(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
26 November 2009 (26.11.2009)

PCT

(10) International Publication Number
WO 2009/142369 A1

(51) International Patent Classification:
E01D 2/00 (2006.01)

(21) International Application Number:
PCT/KR2008/006470

(22) International Filing Date:
3 November 2008 (03.11.2008)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2008-0046660 20 May 2008 (20.05.2008) KR

(71) Applicant *(for all designated States except US)*: **WOO KYOUNG CONSTRUCTION CO., LTD.** [KR/KR]; 6th floor, World biter building, 155-2 Jeongja-dong, Boondang-gu, Sungnam-city, Gyeonggido 463-834 (KR).

(71) Applicants and
(72) Inventors: **NO, Yun Keun** [KR/KR]; 603-1903 Park View, 6 Jeongja-dong Boondang-gu, Sungnam-city, Gyeonggido 463-863 (KR). **PAPK, Geun Hwa** [KR/KR]; 603-1903 Park View, 6 Jeongja-dong Boondang-gu, Sungnam-city, Gyeonggido 463-863 (KR). **NO, Kyung Beom** [KR/KR]; 1105-404 Gwangjang 11th hyundai home town, 579 Gwangjang-dong, Gwangjin-gu, Seoul 143-210 (KR).

(74) Agent: **JOO, Jong Ho**; 2nd floor 201, Kwang-Lim Bldg., 1444-21 Seocho-Dong, Seocho-Gu, Seoul 137-866 (KR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

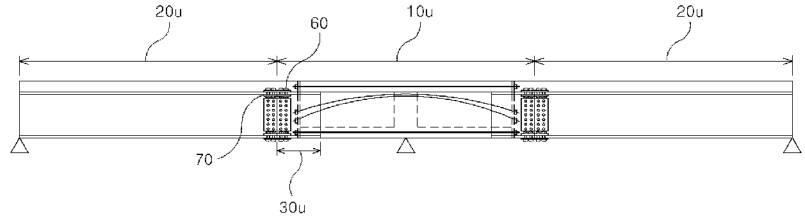
(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report (Art. 21(3))*

WO 2009/142369 A1

(54) **Title**: HYBRID STEEL COMPOSITE GIRDER CONSTRUCTION METHOD

[Fig. 1]



(57) **Abstract**: Disclosed is a hybrid steel composite girder construction method, which uses a PSC girder for a negative moment region and a steel girder for a positive moment region, and the PSC girder of negative moment region and the steel girder of positive moment region are coupled to each other by a steel composite girder composed of a shear connector and a PS tendon for coupling the positive and negative moment regions, so that a building structure and a bridge can be constructed at a low cost and with a high efficiency.

Description

HYBRID STEEL COMPOSITE GIRDER CONSTRUCTION METHOD

Technical Field

[1] The present invention relates to a method of constructing a hybrid steel composite girder, and in particular, to a method of constructing a hybrid steel composite girder in a hybrid steel composite building structure or bridge mixing a concrete girder and a steel girder.

Background Art

[2] In general, the hybrid steel composite building structure or bridge is constructed by a method of using the steel girder for both of positive and negative moment regions to cover the concrete or adding the prestressed (PS) steel.

[3] According to the conventional hybrid steel composite girder configured as described above, it is possible to build a girder with a low girder height and a long span while raising the economical efficiency by means of the mixed usage of concrete and steel in terms of structural mechanics.

[4] However, according to the conventional hybrid steel composite girder configured as described above, an amount of using the steel is large in terms of structural mechanics, so that the conventional hybrid steel composite girder is not widely employed but employed for only a specific interval due to the bad economical efficiency.

[5] Accordingly, to obtain smooth migration from the conventional hybrid steel composite girder to an economical hybrid steel composite girder that can save the amount of steel used, there is a need for development in technology for efficient and structural connection between concrete and steel.

Disclosure of Invention

Technical Problem

[6] In view of the problems mentioned above, the present invention is directed to a method of constructing a hybrid steel composite girder, which uses a PSC girder for a negative moment region and a steel girder for a positive moment region, and couples the positive moment region with the negative moment region by means of a steel composite girder composed of a shear connector and a PS tendon for coupling the positive moment region with the negative moment region, so that a structural building or bridge can be constructed at a low cot and a high efficiency.

Technical Solution

[7] An aspect of the invention is to provide a method of constructing a hybrid steel composite girder, which manufactures a PSC girder for a negative moment region and

a steel girder for a positive moment region to be coupled to the PSC girder of the negative moment region, and couples the positive moment region with the negative moment region by means of a steel composite girder composed of a shear connector and a PS tendon for coupling the positive moment region with the negative moment region, wherein at the time of manufacturing the PSC girder for the negative moment region, the steel composite girder composed of the shear connector and the PS tendon for coupling the positive moment region with the negative moment region is synthesized and coupled with the PSC girder of the negative moment region while the steel composite girder composed of the shear connector and the PS tendon is disposed at an outer circumferential surface of the PSC girder of the negative moment region or at a web and upper and lower flanges, the PSC girder of the negative moment region is installed at an end of the steel composite girder for coupling the positive moment region and negative moment regions by means of high-tensile bolts and coupling steel plate.

Advantageous Effects

[8] According to the hybrid girder using both of the concrete girder and the steel girder of the present invention, an I-shaped or U-shaped PSC girder is employed for the negative moment region, a steel girder having the same I-shaped or U-shaped form as that of the negative moment region is employed for the positive moment region, which are synthesized and coupled with each other, so that the PSC girder accompanying a relative low construction cost, high cross-sectional stiffness but making it difficult to implement a long span due to its heavy self-weight and the steel girder accompanying a relatively high construction cost and allowing a long span to be implemented because of its light self-weight, can be effectively used by making up the respective weak points, thereby raising advantages to implement the hybrid steel composite girder that is economical and allows long span construction to be carried out.

