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Burton et al.

[11] **3,719,389**

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[54] **THERMO PLASTIC TUBING FURNITURE**

[76] Inventors: **Douglas G. Burton,** 9435 Bona Vista Lane, Whittier, Calif. 90603; **Norman L. Kiger,** 7691 Belgrave Avenue, Garden Grove, Calif. 92641

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[52] **U.S. Cl.**.....**297/440,** 297/445, 297/DIG. 1

[51] **Int. Cl.**.....**A47c 4/02,** A47c 7/00

[58] **Field of Search**.....297/440–452, 456, 297/DIG. 1, DIG. 2; 46/15–17, 29, 31; 52/646, 648, 650, 653, 654, 684; 29/453

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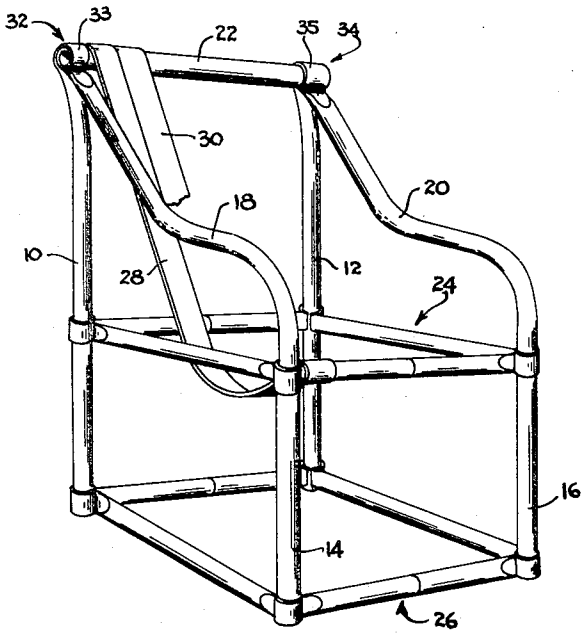
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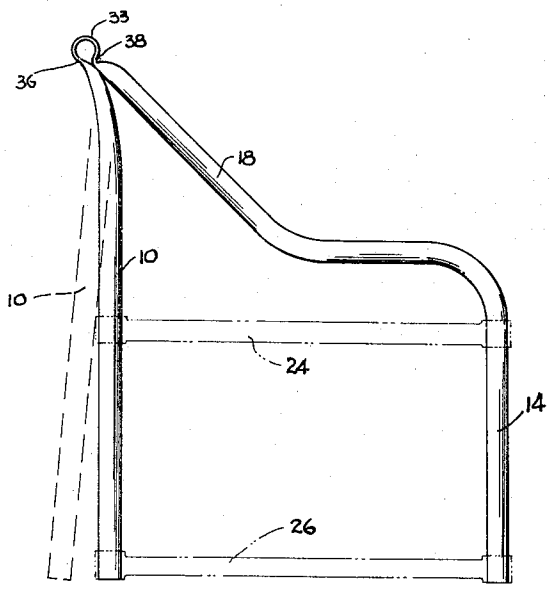
Primary Examiner—Casmir A. Nunberg
Attorney—Gausewitz, Carr & Rothenberg

[57] **ABSTRACT**

A method and apparatus for furniture construction entails the forming of thermo-plastic tubing side and cross frame sections wherein joints for securing interconnected members to each other comprise flattened closed loop clamping sections integrally connected with adjoining frame member portions. The loop sections, even in unstressed condition of the frame members, are dimensioned to be just equal to, or slightly smaller than the tubular members that are retained and clamped therein. Further, the construction is such, that upon assembly the portions of the tubular members on either side of the several flattened closed loop clamping sections are stressed to hold these portions closer to each other, so that they will more tightly grasp the tubular members that each encircles.

