United States Patent

Anderson

[15] **3,698,150**

[45] **Oct. 17, 1972**

[54] **BIPARTITE TUBULAR MOLDED SYNTHETIC RESIN FURNITURE PART WITH INTERNAL REINFORCEMENT**

[72] Inventor: **Victor F. Anderson,** Wenonah, N.J.

[73] Assignee: **Shell Oil Company,** New York, N.Y.

[22] Filed: **June 4, 1970**

[21] Appl. No.: **43,521**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 797,616, Feb. 7, 1969, abandoned.

[52] **U.S. Cl.** **52/731,** 297/452

[51] **Int. Cl.** **E04c 3/00,** E04c 2/30

[58] **Field of Search** 248/188.8; 52/730–732; 297/440, 452, 455

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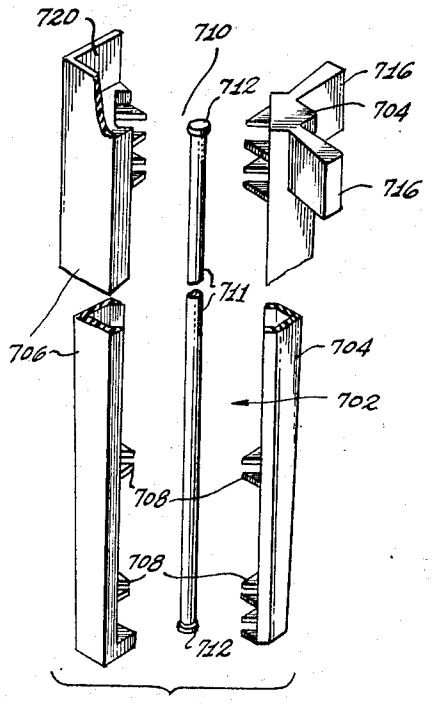
Primary Examiner—Frank L. Abbott
Assistant Examiner—James L. Ridgill, Jr.
Attorney—Beehler and Arant and Martin S. Baer

[57] **ABSTRACT**

A bipartite generally tubular molded synthetic resin furniture part, such as a leg for a chair or table or a chair back assembly. The furniture part is composed of two complementary molded synthetic resin tube sections arranged side by side and having mating longitudinal marginal portions bonded to one another so as to define a cavity extending longitudinally through the part. One or both of the tube sections are provided with integral molded synthetic resin reinforcing formations, such as reinforcing ribs or flanges, which extend across the cavity at intervals and are bonded to the opposite tube section in such a way as to reinforce the part against deformation under the load. Additional reinforcement of the part may be provided by a metal rod positioned longitudinally within the cavity and extending through aligned openings in the reinforcing ribs.

