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TITLE

TURNBUCKLE SPIGOT ASSEMBLY

FIELD OF THE INVENTION

The present invention relates to a turnbuckle spigot
5 assembly particularly, although not exclusively, envisaged for
use in coupling the ends of posts in trusses. This is
especially useful in 4 post trusses (known as box or
rectangular trusses), such as used to carry sound and lighting
equipment for stage and theatre productions. However, the
10 turnbuckle spigot assembly of the present invention could be
used to couple any two members together, such as, for example,
two pipes or tubes.

More particularly, the present invention relates to a
turnbuckle spigot assembly, for internal endwise connection of
15 the main members of two adjacent trusses for pulling the main
members closely together in a secure and rigid manner so as to
form the two trusses into a single truss span.

BACKGROUND OF THE INVENTION

In the art of trusses it is known to use various types of
20 fixed length members to connect two adjacent trusses together
to form a truss span. A typical connector is a rod with
transverse holes at each end. Each of the holes receives a pin
which also fits through a similar hole in a hollow end of a
main member of the truss for fixing the end of the connector
25 into the end of the main member.

It is essential with this type of connector that the holes
in the connector match precisely with the holes in the end of
the main member of the truss. In practice there is a high
probability that the holes will not precisely align. The
30 reason for the lack of precision in the alignment is typically
due to wear in the connector and/or the main member and/or due
to inaccuracies in the manufacture of the connector and/or the
main member. The result is that some configurations of
connectors and trusses will join together successfully and some
35 configurations will not.

In the case of triangular trusses this is not of much
concern because the three main members of the two trusses will
always be able to be connected together. Nevertheless, there
will still be a problem in sloppiness of that connection.

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The problem is most severe in relation to trusses having 4 main members (box trusses). In box trusses usually 3 of the 4 main members can successfully be connected using the connecting rods, but due to the inaccuracies the last main member is typically several millimetres out of alignment. Or looked at in another way the ends of the 4 main members are not truly all in the same plane. Then in order to achieve connection of the 4 main members to those of another truss it is essential to stretch the main member of the truss. This is practically impossible. So the practical solution is to try many different connectors and truss combinations until a selection is arrived at which will connect together. This usually means that the result is a truss span which has movement between each truss in the span (that is, it is "sloppy").

It is also known to use tongue and groove type connectors permanently fixed to the ends of the main members. The inaccuracies referred to above tend to lead to the same problem of lack of alignment with these connectors also.

The solution seems to lie in having a connector whose length can be adjusted. Hence, one possible way to achieve this would be to adapt a conventional turnbuckle into the connector rod. However, this has the added problem that the exact position between the holes of two adjacent trusses must be measured, the turnbuckle set to that length and then the trusses fitted together. Then if there are any errors in the length of one of more of the turnbuckles the trusses must be taken apart and the turnbuckles each re-adjusted and the trusses pushed together again. It is not possible to adjust the length of the turnbuckle whilst only one end of it is fixed in place since any rotation of the turnbuckle will lead to the transverse hole in the other end of the turnbuckle turning and then not aligning with the transverse hole in the main member of the other truss.

Also, conventional turnbuckles have the problem that the threaded ends can get out of phase so that one becomes longer than the other. This can lead to a situation where the turnbuckle can not be adjusted sufficiently to align with the holes in the main members.

Further, since there are two threaded ends of the turnbuckle there is effectively twice the pitch of thread. This results in less leverage in tightening the turnbuckle to bring the two trusses together.

5 A better solution is to use a turnbuckle adapted to have slack in it when in its loose position and which has only one thread for tightening. The slack allows for easier connection to the ends of the main members, whilst the single thread gives increased leverage. Then the main members of two adjacent
10 trusses can be connected together and brought into tight end to end arrangement even where the ends of the main members are not all in the same plane.

SUMMARY OF THE INVENTION

Therefore it is an object of the present invention to
15 provide a turnbuckle spigot assembly capable of joining the ends of two post members closely and rigidly together.

In accordance with one aspect of the present invention there is provided a turnbuckle spigot assembly for use in connecting two post members together, the turnbuckle spigot
20 assembly comprising:

- a first end for attachment to one of the post members;
- a second end for attachment to the other post member;
- a drive member coupling the first end to the second end, the drive member being threadedly fixed to one of the said ends
25 and free to move with respect to the other of the said ends;

and,

- a turning element attached to the drive member for causing rotation of the drive member for driving the first and second ends together or apart for respectively tightening the post
30 members together or loosening the post members.