Brief Description of the Drawings

[9] FIG. 1 is a side view illustrating a hybrid steel composite U girder according to the present invention.

[10] FIG. 2 is a side view illustrating a PSC U girder of negative moment region of a hybrid steel composite U girder according to the present invention.

[11] FIG. 3 is a cross-sectional view taken along line A-A of FIG. 2.

[12] FIG. 4 is a cross-sectional view taken along line B-B of FIG. 2.

[13] FIG. 5 is a cross-sectional view taken along line C-C of FIG. 2.

[14] FIG. 3 is a cross-sectional view taken along line D-D of FIG. 2.

[15] FIG. 7 is a perspective view illustrating a steel U girder for coupling positive and negative moment regions of a hybrid steel composite U girder according to the present

invention.

[16] FIG. 8 is a side view illustrating a hybrid steel composite U girder of which positive and negative moment regions are coupled to each other according to the present invention.

[17] FIG. 9 is a side view illustrating a hybrid steel composite I girder according to the present invention.

[18] FIG. 10 is a side view illustrating a PSC I girder of negative moment region of a hybrid steel composite I girder according to the present invention.

[19] FIG. 11 is a cross-sectional view taken along line A-A of FIG. 10.

[20] FIG. 12 is a cross-sectional view taken along line B-B of FIG. 10.

[21] FIG. 13 is a cross-sectional view taken along line C-C of FIG. 10.

[22] FIG. 14 is a cross-sectional view taken along line D-D of FIG. 10.

[23] FIG. 15 is a perspective view illustrating a steel I girder for coupling positive and negative moment regions of a hybrid steel composite I girder according to the present invention.

[24] FIG. 16 is a side view illustrating a hybrid steel composite I girder of which positive and negative moment regions are coupled to each other according to the present invention.

Best Mode for Carrying Out the Invention

[25] Hereinafter, the present invention will be described in detail with reference to accompanying drawings.

[26] <u>First Embodiment</u>

[27] FIG. 1 is a side view illustrating a hybrid steel composite U girder according to the present invention, FIG. 2 is a side view illustrating a PSC U girder of negative moment region of a hybrid steel composite U girder according to the present invention, FIG. 3 is a cross-sectional view taken along line A-A of FIG. 2, FIG. 4 is a cross-sectional view taken along line B-B of FIG. 2, FIG. 5 is a cross-sectional view taken along line C-C of FIG. 2, FIG. 3 is a cross-sectional view taken along line D-D of FIG. 2, FIG. 7 is a perspective view illustrating a steel U girder for coupling positive and negative moment regions of a hybrid steel composite U girder according to the present invention, and FIG. 8 is a side view illustrating a hybrid steel composite U girder of which positive and negative moment regions are coupled to each other according to the present invention.

[28] As shown in these drawings, according to a method of constructing a hybrid steel composite girder, a PSC (prestressed concrete) girder 10i and 10u of negative moment region is coupled with a steel girder 20i and 20u of positive moment region by means of a steel composite girder 30i and 30u for coupling the positive and negative moment

regions, wherein the negative moment region is composed of the PSC girder 10i and 10u and the positive moment region to be coupled to PSC girder of negative moment region is composed of steel girder 20i and 20u.

[29] At the time of manufacturing the PSC girder 10i and 10u of negative moment region, the steel composite girder 30i and 30u for coupling is disposed at an outer circumferential surface of the PSC girder 10i and 10u or upper and lower flanges 52 and 54 and a web 56, the PSC girder 10i and 10u is synthesized and coupled with a shear connector 40 and a PS tendon 42, and then the steel girder 20i and 20u of positive moment region is coupled with the PSC girder at an end of the steel composite girder 30i and 30u for coupling by means of a high-tensile bolt 60 and a coupling steel plate 70.

[30] In addition, the cross-sectional shape of the PSC girder 10i and 10u of negative moment region is formed of a U girder 10u having its cross-section as a U-shape.

[31] A cross-sectional shape of the steel composite girder 30i and 30u for coupling is dependent on the cross-sectional shape of the PSC girder 10i and 10u of negative moment region.

[32] Here, when the negative moment region corresponds to the PSC U girder 10u, the steel composite U girder 30u for coupling is synthesized and coupled with the shear connector 40 in the form of surrounding the PSC U girder 10u at an outer circumferential surface of a predetermined interval of both ends of the PSC U girder 10u of negative moment region, and is synthesized and coupled with the PSC U girder 10u of negative moment region by means of the shear connector 40 at a PS steel anchoring plate 50 used also for coupling steel plate that is integrated with the web 48 and the lower flange 46 of a steel U girder 44 in an end surface of the PSC U girder 10u of negative moment region is synthesized and coupled with the PSC U girder, and the PS tendon 42 is installed at the web 56 and upper and lower flanges 52 and 54 of the PSC U girder 10u of negative moment region in a symmetric direction of a longitudinal axis direction in the PS steel anchoring plate 50, and the PS tendon 42 is tensed, synthesized and coupled.

[33] That is, according to the method of constructing the hybrid steel composite girder, when the PSC U girder 10u of negative moment region is coupled with the steel U girder 20u of positive moment region, the steel composite U girder 30u for coupling is displaced at an outer circumferential surface of the PSC U girder 10u at the time of manufacturing the PSC U girder 10u, and is synthesized and coupled with the PSC U girder 10u by means of the shear connector 40 and the PS tendon 42 that is responsible for its self-weight when the PSC U girder 10 is placed thereon, which is then placed on a post or pier, and the steel U girder 20u of positive moment region is coupled therewith at an end of the steel composite U girder 30u for coupling that is synthesized

with and attached to the PSC U girder 10u of negative moment region by means of the high-tensile bolt 60 and the coupling steel plate 70

[34] In this case, steel segments are coupled for the steel U girder 20u of positive moment region by a general method of coupling the steel girder.