4 Claims, 32 Drawing Figures



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SHEET 1 OF 6

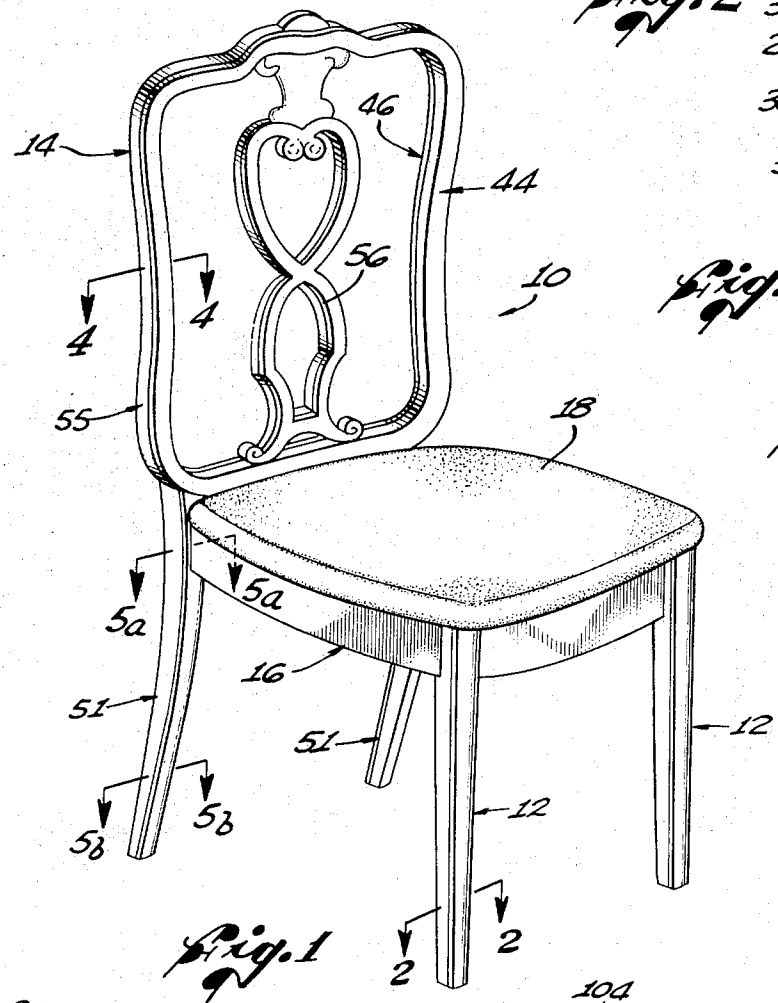

Fig. 1

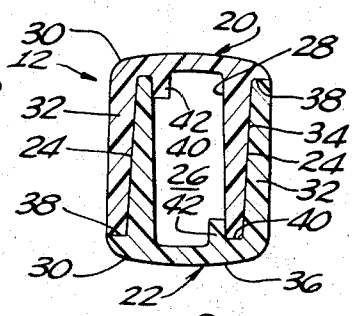

Fig. 2

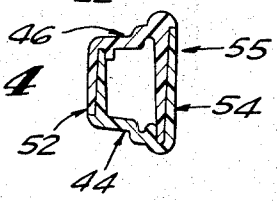

Fig. 4

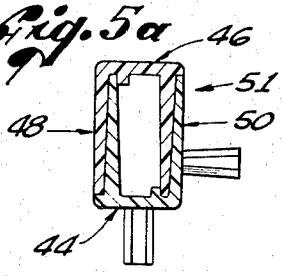

Fig. 5a

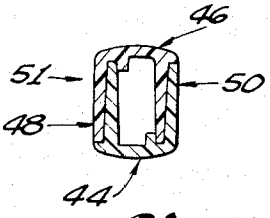

Fig. 5b

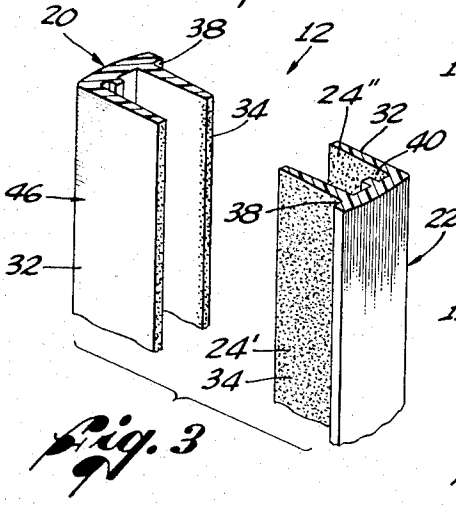

Fig. 3

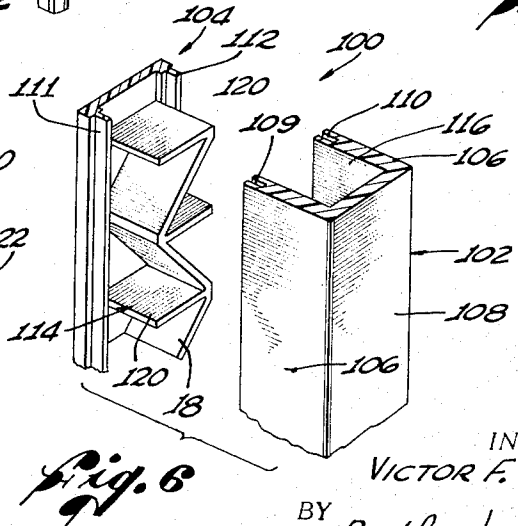

Fig. 6

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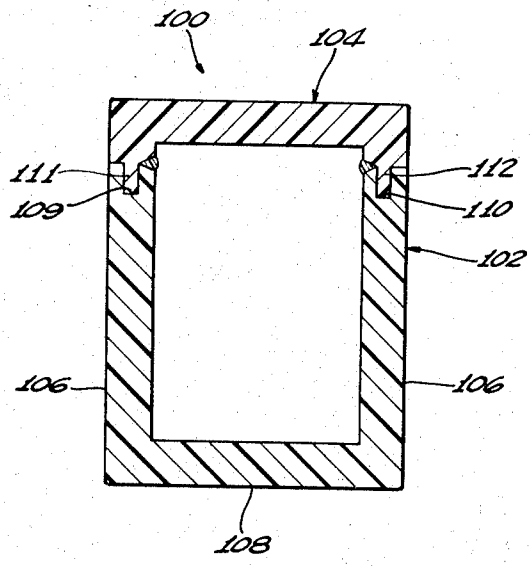

Fig. 6a

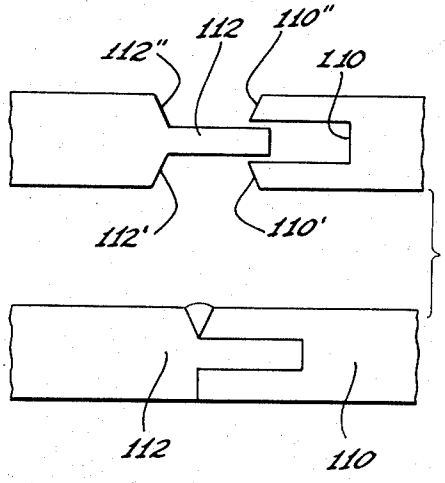

Fig. 6b

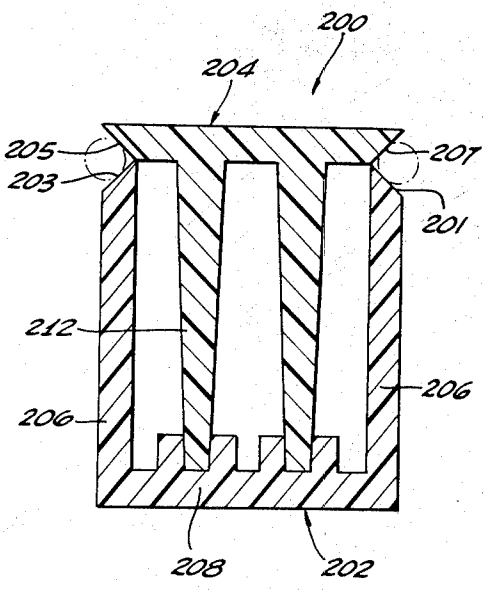

Fig. 7a

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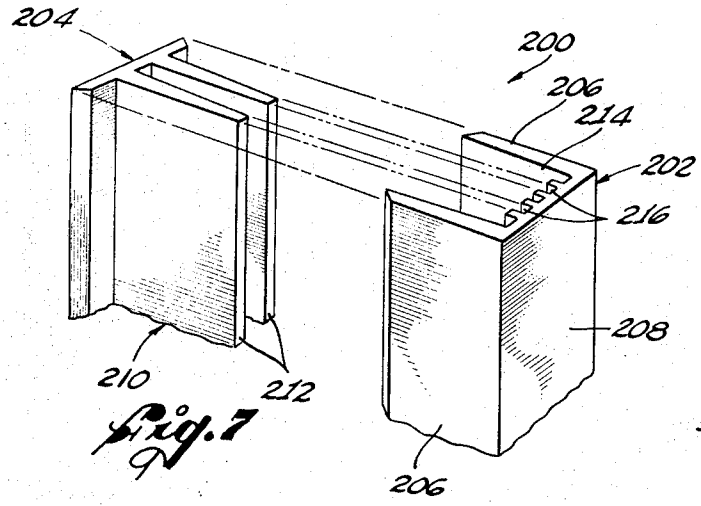
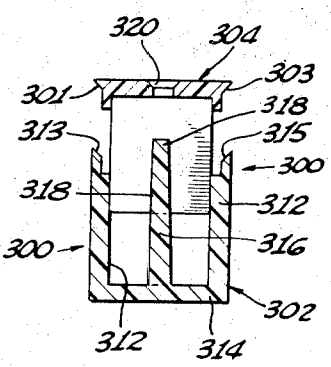


Fig. 7



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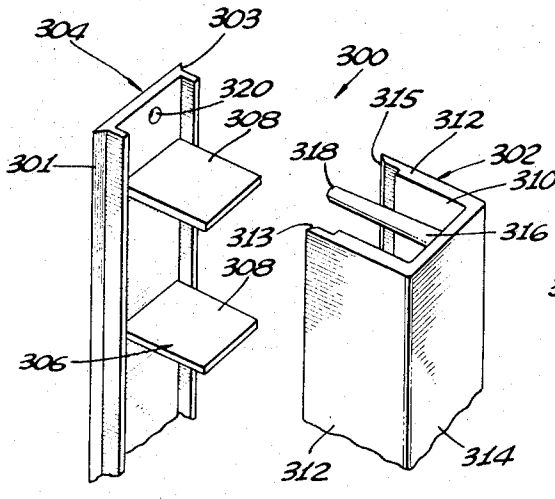

