This invention relates to structures which may be produced by assembly of standard components included in a kit, i.e., in a set of suitably manufactured parts and, particularly, to such structures of the type designed to form the framing of shelves, scaffoldings and like.

It has become common practice to build up the framing of a scaffold, as well as shelves and other pieces of furniture, by assembling a number of previously manufactured and finished parts and members. In particular, it is common practice to use standard components adapted to form a framework, including metal parts such as vertical post members and horizontal cross-bars or rail members, and joint means adapted to connect said members at the crossing or junction thereof. In general such assembled frameworks include lengths of members provided with a plurality of evenly spaced holes adapted for engagement with hooking means to form the joints therebetween.

Most of the structures heretofore proposed are of rugged and somewhat unattractive appearance, and therefore the structures are not suitable for fine furniture and appliances as used in halls, waiting rooms, salons, representatives' or executives' offices, homes and the like.

A further common objection to which heretofore proposed assembled frameworks are subject consists of a somewhat poor connection of the several components, particularly in respect of resistance to sidewise tilting, because the commonly constructed joint means thereof are not properly designed for resistance to torque.

Another problem that sometimes occurs, is that by using previously manufactured standard components a framework having the very desired dimensions and properties to meet the most diversified requirements cannot be assembled. In particular, it is frequently desirable to form a framework, the dimensions of which do not exactly agree with any of the possible dimensions defined by the spaced holes or other fixedly located joint means included in the standard members.

It is an object of the invention, therefore, to provide a new and improved kit for assembling a structure of the foregoing type, which is not subject to the above and other objections.

It is another object of the invention to provide a new and improved framework which may be formed by readily combining and assembling a plurality of standard components including straight members, which serve as posts and rails, and joint means adapted to be combined in a framework of neat and pleasing appearance, and representing smooth and substantially uninterrupted outer surfaces.

It is a further object of this invention to provide a new and useful structure including joint means adapted to rigidly connect the various adjacent post and rail forming components at a given angle, in particular at right angles and/or in aligned relationship.

It is yet another object of the invention to provide a new and improved framework including junction devices which may be readily assembled and made fast by making use of the most simple tooling, in particular of a screwdriver only.

It is an additional object of the invention to provide a new and advantageous method for manufacturing and pre-paring kits for assembling a framework of any desired dimension to meet the special requirements of any particular case.

With these and other objects in view, the invention resides in the provision of a framework structure comprising, in combination, a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in a direction transverse to the elongation of the respective member; connecting means for connecting adjacent ends of the elongated frame members to each other and each comprising a central portion and at least two pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of the elongated frame members, the bracing members in each pair extending substantially parallel and slightly spaced from each other and each having a wedge-shaped cross-section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to the aforesaid given angle; and means operatively connected to each pair of bracing members for pressing the wedge faces thereof in tight engagement with the abutting faces of the frame members so as to connect the frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary perspective view, illustrating a part of a typical framework constructed in accordance with the invention, and including four co-planar straight components connected by joint means;

FIGURE 2 is a similar fragmentary perspective view illustrating further parts of the structure, including junctions and a post foot;

FIGURES 3 and 4 illustrate details of the joint means included in the parts shown in FIGS. 1 and 2, respectively, in the same position and orientation;

FIGURE 5 is a fragmentary enlarged cross-sectional view of the junction shown in FIG. 1 taken along the section line 5—5 thereof;

FIGURE 6 is an enlarged cross-sectional showing of a straight member of the structure, taken in a plane corresponding to the location of brace expanding means to be applied to the joint means to be connected thereto;

FIGURE 7 is an exploded partly sectional view of a junction, taken along line 7—7 of FIG. 3 and including an end portion of a straight member shown in phantom and brace expanding means to be connected thereto;

FIGURES 8 and 9 are front and side views, respectively of a component of such brace expanding means;

FIGURE 10 illustrates another detail of the framework, in a sectional view taken along the section line 10—10 of FIG. 2; and

FIGURE 11 is a perspective fragmentary, diagrammatic view drawn on a reduced scale and showing an example of a simple framework which may be produced according to the invention.

Referring now to the drawings, the simple framework shown in FIG. 11 will be best suitable to explain the principles and general character of the invention. Such framework includes elongated hollow-frame members or straight components, generally indicated at 20B, partly forming the vertical posts of the structure and partly forming horizontal rail members thereof. These rail
members are located so as to support shelves or scaffold flooring 37, say of wood, metal, plywood, plastics, glass, sheet metal, tile, or the like. Bottom members 25 are provided to support the structure on the floor and side wall forming members 35 may be arranged for better accommodation of goods, articles, books, papers and the like on the said shelves.

Obviously the structure shown in FIG. 11 is purely representative and differently formed compound structures may be easily devised, including a different number and/or location of superimposed, shelf forming layers, and further including a different number and/or location of posts, according to the desired height, width and load capacity.

