March 3, 1970 H. M. DIAZ ETAL 3,498,654

FRAME STRUCTURE ASSEMBLY

Filed July 22, 1968 4 Sheets-Sheet 1

Fig. 1

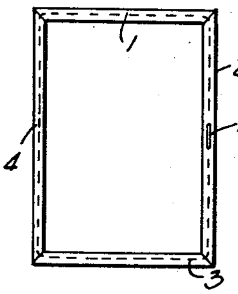


Fig. 2

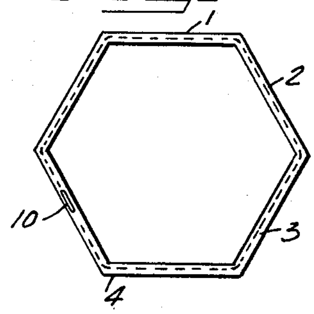


Fig. 3

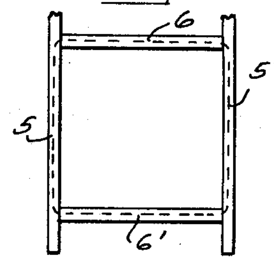


Fig. 4

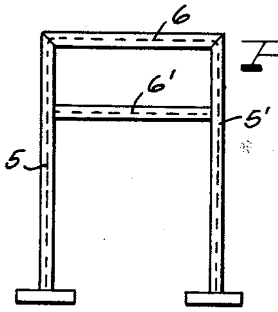


Fig. 5

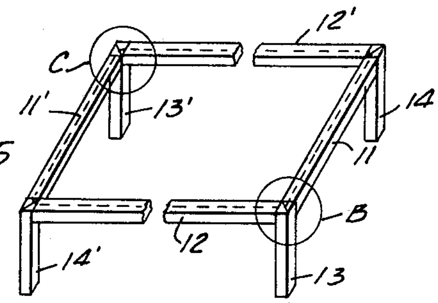


Fig. 6

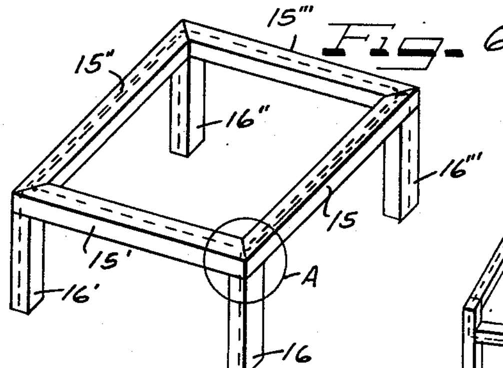


Fig. 7

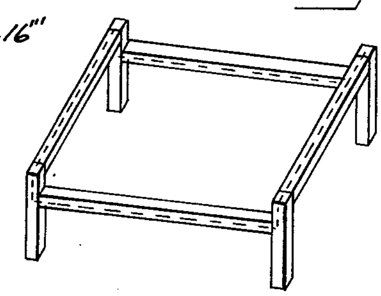


Fig. 8

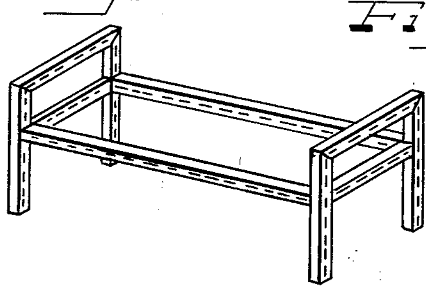
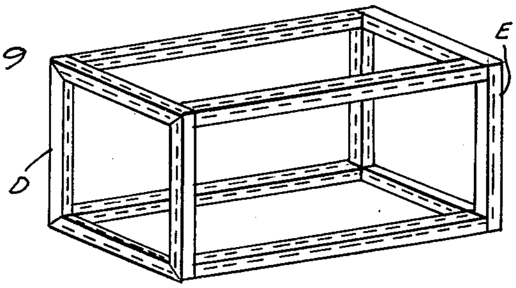