[35] With such a construction method described above, the steel composite U girder 30u for coupling is coupled at the outer circumferential surface of the PSC U girder 10u of negative moment region, so that its manufacture and installment is facilitated, and connection of the steel U girder 20u of positive moment region after being placed on the post or pier is the same as the general connection method for steel girder so that its installment is easy.

[36] In particular, the most important factor of the construction of the hybrid steel composite girder according to the present invention is the structural and effective synthesis and coupling between concrete and steel.

[37] That is, considering that the efficiency and performance of the synthesized portion is the most important part of the hybrid girder, when the amount of steel used for the synthesized portion is large, the synthesis performance is good but not economical, and when the amount of steel used is small, it is economical but is not good for structural safety, so that the development in a synthesis method that is most economical and effective in terms of structure is required.

[38] Therefore, according to the hybrid steel composite girder of the present invention, when the negative moment region corresponds to the PSC U girder 10u, the steel composite U girder 30u for coupling is synthesized and coupled with PSC U girder 10u while the steel composite U girder 30u for coupling surrounds a predetermined interval of both ends of the PSC U girder 10u of negative moment region, and is first synthesized and coupled with the PSC U girder 10u of negative moment region by means of the shear connector 40 at the PS steel anchoring plate 50 used also for coupling steel plate that is integrated with the web 48 and the lower flange 46 of the steel U girder 44 in an end surface of the PSC U girder 10u of negative moment region, and then is installed and tensed to be synthesized and coupled with the PS tendon 42 that is responsible for its self-weight at the upper and lower flanges 52 and 54 of the PSC U girder 10u of negative moment region in the PS steel anchoring plate 50 in a direction symmetric to a longitudinal axis direction at the web 56.

[39] With this arrangement, the coupling by means of the shear connector 40 and the coupling by means of the PS tendon 42 increase the synthesis effect of the steel and the concrete and the stability.

[40] That is, the PS tendon 42 acts to be responsible for its self-weight and to reinforce the synthesized coupling between the steel and concrete.

[41] <u>Second embodiment</u>

[42] FIG. 9 is a side view illustrating a hybrid steel composite I girder according to the present invention, FIG. 10 is a side view illustrating a PSC I girder of negative moment region of a hybrid steel composite I girder according to the present invention, FIG. 11 is a cross-sectional view taken along line A-A of FIG. 10, FIG. 12 is a cross-sectional view taken along line B-B line of FIG. 10, FIG. 13 is a cross-sectional view taken along line C-C of FIG. 10, FIG. 14 is a cross-sectional view taken along line D-D of FIG. 2, FIG. 15 is a perspective view illustrating a steel I girder for coupling positive and negative moment regions of a hybrid steel composite I girder according to the present invention, and FIG. 16 is a side view illustrating a hybrid steel composite I girder of which positive and negative moment regions are coupled to each other according to the present invention.

[43] As shown in these drawings, according to a method of constructing a hybrid steel composite girder, a PSC girder 10i and 10u of negative moment region is coupled with a steel girder 20i and 20u of positive moment region by means of a steel composite girder 30i and 30u for coupling the positiveand negative moment regions, wherein the negative moment region is composed of the PSC girder 10i and 10u and the positive moment region to be coupled to PSC girder of negative moment region is composed of steel girder 20i and 20u.

[44] At the time of manufacturing the PSC girder 10i and 10u of negative moment region, the steel composite girder 30i and 30u for coupling is disposed at the web 56 and upper and lower flanges 52 and 54 of negative moment region, which is then synthesized and coupled with the shear connector 40 and the PS tendon 42, and then the steel girder 20i and 20u of positive moment region is coupled with the PSC girder at an end of the steel composite girder 30i and 30u for coupling by means of the high-tensile bolt 60 and the coupling steel plate 70.

[45] In addition, the cross-sectional shape of the PSC girder 10i and 10u of negative moment region is formed of an I girder 10i having its cross-section as an I-shape.

[46] A cross-sectional shape of the steel composite girder 30i and 30u for coupling is dependent on the cross-sectional shape of the PSC girder 10i and 10u of negative moment region.

[47] Here, when the negative moment region corresponds to the PSC I girder 10i, the steel composite I girder 30i for coupling is displaced at an outer circumferential surface of the upper and lower flanges 52 and 54 of a predetermined interval of both ends of the PSC I girder 10i of negative moment region, the web 56 of the steel composite I girder 30i for coupling is buried in a web 58 of the PSC I girder 10i of negative moment region, the PSC I girder is synthesized and coupled with the shear connector 40 and the PS steel anchoring plate 50 used also for coupling steel plate that is welded to the steel composite I girder 30i for coupling at both ends of the PSC I girder 10 of negative

moment region, the PS tendon 42 is installed at the PS steel anchoring plate 50, and the PS tendon 42 is tensed and coupled.

[48] That is, it should be noted that the method of constructing the hybrid steel composite girder of the present invention in the case of PSC U girder 10u can be also applied to the PSC I girder 10i in the same way.

[49] Here, the method of constructing the hybrid steel composite girder of the present invention in the case of PSC I girder 10i of negative moment region can be applied to the PSC U girder 10u of negative moment region in the same way, however, differs in that the cross-section of the steel girder 20i has the steel I girder 20i of positive moment region to be conformed to the shape of the PSC I girder 10i of negative moment region, the upper and lower flanges 52 and 54 are exposed at outer circumferential surfaces of the PSC I girder 10 of negative moment region, the web 56 is buried in the web 58 of the PSC I girder 10i of negative moment region, the PS steel anchoring plate 50 having the same shape is installed at cross-sections of both ends of the PSC I girder 10i of negative moment region, and the PS tendon 42 is tensed and synthesized with the PS steel anchoring plate 50.

[50] With this arrangement, the coupling by means of the shear connector 40 and the coupling by means of the PS tendon 42 increase the synthesis effect of the steel and the concrete and the stability.

[51] That is, the PS tendon 42 acts to be responsible for its self-weight and to reinforce the synthesized coupling between the steel and concrete.

