United States Patent [19]

Loikitz

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[54] **CROSS BRACE INTERLOCK**

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[52] **U.S. Cl.** **403/234;** 403/192

[51] **Int. Cl.** **F16b 7/04**

[58] **Field of Search** 403/234, 237, 230, 192, 403/187, 199, 297, 350

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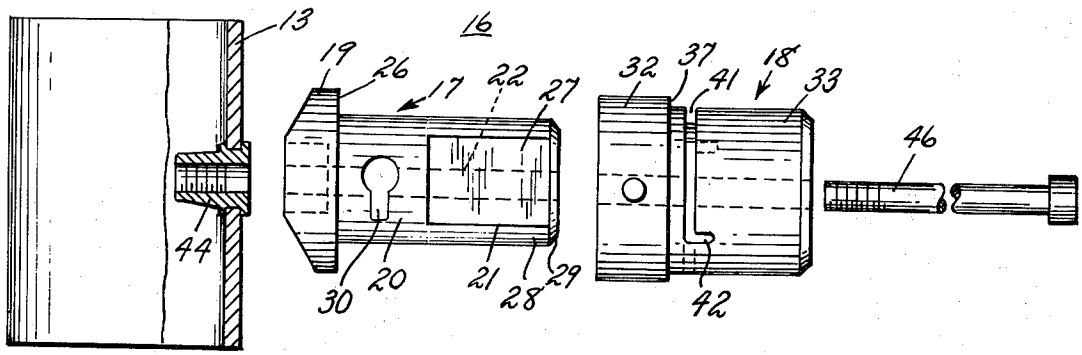
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[57] **ABSTRACT**

A coupling between a vertical tubular leg and a horizontal tubular brace includes an expander member bolted to the leg and projecting radially outwardly and having an elongated transverse cross section with diametrically opposite cylindrically convex faces. An expansion collar having a bore of oval shape rotatably engages the expander member and has longitudinal and circumferential slots delineating opposing expansion fingers. The brace slideably engages the expansion collar which is rotated by a hand tool to cam expand the fingers into tight locking engagement with the brace inside face.