Fig. 9



INVENTORS
HECTOR MARIO DIAZ
RODOLFO OSCAR DIAZ
RODOLFO EXEQUIEL ROMERO

BY Hill, Sherman, Meroni, Gross & Simpson
ATTORNEYS

March 3, 1970 H. M. DIAZ ETAL 3,498,654

FRAME STRUCTURE ASSEMBLY

Filed July 22, 1968 4 Sheets-Sheet 2

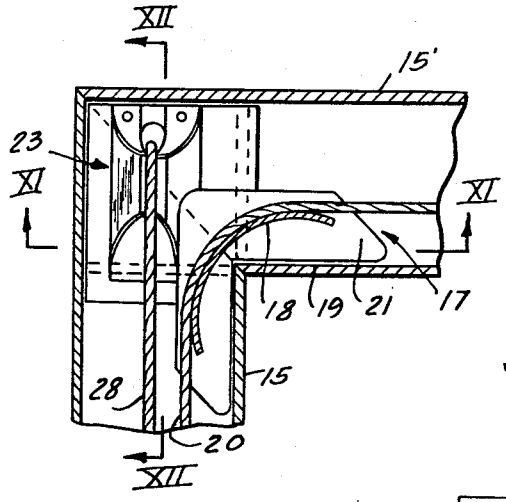


Fig. 10

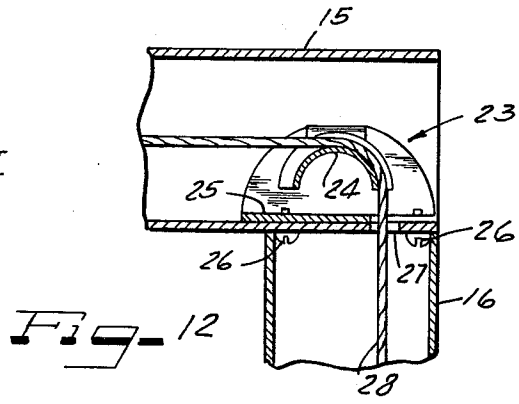


Fig. 12

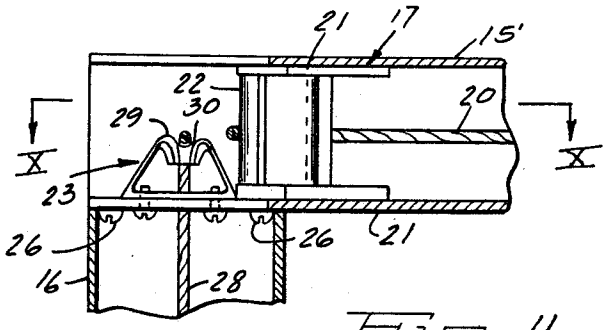


Fig. 11

Fig. 14

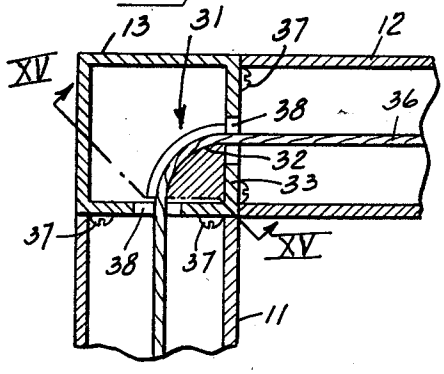
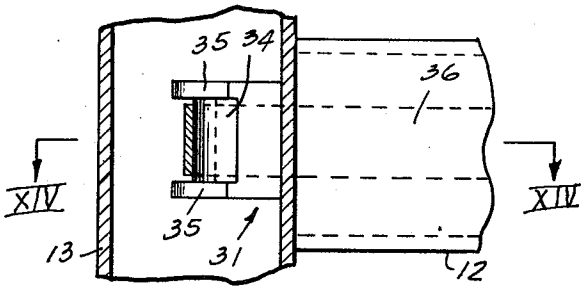


Fig. 15



INVENTORS
HECTOR MARIO DIAZ
RODOLFO OSCAR DIAZ
RODOLFO EXEQUIEL ROMERO

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

March 3, 1970 H. M. DIAZ ETAL 3,498,654

FRAME STRUCTURE ASSEMBLY

Filed July 22, 1968 4 Sheets-Sheet 3

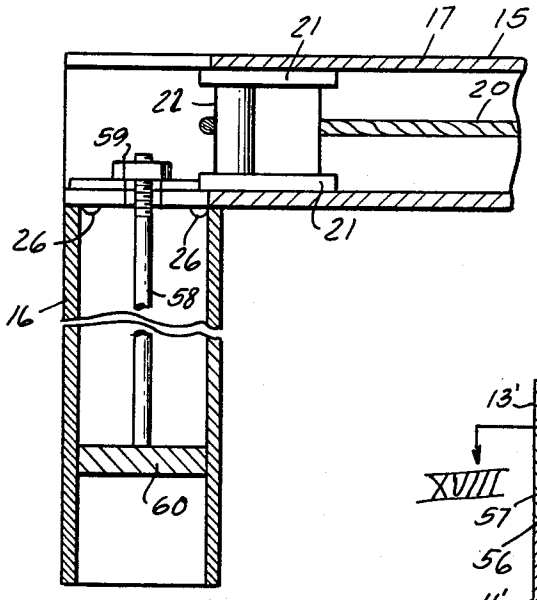
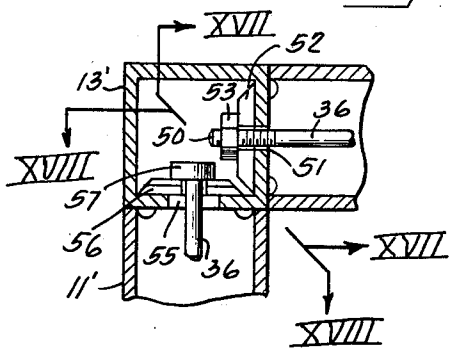