Fig. 8

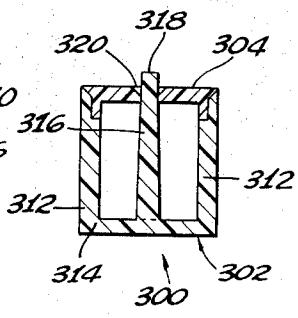

Fig. 10

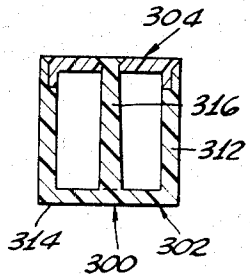

Fig. 11

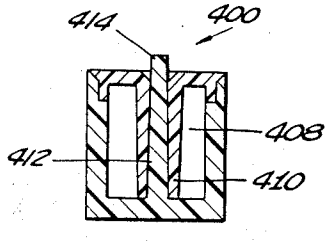

Fig. 13

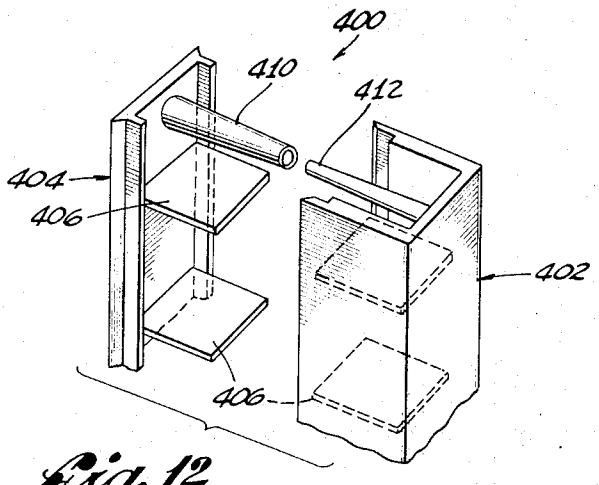

Fig. 12

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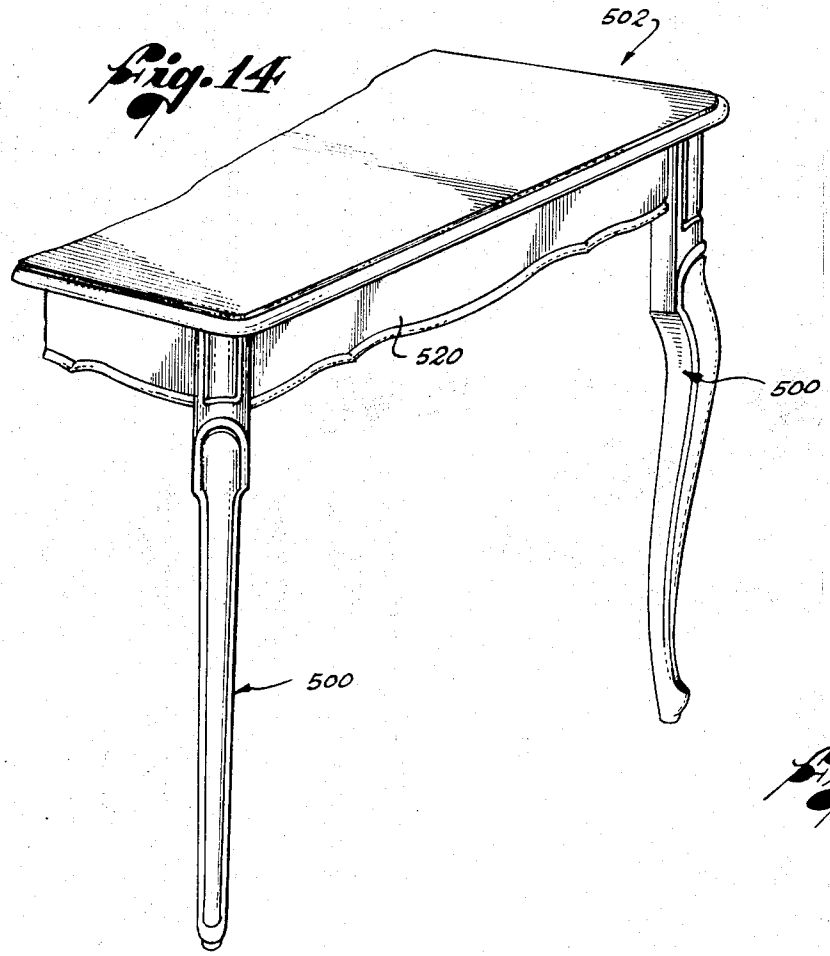
Fig. 14



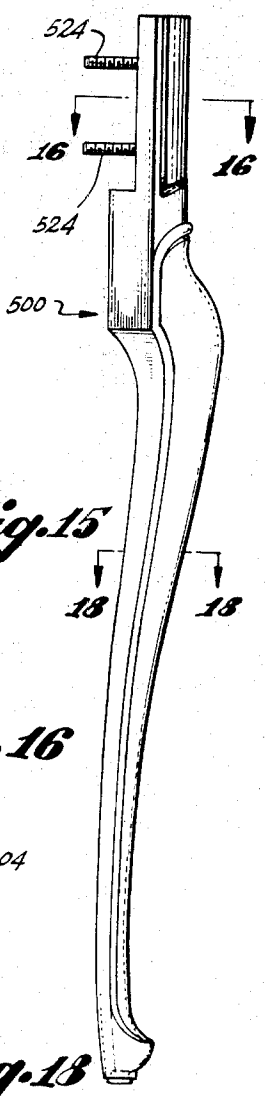
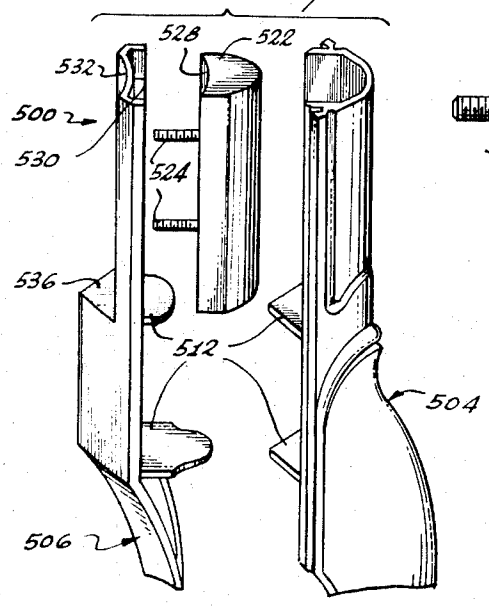


Fig. 15

Fig. 17



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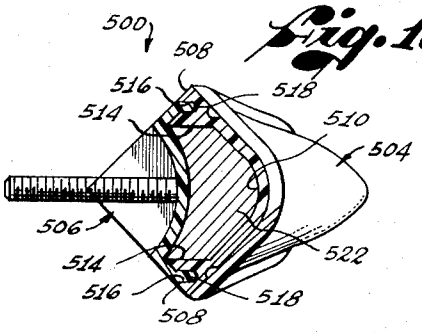

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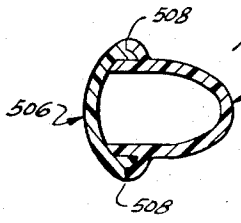

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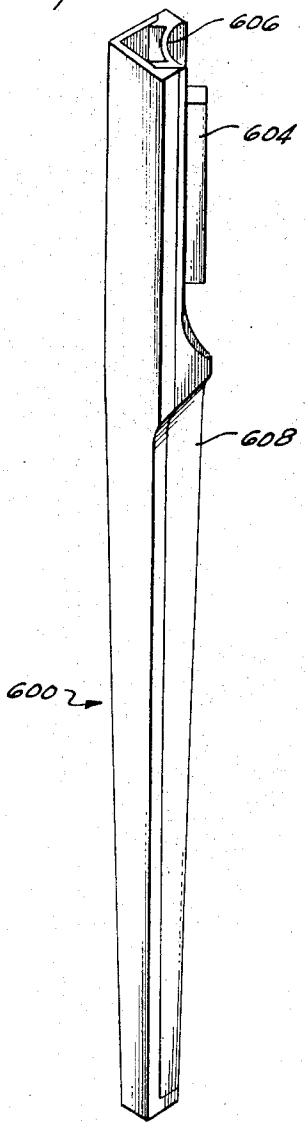
Fig. 19



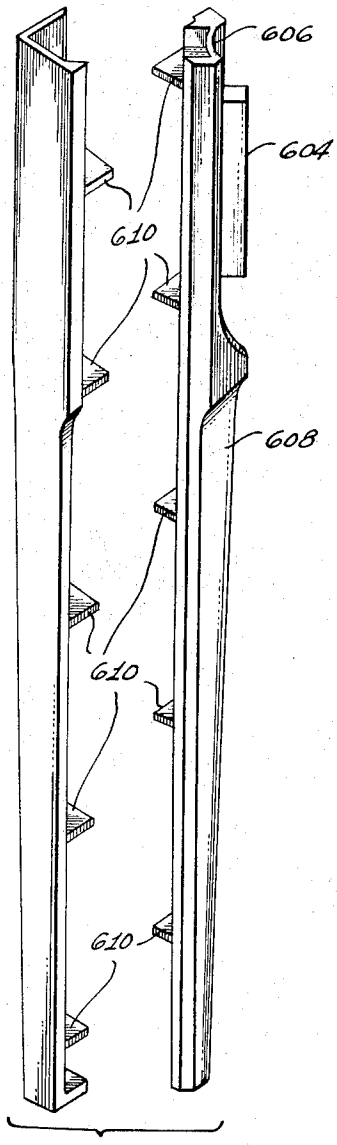
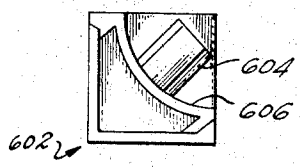


