. Each of the undulated edge portions and of the undulated connecting portions comprises at least one high portion, at least one low portion adjacent to the high portion, and a flat surface between the high and low portion. The flat surface of each of the undulated connecting portions mates with the flat surface of the respective undulating edge portion.

9 Claims, 10 Drawing Figures



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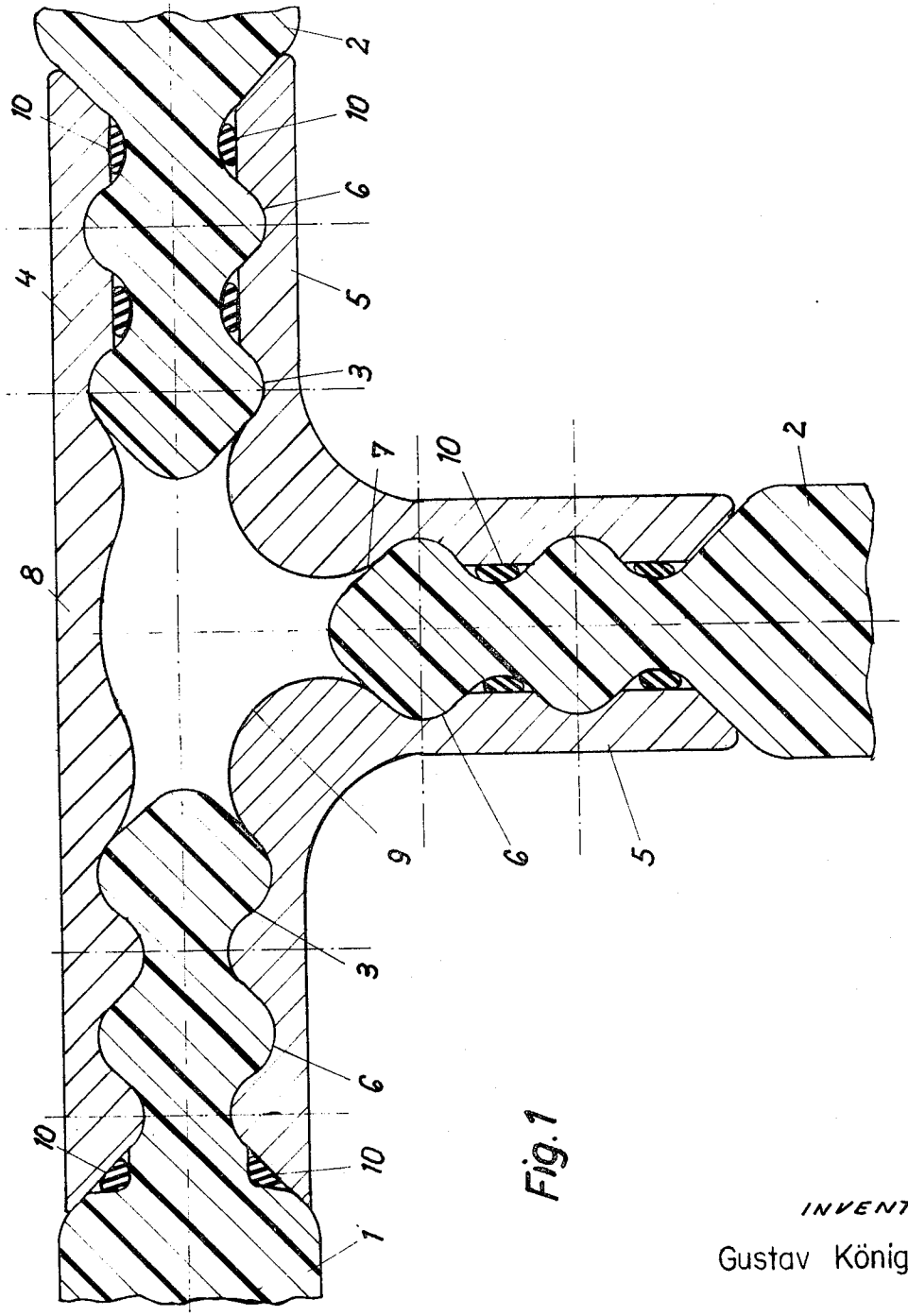

Fig. 1

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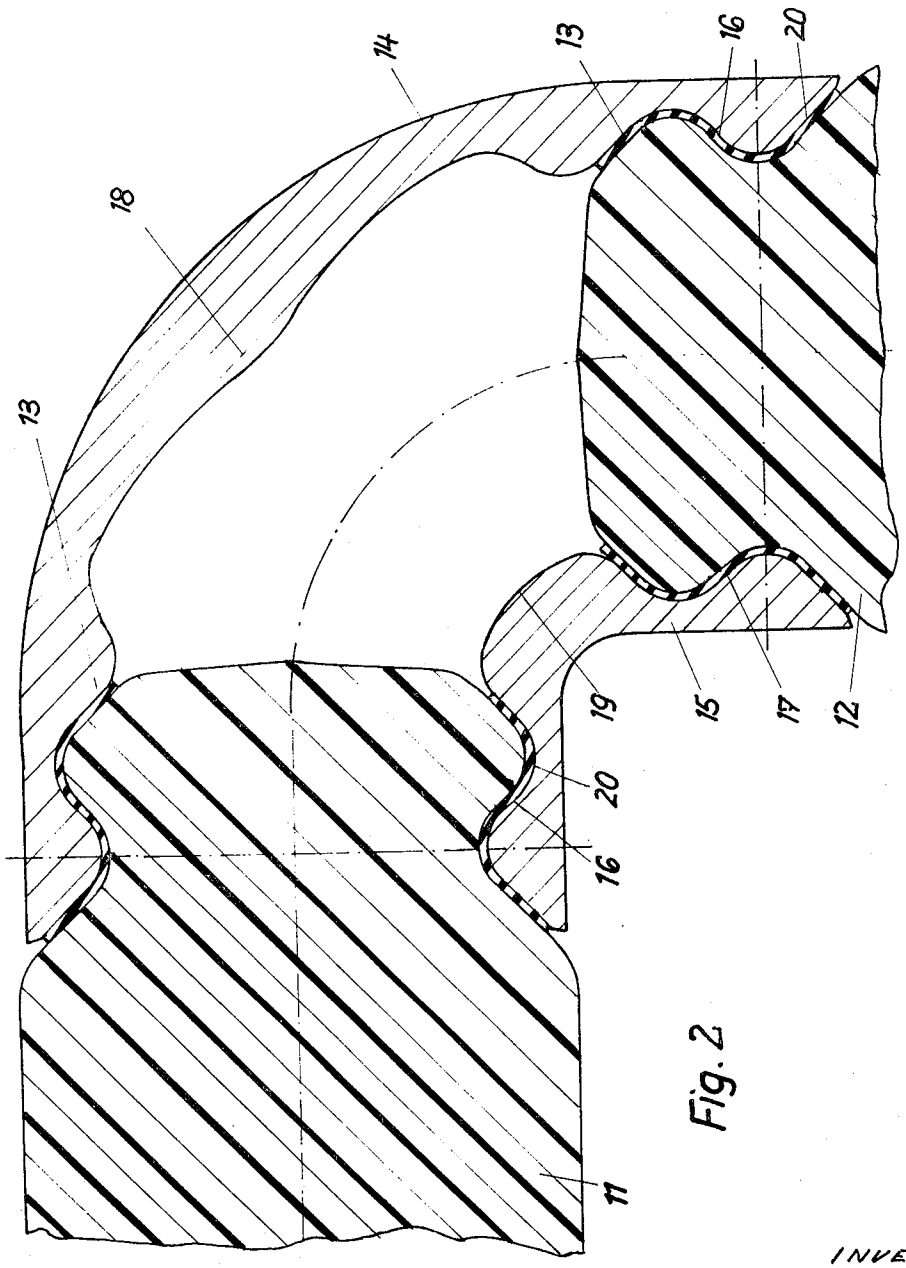