Fig. 13

Fig. 16



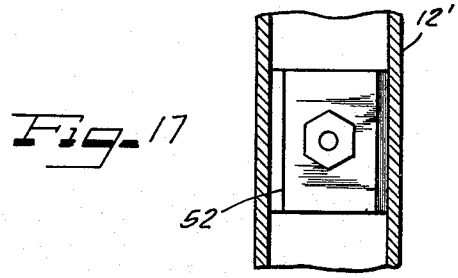


Fig. 17

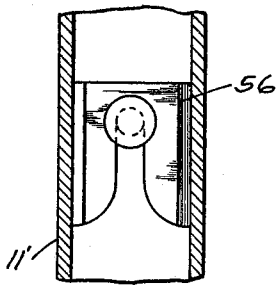


Fig. 18

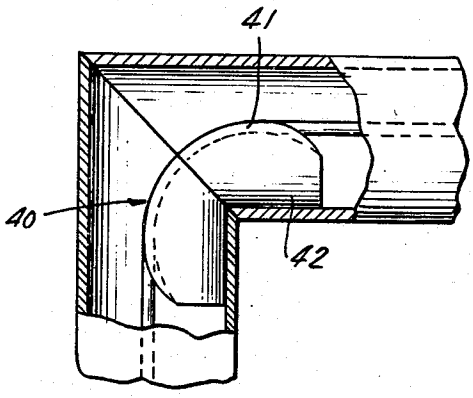


Fig. 21

INVENTORS
HECTOR MARIO DIAZ
RODOLFO OSCAR DIAZ
RODOLFO EXEQUIEL ROMERO

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

March 3, 1970 H. M. DIAZ ETAL 3,498,654

FRAME STRUCTURE ASSEMBLY

Filed July 22, 1968 4 Sheets-Sheet 4

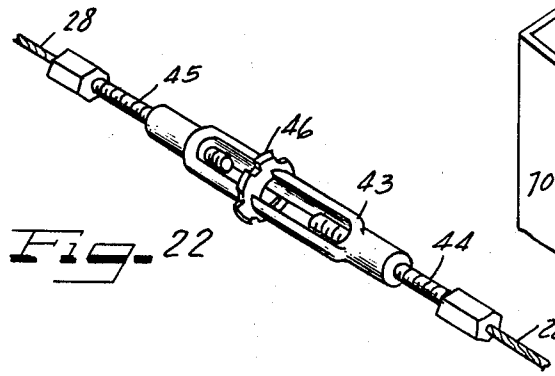


Fig. 22

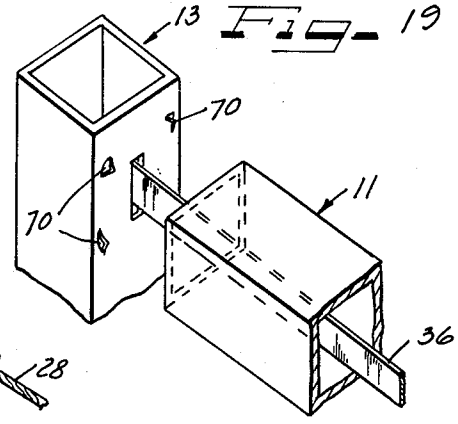


Fig. 19

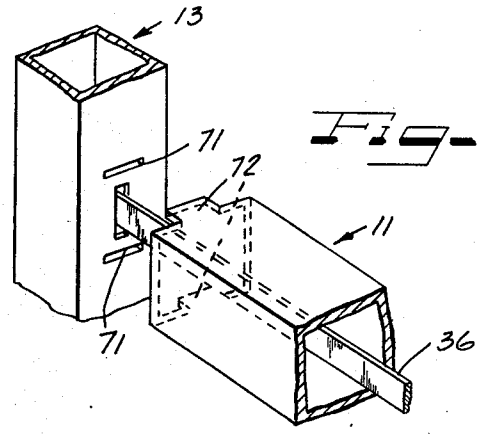


Fig. 20

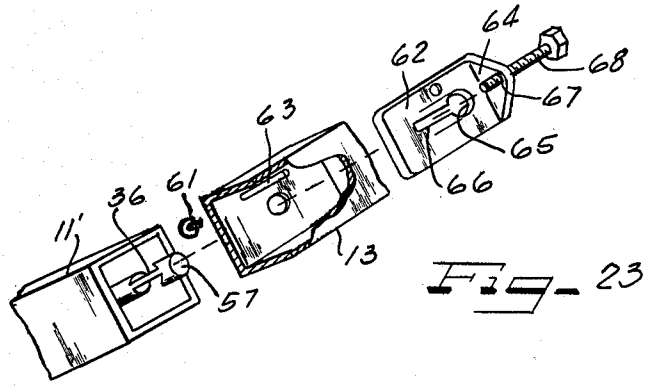


Fig. 23

INVENTORS
HECTOR MARIO DIAZ
RODOLFO OSCAR DIAZ
RODOLFO EXEQUIEL ROMERO

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

United States Patent Office

3,498,654

Patented Mar. 3, 1970

3,498,654

FRAME STRUCTURE ASSEMBLY

Héctor Mario Díaz and Rodolfo Oscar Díaz, both of Pje. Cristobal M. Hicken 2929, and Rodolfo Exequiel Romero, Fonrouge 3089, all of Buenos Aires, Argentina

Filed July 22, 1968, Ser. No. 746,649

Claims priority, application Argentina, Aug. 3, 1967, 208,943

Int. Cl. F16b *1/00*

U.S. Cl. 287—189.36 14 Claims

ABSTRACT OF THE DISCLOSURE

Structures such as furniture bases having hollow girders comprising the frame which are disassembleable and which are retained in their assembled form by joining means invisible from the exterior such as tensioned cables, rods or metal strips interior of the girders which are drawn around guide means in the girder joints and anchored within the frame.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to joints for structures formed by hollow sections and means for retaining said sections in joined relationship, and more particularly to a disassembleable joint, whose joining means are invisible from the exterior of the sections forming the structure.