The said straight members shown at 20 are each produced by cutting into desired lengths, an aluminum or aluminum alloy extruded material of uniform cross-sectional shape, preferably of the shape shown in FIGS. 1, 2, 5 and 10 and, in greater detail, in FIG. 6. Such cross-section shape is somewhat elongated and includes internally and externally tapered side portions. The outer faces of said portions are preferably grooved, as shown at 21 (FIGS. 1 and 6) and the minor side faces are provided with longitudinal grooves 22. The inner outline of said cross-sectional shape includes abutting facets 23 tending toward each other at a given angle and forming a taper therebetween.

The connections between the various adjacent straight members are provided by connecting means or joint means of differing shape, in accordance with the number and location of the two or more straight members adjacent thereto. In FIGS. 3 and 4 two exemplificative embodiments of said joint means are shown, designed to connect four co-planar straight members at right angles therebetween and respectively to connect two co-planar and aligned members, a third member co-planar and right angles to the two members and a fourth member at right angles to all three members.

Any joint means included in a framework produced according to the invention consists of a metallic, pressure die cast component including a center portion 24 of substantially flat and diamond-like shape and a plurality of brace forming extensions, said extensions being located according to the locations of the various straight members which are supposed to be joined in the respective junction of the framework. Each brace forming extension of any joint means of the invention is made integral with the respective block portion 24 and is made expandable by the provision of a longitudinal slot or slots 27 dividing such extension into two parallel symmetrical portions. Any such expansible brace forming extension is further cross-sectionally shaped and dimensioned for slidably entering the hollow of any end portion of any straight member 20, the rigid connection of any joint means with any adjacent straight member being obtained by forcibly expanding the said portions 26 inside said end portion as will be described later. The taper of the inner faces 23 (see FIG. 6) and of the outer faces of the said portions 26 in abutting relationship therewith ensures the most desirable rigid connection, in view of the fact that such parts act as being engaged.

The kit of components provided for obtaining the desired structure may advantageously include ancillary post foot forming components. Such components may include each a shaped portion as indicated at 25 in FIG. 2 and one brace forming extension corresponding to any brace extension of any of the above described, and therefore a further detailed description and showing of such ancillary component will be omitted.

According to the invention, brace expanding means are provided for forcing the said portions 26 of any brace extension of any joint means or of other ancillary components slightly apart, said expanding means including screw driven wedge means designed to be wedgedly forced into said cuts 27 between said portions 26. In FIGS. 5 and 7 to 9 inclusive a preferred form of embodiment of said expanding means is shown.

As shown in these figures, in each one of said cuts 27, near to the free end thereof, a frusto-conical hollow 28 is provided to form a seat for a correspondingly shaped member or nut 29 (FIGS. 5 and 7-9) having oppositely located wing portions 30 adapted to slidably fit in the adjacent portion 27 to prevent rotation of the member 29. The latter has a screw-threaded bore 31 (FIG. 8) designed to engage with a screw 32 (FIG. 7) inserted into said member 29 through a hole 34 (FIG. 6) in one wall of the straight member 20 to be connected. Preferably said screw 32 is provided with a conical box 33 shaped to fit into the respective hole 34 so as to be flush with the outer surface of the corresponding straight member. Such conical members 29 may, however, be replaced by differently shaped wedge forming means or directly by conical screw means adapted to engage a correspondingly conical thread provided in the faces of said hollow 28, if desired.

As shown in the right-hand portion of FIG. 7, the said hole 34 is preferably drilled so as to be initially slightly offset with respect to the axis of said conical hollow 28, so that by driving a screw 32 into said hole a side thrust in the direction shown in FIG. 7 may be imparted to the straight member 29 for longitudinally forcing the same towards the block portion 24 of the adjacent and mating joint means.

As it will be readily understood from a consideration of the foregoing description and of the accompanying drawings, any connection between one straight member 20 and one joint means, according to the invention, includes one hole 34 drilled in the wall of the member 20, and one screw. Such hole 34 may obviously be drilled in that wall of the straight member which, upon assembling of the framework, will face the interior of the work, whereas the appearance of the structure will not be prejudiced by any screw head or other feature which might alter the smooth and pleasing external surface thereof.

According to the invention, the materials to be manufactured for a proper disposal of components of any structure to be formed includes a stock of extruded or die drawn straight material of the above discussed uniform cross-sectional shape and a plurality of suitably stacked joint means sorted for the various junctions to be provided in assembling the framework. In accordance with the required dimensions and pattern of the framework to be produced, the said factory can be cut into the required lengths and then provided with said holes 34 at the required uniform spacing from the ends thereof. It is therefore believed to be readily apparent that the invention provides a new and advantageous method for forming frameworks from custom prepared kits, and that such custom kits may be very readily and cheaply provided to meet the most diversified requirements simply by suitably sorting a proper number of joint means and by squarely sawing and drilling the straight materials in the required lengths, ready for assembly and connection with the various joint and/or ancillary means and members.