Typically, the first end is a first spigot for receipt in one of the post members, the second end is a second spigot for receipt in the other one of the post members and the drive member has a head and a threaded shank, the head being received
35 in the first spigot and the threaded shank being received in the second spigot so that rotation of the drive member with respect to the second spigot causes the second spigot to be drawn towards the head and driven away from the head depending upon the direction of said rotation.

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Typically, the elongate drive member is a threaded bolt.

Hereinafter the present invention will be described with particular reference to post members which are the main members of a truss. Although, it is to be understood that it is of
5 general applicability, for example, the post members could be any post members that are required to be joined closely together endwise in a secure and rigid manner.

Typically, the main members are cylindrical tubes.

Typically, the turning element is fixed to the bolt by a
10 key in a keyway.

Typically, the spigots are attached to the main members by radially disposed pins.

In an alternative form the turnbuckle spigot assembly also has an elongate pin located in the first spigot and spring
15 biased towards the turning element which has an undulating groove in it so that the end of the pin rides up and down in the groove as the turning element is turned. Hence, when the turning element is not turning any tendency for the first spigot to rotate with respect to the turning element must
20 overcome the added frictional force of the pin in the groove. Also, the bias of the spring holds the first and second spigots away from each other which making alignment with the holes in the main members easier.

BRIEF DESCRIPTION OF THE DRAWINGS

25 An exemplary embodiment of the present invention will now be described with reference to the accompanying drawings in which:-

Figure 1 is a perspective view, seen from below of a turnbuckle spigot assembly in accordance with the present
30 invention, shown in exploded and cut-away view;

Figures 1A and 1B are a part cross-sectional side views of the turnbuckle spigot assembly of Figure 1 shown at 90° to each other along its axis;

Figures 2A and 2B are part cross-sectional side views of
35 the turnbuckle spigot assembly of Figure 1 shown attached between two main members of a two adjacent trusses;

Figures 3A and 3B are an edge view and a side view respectively, of a turning element of the turnbuckle spigot assembly of Figure 1;

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Figure 3C is two side views, one at 90° axially to the other, of a threaded member of the turnbuckle spigot assembly of Figure 1;

Figure 3D is a cross-sectional side view of a first spigot
5 of the turnbuckle spigot assembly of Figure 1;

Figure 3E is a cross-sectional side view of a second spigot of the turnbuckle spigot assembly of Figure 1;

Figure 3F is a side view and an end view of a pin of the turnbuckle spigot assembly of Figure 1; and,

10 Figure 4 is a side view of two trusses coupled together by the turnbuckle spigot assembly of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

In the drawings there is shown a turnbuckle spigot assembly 10 comprising a turning element 20, a bolt 22, a first
15 spigot 24, a second spigot 26 and two pins 28 and 30.

Particularly as shown in Figures 3A and 3B the turning element 20 is substantially cylindrical and has an axial hole 40 which is surrounded by two annular recesses 42, one on each side of the turning element 20. The turning element 20 also
20 has a keyway 44 disposed parallel to the axis of the hole 40 and extending through the recesses 44 and into the hole 40. The turning element 20 further has an outer curved surface 45 which has a plurality of indents 46 formed in it at substantially equal distances around the curved surface 45.
25 The indents 46 are intended to enable a C-spanner to be used to turn the turning element 20 circumferentially.

Particularly as shown in Figure 3C the bolt 22 comprises a head 50, a shank 52 and a keyway 54. The shank 52 is threaded at least part-way along its length. Typically, the
30 thread is relatively fine so as to avoid accidental loosening of the bolt 22 due to vibration. The keyway 54 is disposed substantially parallel to the axis of the bolt 22. Typically, the keyway 54 extends along a substantial portion of the length of the shank 52 from its end towards the head 50. The keyway
35 54 is designed to overlies the keyway 44 in the turning element 20 so as to receive a key 60 (see Figure 3B) to fix the turning element 20 to the bolt 22. Hence, rotation of the turning element 20 causes rotation of the bolt 22 by virtue of the key 60 engaged in the keyways 44 and 54.