Prior art

Constructed structures such as furniture bases and the like are usually constructed from a plurality of individual girds joined together to form a frame. Such frames are either permanently joined as by welding, brazing, soldering and the like or temporarily joined such as by screws, clamps, etc.

Such prior art temporarily joined frames generally have their joining means visible from the exterior producing an unsightly construction ill adapted for use in furniture while the permanent frames cannot be disassembled.

SUMMARY

The present invention overcomes the deficiencies of the prior art as applied to structures in the furniture, metal carpentry, and like industries. According to the present invention, frames are comprised of hollow girders joined together to define the frame. The girders may be of metal, plastic or the like rigid materials, and the completed frame may comprise any of the vast number of geometric shapes.

After joining the separate girders together to form the required frame shape, tensioning means interior of the girders are drawn taut to retain the girders in their joined form providing a rigid structure. The girders are joined one to another in disassembleable fashion so that upon releasing of the tensioning means the frame can be broken down. The tensioning means may consist of rods, steel straps, cable or the like and when passing through a joint is guided therearound by means of guiding devices located in the joint.

The invention proposes the joining of hollow sections at relative angles through the union of their open ends which may be cut in miter or other angles; or by the union of at least two sections, one of which abuts its open end against a wall portion of the other section. The joined sections may form frame structures such as closed squares, polygonal forms with any number of sides, polygonal forms with extensions on the same plane, polygonal forms with extensions on different planes, and tri-dimensional structures of different forms resulting from the

combination of the above-mentioned structures, all of which have joining means practically invisible from the exterior thereof and which can easily be assembled and disassembled and which assure a rigid union when in the assembled form. The structures of the present invention additionally are suitable for mass production techniques.

According to the invention, the frames are characterized by the fact that interiorly of the hollow girders there is disposed a longitudinal tension member guided through the joint angles by guiding means located adjacent the joints, the tension member being secured within the sections to anchoring means located therein. Additionally, centering means may be provided to retain the tension means in a predisposed plane.

In one embodiment, the tension member envelops the frame and is composed of flexible materials along its entire length such as wire, cable, iron strips, or the like. In another embodiment, the tensioning means may comprise a structure which is part rigid and part flexible, being flexible in those areas designed to bend through an angle as at the girder joints. Additionally, in certain cases, rigid tension members can be employed to join two members.

A completed joint may consist of two or more intersecting hollow girders, centering means such as interfitting projections to key the girders one to another and prevent lateral displacement of the girders at the joint, corner guides having guide faces that guide the tensioning means through the joint, second centering means adapted to retain the tension means in a given plane against the guide faces and anchor means to anchor and tension the tension means. Two or more of the above may be provided by a single device.

It is therefore an object of this invention to provide a method of temporarily assembling hollow girders together to form a rigid frame.

It is a further object of this invention to provide methods, apparatus and structures for providing a frame comprised of hollow girders joined together at an angle and retained in position by a tensioning means interior of the girders.

It is yet another and more specific object of this invention to provide frames comprised of hollow girders detachably joined together and retained in position by means of tensioning means passing through the girders and guided through the joint by means of guiding and centering means and anchored within the said girders.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURES 1 through 9 are schematic views in perspective illustrating a number of the framed structures which can be created by the present invention.

FIGURE 10 is an enlarged sectional view of the detail A of FIGURE 6 along the line X—X of FIGURE 11.

FIGURE 11 is an enlarged sectional view of the detail A of FIGURE 6 along the line XI—XI of FIGURE 10.

FIGURE 12 is an enlarged sectional view of the detail A of FIGURE 6 along the line XII—XII of FIGURE 10.

FIGURE 13 on page 3 of the drawings is a view similar to FIGURE 11 illustrating a modified arrangement for the joining of a leg or post.

FIGURE 14 is an enlarged sectional view of the detail B of FIGURE 5 along the line XIV—XIV of FIGURE 15.

FIGURE 15 is an enlarged sectional view of the detail B of FIGURE 5 taken along the line XV—XV of FIGURE 14.

FIGURE 16 is an enlarged sectional view of the detail C of FIGURE 5.

FIGURE 17 is a sectional view taken along the XVII—XVII of FIGURE 16.

FIGURE 18 is a sectional view taken along the line XVIII—XVIII of FIGURE 16.

FIGURE 19 is a perspective view partially in section of a modified form of joint such as that illustrated in FIGURE 14.

FIGURE 20 is a view similar to that of FIGURE 19 representing yet another modified joint.

FIGURE 21 on page 3 of the drawings is a view partially in section of a modified joint for tubular girders.

FIGURE 22 is a perspective view of an anchoring and tensioning means.

FIGURE 23 is an exploded perspective view of an alternative form of anchoring and tensioning means.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The types of frame structures which can be constructed according to the present invention include closed single plane polygonal forms such as those illustrated in FIGURES 1 and 2, closed frames with extensions located in the same plane such as those illustrated in FIGURES 3 and 4, formed by girders **5**, **5'** and joined cross bars **6**, **6'**; closed structures formed by girders **11**, **11'** and **12**, **12'** intersecting with and joined to corner posts **13**, **13'**, **14**, **14'** as illustrated in FIGURE 5; and tridimensional structures resulting from the combination of preceding structures illustrated in FIGURES 1 to 9. In each of the FIGURES 1 through 9 the tensioning means are illustrated by broken lines and it is to be understood that they are interior of the hollow girders which comprise the frame.

