A tube holder for connecting a tube to an interconnector which has clamping dogs, and comprising a base one end of which carries rigid clamping lugs which are adapted to engage the clamping dogs on said interconnector to clamp said holder and said interconnector together when said holder and said interconnector are placed together and relatively rotated, and a resilient intermediate component which can be expanded to engage the internal wall of said tube by an expander actuated by a tension screw which has a head located at the same end of said tube holder as said clamping lugs.

20 Claims, 13 Drawing Figures
TUBE HOLDER AND INTERCONNECTOR SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a tube holder which allows the assembly and dismantling of frames and structures made up of profiled tubes, and is particularly but not exclusively applicable for use with square tubes for racks, furniture, etc. The tube holder being designed to be clamped to a cuboid interconnector, the latter having dogs and the tube holder having clamping lugs, which dogs and lugs, by rotation of the tube assembled on the tube holder, in either direction, can be clamped together; a resilient intermediate component of the tube holder being forced against the internal wall of the tube by means of a tensioner.

One tube holder is known in which the cuboid interconnector and/or the tube holder itself, has curvilinear tracks and slider pins. The tube holder is introduced into the tube and its clamping lugs directed into the interconnector. By rotating the tube which is then in position upon the tube holder, a resilient intermediate component inside the tube is compressed with the aid of a tensioner and thus loaded against the internal wall of the tube. At the same time, clamping takes place between the tube holder and the cuboid interconnector, through the agency of the dogs and clamping lugs.

In this embodiment, stringent requirements are imposed upon the material and the accuracy of manufacture, and if tube internal tolerances differ widely, it cannot be ensured that an adequately solid connection will be produced. The present invention separates the function of fixing the tube holder inside the tube, from that of clamping the tube holder to the cuboid interconnector.

According to the present invention a tube holder for connecting a tube to an interconnector which has clamping dogs comprises a base one end of which carries rigid clamping lugs which are adapted to engage the clamping dogs on said interconnector to clamp said holder and said interconnector together when said holder and said interconnector are placed together and relatively rotated, and a resilient intermediate component which can be expanded to engage the internal wall of said tube by an expander actuated by a tension screw which has a head located at the same end of said tube holder as said clamping lugs.

The tube is fixed to the tube holder by the expansion of spreader arms on the resilient intermediate component, using a wedge-like expander, operated by the tension screw, the operation taking place in a region or plane perpendicular to the tube axis. The tube holder with the spreader arms in the relaxed retracted state, has a greater or lesser degree of clearance in the tube, because of the latter's internal dimensional tolerances, and this clearance, outside the region or plane where the expansion of the spreader arms takes place within the tube, is still present to a partial extent, even after fixing has taken place. Consequently, the fixed tube holder, although it is attached to the cuboid interconnector in a fixed backslash-free fashion, can tilt a certain amount in the tube, under bending loads, and this has the disadvantage of giving the joint a certain resilience. If frequent alternating bending loads are applied, it may happen that the fixed tube holder will shift some distance out of the tube.

A further example avoids this drawback however by virtue of the fact that the tube holder is provided with a second resilient intermediate component which can be expanded in a plane perpendicular to the axis of said tube in which it is to be used, said plane being spaced apart axially from the perpendicular plane of expansion of said first resilient intermediate component.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may be performed in various ways and a number of embodiments will now be described by way of example and with reference to the accompanying drawings in which:

FIG. 1 is a section through a cuboid interconnector and with a first tube holder illustrated partially in section and partially in elevation, and a plan view of part of a second tube holder inserted in the interconnector at right angles to the first,

FIG. 2 is a plan view of one of the tube holders shown in FIG. 1,

FIG. 3 is an elevation of the cuboid interconnector shown in FIG. 1,

FIG. 4 is a section on the line IV—IV of FIG. 1,

FIG. 5 is a plan view of the expander used in the tube holder shown in FIG. 1,

FIG. 6 is a section through the expander,

FIG. 7 shows a second embodiment of the tube holder partially in section and partially in elevation,

FIG. 8 shows the two resilient intermediate components used in the construction shown in FIG. 7, partially in section,

FIG. 9 is a plan view in the direction of the arrow IX on one of the intermediate components,