10 Claims, 9 Drawing Figures





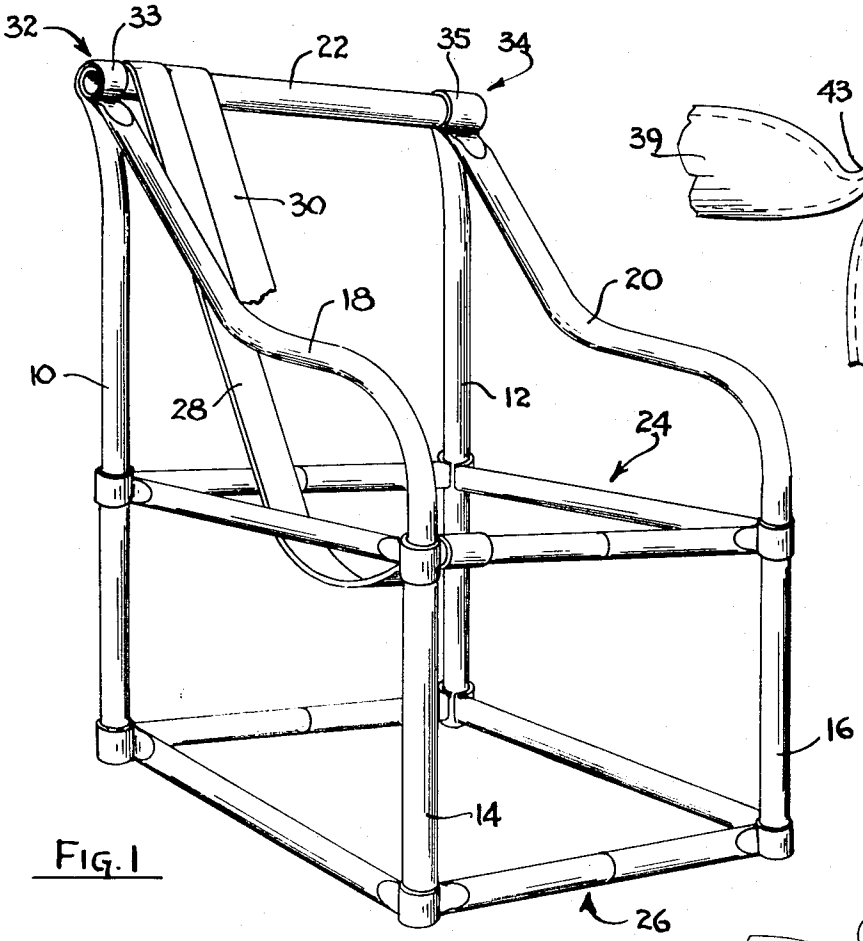


FIG. 1

FIG. 3

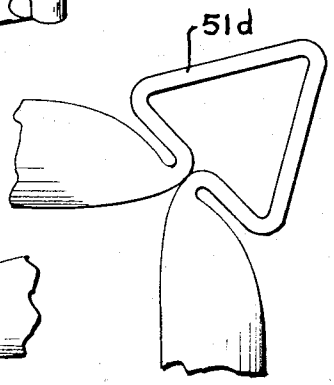


FIG. 9

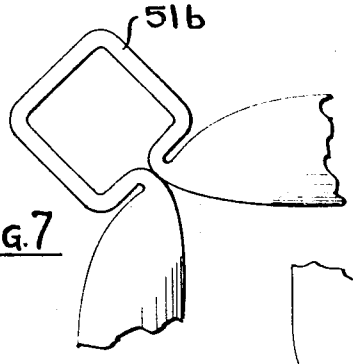


FIG. 7

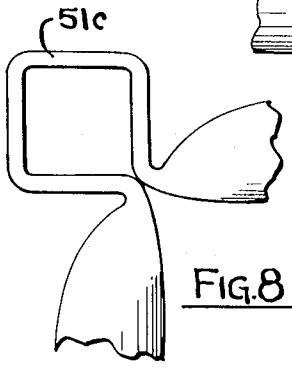


FIG. 8

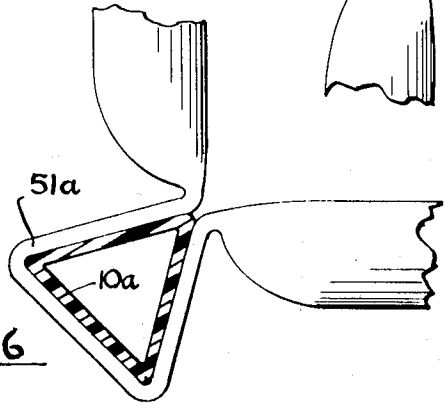


FIG. 6

INVENTORS
DOUGLAS G. BURTON
NORMAN L. KIGER
BY Jacquemin, Cass & Rothenberg
ATTORNEYS