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Particularly as shown in Figure 3D the first spigot 24 comprises a cylindrical wall 70 which defines a cavity 71. The cavity 71 has an annular shoulder 72 located towards one end 74. The shoulder 72 and the wall 70 define a hole 76 which
5 extends from the cavity 71 to the end 74. The hole 76 is dimensioned to receive the shank 52 of the bolt 22 and the cavity 71 is dimensioned to receive the head 50 of the bolt 22. The end 74 of the first spigot 24 is dimensioned to fit into the recess 42 in the side of the turning element 20 and is able
10 to rotate with respect thereto.

Particularly as shown in Figure 3E the second spigot 26 is substantially the same as the first spigot 24 and like numerals denote like parts. The second spigot 26 differs from the first spigot 24 in that its shoulder 72 and the end 74
15 define a hole 80 which is threaded for receiving the threaded shank 52 of the bolt 22.

Particularly as shown in Figure 3F the pins 28 and 30 each have a head 90, a shank 92 and a hole 94 located at the end of the shank 92 remote from the head 90. The shank 92 is
20 dimensioned to pass through the holes 78 in the spigots 24 and 26, with the head 90 bearing against the cylindrical wall 70 of the spigots 24 and 26 and the hole 94 located on the outer side of the cylindrical wall 70 for receiving a clip to secure the pin 28, 30 into the holes 78.

25 Typically, the turnbuckle spigot assembly 10 is made from metal materials although it could be made from plastics materials or the like or it could be made from a combination of materials.

In use, the shank 52 of the bolt 22 is inserted into the
30 cavity 71 of the first spigot and passed through the hole 76. The shank 52 is then passed through the hole 40 in the turning element 20 and the keyways 44 and 54 are aligned. Then key 60 is then inserted into the keyways 44 and 54 so that the bolt 22 will rotate together with the turning element 20. The
35 threaded shank 52 of the bolt 22 is then threaded into the threaded hole 80 in the second spigot 26 to complete the assembly of the turnbuckle spigot assembly 10.

The first spigot 24 is then inserted into a main member
100 of a truss 102 as shown in Figure 4. The pin 28 is

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inserted through holes in the main member 100 and through the holes 78 in the cylindrical wall 70 and fixed in position with a clip through the hole 94 in the end of the pin 28 to secure the first spigot 24 to the main member 100. Another truss 104
5 is brought into position so that its main member 106 is aligned with the second spigot 26. The second spigot 26 is rotated so that the hole 78 generally aligns with corresponding holes in the main member 106. The main member 106 is then pushed over the second spigot 26 and the turning element 20 rotated so that
10 the holes 78 align with the holes in the main member 106. A tapered end rod may also be used to assist in the alignment of the said holes. The pin 30 is then inserted through the said holes and secured in position with a clip through the hole 94 in the end of the pin 30.

15 The turning element 20 is then rotated to draw the two main members 100 and 106 together so as to tighten the two trusses 102 and 104 securely and rigidly together to form a single truss span. A C-spanner is then applied to the indents 46 of the turning element 20 to turn the turning element 20 to
20 tighten it even further and to reduce the likelihood of inadvertent loosening due vibration and the like.

The turnbuckle spigot assembly 10 of the present invention has the effect of drawing adjacent trusses very closely together, i.e. spaced apart only by the width of the turning
25 element 20. Also, since the turnbuckle spigot assembly 10 can be assembled and secured between the two main members 100 and 106 before tensioning it is possible to use it with difficult trusses such as rectangular trusses and the like. That is, the turnbuckle spigot assembly 10 has the advantage that it makes
30 the alignment and securement of adjacent trusses much easier than with prior art systems for joining adjacent trusses.

In an alternative arrangement an anti-slip device is inserted between the end 74 of the first spigot 24 and the turning element 20. In one form the anti-slip device is a
35 spring washer. In another, more preferred form, the anti-slip device is an elongate pin located in the cylindrical wall 70 and spring biased towards the recess 42 of the turning element 20. The recess 42 has an undulating groove in it so that the end of the pin rides up and down in the undulating groove as

the turning element 20 is turned. Hence, when the turning element 20 is not turning any tendency for the first spigot 24 to rotated with respect to the turning element 20 must overcome the added frictional force of the pin in the groove.

- 5 Hence, vibration in the trusses 102 and 104 is less likely to cause the turnbuckle spigot assembly 10 to loosen.