The closed structures having polygonal form such as illustrated in FIGURES 1 and 2 are formed from hollow girder sections which are joined together at the respective open ends of the girders, the girders being cut in miter as for example in FIGURE 1 or at other angles, as in FIGURE 2 so as to provide the desired geometric shape. Each structure is assembled by an enveloping tensioning member indicated by the broken line which abuts against guiding bodies disposed in the joints as hereinafter described, and which is secured by anchoring means through an opening formed in a hidden place of the structure. The girders of the structure can have a circular, polygonal, or other cross section and the only requirement in these examples and in other cases where the opened ends of the girders are joined with each other is that the inner cross sections of the girders must be the same in the joint zones to assure a correct seat of the opened ends and an accurate centering of the girders.

According to an alternative arrangement of the structure of FIGURE 1, the enveloping tensioning member can be subdivided, for example, into two parts whose respective ends are anchored, for example, in the corner guides or in anchoring members provided for this purpose.

The closed structures with extensions located on the same plane as illustrated in FIGURES 3 and 4 can have the girder joints composed of the opened ends of the branches **6**, **6'** against the girder walls of the trunks **5**, **5'** as in FIGURE 3 or a combination of that joint and joints in miter as in FIGURE 4. The tensioning member of FIGURE 3 can be enveloping and abut against guiding bodies in the joint corners of the type illustrated in FIGURE 16. In FIGURE 4, a tensioning member is illustrated which traverses and envelopes the arch formed by the posts **5**, **5'** and the crossbar **6** joined to the post with joints in miter. The tensioning member abuts against guiding bodies similar to the one illustrated in FIGURE 10 and is secured at the open end of the posts **5**, **5'** by means such as anchors retained in the feet. According to an alternative arrangement, the crossbar **6** can be secured by means of a straight tensioning member disposed longitudinally inside of the cross bar which traverses the crossbar and projects through the open ends thereof into the walls of the posts **5**, **5'** where it is secured to anchoring means interior of the post with keys or threaded means.

The structure in FIGURE 5 is formed by girders **11**, **11'**, **12**, **12'**, disposed on the same plane and joined at their ends to corner trunks or posts **13**, **13'**, **14**, **14'**. If necessary, intermediate posts can be added to the girders. The corner posts can be cut to the same height as the top plane of the structure or can project above or below that plane. The posts are illustrated as being at right angles with the plane of the structure but can be inclined at any desired angle. The structure is retained by a single enveloping tensioning member whose ends can be joined to each other through an adjusting means such as a turnbuckle, or to the component sections of the structure and secured by means of anchoring means accessible through an opening formed at a hidden point of the structure or through the open end of one of the corner posts.

The tridimensional structures illustrated in FIGURES 6 to 9 can include combinations of the above structures with interconnected joints of the open ends of the girders and of structures formed by joints of open ends of several girders against wall sectors of other girders, whereby in each case the most suitable types of tensioning members, guiding bodies, centering means, and anchoring means are selected to assure the perfect mounting of each girder. For example, in one of the most complex cases, the one illustrated in FIGURE 9, a parallel frame has been created by two caps D and E formed by closed flat squares with joints and miter similar to that of FIGURE 1 interconnected by four girders secured in a fashion illustrated in FIGURE 6. The anchoring of the tensioning members can be effected through a small opening formed in the caps or in the girders.

FIGURES 10, 11 and 12 illustrate the detail A of the joint of FIGURE 6 including, on the one hand, the joint in miter of the sections **15**, **15'** relating to the closed flat structure of the upper part of the frame and the joint of the open end of the section **16** against the walls of the sections **15**, **15'** in the joint zone of these girders and on the lower plane of the square frame. For the miter joint of the sections **15**, **15'** a guiding body **17** is disposed interior of the sections. The guiding body is substantially formed by a cylinder sector **18** subtended by an incoming dihedral angle **19**. This dihedral angle abuts against the incoming angle of the square caused by the miter intersections of the two girders **15**, **15'**, and the cylinder sector serves as a seating surface for a tensioning member **20** which can be flexible along its entire length or at least in the seat area and which traverses the interior of the sections of the square **15**, **15'**, **15''**, **15'''**, and is anchored at a suitable point as will be described below. To prevent lateral shifting of the sections **15**, **15'**, the same guiding body **17** can be utilized. For this purpose, as illustrated in FIGURE 11, the height of the guiding body **17** is substantially the same as the inner span of the sections **15**, **15'** to create a close fit therein and the guiding body keys closely in the interior of the girders. This prevents lateral displacement of the girders inasmuch as the guiding body extends into both of the girders through the joint angle. Upon stretching of the tensioning body **20** to rigidify the structure, it firmly urges the dihedral angle **19** of the guiding body **17** against the inner surfaces of the girders **15**, **15'** at the joint so that the displacement of the girders is hindered to prevent longitudinal sliding of the plane of the joint. To prevent the lateral displacement of the tensioning member with respect to the guiding body, the latter may be provided with flanges **21** which define a channel **22** in which the tensioning member is guided. Therefore, what is provided in the joint between the girders **15**, **15'** is a combination of a centering means

preventing lateral displacement of the girders, a guide means for the tensioning member and means against which the tensioning member can ride which when subjected to the tensioning force of the tensioning member will lock up the joint between the girders.