Claims

[1] A method of constructing a hybrid steel composite girder, comprising:
coupling a PSC (prestressed concrete) girder 10i and 10u of negative moment region with a steel girder 20i and 20u of positive moment region by means of a steel composite girder 30i and 30u for coupling the positiveand negative moment regions, the negative moment region being composed of the PSC girder 10i and 10u and the positive moment region to be coupled to PSC girder of negative moment region being composed of steel girder 20i and 20u,
wherein coupling the PSC girder 10i and 10u of negative moment region with the steel girder 20i and 20u of positive moment region comprises:
displacing, at the time of manufacturing the PSC girder 10i and 10u of negative moment region, the steel composite girder 30i and 30u for coupling at an outer circumferential surface of the PSC girder 10i and 10u or upper and lower flanges 52 and 54 and a web 56;
synthesizing and coupling the PSC girder 10i and 10u with a shear connector 40 and a PS tendon 42; and
coupling the steel girder 20i and 20u of positive moment region with the PSC girder at an end of the steel composite girder 30i and 30u for coupling by means of a high-tensile bolt 60 and a coupling steel plate 70.

[2] The method as set forth in claim 1, wherein the PSC girder 10i and 10u of negative moment region is formed of an I-shaped girder 10i having its cross-section as an I-shape or a U-shaped girder 10u having its cross-section as a U-shape.

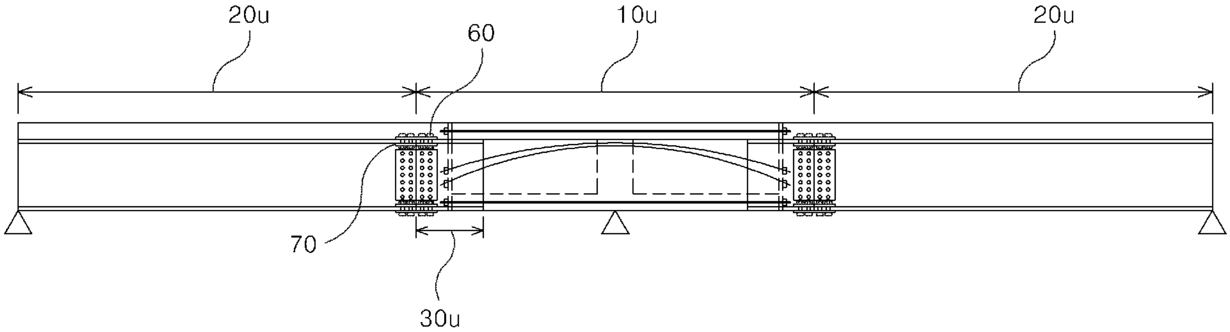
[3] The method as set forth in claim 1 or 2, wherein a cross-sectional shape of the steel composite girder 30i and 30u for coupling is dependent on the cross-sectional shape of the PSC girder 10i and 10u of negative moment region.

[4] The method as set forth in claim 1 or 2, wherein when the negative moment region corresponds to the PSC U girder 10u, the steel composite U girder 30u for coupling is synthesized and coupled with the shear connector 40 in the form of surrounding the PSC U girder 10u at an outer circumferential surface of a pre-determined interval of both ends of the PSC U girder 10u of negative moment region, and is synthesized and coupled with the PSC U girder 10u of negative moment region by means of the shear connector 40 at a PS steel anchoring plate 50 used also for coupling steel plate that is integrated with the web 48 and the lower flange 46 of a steel U girder 44 in an end surface of the PSC U girder 10u of negative moment region is synthesized and coupled with the PSC U girder, and the PS tendon 42 is installed at the web 56 and upper and lower flanges 52

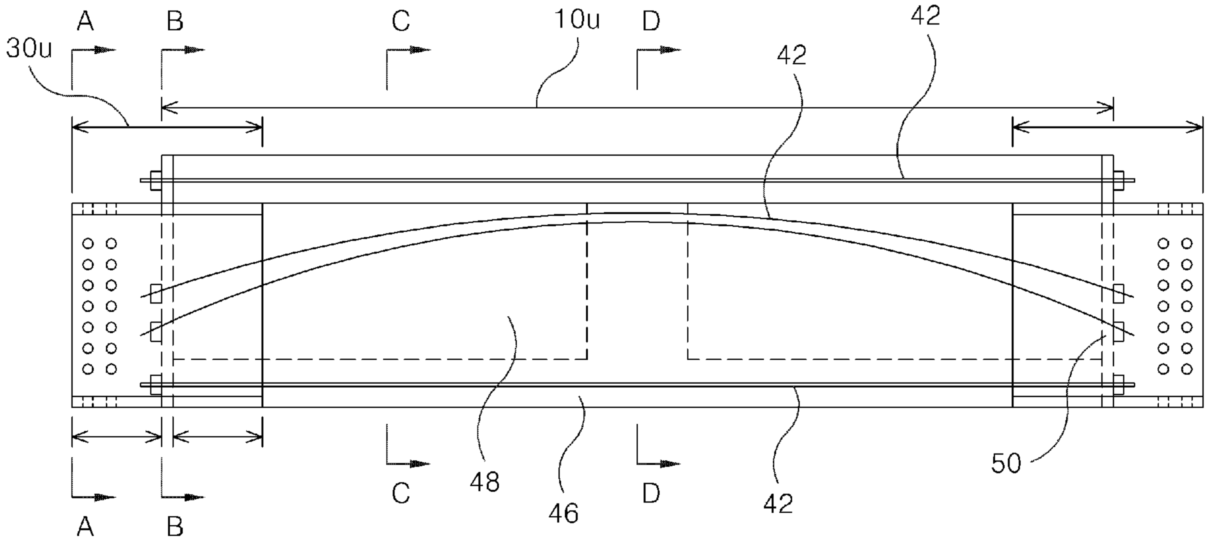
and 54 of the PSC U girder 10u of negative moment region in a symmetric direction of a longitudinal axis direction in the PS steel anchoring plate 50, and the PS tendon 42 is tensed, synthesized and coupled.