Fig. 2

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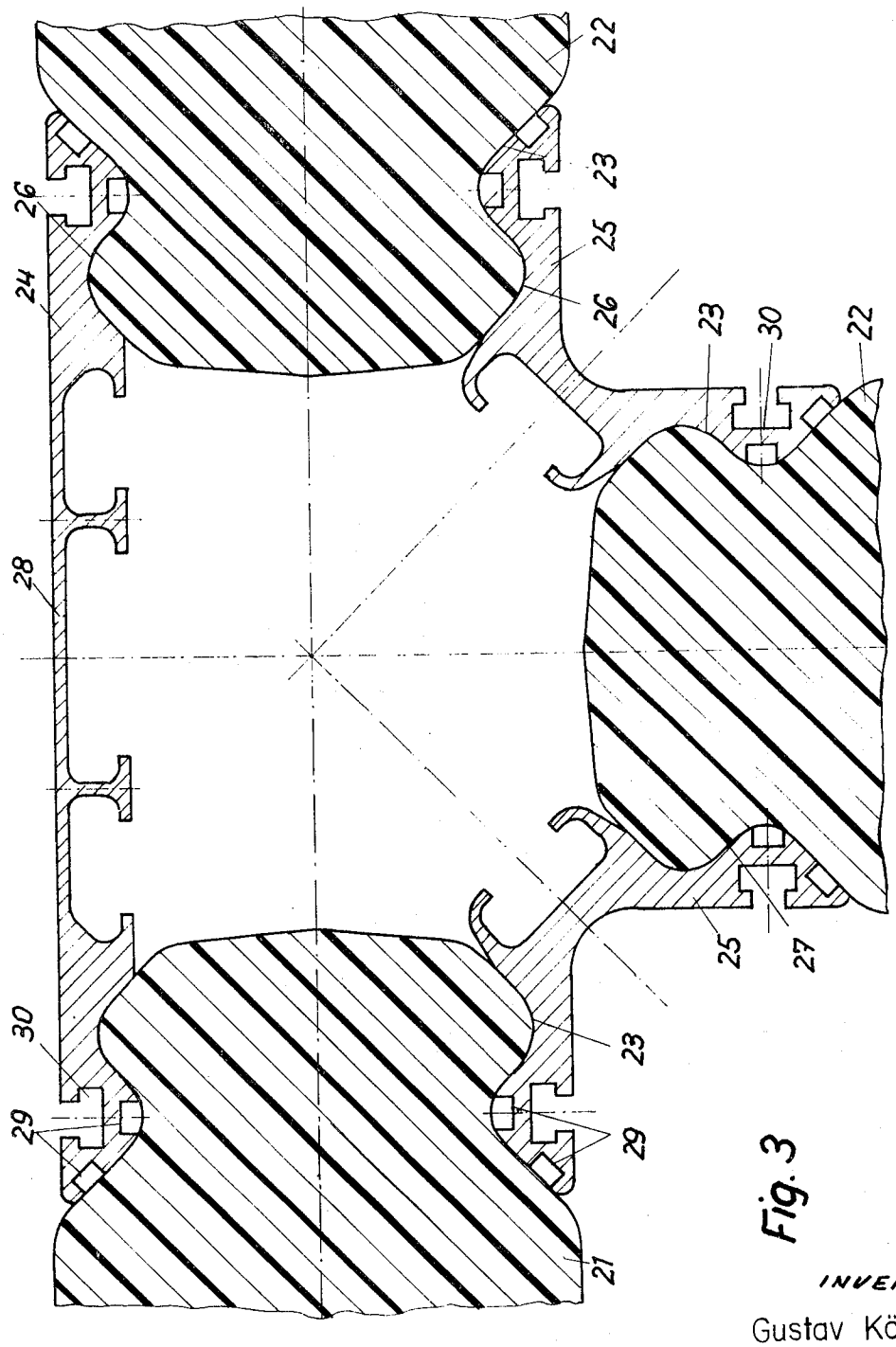