FIG. 10 shows a third embodiment partially in elevation and partially in section,

FIG. 11 shows a fourth embodiment in section and side elevation,

FIG. 12 shows a further variant embodiment in section and side elevation, and,

FIG. 13 shows a sixth embodiment partially in section and partially in side elevation and plan, considered in the direction of the arrow X.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENT

The cuboid interconnector 1 shown in FIG. 1 consists of two identical parts 3 and 3' which have prongs 4 and corresponding recesses 5 which interlock with one another when the two parts are assembled so that they are accurately located in the correct position for a brazing operation which holds the parts together, and the cube thus made is then hardened. All six sides of the cube have identical openings 6 each of which has four recesses 7. Between these recesses, pointing towards the interior are four curvilinear projections or cams 8 which have been punched inwards, in the manner shown in FIG. 4. The recesses 7 are directed towards the side of the cube, whilst the cams 8 are directed towards the corners and are thus each located upon a diagonal.

A first tube holder 2 shown half in section and half in elevation is shown engaged in the lower opening 6 of the cube. At right angles thereto a second tube holder 2' engages in the cube, the visible top section of which has only been partially illustrated, in order not to overburden the drawing. The tube holder 2 consists of the base 9 with four spreader arms 10, a tensioner 11 with...
clamping lugs 15, a tension screw 18 and an expander 12. The base 9 has a shoulder 13 which prevents the tube holder 2 from slipping into the tube 20 which it is holding. The hardened tensioner 11 has four laterally projecting clamping lugs 15 and is embedded in the base 9 which is made of synthetic material so that the clamping lugs 15 point diagonally towards the corners. The expander 12, has a pocket 16 containing a square-headed nut 17 which is engaged by the screw 18. The expander 12 is in the form of a regular octagonal pyramid so that it can be assembled in arbitrary positions in co-operation with taper surfaces 14 on the rear internal surfaces of the spreader arms 10. The screw head 22 is located in the region inside the tensioner 11 with its clamping lugs 15.

In order to establish the connection between square-section tubes 20, an assembly of a frame tube holder is first inserted into the tube up to the shoulder 13, and secured there by tightening up the screw 18. Rotation of the screw 18, causes the expander 12 to move in the direction of the taper surfaces 14 on the spreader arms 10, until the taper surfaces 14 contact them. As the screw 18 is rotated further, the spreader arms are forced outwards and are thus loaded firmly into contact with the corner surfaces of the tube 20 so that the latter is securely connected to the tube holder 2. Instead of a nut 17, the bore 21 in the expander 12 can be internally threaded to co-operate with the screw 18.

The tensioner 11, with its clamping lugs 15 is now introduced into an opening 6 in the cube 1, the square profile of tube and cube being arranged at an angle of 45° to one another. By forceful rotation through 45° in one direction or the other, using suitable spacers, the clamping lugs 15 of the tube holders 2 can be engaged behind the cams or dogs 8 formed in the opening 6 of the cube 1, the relevant sideplate of the hardened cube being resiliently distorted by a small amount. In this fashion a very secure connection between cube and tube holder is obtained. In the same fashion, if required, tubes can be connected to all the other sides of the cube, through the medium of tube holders, for example, as shown by tube holder 2'. The detachment of the connection is just as simple and is achieved by rotating the relevant plastic material. For turned connections of the cube can be covered over by cheap caps, for example, of synthetic plastics material, to improve the appearance.

By application of the features of the invention, a whole series of other constructions can be achieved. For example, the expander 12 can be in the form of a deep-drawn metal component with a threaded bore and the spreader arms can likewise consist of sheet steel. If a frame or rack is to be dismantled and re-erected at another point, for example a requirement which occurs in the case of measuring equipment, then the tube holders remain attached to the tube sections so that the assembly time for re-erection is shortened and additional attachments to the frame can be produced without the need to change any of the connectors.

