

DESCRIPTIONIMPROVEMENTS RELATING TO SPACE FRAMES

The invention relates to a space frame of the kind,
5 hereinafter referred to as of the kind described,
comprising a plurality of nodes, each provided with a
plurality of screw threaded sockets; and a plurality of
elongate struts for linking respective pairs of nodes.
Each end of each strut is provided with a longitudinally
10 extending bolt which is freely rotatable relatively to a
strut body and which has a shank with a screw threaded
portion extending from the end of the strut body for
engagement of the screw threaded portion with a respective
node socket, whereby rotation of the bolt draws the end of
15 the strut body towards the node. Each shank is surrounded
by a collar having a non-circular external surface to which
a turning tool can be applied, the collar and the shank
each having one a key and the other a complementary
longitudinal keyway whereby the shank is constrained to
20 rotate with the collar but is movable axially therethrough
and the collar is gripped between the end of the strut body
and the node when the bolt has been fully tightened.

A problem with space frames of the kind described, is
that when two nodes are rigidly positioned relatively to
25 one another, as a result of complete, or near complete,
assembly of the frame, it is difficult to insert or replace
a strut between the two nodes which are at a fixed distance
from one another. This is because it is necessary for the
screw threaded ends of the bolt shanks to extend from the
30 strut collars, so that they can engage the screw threads in
the node sockets, upon rotation of the collars and bolts.
However, if the shanks extend, even marginally, from the
ends of the strut collars, the strut body, with the collars
at its ends, cannot be inserted between two nodes which are
35 spaced by no more than the total length of the strut body
and collars. Consequently, some clearance to accommodate
the projecting bolt shank, is necessary between the end of

each collar and the respective node, so that when the bolts are subsequently tightened into the node sockets, either the collars will not be drawn up closely against the nodes, or the frame will be deflected and stressed by drawing of the nodes towards one another.

In accordance with the invention, in a strut for a space frame of the kind described, each bolt being retractable, against a compression spring, within the strut body to a position in which the tip of the shank is flush with the outer end of the respective collar, whereby a strut body with collars at each end can, in use, be inserted between fixed nodes having a spacing substantially equal to the combined length of the strut body and two collars whereupon the springs will extend the bolt shanks so that the screw threaded portions will be pushed into the entrances to the respective node sockets ready for engagement with the socket screw threads when the bolts are turned by a torque applied to the collars; each strut body is provided by a tube, each end of which receives a housing which houses the head of the bolt and, behind the bolt, a circlip which is located in an internal groove in the housing and which retains the compression spring between the circlip and bolt head, the outer surface of the housing, which is exposed between the end of the tube and the collar, tapering towards the collar.

An example of a space frame constructed in accordance with the present invention is illustrated in the accompanying drawings, in which:-

Figure 1 is a side elevation of the end of one strut;
Figure 2 is a section taken on the line II-II in Figure 1;

Figure 3 is a perspective view of a strut bolt;

Figure 4 is a perspective view of a strut collar; and,

Figure 5 is a perspective view of a node.

Each strut comprises a body in the form of a steel tube 6, each end of which receives as a force fit a reduced diameter end portion of a tapered housing 7. Captive by

its head 8 within the housing is a bolt having a shank 9, which extends out of the housing and is provided at its end with a screw threaded portion 10. The shank is closely surrounded by a collar 11 having a hexagonal tool engaging portion 12. The bolt is urged out of the housing 7 by a helically coiled compression spring, which abuts at one end a washer 14, engaging the head 8, and at its other end, a washer 15, which is held in position by a circlip 16. The clearance within the housing 7 is such that the bolt can be retracted against the action of the spring 13 until the tip of the screw threaded portion 10 is flush with the outer end of the collar 11.

The shank 9 of the bolt is provided with a hemispherical recess 17, in which is seated a steel ball, the ball being slidable within a complementary groove 18 within the interior of the collar 11. This feature is the subject of parent application no. 8904083.6, (GB2216218A).

In addition to a number of the struts, the frame comprises a number of nodes, such as that shown in Figure 5. Each node comprises a generally spherical body 19 formed with a symmetrical array of internally screw threaded sockets 20, each complementary to the screw threaded portion 10 of a strut bolt.

A strut may be assembled between two fixed nodes by retracting the bolts within the housing 7 and collars 11, inserting the strut between the nodes, in alignment with two of the sockets 20, whereupon the springs 13 will advance the bolts so that the screw threaded portions 10 of the bolts are urged into the respective sockets 20. Rotation of respective collars 11, by application of a spanner or similar tool to the portions 12, will then screw the bolts into the respective sockets, until the collars 11 are clamped between the ends of the strut body and the nodes. This results from each ball, acting between a respective recess 17 and groove 18, transmitting the rotation of the respective collar 11 to the respective bolt, whilst allowing axial movement of the bolt through

the collar. As shown in Figure 2, each groove 18 opens at the strut body end of the respected collars, so that the collar can be assembled on to the bolt shank over the screw threaded portion 10.

CLAIMS

1. A strut for a space frame of the kind comprising a plurality of nodes, each provided with a plurality of screw threaded sockets; and a plurality of elongate struts for linking respective pairs of nodes; the strut having, at each end, a longitudinally extending bolt which is freely rotatable relatively to a strut body and which has a shank with a screw threaded portion extending from the end of the strut body for engagement of the screw threaded portion, in use, with a respective node socket, whereby rotation of the bolt draws the end of the strut body towards the node; each shank being surrounded by a collar having a non-circular external surface to which a turning tool can be applied, the collar and shank each having one a key and the other a complementary longitudinal keyway whereby the shank is constrained to rotate with the collar but is movably axially therethrough and the collar is gripped between the end of the strut body and the node when the bolt has been fully tightened; each bolt being retractable, against a compression spring, within the strut body to a position in which the tip of the shank is flush with the outer end of the respective collar, whereby a strut body with collars at each end can, in use, be inserted between fixed nodes having a spacing substantially equal to the combined length of the strut body and two collars whereupon the springs will extend the bolt shanks so that the screw threaded portions will be pushed into the entrances to the respective node sockets ready for engagement with the socket screw threads when the bolts are turned by a torque applied to the collars; wherein each strut body is provided by a tube, each end of which receives a housing which houses the head of the bolt and, behind the bolt, a circlip which is located in an internal groove in the housing and which retains the compression spring between the circlip and bolt head, the outer surface of the housing, which is



exposed between the end of the tube and the collar, tapering towards the collar.

2. A space frame, comprising a plurality of nodes, each provided with a plurality of screw threaded sockets; and a plurality of struts, each according to claim 1, for linking respective pairs of nodes.
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