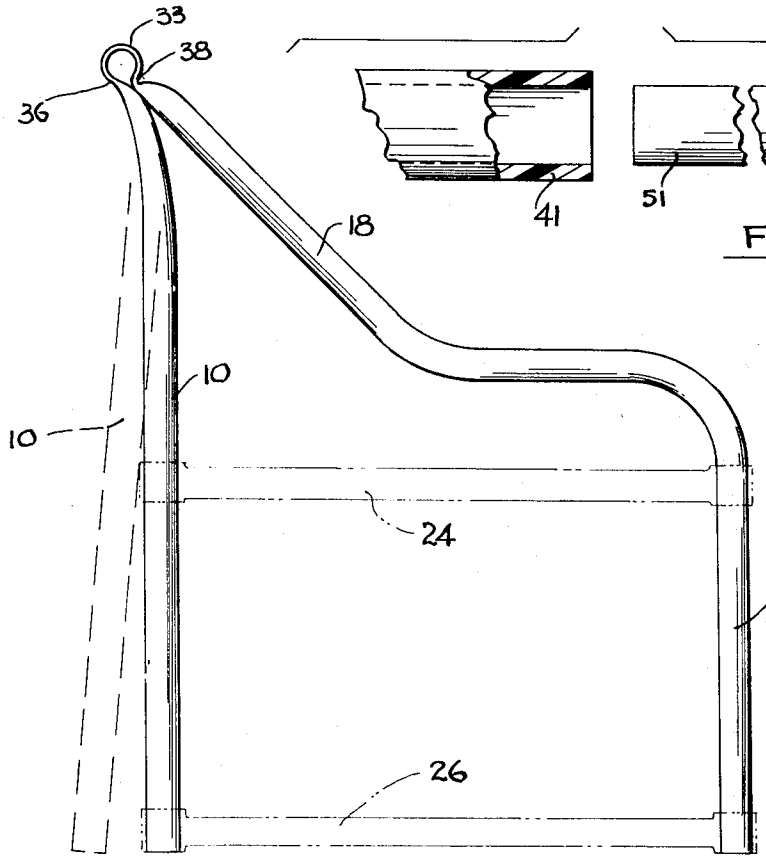


FIG. 2

FIG. 5

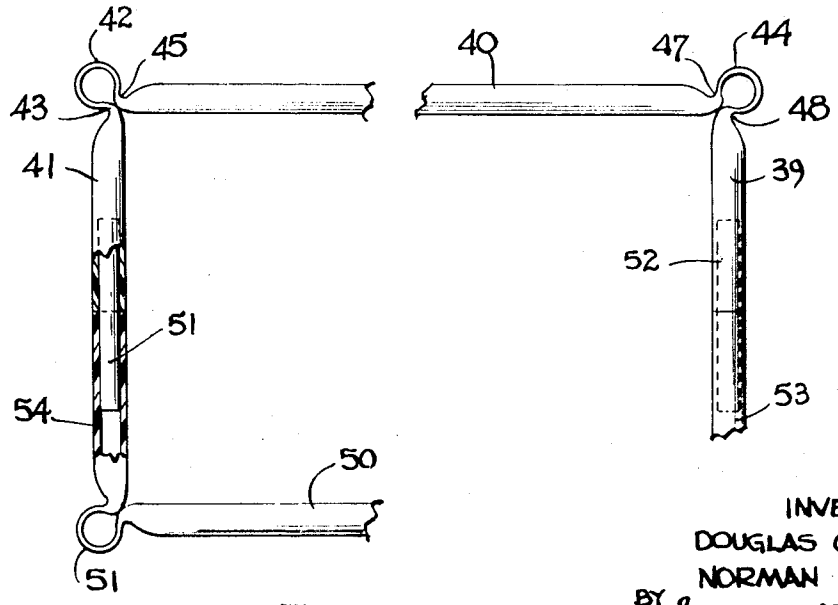


FIG. 4

INVENTORS
DOUGLAS G. BURTON
NORMAN L. KIGER
BY Sarjeant, Carr & Rothenberg
ATTORNEYS

THERMO PLASTIC TUBING FURNITURE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to methods and apparatus for construction of furniture, and more particularly concerns tubular furniture involving improved joint arrangements and configuration.

2. Description of Prior Art

Furniture construction is among the oldest of tasks to which man has devoted inventive ingenuity. With the fast spreading outdoor living style in areas of mild climate there is a rapidly developing requirement for sturdy lightweight and attractive furniture having the ability to withstand relatively rough handling and abuse of outdoor use, and, of primary importance, the ability to endure under adverse weather conditions.

Presently available outdoor furniture includes pieces having frames of wood, steel or aluminum. Commonly, springs supports and cushions or plastic strips of webbing are employed for body support. Among the many different types of outdoor furniture, those shown in U.S. Pat. No. 2,993,733 to Pinkham, U.S. Pat No. 3,230,013 to Morrison et al, U.S. Pat. 3,180,682 to Paulen and U.S. Pat. 2,731,078 to Cadman et al. are made of plastic. Such furniture may be well withstand adverse weather. Nevertheless, the prior art constructions are difficult and expensive to fabricate, requiring complex and costly molding and fabricating operation. Yet they fail to take advantage of tubular construction that provides maximum strength with minimum weight and cost. Where tubular frames are employed, these are generally of metal, and conventional joints such as screw, nut and bolt or welding arrangements are used, as shown in the patent to Morrison U.S. Pat. No. 3,471,200 for example. The welded joint is exceedingly expensive and difficult to fabricate whereas the bolted joint involves relatively complex assembly and nevertheless, fails to withstand either weather or hard use.