In the second embodiment to be described and as shown in FIGS. 7, 8 and 9, the tube holder, made primarily of synthetic plastics material is intended for use with square-section tubes and consists of a base 109 in which tensioner 111, with its clamping lugs 115, is embedded, and on the expander 112 and a tensioner screw 118 with the nut 117 are provided. The base 109 has four spreader arms 110 provided with chamfered surfaces 114 at their inner ends. Also, the base 109 has four chamfered surfaces 123, supplementary to those shown in the first example. The expander 112 additionally possesses four spreader arms 124 with chamfered surfaces 125 and also has four chamfered surfaces 119, corresponding with the tapered surfaces 19 of the first example.

When assembled together, as shown in FIG. 7, the tube holder is introduced into a tube 20 and here fixed by tightening up the screw 118. In so doing, by the action of the surfaces 123 on the surfaces 125, the spreader arms 124 of the expander 112 are clamped in the tube 20 in the neighbourhood of the plane A—A, whilst at the same time the surfaces 119 act upon the surfaces 114 so that the spreader arms 110 of the base 109 are secured in the tube in the neighbourhood of the plane B—B. The spreader arms 110 of the base 109 are pressed, as in the case of the first example, into the internal corners of the tube whilst the spreader arms 124 of the expander 112 are located against the flat internal walls of the tube. The axial interval between the planes A—A and B—B means that the system of securing the tube holder inside the tube is particularly resistant to bending and buckling stresses, even under conditions of frequent load alternation.

In addition to the embodiment described, tube holders with the features of the present invention, could also be designed for other materials and for other tube profiles.

In the embodiment shown in FIG. 10, all the components are made of metal, the expander 12 is a dish-like sheet metal component with a threaded central bore in which a tension screw 18 engages. The base 9 is rigidly attached to the end 9 of a cupped sheet metal component whose walls consist of spreader arms 10 and a tensioner 11 with clamping lugs 15 rigidly connected to the base 9.

In the case of the tube holder shown in FIG. 11, a tensioner 311, with clamping lugs 315, is rigidly attached to a base 309. Rigidly connected to the base 309 is an intermediate component 310 and arranged within the intermediate component, and between tensioner plates 312 and 312', is an expander 312 which consists of an L-shaped cut-out 310 in the intermediate component 310. By using this shape of cut-outs the spreader arms 310 bear against the internal wall of the tube which is to be clamped, over virtually their entire length.

In the embodiment of FIG. 12, a tubular tensioner 411 with clamping lugs 415 is rigidly attached to a base 409. Inside the tubular tensioner 411, there is a rigid shoulder 427 against which the head of a tension screw 418 can seat. Rigidly connected to the base 409 is an intermediate component 410, preferentially in two mutually opposite locations 428. The tension screw 418 engages in a threaded bore in the tensioner plate 412 and the intermediate component 410, once again there is an expander 412 of resilient material, surrounding a tubular tensioner 411. The tensioner plate
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412' is provided with a shoulder 426 which serves to centralise the tensioner plate 412' of the sleeve-like tensioner 411.

In the example of FIG. 12, the intermediate component is provided with several cut-outs 410', extending in the longitudinal direction, so that several spreader arms 410' are formed. The fixing of the tube holder in the tube, is thus effective over virtually the full length of the tube holder.

In a final embodiment, shown in FIG. 13, a base 509 is once again rigidly connected to a tubular tensioner 511 which has clamping lugs 515. Within the tubular tensioner a shoulder 527 is provided against which the head of a tension screw 518 seats, the end of the screw 518 engaging in a threaded bore in an expander 512.

This capshaped expander 512 enshrouds the rear end of a part 526 of an intermediate component 510. Said part 526 is guided on the outside of the tensioner 511 and also at the centre, over the section 529. The intermediate component 510 has several spreader arms 510', U-shaped and articulated at their ends, which arms, when the expander 512 is tightened up by the screw 518, expand towards the tube which is to be fixed. The bottom part of FIG. 13 shows the position of the spreader arms 510' relatively to a tube 20 to which the holder is to be secured.