In FIGS. 2, 10 and 11, further ancillary means provided by the invention for supporting the shelf forming layers 37 on the horizontal rails of the structure and for forming side walls or shelves are shown. Such means consist of die drawn extruded materials to be cut into lengths and including a plate portion 38, a horizontal shelf forming side extension 36 designed to support the adjacent layer 37, and a second step forming side extension 38, located at an upper level and oppositely with respect to said bottom extension 36. The extension 38 is provided with a downwardly facing rib 39 adapted for engaging with the upwardly facing groove 22 of the adjacent horizontal straight member 28. Of course, as shown in the various
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Illustrations of the accompanying drawings, the said horizontally arranged straight members are set to have their major axis of the cross-sectional shape thereof in a vertical plane, for the above described arrangement of parts and for better load-carrying ability.

Upon considering the various components, as shown in FIG. 10, the load of the layer 37 and of the goods carried thereby, applied on said stepped bottom portions 36 in the direction indicated at 41, causes the said ancillary member 35 to remain in upright position and to laterally abut the flank 40 of the adjacent straight member 29 of the central portion 20.

While the invention has been described and shown but in one preferred form of embodiment thereof, it is intended that the invention should not be limited to the very details shown, and that such details should not be taken as restrictive of the invention, as it is obvious that various modifications in design may be resorted to by those skilled in the art to which this invention appertains, according to the various requirements of actual service of the framework and/or in accordance with the size, material and character of the stacked standard materials, without departing from the spirit and the scope of the invention, as defined in and by the appended claims.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various applications in structure forming methods and means considered, without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the invention and, therefore, such adaptations should and are intended to be comprehended within the range of equivalents of the invention.

Having thus described the invention, what is claimed as new and desired to be protected by Letters Patent is:

1. A framework structure comprising a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in a direction transverse to the elongation of said member, connecting means for connecting adjacent ends of said elongated frame members to each other and each comprising a central portion and at least two pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of said elongated frame members, the bracing members in each pair extending essentially parallel and slightly spaced from each other and each having a wedge-shaped cross section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to said given angle, and means operatively connected to each of said pair of bracing members for pressing said wedge faces thereof in tight engagement with said abutting faces of said frame members so as to connect said frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

2. A framework structure comprising, in combination, a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in outward direction and transverse to the elongation of said member; connecting means for connecting adjacent ends of said elongated frame members to each other and each comprising a central portion and at least two pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of said elongated frame members, the bracing members in each pair extending essentially parallel and slightly spaced from each other and each having a wedge-shaped cross section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to said given angle; and wedge means located in the space between each pair of bracing members and operatively engaging the latter for spreading the same in outward direction for pressing said wedge faces thereof in tight engagement with said abutting faces of said frame members so as to connect said frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

3. A framework structure comprising, in combination, a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in outward direction and transverse to the elongation of said member; connecting means for connecting adjacent ends of said elongated frame members to each other and each comprising a central portion and at least two pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of said elongated frame members, the bracing members in each pair extending essentially parallel and slightly spaced from each other and each having a wedge-shaped cross section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to said given angle, each of said bracing members in each pair of said bracing members being located in the space between each pair of bracing members for pressing said wedge faces thereof in tight engagement with said abutting faces of said frame members so as to connect said frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

4. A framework structure comprising, in combination, a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in a direction transverse to the elongation of said member; connecting means for connecting adjacent ends of said elongated frame members to each other and each comprising a central portion and at least four pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of said elongated frame members, said four pairs of bracing members being located substantially in one plane and forming together a cross-like configuration, the bracing members in each pair extending essentially parallel and slightly spaced from each other and each having a wedge-shaped cross section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to said given angle; and means operatively connected to each of said pair of bracing members for pressing said wedge faces thereof in tight engagement with said abutting faces of said frame members so as to connect said frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

5. A framework structure comprising, in combination, a plurality of elongated hollow frame members having each in the interior thereof opposite surface portions each defined by a pair of abutting faces converging toward each other at a given angle in a direction transverse to the elongation of said member; connecting means for connecting adjacent ends of said elongated frame members to each other and each comprising a central portion and at least four pairs of bracing members projecting from said central portion respectively into the interior of adjacent ends of said elongated frame members, three of
said four pairs of bracing members being located substantially in one plane with two of said pairs extending in opposite direction and the third extending substantially normal to said two pairs of bracing members while the fourth of said pairs of bracing members extends in a plane substantially normal to said one plane, the bracing members in each pair extending substantially parallel and slightly spaced from each other and each having a wedge-shaped cross section defined by a pair of wedge faces inclined toward each other at an angle substantially equal to said given angle; and means operatively connected to each of said pair of bracing members for pressing said wedge faces thereof in tight engagement with said abutting faces of said frame members so as to connect said frame members to each other against separation in longitudinal direction and against twisting movement with respect to each other.

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