Accordingly, it is an object of the present invention to provide strong, lightweight and inexpensive yet attractive furniture construction and methods that eliminate most of the above identified disadvantages through the use of a novel tubular construction and joint.

SUMMARY OF THE INVENTION

In carrying out principles of the present invention in accordance with a preferred embodiment thereof, tubular furniture construction is accomplished by forming first and second frame members of mutually angulated configuration and interconnected by a flattened substantially closed loop clamping section that integrally joins the two frame members. Another frame member is retained and clamped within the flattened closed loop clamping section of which the clamping action is enhanced by still other portions of the furniture construction that stress the first and second frame members toward each other and maintain these in such stress conditions to urge the flattened closed loop to still further closed condition, thus more tightly to grasp the frame member clamped thereby. In one embodiment a pair of substantially rectangular cross member frame half sections each is formed with one of the above described flattened closed loop clamping sections at each corner. Each clamping section receives and clampingly secures a respective one of the four legs of the furniture construction. In some arrangements the legs are formed as part of a pair of side frames that are, in part, joined to each other by an upper cross member secured at its respective ends to said frames by means of flattened substantially closed loop clamping sections integrally connecting adjoining mutually angulated sections of the respective side frames.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a pictorial illustration of a chair constructed in accordance with the present invention, with most of the body support slats not shown, or shown partly broken away;

FIG. 2 is a view of one of the side frames showing an unstressed sprung condition of the legs in dotted lines, and also showing in phantom lines the position of the substantially horizontal cross frames;

FIG. 3 is a detailed view of one of the clamping joint closed loop sections of the chair of FIG. 1;

FIG. 4 is a view, with parts broken away, of one of the assembled cross frame full sections;

FIG. 5 is an exploded view, showing in detail connection of two frame half sections, and

FIGS. 6, 7, 8 and 9 show different arrangements of flattened closed loop clamping sections adapted for use with tubular members of different cross sectional configurations.

DETAILED DESCRIPTION

As illustrated in FIG. 1, a chair constructed in accordance with principles of the present invention, is formed of first and second substantially upright side frames, each composed of a substantially vertical rear leg section **10**, **12** and a substantially upright forward leg section **14**, **16**, interconnected by curving arm sections **18**, **20** that extend rearwardly and generally upwardly in the indicated curved condition to provide arm rests. An upper cross member **22** extends between and is rigidly connected to the respective side frames. First and second substantially rectangular cross member frame full sections **24**, **26** are fixedly connected at the respective corners thereof to the several side frame legs. The uppermost of the two rectangular cross member frame sections is positioned substantially near the upper end of the forward legs **14** and **16** and is connected to the rear legs **10**, **12** at a point intermediate their ends. The lower of the two cross member frame sections is connected to the several chair legs at the bottom ends thereof. The vertical position of sections **24**, **26** relative to the legs may be varied as deemed necessary or desirable for appearance, use and assembly, as long as requisite rigidity of the structure is retained.

Body support in the illustrated chair is formed by a plurality of slats, of which only two are shown at **28** and **30**, with slat **30** being broken away for clarity of the illustration.

Preferably, all of the parts of the chair illustrated in FIG. 1, are formed of a suitable plastic tubing having the desired qualities of weather resistance, rigidity, resilience and thermal forming to enhance and facilitate the shaping and assembly operations to be described in detail hereinafter. Among the many

known plastic materials that are suitable for use in connection with the present invention, are those known as PVC (polyvinylchloride plastic or resin), ABS (acrylonitrile-butadiene-styrene plastic), high impact PS (polystyrene plastic), PP (polypropylene plastic or resin) and various other plastics including buterates, acrylics, cellulosics and acetals. In particular, the wide availability of such heat formable, rigid and resilient plastics in tubular form provides a ready source of inexpensive material for practice of the present invention. As an example, but without limitation, the commonly available polyvinyl chloride extruded as vacuum formed tubing of 1.35 inches outside diameter, and having a wall thickness of 0.133 inches, is conveniently applicable for practice of this invention.

Although other types of tubing, and even metallic tubing, may be employed in the practice of this invention, the ease of forming thermoplastic tubing particularly adapts this type of material to the methods of construction and assembly and, in particular, to the structural joint formation that comprise significant aspects of the present invention.