10 Claims, 7 Drawing Figures



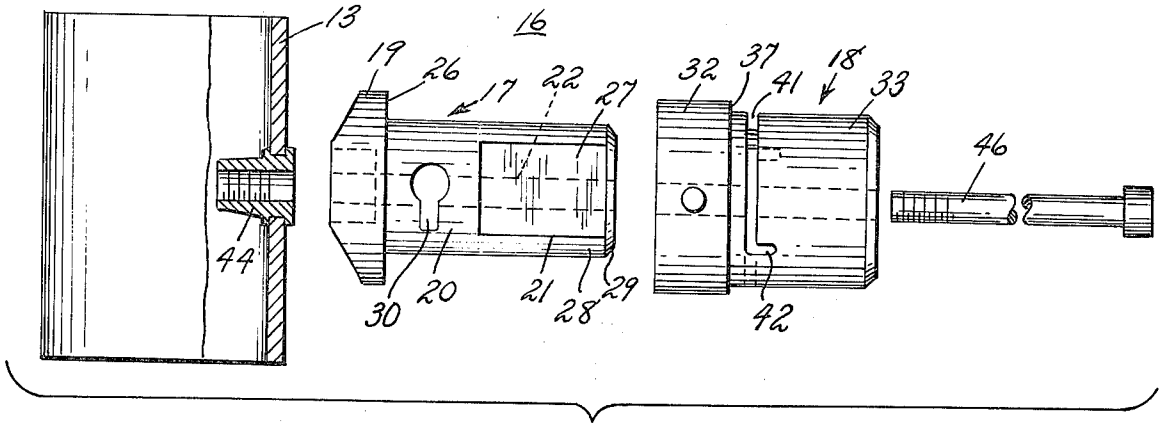


FIG. 1

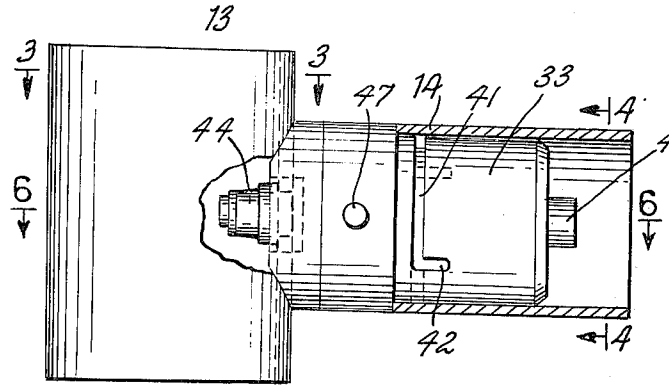


FIG. 2

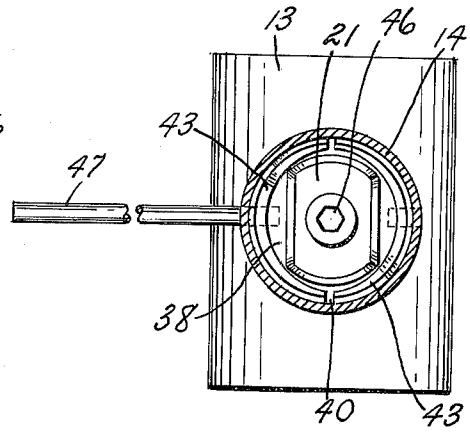


FIG. 4

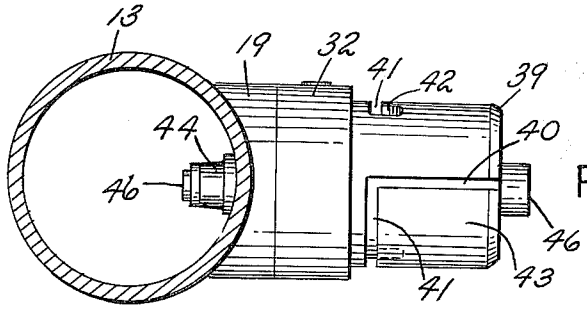


FIG. 3

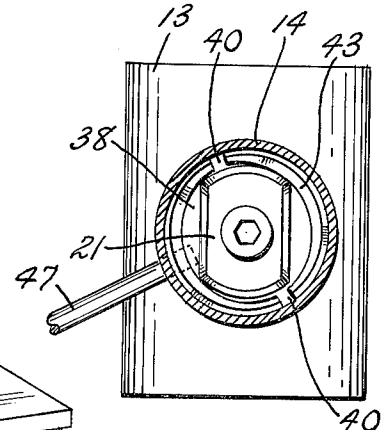


FIG. 5

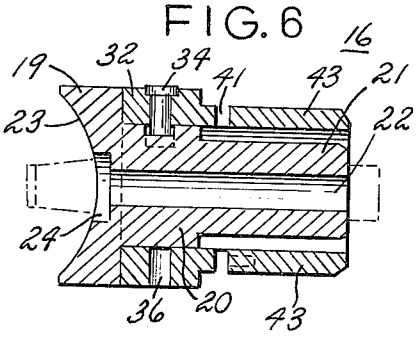


FIG. 6

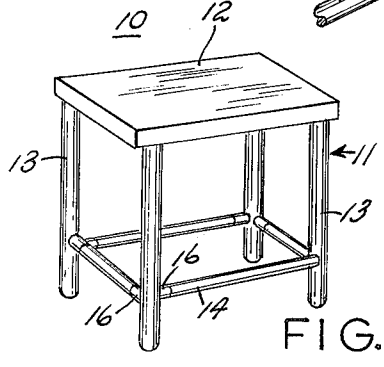


FIG. 7

CROSS BRACE INTERLOCK

BACKGROUND OF THE INVENTION

The present invention relates generally to improvements in frame construction and it relates more particularly to an improved coupling device for rigidly interconnecting vertical frames, legs and horizontal brace members.

Many support structures are in the form of rigid frames which include vertical legs and horizontal brace members interconnecting the legs. Typical of such structures are the supporting substructures of tables, counters, platforms, cabinets and the like. Such structures should be rigid, of light weight and provide a minimum of hinderance to access to the space delineated by the substructure. A conventional expedient is to weld horizontal cross brace members between the vertical legs. However, such practice possesses numerous drawbacks and disadvantages. The on site assembly of such structures is highly time consuming resulting in products of non-uniform and often inferior quality, requires highly skilled labor, close tolerances are difficult and often impossible to attain and it otherwise leaves much to be desired. Moreover, these same drawbacks apply even in the factory assembly of such structures, and in addition, the shipping, handling and storing of the assembled structures are diffucult and expensive. Not only is the welding procedure difficult, but the welds must often be ground and polished for sanitary and visual appearing reasons..

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide an improved frame structure.

Another object of the present invention is to provide an improved structural member connection.

Still another object of the present invention is to provide an improved rigid coupling between angulary related structural members.

A further object of the present invention is to provide an improved coupling device for interconnecting vertical tubular legs and horizontal tubular cross braces which is assembled and locked with a leg and brace by means of a simple hand tool.

Still a further 6bject 6f the present invention is to provide a device of the above nature characterized by its reliability, ruggedness, simplicity, great versatility and adaptability and the ease, rapidity and convenience of application.

The above and other objects of the present invention will become apparent from a reading of the following description taken in conjunction with the accompanying drawing which illustrates a preferred embodiment thereof.