Fig. 20

Fig. 23



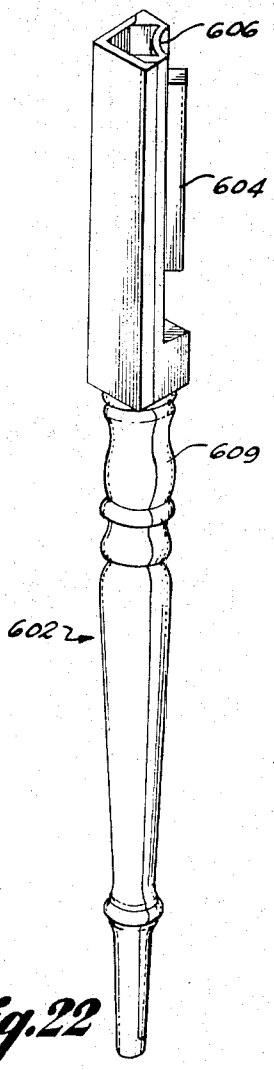


Fig. 22

Fig. 21

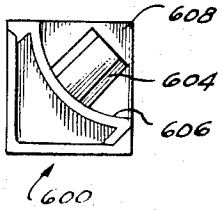


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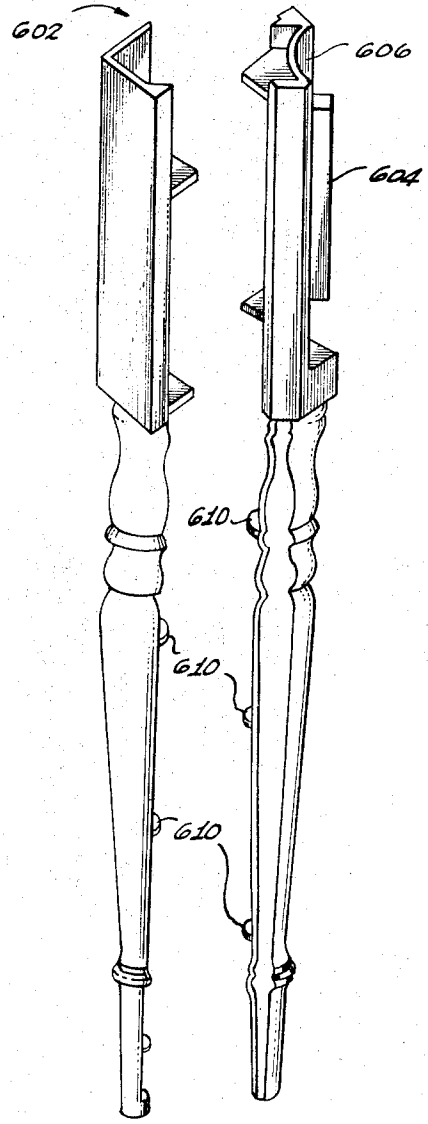
Fig. 24



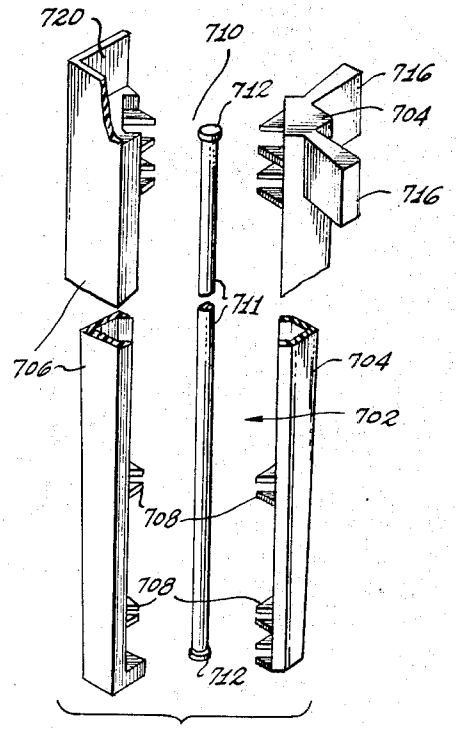


Fig. 25

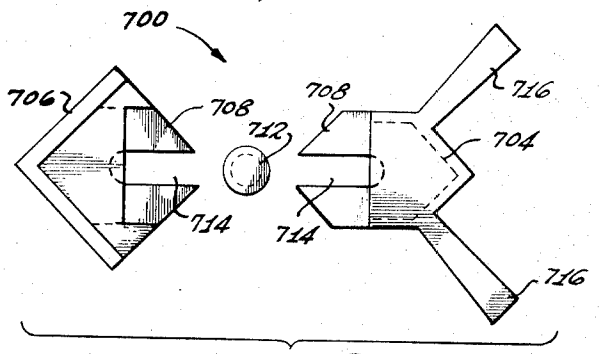


Fig. 26

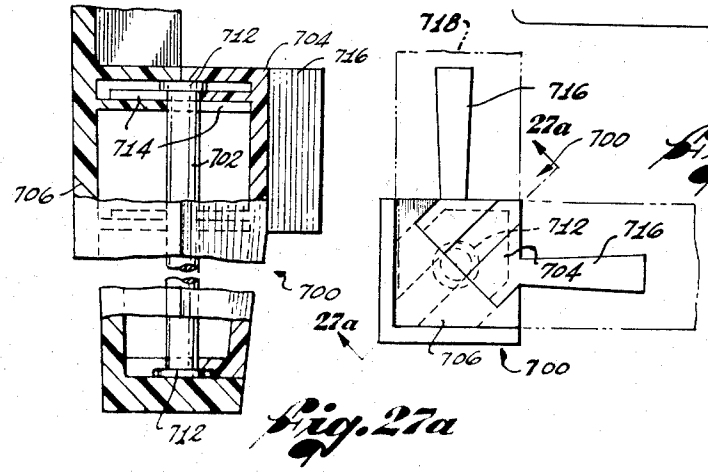


Fig. 27

Fig. 27a

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BIPARTITE TUBULAR MOLDED SYNTHETIC RESIN FURNITURE PART WITH INTERNAL REINFORCEMENT

REFERENCE TO COPENDING APPLICATION

The present application is a continuation-in-part of my copending application Ser. No. 797,616, filed Feb. 7, 1969 now abandoned.

Reference is also made herein to my application Ser. No. 677,153, filed Oct. 23, 1967, and entitled "- PREFABRICATED PLASTIC CHAIR AND ASSEMBLY METHOD," now U.S. Pat. No. 3,455,605.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

This invention relates generally to the field of synthetic resin furniture and more particularly to a hollow molded synthetic resin part for such furniture.

2. Description of the Prior Art:

Recent developments in synthetic resin material and synthetic resin molding techniques have made possible the mass production of synthetic resin furniture which is practical, aesthetically pleasing, and presently favored by ever increasing popularity and demand. A primary advantage of synthetic resin furniture over conventional wooden furniture, of course, resides in the fact that virtually any furniture style, from the very simple to the highly ornate, may be mass produced at relatively low cost. Moreover, the coloring and surface texture of synthetic resin furniture may be readily varied to simulate virtually any furniture wood and surface finish.