In FIGURES 10 to 12, there is also illustrated an embodiment of a guiding member **23** suitable for use in the joint of an open end of a girder against a wall sector of another girder, for example to mount a square according to FIGURE 3 or for the joint of the girders **15**, **15'** with the leg or cross bar **16** of FIGURE 6. The corner guide **23** is formed by a cylinder sector subtended by a plane **25** and is secured by said plane to the interior of the girder **15** which in this example serves as a trunk or main frame girder.

On the outer surface of the girder **15**, centering means **26** are disposed, which in this alternative arrangement, comprise projections which may be in the nature of screw heads with which the open end of the section **16** keys in close fit relationship. The heads of the securing means of the guiding body **23** can provide this keying or centering means **26**. In the zone covered by the open end of the girder **16**, the wall of the section **15** is provided with an opening **27** to permit passage of the tensioning member **28** therethrough. The corner guide **23** which guides the tensioning member **28** between the girder **15** and the leg or crossbar **16** can have lateral flanges **29** defining a channel **30** which reecives and lodges the tensioning member **28** as is illustrated in the figures. The tensioning member **28** traverses the hollow girder **16** and is stretched in parallel relationship to the tensioning member **20**. The tensioning member **28** is supported against the guiding body **23** and passes through the opening **27** extending to the interior of the girder **15** and in like manner into the corner post or girder **16'''** and is anchored therein at a suitable point. The tensioning member **28** keeps the girder **16** abutted against the outer surface of the section **15** and the relative displacement of both sections is hindered by the centering means **26**.

The tensioning member **28** can be formed, in this case also, by cables, iron straps, etc. at least in the zones where it bends and abuts against the guiding bodies.

An alternative arrangement coresponding to the view of FIGURE 11 is illustrated in FIGURE 13 where the legs **16** can be secured to the upper frame by means of a rigid tensioning member **58** disposed in the interior of the girder **16**. One end of the tensioning member **58** is anchored in the girder **16** while the other end extends through the opening **27** in the wall of the girder **15** and is secured to the inner face of that wall by means such as a nut **57**. The anchoring of the end of the tensioning member in the interior of the girder **16** can be effected by any suitable means such as tapped or soldered means in a retaining member, for example, a bridge **60** secured to the interior of the girder **16**.

FIGURES 14 and 15 illustrate the detail of area B in FIGURE 5 which corresponds to the mounting of a frame in a square figure with corner posts. This differs from the previous embodiments in that the girders comprising the square abut the side walls of the corner post to provide the corners. The corner guide **31** which guides the tension member **36** is formed by a cylinder **32** subtended by an outgoing dihedral angle **33** and is disposed in the interior of the corner posts **13**, **13'**, **14**, **14'** of the frame. As in the previous embodiments, the corner guide **31** can be provided with a channel **34** defined by flanges **35** for guiding the tensioning member **36**. On the walls of each corner post girder, centering means **37** are provided. The centering means may, like the centering means **26** of previous embodiments, consist of spaced protuberances on the outside of the post. The open ends of the main frame girder **11**, **11'**, **12**, **12'** are keyed with the centering means **37** to align the girders to provide the frame.

FIGURES 19 and 20 illustrate differing types of centering means for keying the open ends of one girder with a side wall of another girder. As illustrated in FIGURE 19, the centering means can be formed by teeth **70** integral with the wall of the section **13** and which have been tilted outside of the plane of the wall, for example, by molding or punching. These teeth **70** are so disposed that they define a figure congruent with or inscribable in the inner contour of the girder **11**, so that the open end of the latter keys practically without play on the teeth **70**. Thus, the girder is protected against lateral displacement. Another embodiment illustrated in FIGURE 20 has the centering means formed by tongues **72** projecting from the open ends of the girder **11** which key in coincident slot openings **71** formed in the walls of the corner post **13**. These devices provide non-permanent tab-like centering means to align the girder components of the frame with each other. Once the components are so aligned it is the tensioning member which retains them in position.

In FIGURE 14, the tensioning member **36** abuts against the surface **32**, the guiding body **31**, and passes through openings **38** provided in the side walls of the corner post **13**. The tensioning member **36** may extend about the entire square of the frame being anchored at a suitable point in the frame. For purposes of illustration, it can be assumed that in this instance the tensioning member **36** is anchored in the corner post **13'** of FIGURE 5.

FIGURES 16, 17 and 18 illustrate in detail the area C of FIGURE 5 wherein the tension member **36** is anchored. A tapped end **50** of the tensioning member **36** extends through openings **51** in the wall of the corner post **13'** and of a reinforcement plate **52** abutting the inner face of the wall of the post **13'**. A nut **53** threaded on the end **50** of the tensioning member secures the member to the plate **52**.