[5] The method as set forth in claim 1 or 2, wherein when the negative moment region corresponds to the PSC I girder 10i, the steel composite I girder 30i for coupling is displaced at an outer circumferential surface of the upper and lower flanges 52 and 54 of a predetermined interval of both ends of the PSC I girder 10i of negative moment region, the web 56 of the steel composite I girder 30i for coupling is buried in a web 58 of the PSC I girder 10i of negative moment region, the PSC I girder is synthesized and coupled with the shear connector 40 and a PS steel anchoring plate 50 used also for coupling steel plate that is welded to the steel composite I girder 30i for coupling at both ends of the PSC I girder 10 of negative moment region, and the PS tendon 42 is installed at the PS steel anchoring plate 50, and the PS tendon 42 is tensed and coupled.

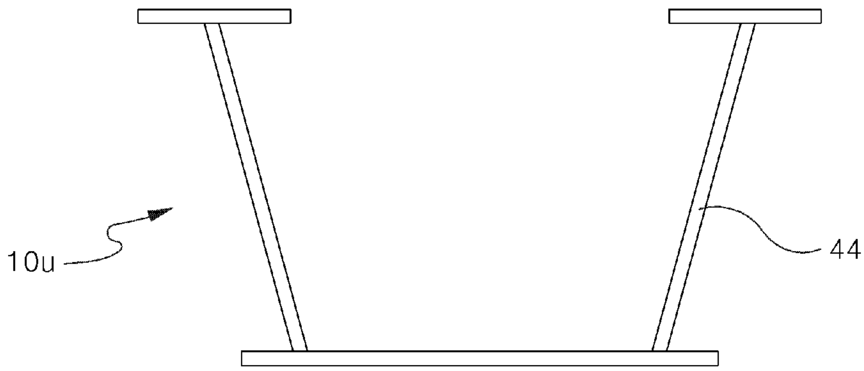
[Fig. 1]



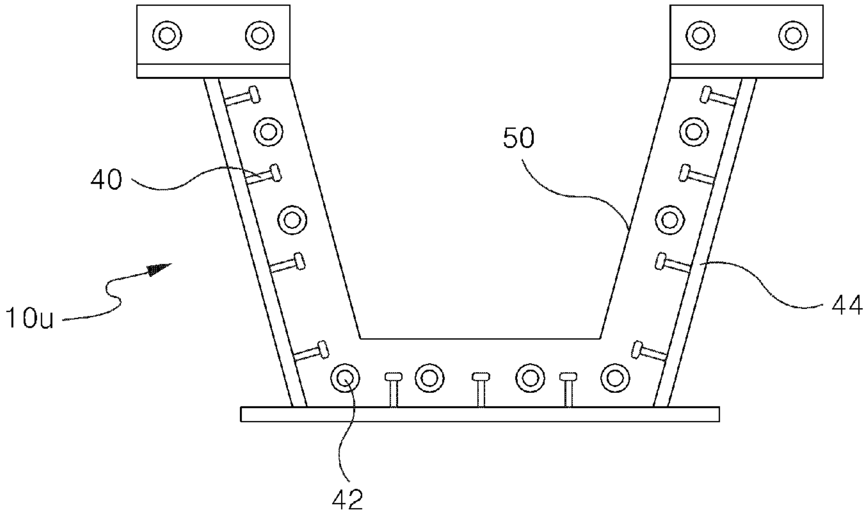
[Fig. 2]



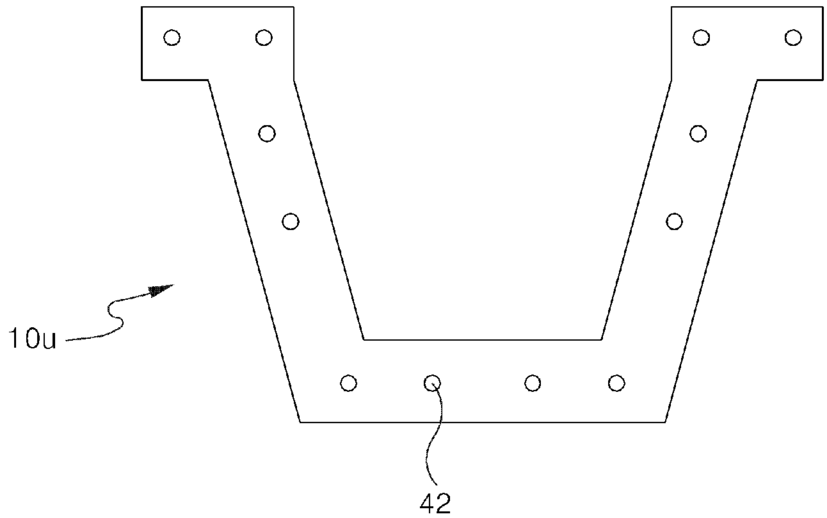
[Fig. 3]



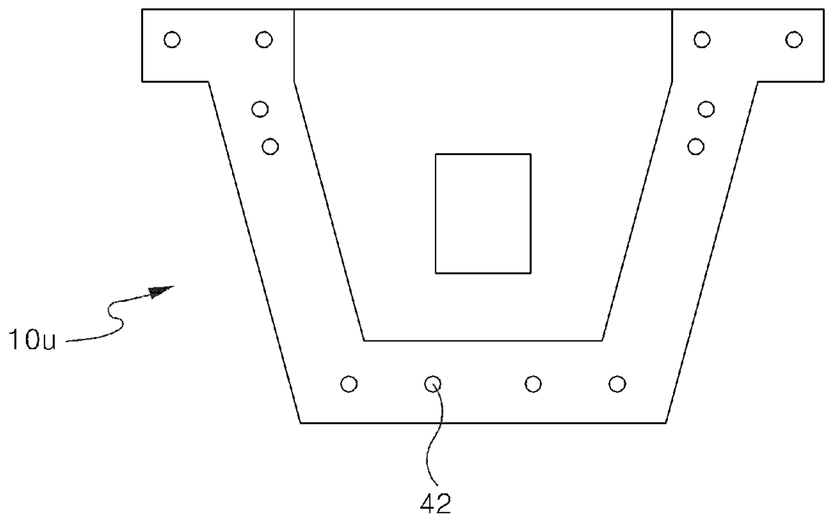
[Fig. 4]