As seen in FIGS. 1 and 2 the upper cross member 22 is fixedly secured at its respective ends to the two side frames by means of resilient clamping joints 32, 34 respectively. Each of these clamping joints comprises a flattened section 33, 35 forming a substantially closed loop that integrally connects the adjoining portions (such as leg 10 and arm 18) of the side frame on opposite sides of the loop. Each side frame is formed of a straight section of tubing of roughly proper length, that is heated until it is workably soft, and then bent upon a form to assume the shape generally illustrated in dotted lines in FIG. 2. Clamping section 33 is flattened and formed by clamping action applied at neck portions 36, 38, while a mandrel is positioned temporarily within the loop that is being formed.

When so formed to provide the side frame shown in FIG. 2, having rear and forward legs 10 and 14 interconnected by the arm section 18 and including the integral flattened closed loop portion 33, the leg 10 will assume the rearwardly sprung position illustrated in dotted lines in FIG. 2. In this unstressed position, and before any cross member, such as member 22, has been clamped within the loop 33, the two mutually opposed neck portions 36, 38 are in, or nearly in, mutual abutment with each other. The two adjoining tubular sections 10 and 18 on either side of the flattened loop are then temporarily expanded, resiliently and elastically, to facilitate insertion of the cross member 22. The natural resilience of the side frame then causes flattened loop section 33 to resiliently grasp the encircled cross member 22, but the loop cannot fully close around the cross member. It will remain with the neck portions 36, 38 somewhat spaced from each other.

When assembled as described below, the side frame of FIG. 2 will assume a position wherein rear leg 10 is as shown in solid lines, such position being retained by connection with the horizontal cross frames 24, 26. Thus, when assembled, the two legs, the forward leg 14 and the rear leg 10, of each side frame are positioned closer to each other than when in unassembled and unstressed condition, whereby further clamping action is exerted by the flattened loop 33 upon the encircled cross member 22 which is firmly locked in place.

Each cross frame 24, 26 is identical to the other and for this reason only one need be described. As shown in detail in FIGS. 3, 4 and 5, the cross frame full section is formed of two substantially identical U-shaped frame half sections that are fixedly interconnected. One of these frame half sections includes a forward cross frame half member 39 and a rear half frame cross member 41, interconnected by a bight portion 40. These sections are also made and formed of the above described heat formable, rigid, resilient plastic tubing of circular cross section. Each of these frame half sections is provided at its respective corners with a flattened substantially closed loop clamping section 42, 44 similar to flattened clamping sections 32, 34 of the two side frames. However, for the cross frames the adjacent tubular portions on opposite sides of the flattened clamping section extend substantially at right angles with respect to each other, rather than at the relatively acute angle of the similar side frame portions. Flattened closed loop clamping sections 42, 44 terminate in neck portions 43, 45 and 47, 48 which are in, or substantially in, abutment with each other when the two frame half sections are connected, but before the tubular members clamped thereby are inserted. This relation is shown in FIG. 4. When the tubular members (legs 12 and 16) are inserted (in the manner to be described below) the sides of the respective flattened clamping sections 42, 44 are resiliently and elastically expanded (as shown in FIG. 3) so that the two neck portions are mutually spaced in a manner analagous to that described in connection with the flattened clamping sections 33, 35 of the side frame.

A second U-shaped cross frame half section (identical to the first,) comprises forward and rear half cross members 53, 54 and a bight member 50. A pair of substantially closed loop clamping sections (of which only that indicated at 51 is shown) integrally connect the bight member 50 with the respective half cross members 53 and 54. Each of the U-shaped frame half sections is individually heated and formed to provide the overall U-shaped configuration illustrated. The flattened clamping sections are also formed when heated. These are formed, just as described in connection with the formation of clamping sections 32, 34, by stretching and deforming the tubular section to flatten it and bend it about a removable mandrel to the desired closed loop configuration.

In forming the flattened substantially closed loop clamping sections, a pair of mandrels are inserted into the heated tubular portions adjacent opposite sides of the member to be flattened and looped, with the adjacent ends of the mandrels mutually spaced from each other within and along the length of the tubular member to be formed by substantially the peripheral distance of the loop that is to be formed in the tubing. With the mandrels inserted, the section of the tubing between the mandrels is flattened and clamped over and around a third mandrel, of which the exterior defines the interior shape of the flattened clamping loop. After withdrawal of the mandrels that are inserted for the formation of the flattened clamping loop, further forming of the particular side frame or U-shaped frame half sections is accomplished as necessary. The part is then allowed to cool, removed from the form and the ends are trimmed to the desired length.