Generally speaking, the mass production of an article of furniture involves two basic operations. These are fabrication of the various parts of the article and assembly of the parts into a unitary furniture structure. The present invention is concerned with the fabrication of certain synthetic resin furniture parts which may be assembled with other parts to provide a completed article of furniture. As will become evident from the ensuing description, the invention may be embodied in various kinds of furniture parts. However, the invention is concerned primarily with and will be disclosed in relation to synthetic resin parts for chairs and tables, such as chair and table legs and chair back assemblies.

SUMMARY OF THE INVENTION

According to its broader aspects, the invention provides a reinforced generally tubular synthetic resin furniture part comprising a pair of complementary molded tube sections; at least one of said tube sections having a generally U-shaped cross section, the legs and the web portion being of generally equal wall thicknesses as is the web portion of the other of said tube sections; predetermined surfaces on each of the tube sections for providing permanent connection between said tube sections; and means integral with at least one of said tube sections extending across the cavity between the tube sections for reinforcing said tube sections. The sections are joined to one another in any convenient way, as by adhesively bonding, solvent welding, or ultrasonically welding the predetermined surfaces. The predetermined surfaces of the tube sections are shaped to mate in such a way that the joints between the tube sections are virtually invisible, except perhaps by extremely close inspection. When thus assembled, the tube sections define a cavity extending longitudinally through the furniture part and bounded by inner wall surfaces of the tube sections. The exterior wall surfaces of the tube sections may be ornately contoured and/or embossed to simulate any desired furniture style, surface finish, or surface texture. The color of the synthetic resin material from which the tube sections are molded may be selected to simulate any furniture wood and finish.

An important feature of the invention resides in novel reinforcing means for reinforcing the furniture parts against deformation under load. This reinforcing feature permits reduction of the wall thickness of the molded synthetic resin tube sections and thereby enables production, at minimum cost, of furniture parts conforming to virtually any furniture style. According to this feature of the invention, one or both tube sections are integrally formed or molded with reinforcing formations, such as reinforcing ribs or flanges, which project from the inner wall surfaces of the respective sections across the longitudinal cavity defined by the tube sections, to the inner wall surfaces of the opposite section. The contacting surfaces of the reinforcing formations and tube sections are bonded to one another in such a way that the completed furniture part possesses great strength in spite of its hollow thin walled construction.

A variety of reinforcing configurations are disclosed. In certain disclosed embodiments, the reinforcing formations comprise ribs which are disposed in planes transverse to and spaced along the longitudinal axis of the part. In one of these embodiments, the reinforcing action of the ribs is aided by a metal rod which extends through openings in the ribs. Other disclosed embodiments of the invention utilize reinforcing flanges disposed in longitudinal planes of the furniture part.

As noted earlier, the invention may be embodied in various types of furniture parts. The particular inventive embodiments disclosed herein are chair and table legs. One disclosed embodiment is an entire back assembly for a chair including two rear legs and a back rest.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a plastic chair embodying molded synthetic resin furniture parts according to the invention which, in this instance, are the front chair legs and the chair back;

FIG. 2 is an enlarged section through one of the front chair legs taken on line 2—2 in FIG. 1;

FIG. 3 is an exploded fragmentary perspective view of the front chair leg;

FIG. 4 is an enlarged section through the chair back taken on line 4—4 in FIG. 1;

FIG. 5*a* is an enlarged section through one of the rear chair legs taken on line 5*a* —5*a* of FIG. 1;

FIG. 5*b* is a section taken on line 5*b*—5*b* of FIG. 1;

FIG. 6 is a fragmentary exploded perspective view of a modified molded synthetic resin furniture part according to the invention;

FIG. 6*a* is an enlarged sectional view of the embodiment shown in FIG. 6;

FIG. 6*b* is an enlarged sectional view of the predetermined surfaces to be connected shown in FIG. 6;

FIG. 7 is a fragmentary exploded perspective view of a further modified molded synthetic resin furniture part according to the invention;

FIG. 7*a* is an enlarged sectional view of the embodiment shown in FIG. 7;

FIG. 8 is a fragmentary exploded perspective view of a further modified molded synthetic resin furniture part according to the invention;

FIGS. 9 through 11 illustrate the manner of assembling the two sections of the furniture part illustrated in FIG. 8;

FIG. 12 is a fragmentary exploded perspective view of a further modified molded synthetic resin furniture part according to the invention;

FIG. 13 is a section through the assembled furniture part of FIG. 12;

FIG. 14 is a fragmentary perspective view of a synthetic resin table embodying molded synthetic resin furniture parts according to the invention which, in this instance, are the table legs;

FIG. 15 is an enlarged side elevation of one of the table legs;

FIG. 16 is an enlarged section taken on line 16—16 in FIG. 15;

FIG. 17 is an exploded fragmentary perspective view of the upper end of the table leg illustrated in FIG. 15;

FIG. 18 is a section taken on line 18—18 of FIG. 15;

FIG. 19 is a perspective view of a further modified molded synthetic resin furniture part or leg according to the invention;

FIG. 20 is an exploded perspective view of the leg illustrated in FIG. 19;

FIG. 21 is an upper end view of the furniture leg illustrated in FIG. 19;

FIG. 22 is a perspective view of a further modified molded synthetic resin furniture part or leg according to the invention;

FIG. 23 is an upper end view of the leg illustrated in FIG. 22;

FIG. 24 is an exploded perspective view of the leg illustrated in FIG. 22;

FIG. 25 is an exploded fragmentary perspective view of a further modified molded synthetic resin furniture part or leg according to the invention embodying a central reinforcing rod;

FIG. 26 is an exploded upper end view of the furniture leg illustrated in FIG. 25;

FIG. 27 is an upper end view of the assembled furniture leg of FIG. 25; and

FIG. 27*a* is an enlarged fragmentary section taken on line 27*a*—27*a* in FIG. 27.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 through 5b of these drawings, there is illustrated a synthetic resin chair 10 embodying molded plastic parts 12 and 14 according to the invention. In this instance, parts 12 are the front chair legs and part 14 is the back assembly for the chair. The front legs and back assembly are attached to the front corners and rear side, respectively, of a molded plastic seat frame 16. This seat frame carries a seat cushion 18. Front legs 12 and back assembly 14 may be attached to the seat frame in any convenient way. One manner of affecting this attachment is disclosed in the aforementioned U.S. Pat. No. 3,455,605. According to the disclosure of the latter patent, attachment of the legs and back to the seat frame is accomplished by providing the legs and back with integral molded lug formations which fit snugly within complementary slots in the seat frame and are bonded to the frame.

The front chair legs 12 are mirror images of one another and each comprises a pair of relatively thin walled complementary synthetic resin tube sections 20 and 22. These tube sections are arranged side by side and have mating longitudinal marginal portions 24 disposed in mutual contact and joined in any convenient way. By way of example, the contacting margins 24 of the tube sections may be solvent welded. The tube sections 20, 22 define a cavity 26, FIG. 2, extending longitudinally through the part and bounded by inner wall surfaces 28 of the tube sections. The tube sections have exterior wall surfaces 30 which may be contoured and/or embossed to simulate various furniture styles. In this instance, the exterior wall surfaces of the tube sections are shaped to simulate a simple tapered furniture leg.