Fig. 3

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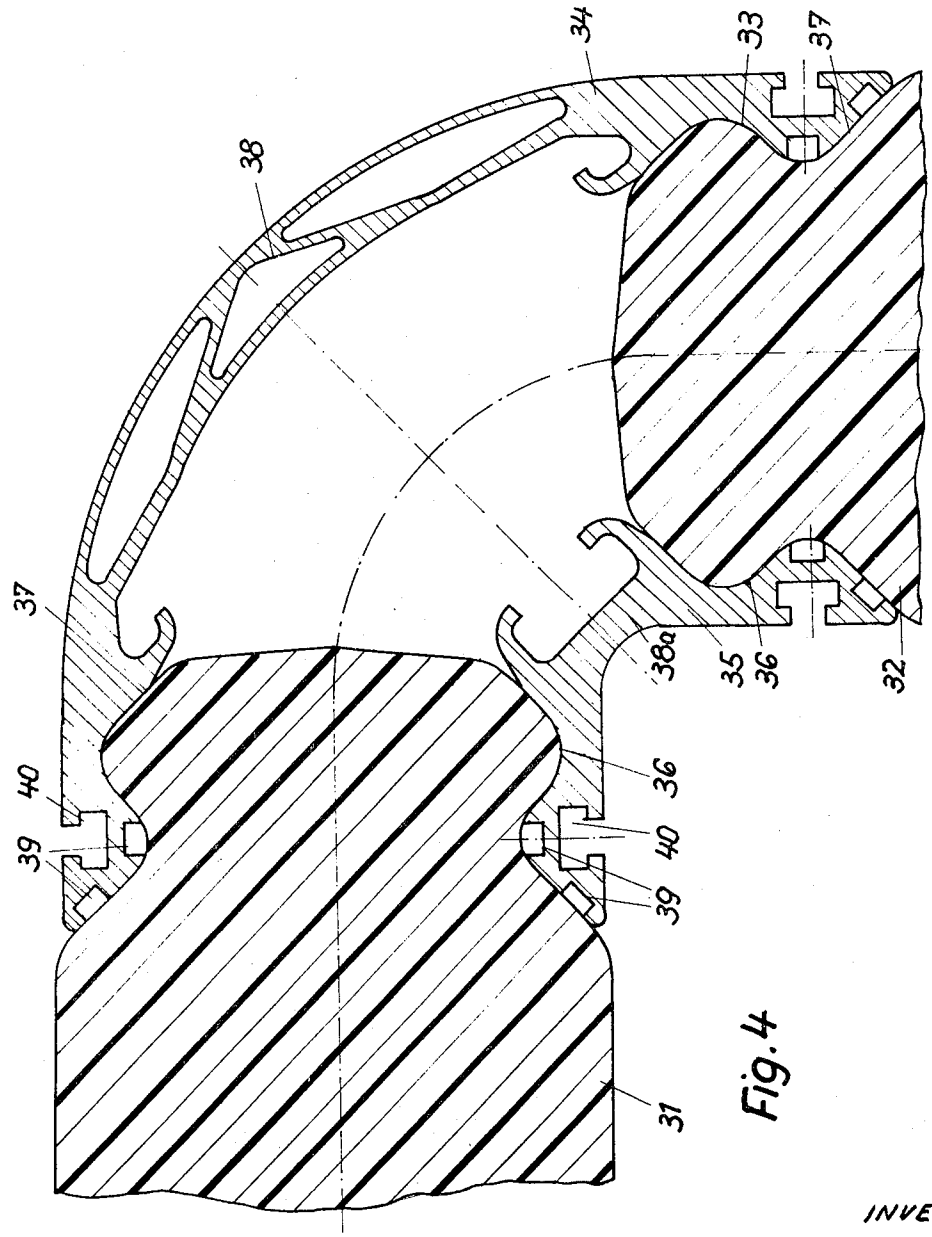

Fig. 4

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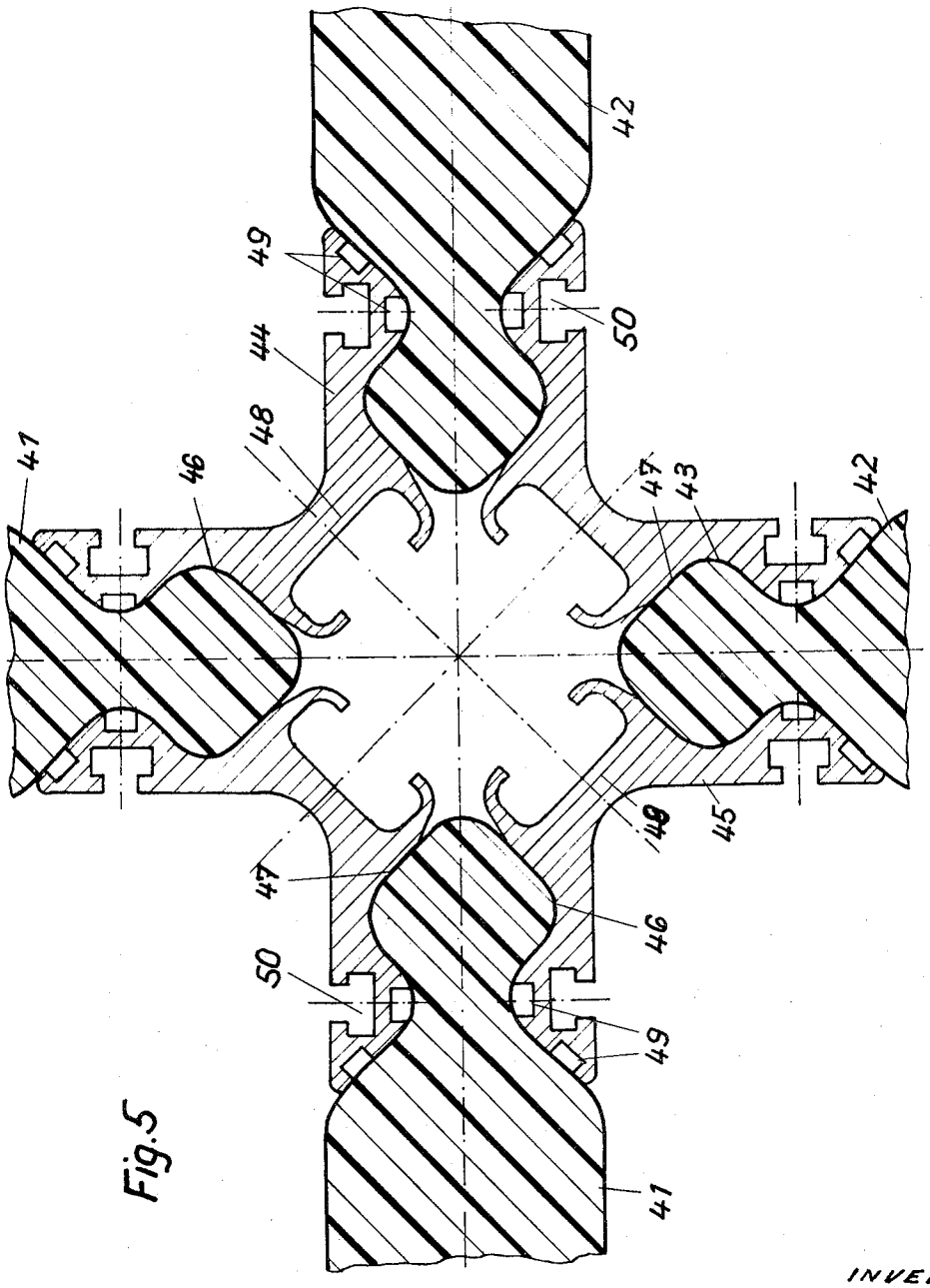