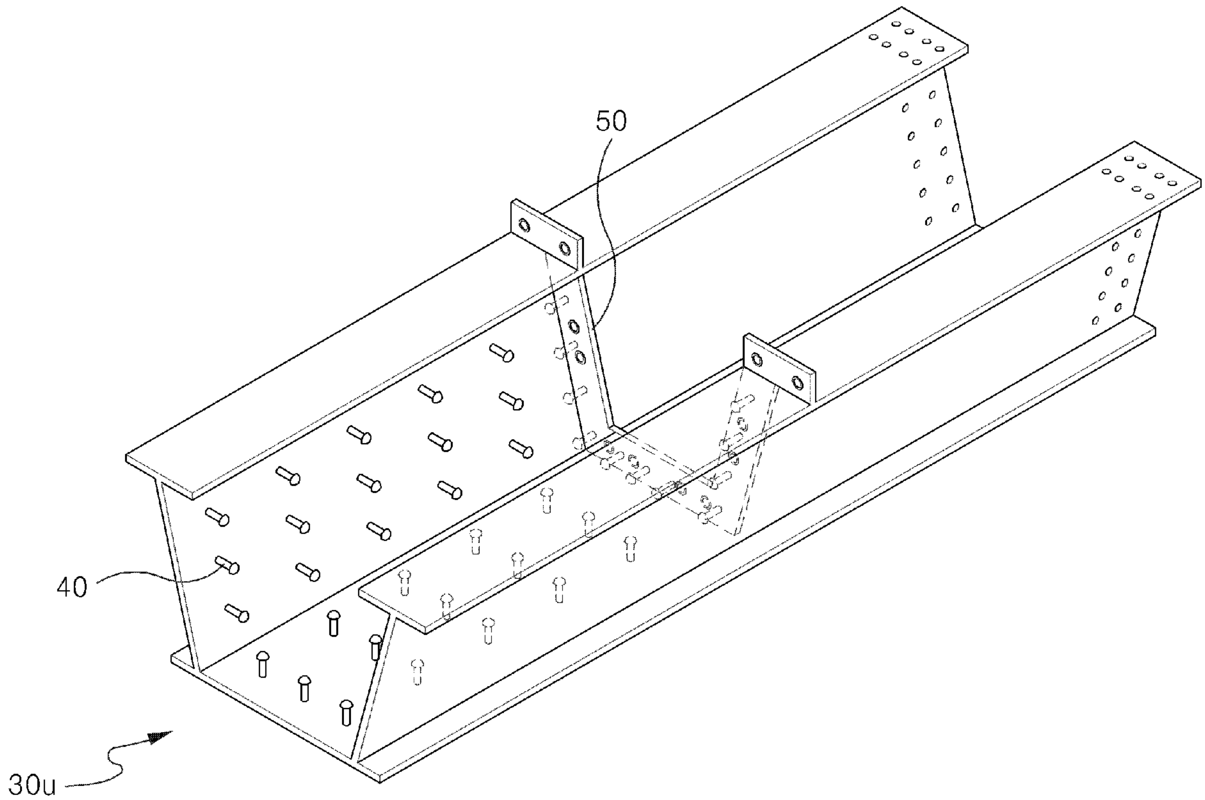
[Fig. 5]



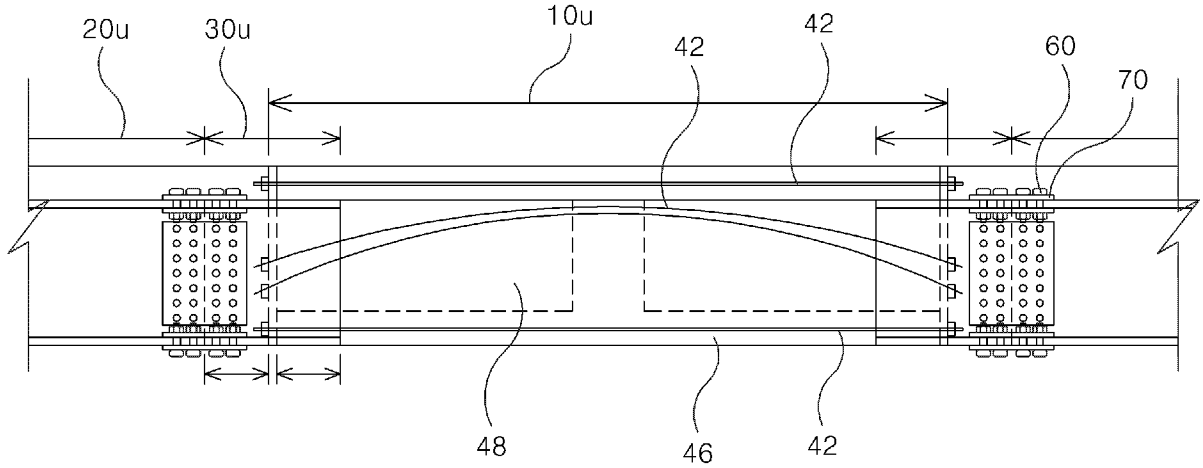
[Fig. 6]