In the particular chair leg configuration under discussion, the tube sections 20, 22 have similar, generally channel shapes in transverse cross-section. Each tube section includes two leg portions, a side wall member 32 and a flange 34 disposed in spaced parallel longitudinal planes of the leg and a web portion 36 extending between and integrally joining the wall member and flange. The side wall member 32 of each tube section is flush with its adjacent edge of the web portion 36. The opposite edge of the web portion projects beyond the flange 34 a distance approximating the thickness of the side wall member to provide a longitudinal ledge or shoulder 38 on each tube section. As shown, the tube sections 20, 22 of each leg are assembled in such a way that the side wall members 32 of each section abut the shoulder 38 on the opposite section and overlap, in face to face contact, the flange 34 on the opposite section.

As noted earlier, a feature of the invention is concerned with reinforcement of the present furniture part or leg to enable the latter to have an economical hollow thin walled molded synthetic resin construction and yet possess sufficient strength and rigidity to resist deformation under load. In the particular inventive embodiment under discussion, the side wall members 32 and web portions 36 of the tube sections 20, 22 provide the main body of the leg and the tube section flanges 34 effectively serve as reinforcing formations or flanges. The longitudinal edge of each flange fits snugly into a groove 40 in the inner wall surface of the opposite tube section. This groove of each tube section is defined by its side wall member 32 and a longitudinal rib 42 projecting from the inner wall surface of the tube section in spaced parallel relation to the wall member. It will be observed that these interfitting flange and groove configurations serve to positively locate the tube sections laterally relative to one another.

As has been mentioned earlier, the tube sections 20 and 22 may be joined by a convenient joining technique, such as solvent welding. It is also to be understood that other forms of joining may be used, such as ultrasonic welding, inert gas welding, or hot

stacking, depending upon the particular cross-sectional configuration used for the furniture leg, as will be discussed in more detail hereinbelow. The cross section illustrated in FIGS. 2, 3, 4, and 5 are uniquely designed for being joined by solvent welding. In solvent welding certain nonvisible surfaces are wetted with a solvent which is highly active with a particular synthetic resin material to be joined. The solvent actually dissolves a portion of the synthetic resin on the joint surfaces. When the wetted, partially dissolved surfaces come together, mixing of the surfaces occur combining the synthetic resin of one part to that of the other. After predetermined contact pressure has been applied along the joint and a precalculated curing time allowed, a fixed joint will be achieved that approaches 100 per cent of the strength of the part material.

For example, referring to FIG. 3, surface 24′ of flange 34 of tube section 22 is wetted as is the surface 24″ of the side wall member 32 of the tube section 22. In addition, the surfaces defining the groove 40 are also coated as are the extended edges of both the flange and the side wall member. In a like fashion, the corresponding members of the tube section 20 are also coated and two tube sections 20 and 22 are brought together to cause a permanent joint so as to form a configuration as shown in FIG. 2. In order to provide room for synthetic resin material which may be squeezed during the time that pressure is applied, the side wall member 32 on each of the two sections is made slightly shorter than the flanges 34 so that when pressure is applied there is a flowing of the synthetic resin material to fill the slight gap provided between the ends of the side wall members and the shoulders 38. This gap will become filled during the process which forms the unitary furniture part. Because of the substantial surface areas of the tube sections in abutment which become bonded, the resultant furniture part is a high strength but economical element. It is, of course, understood that the cross sections shown in FIGS. 2, 4, and 5 will not have distinct boundary lines but rather tend to form a unitary piece without a clear indication of where the tube section 20 ends and where the tube section 22 begins; nevertheless, for purposes of clarity, the cross-sectional drawings are made with distinct boundaries.

The rear molded plastic furniture part or chair back assembly 14 comprises two complementary molded synthetic resin back sections 44 and 46, FIGS. 1, 4, 5*a*, and 5*b*, arranged side by side. These complementary back sections include lower tube sections 48 and 50, FIGS. 5*a* and 5*b*, which form rear chair legs 51, upper generally annular tube sections 52 and 54, FIG. 4, which form a back rest frame 55, and an ornamental insert 56 within and joined to the frame to provide with the frame a back rest. Insert 56 has a cross section like that shown in FIG. 2. Referring to FIGS. 4 – 5*b*, it will be seen that the chair back tube sections 48, 50, 52, 54 are similar in transverse cross section to the tube sections 20, 22 of the front chair legs 12 and mate in the same manner as the latter legs. Accordingly, it is unnecessary to re-describe the back tube sections in detail. Suffice it to say that these back tube sections are secured to one another in the same manner as the front leg tube sections so as to join the back sections 44, 46 into a unitary chair back structure. The ornamental insert 56 of the chair back may be separately formed and secured in place within the chair back frame. Alternatively, this insert may be molded in one piece, integral with one of the chair back sections, or in two mating portions integral with the two chair back sections, as desired.

FIGS. 6 – 13 illustrate various alternative molded synthetic resin configurations according to the invention which may be employed in the front chair legs 12 and/or the chair assembly back 14 of FIG. 1. The molded synthetic resin furniture part 100 of FIG. 6 comprises a pair of complementary molded plastic tube sections in the form of a channel section 102 and a cap strip section 104. The channel section 102 has parallel side walls 106 integrally joined along one longitudinal edge by the web portion 108. The two side walls 106 have grooves 109 and 110 formed in the ends thereof which mate with projections 111 and 112, respectively, of the cap strip section 104. As more clearly illustrated in FIG. 6*b*, the projection 112 is purposely made longer and narrower than the groove 110. In addition, surfaces 112″ and 110″ are slightly oblique so as to provide a V-shaped groove. The groove will be located on the inside of the furniture part. The greater length of the projection 112 insures intimate contact of the tube sections and there is sufficient room for the flow of excess material with squeeze out being directed to the groove on the inside of the furniture part so as to retain an unmarred outer surface.

While any suitable joining technique may be used for the configuration shown in FIG. 6, it has been especially designed for ultrasonic welding. This welding technique is accomplished through the use of high frequency vibrations between two parts of similar material; the high frequency vibration is controlled and transmitted through a special transducer head cone, the size, shape, type, and location of which control the finished weld. The degree of synthetic resin melt is achieved as a result of the frequency of vibration and the thickness of the parts being connected. The parts must be maintained in intimate and accurate contact throughout the welding operation to effect a good bond. As mentioned, the additional space created by the groove 110 allows the melted material to flow in a predetermined manner during the welding operation so that after the joining technique is finished a bonded connection is made, such as shown in FIG. 6*a* and the second part of FIG. 6*b*.

Furniture part 100 is provided with internal reinforcing formations 114 which extend across the cavity 116 within the part. In this instance, the reinforcing formations comprise an integral molded plastic reinforcing rib or flange 118 of generally zig-zag shape which projects from the inner wall surfaces of the cap strip section 104, and transverse reinforcing ribs 120 integral with and extending laterally of the reinforcing flange within each of the interior angles defined by the flange. Ribs 120 are disposed in planes normal to and spaced along the longitudinal axis of the furniture part.

The reinforcing flange 118 and ribs 120 are so dimensioned that when the channel and cap strip tube sections 102, 104 are assembled, the reinforcing flange and ribs fit snugly between the channel section side walls 106 and abut the inner wall surface of the channel section web portion 108. To achieve additional strength, the contacting surfaces of the reinforcing

flange and ribs and the channel section may be bonded to one another to form a rigid synthetic resin furniture part. Bonding may be accomplished by ultrasonic welding or solvent welding techniques.