Fig.5

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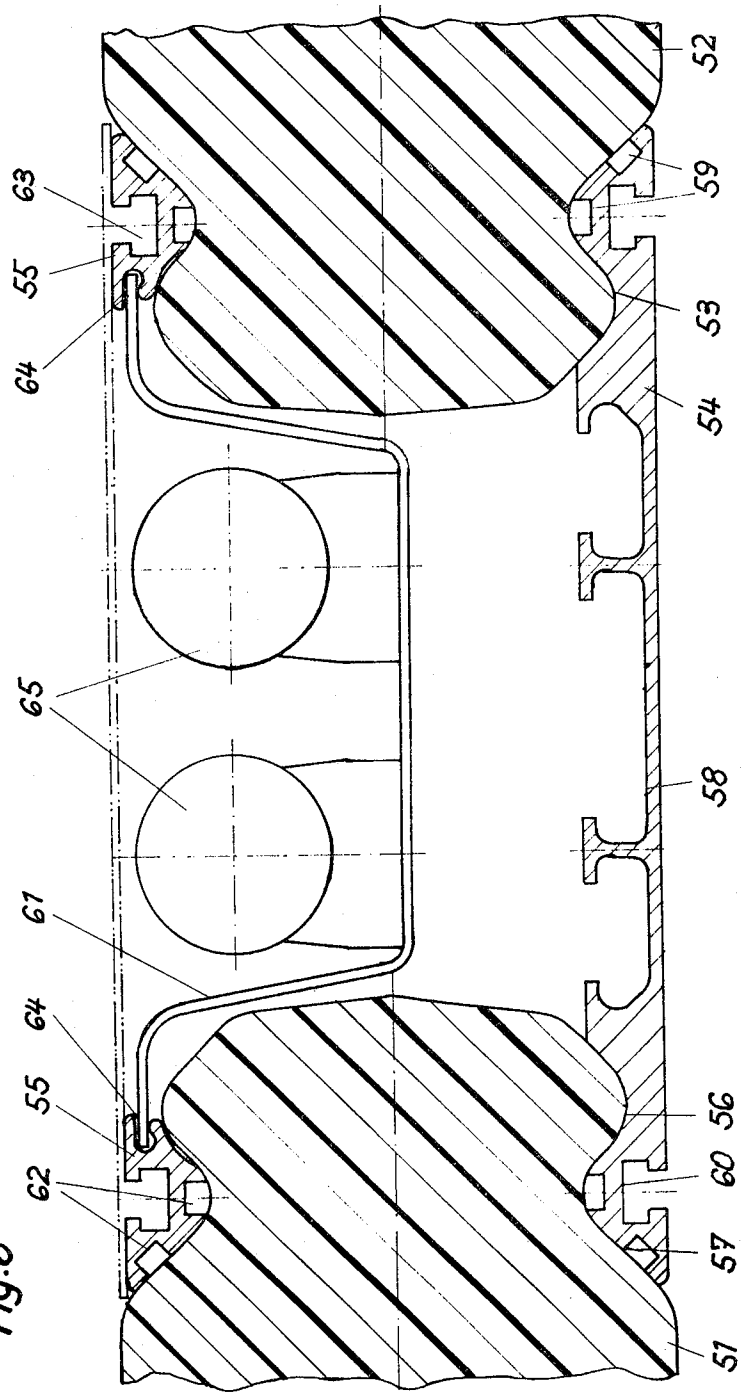

Fig.6

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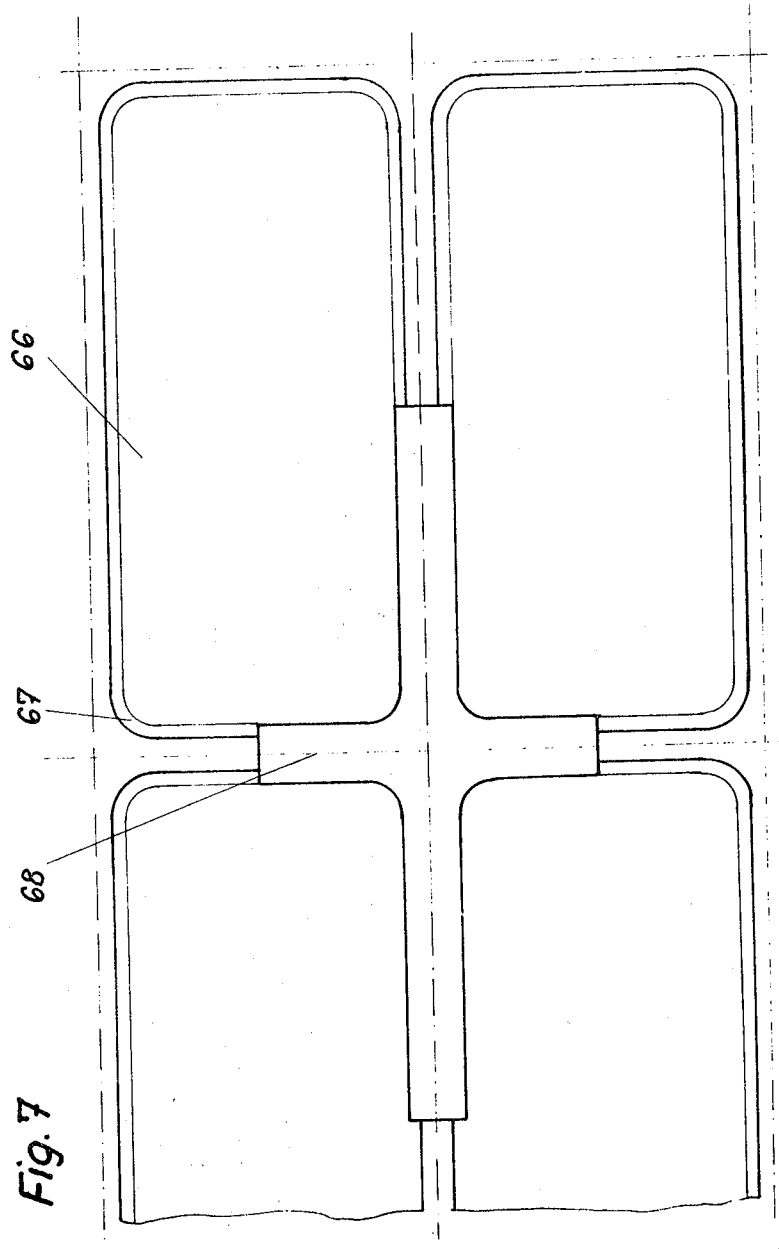