The other end **54** of the tensioning member has a projecting head **57** with a larger diameter than that of the tensioning member and which projects through an opening **55** in the wall of the post **13'** adjacent the wall which the end **50** projects through. Between the projecting head **57** and the inner face of the post a wedge **56** is inserted, for example, in the form of a fork which keys in the tensioning member, anchoring its end **54**.

If necessary, prior to applying the anchoring means, the tensioning member can be blocked with adequate means, for example, bolts or lock nuts which abut the outer faces of the post **13'** and which are covered by the ends of the sections **11'**, **12'** abutting the post. This anchoring feature of the tensioning member can be applied to other embodiments, for example, for anchoring straight tensioning members which individually secure crossbars or legs.

The above embodiments can be employed for assembling the frames illustrated in FIGURES 7, 8 and 9 or in similar and more complex structures by means of suitable combinations which will be self-evident to any person skilled in the art.

When assembling closed frames by means of girders having circular cross sections with their open ends interconnected through a joint, corner guides **40** can be used as illustrated in FIGURE 21. These corner guides are substantially the same as in previous embodiments but the incoming angle which subtends the cylinder section **41** is formed by a member **42** having a curved surface adapted to mate to the inner surface of the girder. In a manner similar to the example described, the corner guides can be adapted to hollow girders of any cross section, whether the guides abut against planes or form angles with different openings which form the girders for the formation of the frame.

In those instances where the ends of the tensioning member are to be joined together, a turnbuckle can be used. A practical example of a double-threaded tensioning device which can be utilized to interconnect the ends of an enveloping tension member disposed in the interior of a frame according to FIGURE 1, is illustrated in FIGURE 22. The device is formed by a substantially

cylindrical body **43** both ends of which are provided with perforations threaded with left and right hand threads respectively. The threaded bars **44** and **45** are threaded into the ends of the cylindrical body **43**. The bars **44** and **45** are integral with the ends of the enveloping tensioning member **28**. To facilitate the operation of the device, that is to say the rotation of the cylindrical body **43**, which may be accessible only through a narrow opening **10** of the frame of FIGURE 1, a ring with a toothed contour **46** may be provided integral with the cylindrical body **43**. A proper tool can be inserted in the notches of the ring **46** to make it rotate and stretch the tensioning member.

FIGURE 23 illustrates a practical example of an anchoring and tensioning device which can be applied to secure one end of the tensioning member **58** shown in FIGURE 13 or of the member **36** shown in FIGURE 16 in place of the nut **59** and key **56**. The anchor comprises a flat base **62** which is provided on its end with a flange **64**. The base **62** has an opening **65**, the diameter of which is slightly larger than that of the head **57** of the tensioning member **36**. A groove **66** extends from the opening **65**. The width of the groove corresponds to the diameter of a reduced-diameter portion of the tensioning member **36**. In the zone where the groove **66** forms the opening **65**, the base **62** is reduced to a wedge. In the flange **64** a threaded opening **67** is formed in which a screw **68** is threaded. The end of the screw **68** can abut the head **57** of the tensioning member when the latter is passed through the opening **65** to firmly key the base plate **62** beneath the head. Thereafter, tightening the screw **68** will force the tensioning member **36** up the ramp of the wedge in the area of the slot **66** thereby tensioning the tensioning member **36**.

To provide for the positioning of the anchor on the inside of the relevant girder before tensioning the entire structure, a small screw **61** threaded in the base **62** can be disposed through the wall of the girder **13'**. A groove **63** is formed through the wall of the girder and receives the main body of the screw **61**. The provision of the groove **63** in place of a cylindrical hole allows movement of the anchoring device within the girder. To mount the device, the wedge is inserted through the open end of the girder until the desired position is obtained and thereafter it is kept in this position by the screw **61** which, however, permits displacement of the wedge for purposes of adjustment by sliding in the groove **63**.

It can therefore be seen from the above that our invention provides methods, apparatus and devices for constructing structural frames and the like which are rigidly joined and which are easily disassembleable. The invention contemplates the use of hollow girder elements which are mated together to comprise the frame and which are indexed one to another by guiding means such as the above-described protuberances, tabs and slots, etc. and which are held in their assembled condition by taut tensioning means passing through the interior of the hollow girders, guided through the joints thereof by corner guides which are centered within the joints and which may be sized to prevent lateral displacement of the joints and which additionally may have channels therein adapted to receive and guide the tensioning member. The ends of the tensioning member are anchored either to the other end of the tensioning member or to anchoring posts or the like disposed within the girder. Various means such as wedges, turnbuckles and the like are described for anchoring and tensioning the tensioning member which may be flexible or rigid and which firmly retains the frame in its desired position.

Although we have herein set forth our invention with respect to certain specific principles and details thereof, it will be understood that these may be varied without departing from the spirit and scope of the invention.

We claim as our invention:

1. A joint for hollow girders which are joined so as to form angles between themselves and which are used for the construction of frames which comprises: a plurality of hollow girders; said girders abutting one another at an angled joint; a longitudinal tensioning member disposed within said girders; said tensioning member guided by guiding means located adjacent the joint of said girdles; said tensioning member secured within the said girders by anchoring means interior of said girders; centering means adjacent said angled joint effective to center said girders and to prevent lateral displacement thereof; means for tensioning said tension member to draw said girders together and lock up said joint; said guiding means, anchoring means, centering means, and tension means disposed entirely in the interior of said hollow girders.