The synthetic furniture part **200** of FIG. 7 is similar to that of FIG. 6 in that part **200** has a pair of molded synthetic resin tube sections in the form of a channel section **202** and a cap strip section **204**, respectively. Channel section **202** has parallel side walls **206** integrally joined along one longitudinal edge by a web portion **208**. Cap strip section **204** is laterally dimensioned to seat against the opposite longitudinal edges of the channel side walls **206** so as to close the open side of the channel section. The lateral edges **205** and **207** of the cap strip section **204** are oblique as are the extended edges **201** and **203** of the side walls **206**. When brought together, the channel section **202** and cap strip section **204** form lateral longitudinally extending grooves which are uniquely designed for still another joining technique than the two already mentioned. For example, the FIG. 7 embodiment may be permanently connected by an inert gas welding technique. Inert gas welding is quite similar to conventional metal welding in that a synthetic resin welding rod of the same material that is to be joined is laid within the two lateral grooves and is melted. Neither the rod nor the part to be welded are totally melted; only a shallow section of the rod and the part surfaces reach the melting temperature. It is the contact pressure of the rod's outer surface that causes the contact between the parts and the rod. Thus, prior to welding a configuration as shown in FIG. 7*a* will exist, and after welding and finishing the outer surface of the side walls will be completely flush, providing an aesthetically beautiful furniture part.

Plastic furniture part **200** is provided with reinforcing formations **210**. In this instance, the reinforcing formations comprise reinforcing flanges **212** integrally molded on the inner wall surface of the cap strip section **204**. Flanges **212** are disposed in spaced longitudinal planes of the part parallel to the side walls **206** of the channel section **202**. These flanges project across the central cavity **214** in the part into contact with the inner wall surface of the web portion **208** of the channel section. Formed in the inner wall surface of the web portion, are longitudinal grooves **216** which snugly receive the longitudinal edges of the reinforcing flanges. The contacting surfaces of the reinforcing flanges and channel web portion may be bonded to one another to provide a strong, rigid synthetic resin furniture part.

Turning now to FIGS. **8 – 11**, the illustrated synthetic resin furniture part **300** comprises molded synthetic resin channel and cap strip tube sections **302**, **304** which are similar to those of FIG. **6**. Part **300** has reinforcing formations **306** in the form of separate reinforcing ribs **308** which are integrally molded on the inner wall surface of the cap strip section **304**. These reinforcing ribs are disposed in planes normal to and uniformly spaced along the axis of the central cavity **310** through the part **300**. Reinforcing ribs **308** are dimensioned to fit snugly between the side walls **312** of the channel tube sections **302** and to seat against the inner wall surface of the channel web portion **314**.

In this particular embodiment, attachment of the channel and cap strip sections is provided by synthetic resin rivet posts **316** which are integrally molded on the inner wall surface of the channel web portion **314** and terminate in rivet-like ends or tips **318**. When the channel and cap strip sections are assembled, these rivet tips project through externally counter-sunk holes **320** in the cap strip section **304**. After assembly of the channel and cap strip sections, pressure and heat are applied to the protruding rivet tips **318** so as to form a flush configuration, shown in FIG. **11**.

As with the FIG. 7 embodiment, the extended ends of the side walls **312** have oblique surfaces **313** and **315** while the lateral edges of the cap strip section **304** have oblique surfaces **301** and **303**. However, unlike the FIG. 7 embodiment, the corresponding surfaces, such as **301** and **313**, complement each other to form an abutment so that the surfaces **301** and **313** lie in an oblique plane which intersects a corner of the finished furniture part. By being so constructed, the boundary line between the two sections become nearly invisible. Additionally, the surfaces, such as **301** and **313**, may be bonded to one another, such as by solvent welding, to additionally hold the two sections in rigid connection.

FIGS. **12** and **13** illustrate a modified synthetic furniture part **400** according to the invention which is identical to the furniture part **300** of FIGs. **8 – 11** with two exceptions. First, both the channel tube section **402** and the cap strip tube section **404** of the part **400** are formed with reinforcing ribs **406**. These ribs are arranged in alternate sequency along the axis of the cavity **408** through the furniture part. Secondly, the cap strip section **404** is provided with integral molded plastic sleeves **410** which project from the inner wall surface of the strip section and receive rivet posts **412** on the channel section **402** when the sections are assembled. After assembly, the protruding tips **414** of the rivet posts are deformed by the application of heat and pressure, in the same manner as discussed in connection with the synthetic resin furniture part of FIGS. **8 – 11**.

Referring now to FIGS. **14 – 18**, there is illustrated a further modified synthetic resin furniture part according to the invention which, in this instance, is a leg **500** for a table **502**. Leg **500** has two complementary molded synthetic resin tube sections, a channel section **504** and a cap strip section **506** arranged side by side with mating longitudinal marginal portions **508** of the sections in contact. As in the previous embodiments of the invention, the tube sections may be joined by adhesively bonding, inert gas welding, solvent welding, or ultrasonically welding their contacting marginal surfaces. When thus assembled, the tube sections define a cavity **510** extending longitudinally through the leg. Integrally molded on the inner wall surfaces of the tube sections are reinforcing ribs **512** which extend across the cavity and seat against and which may be bonded to the opposite tube section, as before.

It will be observed that the channel section **504** has a generally channel shape in transverse cross section and the cap strip section **506** is essentially a cap strip which closes the upper side of the channel section. From this standpoint, the table leg **500** is generally similar to the furniture parts or chair legs described earlier. However, the external wall surfaces of the table leg are shaped to

provide the leg with a French provincial design. As a consequence, the channel section **504** has an arcuate cross section which varies along the leg from a relatively deep arcuate channel shape at the lower end of the leg to a relatively shallow arcuate channel shape at the upper end of the leg. The cap strip section **506** also has an arcuate cross section which varies along the leg from an externally convex shape at the lower end of the leg to an externally concave shape at the upper end of the leg.

In the particular table leg illustrated, the mating longitudinal marginal portions **508** of the channel and cap strip sections **504**, **506** comprise laterally thickened wall portions **514** on the channel section, along its longitudinal edges. These thickened wall portions form recesses **516**. The recesses **516** receive mating longitudinal beads or tongues **518** which are integrally molded on the cap strip section along its longitudinal margin. Referring to FIGS. **16** and **18**, it will be observed that the longitudinal marginal portions **508** of the tube sections mate or engage in a manner such that the external wall surfaces of the tube sections are flush with one another along the marginal joints between the sections so as to render these joints virtually undiscernible, except perhaps by extremely close inspection.

Table **502** has a frame **520** to which the upper end of the table leg **500** is attached. This attachment may be accomplished in various ways. In the particular embodiment shown, an insert **522** with threaded studs **524** is contained within the upper end of the leg cavity **510**. The studs **524** protrude through holes (not shown) in the confronting upper portion of the cap strip section **506**. As already noted, this upper portion of the cap strip section has an externally concave and hence an internally convex arcuate shape in transverse cross section. The upper portion of the channel section **504**, on the other hand, has an externally convex and hence internally concave arcuate shape in transverse cross section. As a consequence, the upper end of the leg cavity **510**, which receives the insert **522**, has an arcuate cross section. The insert **522**, which may comprise a molded synthetic resin, foam synthetic resin, or filled wood part, has the same arcuate shape in transverse cross section as the leg cavity and thus complements the cavity. The inner concave surface **528** of the insert seats flush against the inner concave wall surface **530** of the cap strip section so as to provide extensive face to face contact between these parts.