Fig. 7

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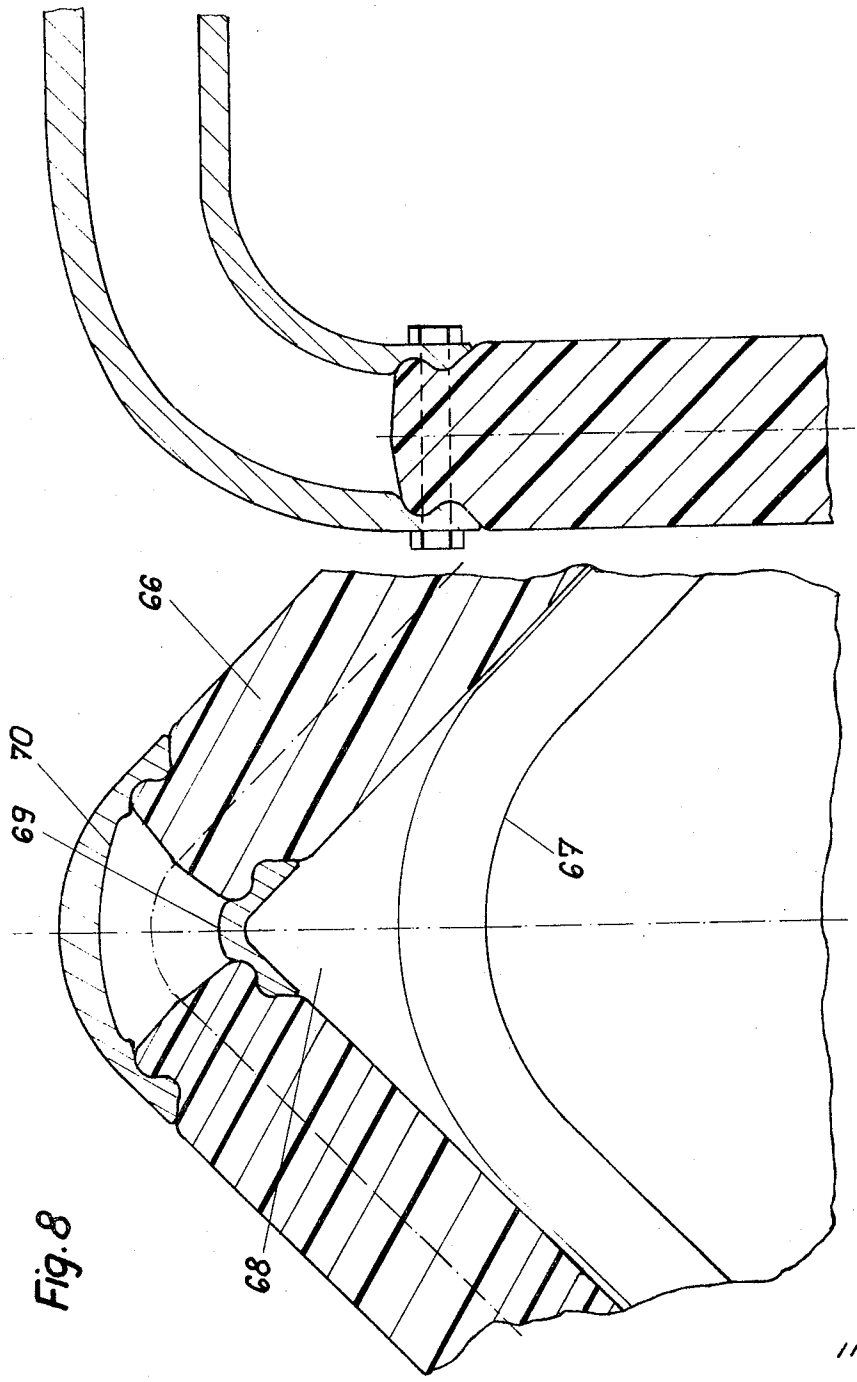

Fig. 8

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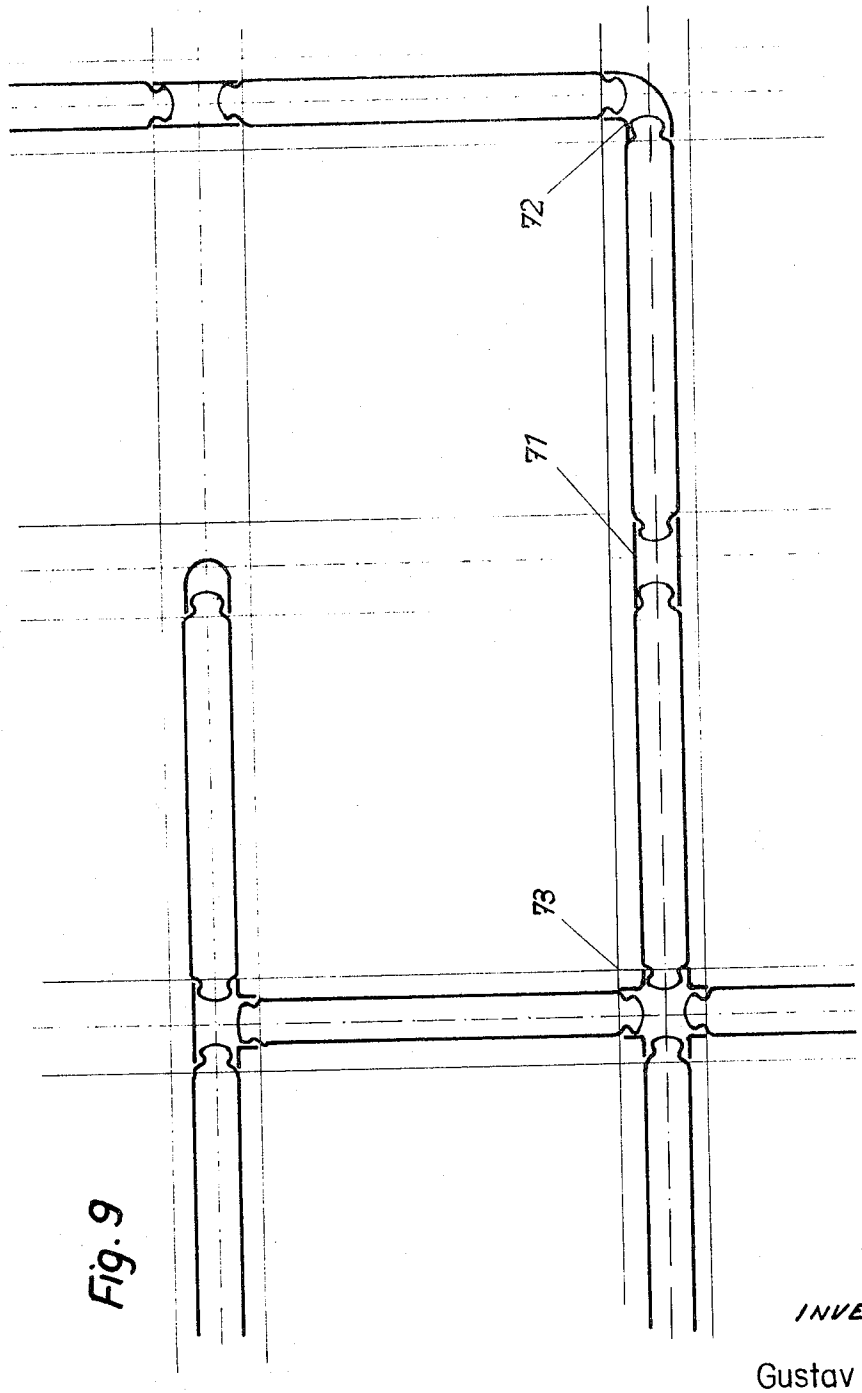