Because many varying and different embodiments may be made within the scope of the inventive concept herein taught, and because many modifications may be made in the embodiments herein detailed in accordance with the descriptive requirements of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

What is claimed as invention is:

1. A tube holder and interconnector system for the assembly and dismantling of frames and structures made up of at least two profiled tubes comprising: multi-sided, bridging interconnector means (1) for connecting the tubes together having an opening (6) therein with dogs (8) associated therewith in at least two of its sides; and

at least two tube holders (2,2'), each comprising a base (9,109,9',309,409,509), one end of which carries rigid clamping lugs (15,115,315,415,515), a tension screw (18,118,18',318,418,518) having a head located at the same end of said tube holder as said clamping lugs; an expander (12,112,12',312,412,512) actuated by said tension screw; and

an intermediate component (10,110,10',310,410,510) located between said base and said expander and being expandable to engage the internal wall of the tube by said expander being actuated by said screw;

said tube holders being designed to be clamped to said interconnector means by means of inserting said lugs into said openings and rotating said lugs with respect to said dogs until said lugs and said dogs interlock.

2. A tube holder and interconnector system as claimed in claim 1 in which said clamping lugs are rigidly connected to said base and in which said screw passes through said base and is seated with said head against said end carrying said clamping lugs.

3. A tube holder and interconnector system as claimed in claim 2, in which said tube holder further includes an anchor (11,111,311,411,511), said clamping lugs being integrally part of said anchor, and said anchor being rigidly connected to said base; and wherein the shape of said lugs and said anchor correspond with the profile of said openings provided in said interconnector.

4. A tube holder and interconnector system as claimed in claim 3 in which said clamping lugs and said clamping dogs have the same radial dimensions.

5. A tube holder and interconnector system as claimed in claim 4 in which said clamping lugs and said dogs are engaged on diagonals of said interconnector.

6. A tube holder and interconnector system as claimed in claim 2 in which said screw head is located within the area defined by said clamping lugs.

7. A tube holder and interconnector system as claimed in claim 1 in which said expander is conical in shape in its axial plane and has tapered surfaces, and in which said intermediate component includes several spreader arms which also have tapered, internal surfaces which are engaged by the tapered surfaces on the expander when said expander is actuated by said screw.

8. A tube holder and interconnector system as claimed in claim 7 in which said expander has a pocket extending at right angles to the axis of said screw and in which pocket a nut is located which is threaded on said screw.

9. A tube holder and interconnector system as claimed in claim 7 in which four spreader arms are provided and wherein said expander in its radial plane is in the shape of a regular octagonal pyramid.

10. A tube holder and interconnector system as claimed in claim 1 in which a second intermediate component is provided which can be expanded in a plane perpendicular to the axis of the tube in which it is to be used, said plane being spaced apart axially from the perpendicular plane of expansion of said first intermediate component.

11. A tube holder and interconnector system as claimed in claim 10 in which said base has chamfered faces, and said second intermediate component being provided by spreader arms formed on said expander, said expander spreader arms having chamfered faces which engage those on the base.

12. A tube holder and interconnector system as claimed in claim 11 in which said expander with spreader arms is made from one piece of a synthetic plastics material.

13. A tube holder and interconnector system as claimed in claim 11 in which said first intermediate component is provided by several spreader arms on said base which are arranged at 45° to said spreader arms on said expander.

14. A tube holder and interconnector system as claimed in claim 13 in which said spreader arms of said base are arranged in gaps between said spreader arms of said expander.

15. A tube holder and interconnector system as claimed in claim 1 in which said expander comprises a resilient body and there is included a tensioner plate on said expander, and wherein said intermediate component comprises several spreader arms which surrounds said expander, and which, when said tension screw is actuated, is compressed by said tensioner plate and acts with its peripheral surface to expand said spreader arms of said intermediate component which surrounds it.

16. A tube holder and interconnector system as claimed in claim 15 in which said spreader arms are
formed by L-shaped cut-outs in said intermediate component.

17. A tube holder and interconnector system as claimed in claim 15 in which said spreader arms are formed by cut-outs directed axially towards one another in said surrounding intermediate component.

18. A tube holder and interconnector system as claimed in claim 15 in which there is further included a tension sleeve which carries said clamping lug and wherein said expander surrounds said tension sleeve, said tension plate having a guide shoulder which guides said plate on said tension sleeve.

19. A tube holder and interconnector system as claimed in claim 1 in which said intermediate component has several U-shaped spreader arms.

20. A tube holder and interconnector system as claimed in claim 1 wherein said interconnector is a cube and has an opening with the dogs associated therewith on everyone of its six faces.

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