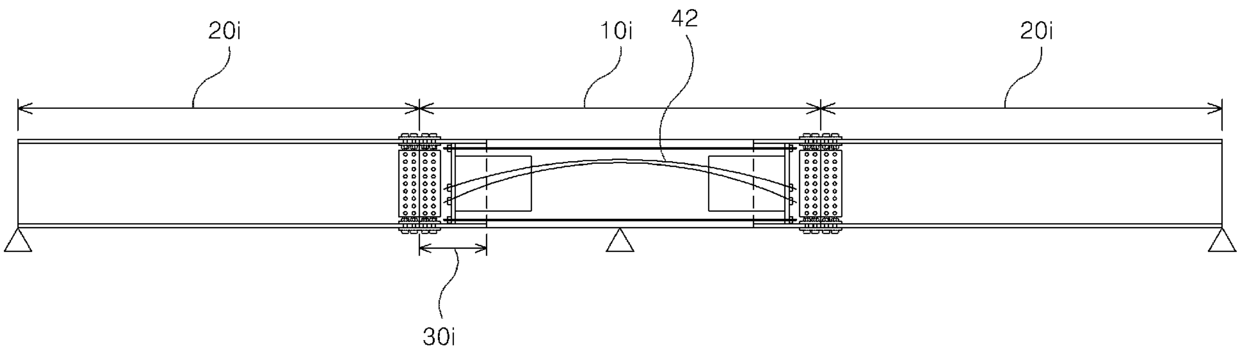
[Fig. 7]



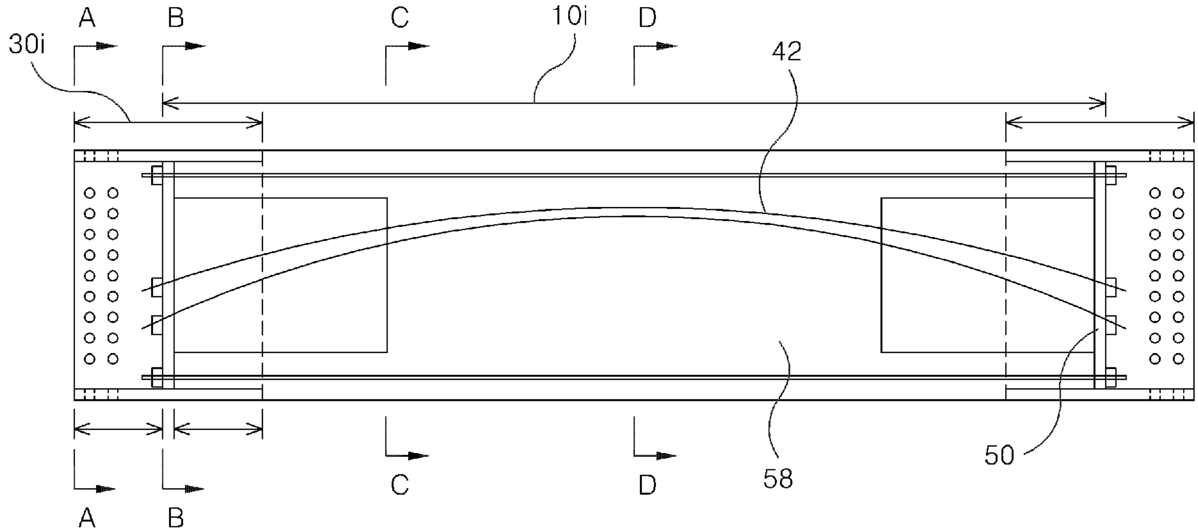
[Fig. 8]



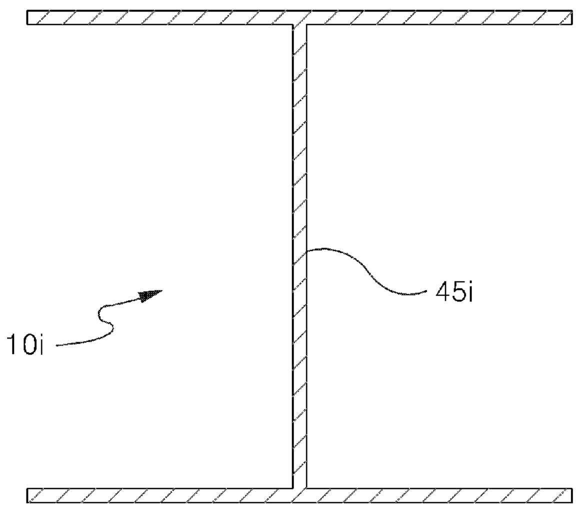
[Fig. 9]



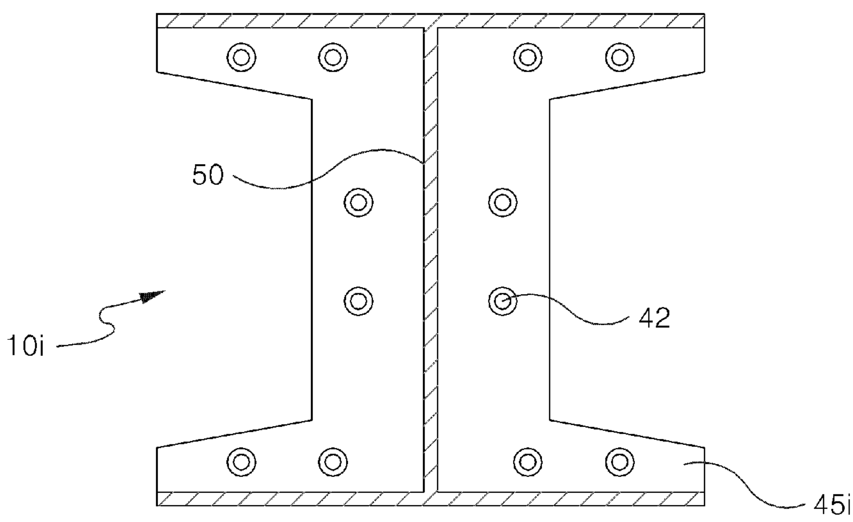
[Fig. 10]