Fig. 9

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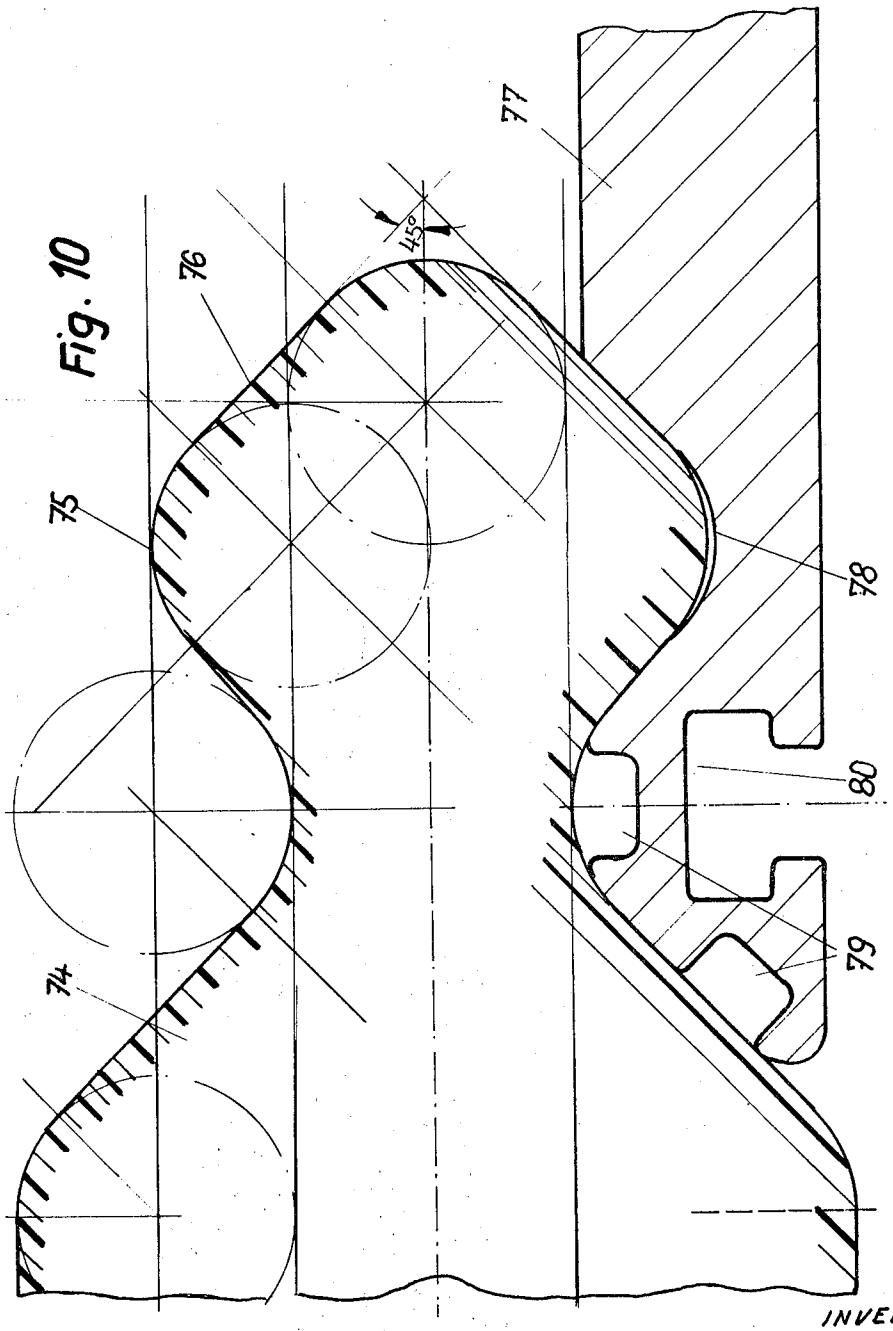
Fig. 10



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STRUCTURAL ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to a structural assembly comprising at least two prefabricated platelike elements. Such assembly has been disclosed and claimed in the prior U.S. Pat. application Ser. No. 696,571 filed Jan. 9, 1969, and now U.S. Pat. No. 3,632,149.

In the structural assembly disclosed in the prior application, the platelike elements have undulated or curvilinear edge portions, and connecting members are provided which have undulated or curvilinear connecting flanges which are complementary to and mate with said undulated edge portions of said platelike elements to join them in the assembly. Each of the platelike elements comprises preferably two spaced apart layers.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide such structural assembly having joints which have a higher force resisting and transmitting capacity.

This object is accomplished in accordance with the invention in that each wave of the undulating edge portions and of the undulating connecting flanges comprises between its crest and trough a flat portion, which extends preferably at an angle of 45° to the direction of rise of the wave. In a platelike element consisting of two spaced apart layers, each of said layers is provided with undulated edge portions which are symmetrical to those of the other layer. The flat intermediate surfaces in contact with each other enable a transmission of high tensile and compressive forces and result in an increased resistance to tilting. Just as in the assembly according to the prior application, individual platelike elements can easily be joined to and removed from the assembly, also at the corners, because the flanged connecting elements can be loosened so that the respective platelike elements can be slidably moved relative to each other without interengagement.