When completely formed, but not connected to each other, the two U-shaped frame half sections have the respective legs or half cross members **39**, **41**, **53**, **54** thereof extending from the bight sections at an angle somewhat greater than the illustrated 90°, whereby these legs are outwardly sprung. To connect the two frame half sections and form a single substantially rigid cross frame full section, these resilient and outwardly sprung half cross members are forced inwardly toward each other so that legs **41** and **54** are in mutual alignment, and legs **39** and **53** are in mutual alignment. A connecting rod **51**, **52**, which may be either solid or tubular, is then inserted in the respective open ends of the aligned half cross members to thereby connect the two frame half sections and hold these as a single closed rectangular frame, to be employed in assembly of the furniture as described below. If deemed necessary or desirable, a suitable adhesive may be applied to the connecting rod members **51**, **52** or to the frame half sections connected thereby, prior to this connection of the two U-shaped frame half sections.

Chair slats or body support members, of which any suitable number, such as six, for example, may be provided for a single chair, are formed of the same plastic tubing from which the above described frame parts are formed. Tubing sections of the desired length are flattened in a suitable jig and the respective end thereof bent to form open ended substantially semi circular loops. These loops have an unstressed inner diameter slightly less than the outer diameter of the associated furniture cross members. The flattened tubing is bent to provide a suitable body contour to thereby form both seat and back of the body support elements. The forming of these body support elements, just as the forming of all the other parts described herein, is accomplished while the tubing is heated to a temperature at which it is workably soft.

In assembly of the completed chair, the several parts are initially assembled to provide three sub-assemblies. Two of these sub-assemblies comprise the substantially rectangular cross member frame full sections **24** and **26** that are initially assembled each from a pair of identical U-shaped frame half sections as described above. A second sub-assembly is formed of two side frames and the upper cross bar **22**. As previously described, flattened closed loop clamping sections **32** and **34** are forcibly spread apart to permit insertion of the upper cross bar **22** that is clamped therein. If deemed necessary or desirable, suitable adhesive may be employed to enhance rigidity of this assembly.

The upper of the two cross member frame full sections **24** is positioned on a work table that has four apertures respectively aligned with the four flattened closed loop clamping sections of the frame **24**, such apertures being somewhat larger than the external diameter of the chair legs. Adjacent cross members of the rectangular frame section **24** are then forcibly spread apart to provide a temporary enlargement of each of the flattened closed loop clamping sections of the rectangular frame **24**. The chair legs **10**, **12**, **14** and **16** are then inserted through a respective one of the temporarily spread clamping sections of frame **24** and through the aligned apertures in the work table, until the two side frames and the upper rectangular frame **24** assume the relation illustrated in FIG. **1**. The temporary enlargement of the clamping sections of the frame **24** is then released to allow the clamping sections to tightly grip the respective legs.

The second, lower, cross member frame section **26** is then placed on the work table, after the apparatus previously partially assembled has been removed therefrom. The four flattened closed loop clamping sections of frame **26** are then temporarily spread to allow reception of the respective chair legs **10**, **12**, **14** and **16**. If deemed necessary or desirable, suitable adhesive may be applied to the inner surface of each of the clamping sections to enhance rigidity of the structure.

The flattened body support members or slats **28**, **30** etcetera, are then snapped in place as illustrated in FIG. **1**. This portion of the assembly is achieved simply by forcing the semi-circular open loop ends of each slat over a respective one of the associated cross members. Inherent resilience of the plastic material from which the parts are formed allow these open looped slat ends to be forcibly spread apart. This resilience also achieves a clamping of the slat upon the associated cross member, which clamping is all of the securement that is necessary in the described arrangement. Although it is possible to enhance securement of the slats to the chair frame by use of adhesive, it is preferred to merely secure the slats by their inherent resilient clamping action so that they may be readily removed for repair or replacement. Thus the appearance of the furniture may be quickly and simply changed by replacing slats of one color with slats of another color, or by rearranging slats of multiple colors to provide different color patterns.

Although the chair described in connection with FIGS. **1** through **5** is made of widely available inexpensive plastic tubing of a circular cross section, it will be readily appreciated that tubing of other cross sections whether non-circular or polygonal, may be readily employed as deemed necessary or desirable. Thus, as shown in FIG. **6**, the described construction may employ tubing of substantially triangular section for certain of the furniture parts, and at least for the legs **10**, **12**, **14**, **16** and upper cross member **22**. Where a leg having a triangular cross section such as that illustrated at **10***a* is employed, the several frame full sections will be formed with flattened closed loop clamping sections such as that shown at **51***a*, having a mating triangular configuration as shown in FIG. **6**.

Illustrated in FIG. **7** is a flattened closed loop clamping section **51b** for use with furniture having some, or all elements thereof formed of tubing having a rectangular cross section.