 The turnbuckle spigot assemblies 10 can be used to connect collapsible box trusses of the type described in my co-pending patent application entitled Collapsible Box Truss which is
10 considered to be brought into this specification by reference.

 Modifications and variations such as would be apparent to a skilled addressee are considered within the scope of the present invention. For example, the spigots 24 and 26 could be other than cylindrical, such as, for example, irregular,
15 square, triangular or rectangular of the like, although it is preferred that their cross-sectional shape conform generally with the internal shape of the main members of the truss. Also, the turning element 20 could be other than cylindrical, such as for example, square, triangular or rectangular or the
20 like. Further, the bolt 22 could be threaded into a box, a beam, a wall or the like, instead of the second spigot 26, for terminating the assembly to other than another truss. That is, the second spigot 26 could be formed into a box or beam or wall or the like. Still further, the turnbuckle spigot assembly 10
25 could be used to couple rigid hydraulic pipes together. In such a case O-ring seals are used to seal the bolt 22 and the turning element 20 to the spigots 24 and 26. Also, in such a case the bolt 22 has a hole passing along its length to allow the flow of hydraulic fluid between the cavities 71 in the
30 spigots 24 and 26.

CLAIMS

1. A turnbuckle spigot assembly for use in connecting two post members together, the turnbuckle spigot assembly comprising:
- 5 a first end for attachment to one of the post members;
a second end for attachment to the other post member;
a drive member coupling the first end to the second end, the drive member being threadedly fixed to one of the said ends and free to move with respect to the other of the said ends;
10 and,
a turning element attached to the drive member for causing rotation of the drive member for driving the first and second ends together or apart for respectively tightening the post members together or loosening the post members.
- 15 2. A turnbuckle spigot assembly according to Claim 1, in which the first end is a first spigot for receipt in one of the post members, the second end is a second spigot for receipt in the other one of the post members, and the drive member has a head and a threaded shank, the head being received in the first
20 spigot and the threaded shank being received in the second spigot so that rotation of the drive member with respect to the second spigot causes the second spigot to be drawn towards the head and driven away from the head depending upon the direction of said rotation.
- 25 3. A turnbuckle spigot assembly according to Claim 2, in which the first spigot receives the head of the elongate drive member so that the elongate drive member can rotate freely within the respect to the first spigot, and first spigot being able to move axially upon the elongate drive member up to the
30 head so as to provide an amount of slack to facilitate easier coupling of the turnbuckle spigot assembly between the two post members.
4. A turnbuckle spigot assembly according to Claim 1 or 2, in which the turning element has means for receiving a tool for
35 turning the turning element for moving the elongate drive



member axially with respect to the second spigot.

5. A turnbuckle spigot assembly according to Claim 4, in which the turning element has radially disposed indents for receiving a lug of a C-shaped spanner, and the turning element
5 has a perimetal shape which conforms to the C-shaped spanner so that when the lug is in one of the indents the C-shaped spanner rests against the perimeter of the turning element and rotating force applied to the C-shaped spanner causes rotation of he turning element.
- 10 6. A turnbuckle spigot assembly according to Claim 2, also including a bias means for biasing the first spigot axially away from the second spigot for maintaining the maximum length of the turnbuckle spigot assembly as the first and second
15 spigots are inserted into the post members so as to make alignment of the first and second spigots with the post members easier.
7. A turnbuckle spigot assembly according to Claim 2, also having an anti-slip means located between the first spigot and the turning element, the anti-slip means providing an added
20 frictional force between the first spigot and turning element so as to inhibit rotation thereby when the turning element is not turning.
8. A turnbuckle spigot assembly according to Claim 7, in which the anti-slip means has an elongate pin located in an end
25 of the first spigot, a bias means for biasing the pin towards the turning element, and an undulating groove located in the turning element, the pin riding up and down in the undulating groove as the turning element is turned and the pin providing a frictional force for inhibiting rotation of the spigot with
30 respect the elongate drive member when the turning element is not turning.
9. A turnbuckle spigot assembly according to Claim 2, in which the post members are the main members of two trusses and the first and the second spigots each having a radial hole for

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receiving a pin for locking the spigot into an end of the main members of the trusses, the first spigot being fixed into the main member of one of the trusses and the second spigot being fixed into the main member of the other truss, and the turning
5 element being rotatable for causing the elongate driving member to draw the main members together for forming a single truss span.