The upper external concave wall surface **532** of the cap strip section **506** seats flush against a mating side surface on the table frame **520** when the leg is assembled on the frame. The studs **524** of the leg insert extend through openings in the frame and receive nuts (not shown) which are tightened against the inner sides of the frame to firmly attach the leg to the frame. In this regard, it will be understood that the face to face contact of the upper portion of the cap strip section **506** with the table frame **520** and the leg insert **522** prevents deformation of the leg when the nuts are tightened and thereby assures firm attachment of the leg to the frame. Referring to FIG. **17**, it will be seen that the cap strip section is also enlarged to provide an upwardly presented shoulder **536** just below its upper concave, table frame seating surface. This shoulder seats against the under side of the table frame to vertically support the frame and resist lateral rotation of the leg relative to the frame.

FIGS. **19 – 24** illustrate modified synthetic resin table legs **600** and **602** according to the invention which are generally similar to the table leg **500**, just described. The table legs **600**, **602** differ from the legs **500** in that the external wall surfaces of the modified leg are shaped to conform to contemporary designs, rather than a French provincial design. Also, the fastening means for securing the modified legs to the table frame comprise tapered attachments lugs **604** which are integrally molded on the upper concave table frame seating surfaces **606** of the cap strip tube sections **608**, **609** of the legs. These lugs are adapted to fit snugly within mating tapered grooves in the table frame and to be force fitted or bonded to the frame. The leg tube sections have alternate reinforcing ribs **610**.

Turning now to FIGS. **25 – 27**, there is illustrated a modified synthetic resin furniture leg **700** according to the invention which may be utilized, for example, as either a chair leg or a table leg. The synthetic resin furniture part or leg **700** comprises two complementary molded synthetic resin tube sections **704**, **706**. In this instance, the tube sections are generally triangular in cross section and mate in such a way as to provide a furniture leg of rectangular cross section. The external wall surfaces of the tube sections are quite plain and provide a leg of simple tapered configuration. It will be understood, of course, that the furniture leg **700** may have any cross-sectional shape and conform externally to any desired furniture style.

Projecting from the inner wall surfaces and beyond the confronting open sides of the tube sections **704**, **706** are a number of integral molded synthetic resin reinforcing ribs **708**. These ribs are disposed in planes normal to and spaced along the longitudinal axis of the leg. When the tube sections **704**, **706** are assembled, the ribs **708** project across the cavity **710** through the leg into contact with the opposite tube section. As in the previous embodiments of the invention, the tube sections are joined to one another, as, for example, by bonding to one another the mating longitudinal marginal portions of the tube sections and the contacting inner wall surfaces of the sections and the reinforcing ribs.

The reinforcing ribs **708** of the tube sections **704**, **706** alternate. Moreover, these ribs are spaced along the axis of the leg **700** in such a way that when the tube sections are assembled, the corresponding ribs on the sections overlap in face to face contact. Leg reinforcing means **702** comprise a metal reinforcing rod **711** with end flanges or heads **712** which is positioned longitudinally within the leg cavity **710** and extends through aligned rib openings **714** in the reinforcing ribs **708**. In this instance, the rib openings **714** comprise slots which open longitudinally through the outer edges of the ribs and overlap one another at their closed ends to effectively define a circular rod receiving opening. As shown in FIG. **27***a*, the rod end flanges **712** project edgewise into laterally opening grooves in the tube sections **704**, **706**, whereby the rod supports a portion of the axial load on the furniture part. The rod thus reinforces the part axially as well as against bending. It will be understood that the open ended slot configuration of the reinforcing rib openings **714** permits the tube sections

704, 706 to be assembled about the reinforcing rod 702. In this latter connection, it will be observed that in the particular inventive embodiment shown, as well as in all of the other disclosed inventive embodiments, the complementary tube sections are shaped to be brought into mating assembled engagement by relative assembly movement of the sections along direction lines transverse to the length of the furniture part or leg. It would also be possible to insert a series of filament fiber lines into the location of the rod 711 while under tension, thus increasing the load carrying strength beyond a metal rod support.

In the particular furniture leg 700 selected for illustration in FIGS. 25 – 27, normally inner or rear tube section 704 is formed with integral molded synthetic lugs 716 to fit within and be bonded to mating grooves in the furniture frame 718 for attaching the leg to the frame. The normally outer or front tube section 706 has a V-shaped upper end 720 which projects above the upper end of the tube section 704 and is adapted to fit about the corner of the frame in the manner shown.

What has been described more generally are furniture pieces or parts made up of two tube sections which have predetermined surfaces which are bonded to achieve a unitary, rigid and strong furniture part. As mentioned, there are several techniques for connecting the two tube sections together with unique designs favoring one or the other of the joint techniques. The designer of a piece of furniture will choose whichever technique and corresponding structure is most economical and suitable for the particular style that he is concerned with.

In each embodiment of the invention, the cavity through the molded synthetic resin part may be filled with foam synthetic resin or other filler material similar to the insert 522, FIGS. 16 and 17, to provide the part with a solid sound and feel resembling a wood part.

It will be immediately evident to those versed in the art that a hollow, split molded synthetic resin furniture part according to the invention has numerous inherent advantages over a solid, one piece molded part. Among the foremost of these advantages are the following:

1. Individual parts will weigh substantially less.

2. Initial part costs will be greatly reduced by reducing the amount of material used in and reducing the production cycle time (cycle time reduction is obviously due to quantity of material that must fill the mold cavity and the time required for preliminary cooling).

3. Section modular strength is greater in a hollow cross section than a solid cross section.

4. There is less material wasted in a rejected part.

5. As part of the art of injection molding, equal wall thickness produces parts with a minimum of internal stresses developed during the molding operation and cooling.

6. Hollow parts will more closely equal the weight of wood.

7. Hollow parts will not warp as readily as thick solid sections.

8. Injection molding equipment required to produce two piece hollow parts will need less mold clamp pressure and less pressure need to squeeze the injecting synthetic resin into the mold.

The invention has been described in considerable detail in order to comply with the patent laws by providing a full public disclosure of at least one of its forms. However, such detailed description is not intended in any way to limit the broad features or principles of the invention, or the scope of patent monopoly to be granted.

I claim:

1. A bipartite tubular molded synthetic resin furniture part with internal reinforcement comprising:

a pair of complementary molded synthetic resin tube sections arranged side by side and having mating longitudinal marginal portions disposed in mutual contact and bonded to one another to join said tube sections into a unitary tube, said tube sections together defining a cavity extending longitudinally therethrough and bounded by interior wall surfaces of said tube sections;

each of said tube sections including a plurality of integrally molded, plastic reinforcing ribs which project from the interior wall surface of said tube section and extend across said cavity in planes generally perpendicular to the longitudinal axis of said cavity, said plurality of ribs being spaced along the length of said cavity and having projecting end edges which are seated against and bonded to the interior wall surface of the other tube section;

the projecting ends of all of said ribs also having openings formed therein which are aligned longitudinally of said cavity; and

a metal reinforcing rod extending longitudinally within said cavity and being received by all of said rib openings, the tube cooperatively formed by said pair of tube sections also having interior end surfaces which are engaged by respective ends of said metal reinforcing rod;

whereby said reinforcing rod is effective to support a portion of any axial load placed upon said tube as well as reinforcing said tube against bending.

2. A furniture part as claimed in claim 1 wherein said rib openings comprise slots which open through the projecting end edge of each of said ribs, whereby said tube sections may be assembled together about said reinforcing rod by placing all of said ribs into straddling relationship with said reinforcing rod.

3. A furniture part as claimed in claim 1 wherein the ribs on one tube section alternate with the ribs on the other tube section.

4. A furniture part as claimed in claim 1 wherein each of said tube sections is generally triangular in cross-section, and said tube sections together form a tube of generally rectangular cross-section.

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