FIG. **8** illustrates a closed loop clamping section **51***c* also for use with furniture having some, or all of the structural elements formed of tubing having a rectangular cross section. However, in the arrangement of FIG. **8** the rectangular cross section members are differently oriented than in the arrangement of FIG. **7**.

FIG. **9** illustrates an alternate orientation of a closed loop clamping section **51d** for use in furniture having some, or all of the structural elements thereof formed of tubing having triangular cross sections.

As can be seen in the illustrations of FIGS. **7** through **9**, and as is the case for all of the closed loop clamping sections described herein, each flattened closed loop

clamping section is formed in such a size and configuration that, before the insertion therein of the member to be clamped thereby, it assumes a configuration that substantially conforms to the exterior configuration of the member to be clamped, but has dimensions equal to, or somewhat less than the corresponding dimensions of such clamped member. Thus, with the clamped member inserted within the closed loop clamping section, the latter is permanently stressed outwardly thereby and somewhat resiliently deformed, having its adjacent portions mutually spread apart, within its elastic limits so as to exert a strong and effective clamping action upon the member confined therein. This clamping action is further enhanced by the additional clamping stresses exerted by the several side frames and cross member frame sections. These are formed so that, in unstressed condition they have the parts thereof adjoining the closed loop clamping section relatively sprung or spread apart. The assembled relation of the parts is such that the relatively spread apart elements are forced and held together by an interlocking action of co-operating chair parts. Even in the absence of adhesive applied to the clamping sections, a secure and rigid mechanical joint is provided.

It will be readily appreciated that the described furniture construction may be applied to different types of furniture arrangements and different overall configurations, the chair illustrated being shown merely for purposes of exposition. Thus, a simple foot stool or table may be made, employing principles of the invention described herein by using only a pair of rectangular cross frame sections, such as sections **24** and **26** interconnected only by leg members **10**, **12**, **14** and **16**. Such a table or foot stool would have a solid or slatted top that could be formed by slats similar to those indicated at **28** and **30**, but of such a shape and configuration as to extend horizontally between opposed cross members of the upper of the two rectangular frame sections.

A significant feature of the described furniture construction, in addition to its light weight, simplicity of forming and low cost, is the ease of assembly of the several parts without the use of any special tools. This enables the several parts of the described chair, or the several sub-assemblies, to be shipped in a relatively compact package. For example, the two side frames (unassembled to each other), the two rectangular cross frames, the upper cross member **22** and the several body support slats may be compactly packaged for handling and shipment. These components may be readily assembled by a distribution outlet, or by the consumer himself without the use of anything more than a screw driver, or the like, to force apart the substantially closed loop clamping sections for the described assembly.

There have been described an improved method and apparatus for furniture construction employing tubular plastic materials that can be readily worked and which provide improved structural characteristics by spreading stresses over large areas, all without the use of any metal fasteners or other reinforcing devices. The described flattened closed loop clamping joint is resiliently and elastically expanded during assembly to accept the part to which it is secured, and is so positioned within the assembly that the assembly itself and, also, certain stresses involved in normal use, will urge the joint to exert a tighter gripping action.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

We claim:

1. Furniture construction comprising
a plurality of tubular frame members, and
joint means for a securely interconnecting at least some of said tubular members to each other, said joint means comprising
resilient clamping means formed integrally with one of said members for substantially and tightly encircling a second of said members in a stressed clamping relation,
said clamping means comprising an integral portion of said one tubular member that is flattened and formed into a substantially closed configuration closely conforming to the exterior cross sectional configuration of said second member that is clamped therein,
said clamping means having interior dimensions substantially equal to, but not greater than, comparable dimensions of said second member clamped therein,
whereby the portions of said first tubular member on opposite sides of said clamping means may be spread apart to resiliently deform said integral clamping flattened clamping portion to allow insertion of said second member therein, and whereby the resilience of said clamping means will urge said flattened clamping portion into a tight clamping encirclement of the second member clamped therein, and
means for urging said portions of said one member on opposite sides of said clamping means toward each other and retaining them in a stressed condition under such urging to thereby enhance the gripping action caused by the inherent resilience of said flattened clamping portion.

2. The furniture construction of claim **1** wherein said last mentioned means comprises other elements of said furniture construction that interconnect said portions on either side of said flattened clamping means, whereby when said furniture construction is assembled at least some of the members thereof are stressed by other members into secure clamping relation.