2. A joint according to claim **1** wherein the tensioning member is composed of flexible materials along its entire length.

3. The joint according to claim **1** characterized in that the tensioning member is composed of flexible materials in the areas where it passes through an angled union joint and of rigid materials for the remainder of the tensioning member.

4. The joint according to claim **1** wherein a single enveloping tension member secures the entire frame.

5. The joint of claim **1** wherein a plurality of tensioning members secures the frame, each tensioning member securing a portion of the frame.

6. A joint according to claim **1** wherein the centering means is formed in an external wall of one of said girders and has projecting contours which key with a close fit in the interior of an open end of the other girder comprising the joint.

7. A frame constructed of hollow girders joined together at angled joints comprising:
- a plurality of hollow girders;
- said girders joined one to another at angled joints;
- longitudinal tensioning members disposed interiorly of the said girders;
- guiding means located adjacent the said joints;
- said tensioning member retained within said girders by anchoring means;
- said anchoring means disposed interior of said girders;
- centering means adjacent said joints;
- said centering means effective to prevent longitudinal displacement of said girders at said joints;
- one of said girders joining a second of said girders through one of said joints with an open end of said one of said girders against an outer wall of said second girder; the guiding body of the said one of said joints having a curved sector;
- the tensioning member abutting against said curved sector;
- said curved sector subtended by a base;
- said base adapted to mate with the inner wall of the said girders in the said joint;
- and the said guiding body secured to at least one of the said girders.

8. A frame according to claim **6** wherein the centering means comprises:
- projections on the said one of said girders;
- openings in the wall of the said second girder;
- and the said projections and said openings dimensioned to mate in close fit relationship.

9. A frame comprising: a plurality of hollow girders; said girders abutting one another in angled joints; centering means associated with said joints effective to prevent lateral displacement of said girders; a tension means extending interiorly of said girders into said joints; anchoring means interior of said girders effective to anchor said tension means; guide means associated with said joints effective to guide said tension means in said joints; and means for tensioning said tension means to lock up said joints, each of said means disposed entirely interiorly of said girders.

10. The frame of claim 9 wherein the said tension means passes through at least one of said angle joints and is guided through the angle by abutting against a curved face on the said guide means and means on said guide means for preventing displacement of the tension means.

11. The frame of claim 9 wherein at least one of said joints the said girders abut with the open end of one girder against the side of a second girder, the tension means terminates adjacent the said joint interior of the second girder, and the anchoring means is provided adjacent the said joint interior of the said girder.

12. An angled joint construction comprising: a plurality of hollow girders, said girders joined one to another at angled joints; longitudinal tensioning members disposed interiorly of the said girders; guiding means located adjacent the said joints; said tensioning means retained within said girders by anchoring means; said anchoring means disposed interiorly of the said girders; one of the said girders joining a second of said girders through one of said joints with both open ends of the respective girders cut at mating angles and both open ends abutting one against the other; the guiding means at said joint having a curved sector subtended by an incoming dihedral angle having the same angle and form as the incoming angle of said angled joint; the tensioning member curved against and engaging said curved sector; the said guiding means teamed with the said girders in close fit relationship through the said angled joint, providing centering means effective to prevent lateral relative displacement of the said girders.

13. An angled joint construction comprising: a plurality of hollow girders; said girders joined one to another at angled joints; longitudinal tensioning members disposed interiorly of the said girders; guiding means located adjacent the said joints; said tensioning means retained within said girders by anchoring means; said anchoring means disposed interiorly of the said girders; centering means adjacent said joints; said centering means effective to prevent lateral relative displacement of said girders at said joints; one of said girders joining a second of said girders through one of said joints with an open end of said one of said girders against an outer wall portion of said second girder and a third of said girders joining said second girder at said joint with the open end of said third girder against another outer wall portion of said second girder, said third girder lying substantially in the same plane and at an angle to said first girder; the guiding means of the said one of said joints having a curved sector; the tensioning member curved against and engaging said curved sector, and protruding into said first and third girder through openings in said outer wall portions of said second girder; said curved sector subtended by an outgoing dihedral angle; said outgoing dihedral angle mating with the inner wall of said second girder at said angled joint.

14. An angled joint construction comprising: a plurality of hollow girders; said girders joined one to another at angled joints; longitudinal tensioning members disposed interiorly of said girders; said tensioning means retained within said girders by anchoring means; said anchoring means disposed wholly interiorly of said girders; centering means adjacent said joints; said centering means effective to prevent lateral relative displacement of said girders at said joints; one of said girders joining a second of said girders through one of said joints with an open end of said one of said girders against an outer wall of said second girder; the tensioning member running through said one girder and through an opening in said outer wall of said second girder and protruding into the bore of said second girder; said anchoring means disposed respectively interior of said first girder and said second girder, and effective to draw said girders together.

References Cited

UNITED STATES PATENTS

936,451	10/1909	Havenhill.
1,239,043	9/1917	Russell.
1,968,890	8/1934	Huff.
2,152,584	3/1939	Cranshaw.
2,951,565	9/1960	Haglund.

FOREIGN PATENTS

512,969	10/1952	Belgium.

RAMON S. BRITTS, Primary Examiner

U.S. Cl. X.R.

287—54