The complementary undulated flanges are provided with wave crests, which are connected by connecting webs, which span the gap between the plates. At corner joints, the wave crests of the connecting flanges may merge into a long or a short arcuate connecting web.

The connecting flanges may consist of hollow or open profiled members and may be provided with stiffening crosspieces. Alternatively, the space between the platelike elements and the connecting members may accommodate stiffening ribs, or the connecting flanges may form parts of a stiffening framework.

BRIEF DESCRIPTION OF THE DRAWINGS

Further details of the invention will now be described more fully with reference to the drawing, in which

FIGS. 1 and 2 are transverse sectional views showing longitudinal and corner joints of a first embodiment of the invention.

FIGS. 3 and 4 are transverse sectional views showing longitudinal and corner joints of a second embodiment of the invention.

FIG. 5 is a transverse sectional view showing a cross-shaped joint of a third embodiment of the invention.

FIG. 6 is a transverse sectional view showing a longitudinal joint of a fourth embodiment of the invention.

FIGS. 7 and 8 are, respectively, an elevation and a sectional view showing a corner joint between platelike elements having rounded corners.

FIG. 9 is a diagrammatic view showing several joints between platelike elements and

FIG. 10 is a sectional view showing a profiled edge portion according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a transverse sectional view showing a longitudinal joint and a corner joint between plates 1 and 2, which are provided at their edges with waves 3. Connecting members 4 and 5 are provided with flanges, which have waves 6 that are complementary to the waves 3. The flanges and plates may be connected, e.g., by means of transverse threaded fasteners or transversely acting clamping means, as is disclosed more in detail in the prior application. To improve the transmission of force, each of the waves 3 and 6 comprises a flat surface 7, which in the present embodiment extends at an angle of 45° to the direction of rise of the wave. Reference is made in this connection to FIG. 10, which is drawn in full size. If the plates 1 and 2 consist of two spaced apart layers, each plate comprises two symmetrical halves and each layer comprises undulated or curvilinear edge portions 3 which are symmetrical to those of the other layer.

The complementary undulated or curvilinear connecting members 4 and 5 consist, e.g., of plastic material and have flanges which are provided with wave crests 6. The flanges of the connecting member 4 of the longitudinal joint are connected by a web 8, which spans the space between the plates. At the corner joint, the flanges of the inner connecting member 5 merge into shorter arcuate connecting webs 9. Gaskets 10 are inserted between the waves 3 of the plates and the waves 6 of the flanges. In the present embodiment, these gaskets are contained in continuous peripheral grooves formed at the edges of the plates so that the gaskets may consist of closed rings.

FIG. 2 is a transverse sectional view showing another corner joint between two plates 11 and 12, which are formed at their edges with waves 13, which merge into flat surfaces. The plates are connected by connecting members 14 and 15 having flanges formed with complementary waves 16 and by means of transverse threaded fasteners or transversely clamping means. To improve the transmission of force, the waves 13 and 16 have flat surfaces 17 between the wave crests and wave troughs. In the present embodiment, the surfaces 17 extend at an angle of 45° to the direction of rise of the wave crests. The plates 11 and 12 consist of two spaced apart layers, each plate consists of two symmetrical halves, and each layer has undulated edge portions 13 which are symmetrical to those of the other layer. The connecting members 14 and 15 having complementary waves including the wave crests 16 consist again of plastics material. The outer connecting member is provided with a long arcuate connecting web 18 and the inner connecting member is provided with a short arcuate connecting web 19. These arcuate connecting webs span the space between the plates. Flange gaskets 20 are disposed between the waves 13 of the plates and the waves 16 of the flanges.

FIG. 3 is a transverse sectional view showing a longitudinal joint and a corner joint between plates 21 and 22. The latter have edge portions formed with waves 23, which merge into flat surfaces. The plates are connected by connecting members 24 and 25 formed with

complementary waves **26** and by means of transverse threaded fasteners or transversely clamping means. To improve the transmission of force, each of the waves **23** and **26** is provided between its crest and trough with a flat surface **27**, which extends at an angle of 45° to the direction of rise of the wave. The connecting members **24** and **25** provided with the complementary waves consist, e.g., of aluminum sections and are formed with the wave crests **26**. In the present embodiment, the aluminum sections form open profiles **28** and are provided with stiffening ribs. Cross-pieces between the two connecting flanges may be provided and are not shown here.

As is also apparent from the drawing, the connecting flanges are provided at their waves **26** with sealing grooves **29** for receiving sealing material. The connecting flanges **24** and **25** may be provided with fixing grooves **30** on the outside and/or inside. In external walls, the fixing grooves **30** may hold sheeting plates; in ceilings they may hold ceiling plates, lighting fixtures or the like; and in internal walls they may be used for a fixation of decorative panels, suspended shelves or other furniture or the like. The grooves may also form tracks for curtains, roller blinds, sliding doors and the like without need for special track rails.

FIG. **4** is a transverse sectional view showing a corner joint between two plates **31** and **32** having undulated edge portions **33** and flat-surfaced ends. Connecting members **34** and **35** are provided with complementary waves **36** and together with transverse threaded fasteners or transversely clamping means provide a releasable connection between the plates. The transmission of force is improved by flat surfaces **37**. The connecting members **34** and **35** consist, e.g., of aluminum sections and are formed with the wave crests **36**. The outer aluminum sections comprise a hollow profile **38** having stiffening ribs and the inner aluminum sections comprise an open profile **38***a*. In this case too, the space between the plates **31** and **32** and the connecting members **34** and **35** may accommodate stiffening ribs or a stiffening framework. The waves **36** of the connecting members are provided with sealing grooves **39** and fixing grooves **40**.

FIG. **5** is a transverse sectional view showing a cross-shaped joint. In FIG. **5**, items **41** to **50** correspond respectively to items **31** to **40** in the embodiment of FIG. **4**. It is also apparent that transverse threaded fasteners may be accommodated in the cross-shaped free space to clamp the parts of the assembly together.