In a sense, the present invention contemplates the provision of an assembly of first and second structural members by a coupling member mounted on the first structural member and including an axially extending expander section of non-circular cross section and an expansion collar rotatably engaging the expander section and having a non-circular bore with a minor transverse dimension less than the major transverse dimension of the expander section, the second structural member having a bore slideably engaging the collar when the collar is in its contracted condition with the major axes of the expander section and collar coinciding. By turning the collar on the expander section, the collar is expanded into firm locking engagement with the section structural member thereby providing a rigid connection between the structural members.

In the preferred form of the assembly, the structural members are tubular the first defining a support leg and the second a cross brace. The expander section is mounted in the leg by an axial bolt and is of elongated transverse cross section with opposite curved end faces. The expansion collar is provided with diametrically exposed longitudinal slots extending to its free outer edge and joined at their inner ends by circumferentially extending slots to delineate a pair of opposite expansion fingers. In its unstressed state the collar outer face is of circular transverse cross section and its bore is of oval transverse cross section with its major axis extending between the longitudinal slots. The base of the collar is enlarged and provided with a hand tool receiving recess.

The improved coupling device and the assembly effected thereby are reliable, rugged and simple and are of great versatility and adaptability.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded front elevational view of the improved coupling device and the associated leg structural member shown partially in section;

FIG. 2 is a front elevational view, partially in section, of the assembled coupling member and structural members;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along line 4—4 in FIG. 2;

FIG. 5 is a view similar to FIG. 4 but with the coupling shown in a locked condition;

FIG. 6 is a sectional view taken along line 6—6 in FIG. 2; and

FIG. 7 is a perspective view of a table employing the improved structural assembly.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing which illustrates a preferred embodiment of the present invention as applied, by way of example, to a table or counter structure 10, the reference numeral 11 generally designates the table support frame which includes a horizontal rectangular top panel 12. Depending from the corners of top panel 12 and secured to the underface thereof are vertical tubular legs 13. The lower portions of adjacent legs 13 are interconnected by horizontal tubular brace members 14 whose ends are rigidly connected to corresponding legs 13 by means of coupling devices 16 constructed in accordance with the present invention.

The coupling device 16 primarily includes an expander section 17 and an expansion collar 18 and fastening means for connecting the expander section 17 to a tubular leg 13. The expander section 17 is integrally formed of metal and consists of an inner base portion 19, an intermediate bearing portion 26, and an outer and expander portion 21, a longitudinal axil bore 22 being formed in the expander section 17.

The inner base portion 19 is of cylindrical configuration and has a concave cylindrical face 23 mating the outer face of leg member 13, the bore 22 having an enlarged counterbore 24 at the rear face 23. The intermediate bearing portion 20 is likewise of circular cylindri-

cal configuration coaxial with the base portion **19** and of smaller diameter, being delineated from the base portion by a peripheral shoulder **26.** Projecting axially outwardly from bearing portion **20** is the relatively longitudinally elongated expander portion **21** which has diametrically opposite parallel longitudinally extending side faces **27** and diametrically opposite longitudinally extending convexly curved end faces not extending radially beyond the plane of the peripherial face of intermediate section **20** and preferably substantially coincident therewith at the medial longitudinal sections of the faces **28** whose longitudinal borders are spaced shortly inwardly of such plane. The forward edges of expander portion **21** are beveled as at **29.** A peripherally extending channel or groove **30** is formed in the outer face of intermediate portion **20.**

The expansion collar **18** surrounds the expander portions **20** and **21** and is rotatably supported by and coaxial with expander member **17** and includes an enlarged base portion **32** which rotatably engages bearing portion **20** and a forwardly projecting expansion portion **33** integrally formed with base portion **32.** A follower pin **34** is fixed in a radial bore in collar base portion **32** and slideably engages channel **30** to permit rotation of expansion collar **18** in expander section **17** while preventing their relative axial movement. Also formed in the collar base **32** is a tool receiving radial bore **36.** The expansion portion **33** in its unstressed state has a circular cylindrical outside face of lesser diameter than that of base portion **32** and delineated therefrom by a peripheral shoulder **37.**

The bore **38** is collar base portion **32** and the immediately adjacent part of expansion portion **33** is circular whereas the bore of the remainder of expansion portion **33** is oval or ecliptical with the dimension along its major axes being approximately equal to or slightly greater than that of expander portion **27** and the dimension along its minor axis being less than that along the major axis of expander portion **27.** The leading edge of expansion portion **38** is beveled as at **39.**

A pair of diametrically opposite longitudinal slots **40** are formed in collar expansion portion **33** at opposite ends of the major axis of bore **38** and extends from the free edge of expansion portion **33** to points short of the base portion **32.** Extending from the inner end of each longitudinal slot **40,** counter clockwise, as viewed in FIGS. **4** and **5,** to points short of the opposite slots **40** are circumferentially extending slots **41** which terminate in short forwardly extending slots **42.** The slot **40,** 41 and **42** delineate a pair of opposite arcuate expansion fingers on wings **43** whose medial longitudinal sections are of greater thickness than the outer parallel longitudinal edges thereof, the fingers **43** tapering inwardly from its medial longitudinal axis to the opposite longitudinal edges the inner faces of the fingers **43** defining cam surfaces.