3. The construction of claim **2** wherein said first member comprises a side frame having a substantially vertical rear leg section, a substantially vertical forward leg section considerably shorter than said rear leg section and an arm section integrally interconnecting the upper portion of said rear leg section with the upper portion of said forward leg section,
said clamping means being formed as an integral portion of the connection between said arm section and the upper end of one of said leg sections, said clamping means comprising a flattened substantially closed loop formed at said intersection of said arm section and said one leg section and opening inwardly of said side frame,
said second member comprising a substantially horizontal cross member received and resiliently clamped within said flattened closed loop portion,

said means for urging said portions of said one member on opposite sides of said clamping means toward each other comprising a second substantially horizontal cross member connected to and between said rear and forward leg sections and having a length less than the distance between said leg sections when said side frame is in unstressed condition, whereby when said second horizontal cross member is connected to and between said forward and rear leg sections the side frame is stressed to retain the leg sections in a position that tends to close the flattened loop of said clamping means and thereby retain it in gripping engagement with said second member therein.

4. The construction of claim 3 including

a second side frame substantially identical to said first mentioned side frame and having substantially vertical rear and forward leg sections integrally interconnected by a second arm section,

said second side frame being formed with clamping means comprising a flattened integral closed loop positioned at the intersection between said second arm section and one of said second leg sections,

said first mentioned cross member also being received and securely gripped within said flattened closed loop of said second side frame,

a third substantially horizontal cross member interconnecting leg sections of said second side frame and having a length less than the distance between said leg sections of said second side frame when the latter is in unstressed condition to thereby urge and retain said second leg sections to and in a position wherein they exert an increased clamping and gripping action upon said first cross member, and means for retaining said side frames in mutually spaced relation.

5. The apparatus of claim 1 wherein said one member comprises first and second mutually angulated cross members, each integrally connected at a corner thereof by means of an integral flattened substantially closed loop, said integral flattened loop comprising said clamping means, and wherein said second member comprises an upstanding frame member securely retained and clamped within said flattened closed loop.

6. The apparatus of claim 1 wherein said one member comprises a first substantially U-shaped rectangular frame half section having forward and rear cross members and a bight member extending therebetween, said clamping means comprising a first and second flattened substantially closed loop clamping sections integrally connecting said bight portion with said forward and rear cross members respectively, wherein said second member comprises a side frame having substantially upstanding forward and rear leg sections integrally interconnected by arm section, said forward and rear leg sections respectively extending through and clamped within respective ones of said flattened closed loop sections of said U-shaped frame half section, and wherein said means for retaining portions of said one member on opposite sides of said clamping means in a stressed condition and urging them toward each other to tend to close said flattened loop comprises a second substantially U-shaped rectangular frame half section having forward and rearward cross members and a bight member extending therebetween, said second frame half section having flattened substantially closed loop clamping sections integrally interconnecting its bight section with said forward cross member and with said rear cross member, and means for fixedly connecting rear and forward cross members of said first frame half section to respective rear and forward sections of said second frame half section, and including

a second side frame comprising second forward and second rear leg sections integrally interconnected by a second arm section,

said second forward and rear leg sections respectively extending through and clamped within said respective ones of said flattened closed loop sections of said second frame half section,

each of said side frames being formed with a flattened substantially closed loop clamping section integrally connecting the arm section thereof with the rear leg section thereof so that each rear leg section is spaced from each forward leg section, when the side frame is in unstressed condition and not assembled in the furniture construction, by a distance greater than the distance between the two flattened closed loop clamping sections of the associated frame half section, and

an upper cross member extending through and clamped within said flattened closed loop clamping section of said first and second side frames, whereby assembly of said construction will stress all of said integral flattened closed loop clamping sections by holding the associated member sections on opposite sides thereof in closer relative position to each other, to thereby enhance the encircling and gripping action of the respective flattened closed loop clamping sections upon the respective member sections received therein.

7. The apparatus of claim 6 including a plurality of seat forming slats extending between said upper cross member and the forward cross members of said first and second frame half sections, each slat comprising an integral flattened tubular member having the ends thereof bent to form a resilient tubular member grasping loop that is resiliently enlarged to partly encircle and grip the respective upper cross member and forward cross member.

8. The apparatus of claim 7 including a third and fourth substantially U-shaped frame half sections each having forward and rear cross members and a bight section integrally joined to respective ones of the associated forward and rear cross members by clamping means formed by flattened closed loop integral sections thereof, the respective clamping means of said third and fourth frame half sections receiving and clamping respectively different ones of said side frame legs, and

means for fixedly interconnecting said third and fourth frame half sections.

9. The apparatus of claim 8 wherein said tubular members are of generally circular cross section and wherein said flattened closed loop sections have substantially mating circular configuration.

10. The apparatus of claim 8 wherein at least some of said tubular members have substantially polygonal cross sections, and said flattened closed loop sections form polygonal loops of mating configuration.

* * * * *