FIG. **6** is a transverse sectional view showing another longitudinal joint. In FIG. **6**, items **51–60** basically correspond respectively to parts **31** to **40** of the embodiment of FIG. **4**. In FIG. **6**, however, the flanges of the connecting members **35** are replaced by undulated connecting elements **55**, which are connected by a connecting trough **61**. The connecting elements **55** consist, e.g., of aluminum sections and are formed each with a wave crest, a sealing groove **62** and a fixing groove **63**, as in the embodiment shown in FIG. **5**. FIG. **6** shows also a locking slot **64** for the connection to the connecting trough **61**. These connecting troughs **61** serve, e.g., for spanning different spaces or for connections to other walls. They may also be used to accommodate various elements, such as neon tubes **65**, which form a light source that is apparently incorporated in the wall.

FIG. **7** is an elevation from which it is apparent that the plates **66** may have rounded corners **67** and may be connected to form corner joints with flanged connecting members **68** which have the form of angles, Tees or cross-shaped members or three-dimensional nodes. Such connection is shown in a transverse sectional view in FIG. **8**, where the connecting members **69** and **70** of the corner joints **67** are also apparent. The rounded corners enable also an improved transmission of force, e.g., because they can accommodate corner pieces of stiffening frameworks, and they also facilitate the access to electric wiring conduits and water conduits.

FIG. **9** shows diagrammatically the application of the invention to corner joints **72**, cross-shaped joints **73** and other joints **71** between plates. Owing to the flanged connection according to the invention, the plates are freely movable relative to each other when a plate is to be assembled or removed.

FIG. **10** shows clearly a plate edge portion **74** formed with curvilinear edge portion or waves **75** which include at least one convex high portion, one concave low portion and a flat surface **76** between the convex high and concave low portions, which are provided according to the invention. Connecting members **77** with mating curvilinear edge portions are also provided. For an improved transmission of force, the convex high and concave low portions have substantially equivalent radii of curvature, and the surfaces **76** extend preferably at an angle of 45° to the direction of rise of the associated convex high portions. Because of the substantially equivalent radii of curvature, the distance between the peak of each convex portion and the trough of its respective adjacent concave portion in the thickness direction of the plate is of the order of magnitude of the radii of curvature. According to a preferred embodiment, each plate is provided with a pair of curvilinear edge portions which are in mirror image relationship. The mirror image relationship is such that the ratio of the thickness of the plate between corresponding convex high portions and the thickness of the plate between corresponding concave low portions is of the order of magnitude of 2 to 1. The connecting member **77** defines a clearance **78** for improved resilience and just as in preceding embodiments is provided with sealing grooves **79** and a fixing groove **80**.

What is claimed is:

1. In a structural assembly of finished plates spaced from one another a distance corresponding at least to the thickness of the edge of the finished plates, each plate initially having at least one curvilinear edge portion, and profiled connecting means disposed on the sides of the spaced apart finished plates, with each connecting means having a plurality of curvilinear connecting portions at least at their sides facing the finished plates, which connecting portions are complementary to and mate with a respective curvilinear portion of the finished plates, each of the curvilinear edge portions and the curvilinear connecting portions comprise at least one high portion, at least one low portion adjacent to the high portion and a flat surface between the high and low portion, with the flat surface of each of the curvilinear connecting portions mating with the flat surfaces of a respective curvilinear edge portion, the connecting means covering the space between adjacent finished plates, the assembly also comprising means securing said connecting means to each said plate, the improvement wherein the high portions have a predetermined direction of rise and each of the flat surfaces extends at an angle of 45° to the direction of

rise of the associated high portion, thereby improving the force transmission between mating flat surfaces.

2. In a structural assembly of finished plates spaced from one another a distance corresponding at least to the thickness of the edge of the finished plates, each plate having at least one curvilinear edge portion, and profiled connecting means disposed on the sides of the spaced apart finished plates, with each connecting means having a portion covering the space between adjacent finished plates and a plurality of connecting arms each having a curvilinear edge portion at least at their sides facing the finished plates, which curvilinear edge portions are complementary to and mate with a respective curvilinear edge portion of the finished plates, the assembly also comprising means securing said connecting means to each said plate, the improvement wherein each of the curvilinear edge portions comprises at least one convex high portion, at least one concave low portion adjacent to the convex high portion and a flat surface between the convex high and concave low portions, with the flat surface of each of the curvilinear edge portions of said arms mating with the flat surfaces of a respective curvilinear edge portion of said plates, said convex high and concave low portions having substantially equivalent radii of curvature such that the distance between the peak of each convex portion and the trough of its respective adjacent concave portion in the thickness direction of said plate is of the order of magnitude of said radii of curvature, said convex high portions having a predetermined direction of rise and each of the flat surfaces extending at an angle of 45° to the direction of rise to its associated convex high portion, thereby improving the force transmission between mating flat surfaces.

3. An assembly as set forth in claim 2, wherein each said plate has a pair of curvilinear edge portions in mirror image relationship, with the ratio of the thickness of each said plate between corresponding convex high portions and the thickness thereof between corresponding concave low portions being of the order of magnitude of 2 to 1.

4. An assembly as set forth in claim 2, in which the finished plates further have rounded corners adjacent to the curvilinear edge portions.

5. An assembly as set forth in claim 4, in which two of the finished plates define a corner joint and the profiled connecting means comprise an angle member, said angle member including connecting arms each having a curvilinear edge portion in mating engagement with the curvilinear edge portions of the finished plates defining said corner joint, and an arcuate interconnecting portion adjacent to the connecting arms.

6. An assembly as set forth in claim 4, in which three of the finished plates define a T-shaped joint and the profiled connecting means comprise a T-member, said T-member including connecting arms each having a curvilinear edge portion in mating engagement with the curvilinear edge portions of the finished plates defining said T-shaped joint, and arcuate interconnecting portions adjacent to the connecting arms.

7. An assembly as set forth in claim 4, in which four of the finished plates define a cross-shaped joint and the profiled connecting means comprise cross-shaped members, said cross-shaped members including arms each having a curvilinear edge connecting portion in mating engagement with the curvilinear edge portions of the finished plates defining said cross-shaped joint, and arcuate interconnecting portions adjacent to the connecting arms.

8. An assembly as set forth in claim 4, in which at least three of the finished plates define a three-dimensional nodal joint and the profiled connecting means comprise a node member, said node member including arms each having a curvilinear edge connecting portion in mating engagement with the curvilinear edge portions of the finished plates defining said nodal joint, and arcuate interconnecting portions adjacent to the connecting arms.

9. An assembly as set forth in claim 2 wherein said radii of curvature and the distance between the peak of each convex portion and the trough of its respective adjacent concave portion in the thickness direction of said plate have a value of at least of the order of one-fourth of an inch.

* * * * *