An internally threaded bushing or sleeve **44** engages an opening in leg **13** and projects radially inwardly and is firmly anchored to the wall of leg **13** by axially spaced peripheral flanges or lips embracing the border of the opening in the known manner. The expander section **17** is affixed to a leg **13** by an allen head bolt **46** extending through bore **22** and engaging the threaded anchor bushing **44.** The end face **23** of base portion **19** embraces the outer face of leg **13** with the outwardly projecting portion of bushing **44** nesting in the counterbore **24.**

In connecting a tubular brace member **14** to the leg **13** by means of the coupling device **16** a corresponding end of the brace member **14** is axially slipped into engagement with the expansion collar **18** and slid to bring its end edge into abutment with the peripheral shoulder **37** on expansion collar **33.** Thereafter, a suitable lever tool such as a rod **47** or the pin of a suitable spanner wrench is inserted into the tool receiving bore **36,** as shown in FIG. **4,** and the expansion collar **18** forcibly turned with a predetermined torque, as shown in FIG. **5.** With the turning of expansion collar **18** relative to expander member **17** which is maintained stationary by reason of its attachment and relationships to leg **13** the inner faces of the thicker portions of the opposite fingers **43** which faces define cam surfaces are engaged by corresponding curved end faces **28** of expander portion **21** to expand or spread the fingers **43** outwardly into a tight wedging engagement with the inside face of the brace member **14** whereby to effect a locked rigid connection between the leg and brace members.

The degree of rotation of expansion collar **18** relative to the expansion section **17** is limited by the length of channel **30.** The same procedure is followed in connection with each of the brace members **14** between each corresponding pair of legs **13.** If desired, the brace and leg may be disconnected by rotating the collar **18** in an opposite direction to bring the major axes of expander portion **21** and bore **28** into coincidence whereby fingers **43** contract to release the brace member **14** for axial sliding out of engagement with expansion collar **18.**

While there has been described and illustrated a preferred embodiment of the present invention it is apparent that numerous alterations, omissions and additions may be made without departing from the spirit thereof.

I claim:

1. A structural assembly comprising a first structural member, a coupling member mounted on and projecting from said first structural member and including an axially extending expander section of non-circular transverse cross section and an expansion collar engaging said expander section and having a non-circular bore with a minor transverse dimension less than the major transverse dimension of said expander section and being expandable and contractable in response to angular variation between said expander section and expansion collar, and a second structural member having a bore axially slideably engaging said collar, said collar being rotatable relative to said expander member between a collar contracted condition with the major axis of said expander section and said collar bore coinciding permitting relative axial movement between said coupling member and said second structural member and a collar expanded condition locking said second structural member to said coupling member with the major axes of said collar bore and said expander section being relatively angularly offset.

2. The structural assembly of claim **1** wherein said collar has a pair of diametrically opposed longitudinally extending slots formed therein extending to the outer end thereof to define a pair of opposite expandable fingers.

3. The structural assembly of claim **2** wherein said collar has formed therein peripheral slots extending from the inner ends of said longitudinal slots in a common direction to points short of the respective opposite longitudinal slots.

4. The structural assembly of claim 3 wherein each of said peripheral slots terminates in a short forwardly extending longitudinal slot.

5. The structural assembly of claim 2 wherein said collar bore is of oval transverse cross section with its major axis extending between said longitudinal slots.

6. The structural assembly of claim 5 wherein said expander section has peripherally cylindrical convex diametrically opposed end faces spaced along the major axis thereof.

7. The structural assembly of claim 5 wherein the outer face of said collar is of circular cylindrical configuration when said collar is in its unstressed condition and said second structural member bore is of circular cylindrical configuration.

8. The structural assembly of claim 2 including a circular cylindrical head integrally formed at the base of said expander section and having a peripherally extending groove formed therein, the inner portion of said collar being of circular transverse cross section and rotatably engaging said head, and a follower pin projecting from said collar inner portion into sliding engagement with said groove.

9. The structural assembly of claim 8 wherein said collar inner portion has a tool receiving recess formed in its outer face.

10. The structural assembly of claim 1 wherein said first structural member comprises a tube and including an internally threaded sleeve affixed to and projecting radially through an opening in said tube, said expander member having an axial bore and a concave cylindrical face at its inner end matingly engageing the outer face of said tube, and a bolt extending through said expander member bolt and engaging said threaded sleeve to lock said coupling member to said tube.

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