New Products & Technologies

Space Frame with Spherical Nodes, "KT Truss"*

Katsuhiko Imai** Yuichi Fukuda***

1 Introduction

Structural members are sometimes required not only to provide aesthetic appearance but provide long spans as well. In addition, the problems with conventional space frames are being reviewed all over the world based on a consideration of recent NC machining techniques. In view of this trend, Kawatetsu Steel Products Corporation developed the space-frame joint system "**KT Truss**" in which many new concepts have been incorporated. This report presents an outline of this new truss system.

2 Joint System of KT Truss

Joints of the KT truss are spherical steel nodes. It is possible to arrange a maximum of 18 tapped holes for joining truss members to each joint. Left-hand threaded stub cones are welded to both ends of the steel tube as the truss member, and sleeve nuts are used for transmitting the tensile force of the bolts which are fitted into the stub cones.

The bolts are of special shape and the middle of the bolt shank is provided with a hexagonal portion that comes into contact internally with the inner hexagonal section inside the hexagonal sleeve. The torque given by the hexagonal sleeve is transmitted to the bolt through this hexagonal portion.

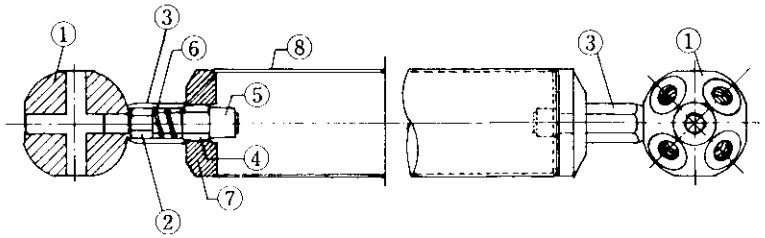
A spring for pushing out the bolt is inserted between the sleeve nut and the hexagonal portion of the bolt. The dimensions of each part of the joint assembly are determined so that the end of the bolt thread on the node side enters the hexagonal sleeve slightly while the bolt is pushed toward the steel tube and is pressed tightly on the spring.

When the above-mentioned joint assembly is pressed against the tapped holes of the node slightly and the hexagonal sleeve is rotated, the bolt is pushed out by the spring, and the thread is fitted in order to connect the member to the node. The hexagonal sleeve between the node and stub cone then serves to transmit the compressive force acting on the member to the node (**Fig. 1**).

3 Features of KT Truss

Conventional space frames have many problems related to safety, workability, etc., and their performance is often determined by suppliers' desires rather than by users' needs. In view of these points, the KT truss was developed so as to provide the following features:

(1) Beautiful appearance with "high-tech" image.
(2) High safety and reliability considering fatigue resistance.
(3) High corrosion resistance with a closed type joint.



① Node (SCM435)
② Bolt (SCM435)
③ Hexagonal sleeve (S45C)
④ Sleeve nut (S45C)
⑤ Anchor nut (SCM435)
⑥ Spring (SWP)
⑦ Stub cone (SS41)
⑧ Hollow tube (STK41)

Fig. 1 Connection detail

* Originally published in *Kawasaki Steel Giho*, **20**(1988)4, pp. 349-350
** Dr. Eng., Manager, Technical Research Laboratories, Kawatetsu Steel Products Corp.
*** Manager, Technical Research Laboratories, Kawatetsu Steel Products Corp.

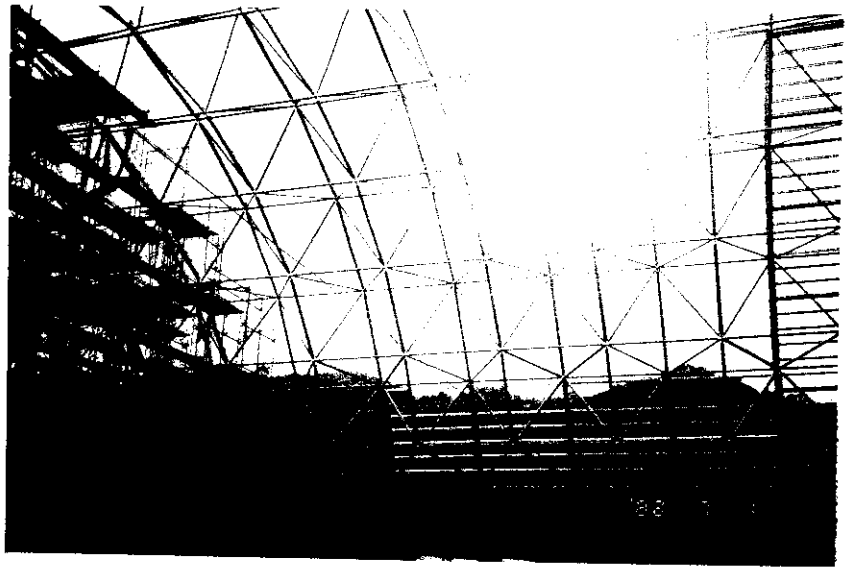


Photo 1 Construction of hall by sliding technique

(4) Workability with high efficiency.
(5) Applicability of various surface treatments.
(6) High productivity and good economy obtained by totally adopting NC machining techniques.

A hall constructed using this system is shown in **Photo 1**.

4 Scope of Application

4.1 Members

(1) Available Sizes of Members
ϕ42.7 × 2.3 to ϕ216.3 × 8.2, 20 sizes (mm)
(2) Sizes of Bolts
M-12, 16, 20, 24, 30 and 36 (10 T)
M-42 and 48 (9.5 T)
(3) Sizes of Nodes
ϕ90, ϕ110, ϕ130, ϕ155, ϕ185, ϕ210 and ϕ235 (mm)
(4) Ranges of Allowable Proof Stress (for Permanent Loading)
Tensile: 3.34~60.3 t
Compression: 4.67~83.2 t (for slenderness ratio $\lambda = 0$)

4.2 Roof Shapes and Basic Units

(1) Roof Shapes
Flat roof, gable roof, hip roof, cylinder shell (arch), dome, HP shell, translating shell, etc.
(2) Basic Units
Double layer—2 and 3 way
Single layer —3 way

4.3 Maximum Span

Maximum spans available for the double layer in temperate regions are:
(1) Flat roof (65 m), gable roof (70 m) and hip roof (70~80 m)—Roller support
(2) Arch (120~130 m) and dome (200~240 m)—Pin Support

5 Authorization by Ministry of Construction

General evaluation and general approval were given by the Ministry of Construction.

For Further Information, Please Contact:
Technical Research Laboratories
Kawatetsu Steel Products Corporation
Fax: 078 (431) 4166 Phone: 078 (232) 8886