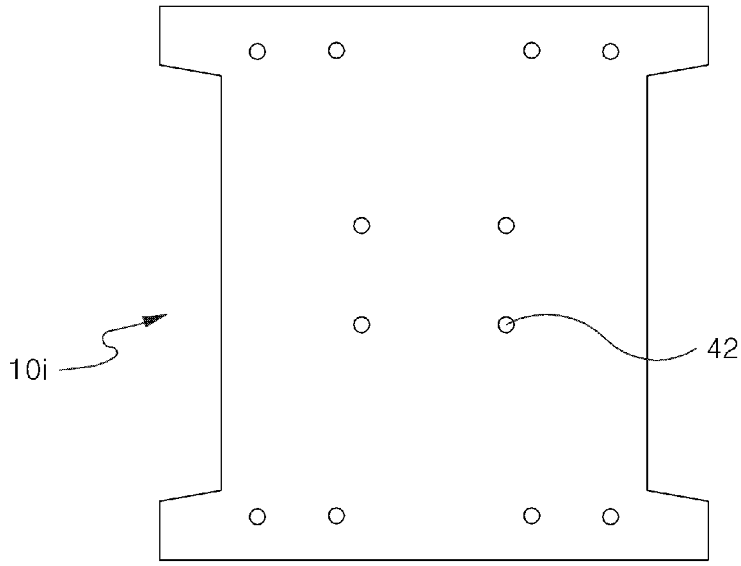
[Fig. 11]



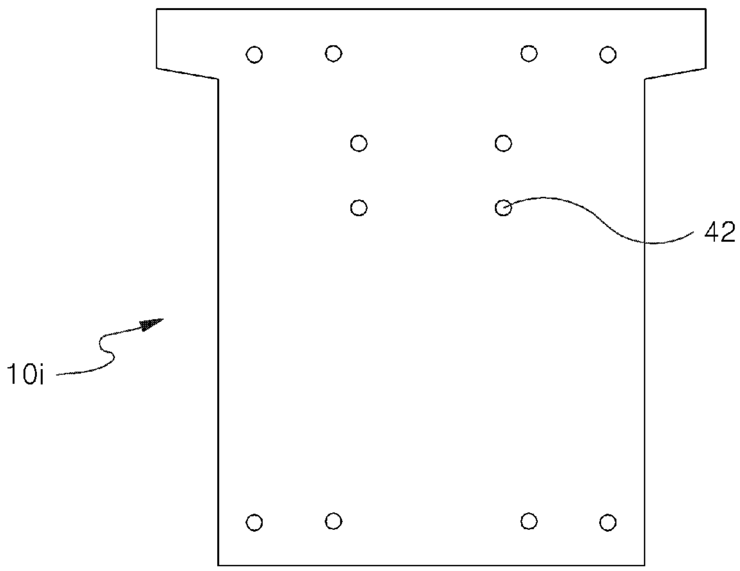
[Fig. 12]



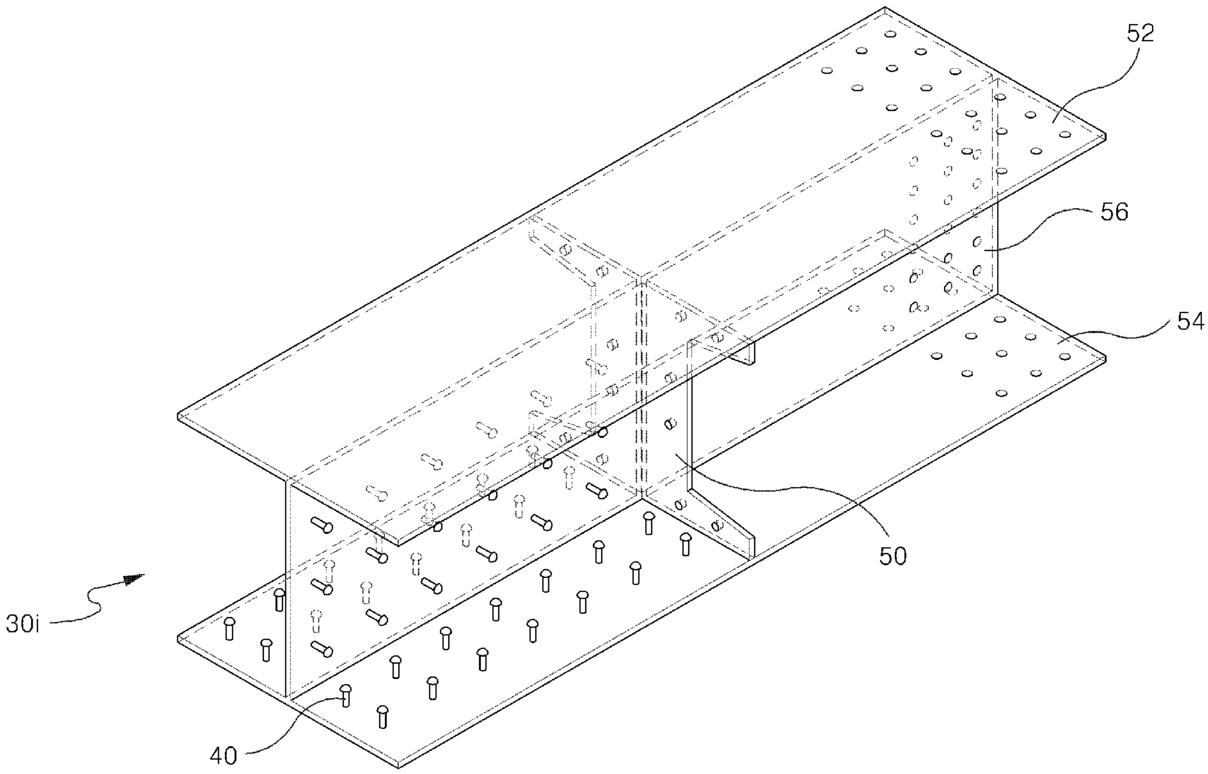
[Fig. 13]



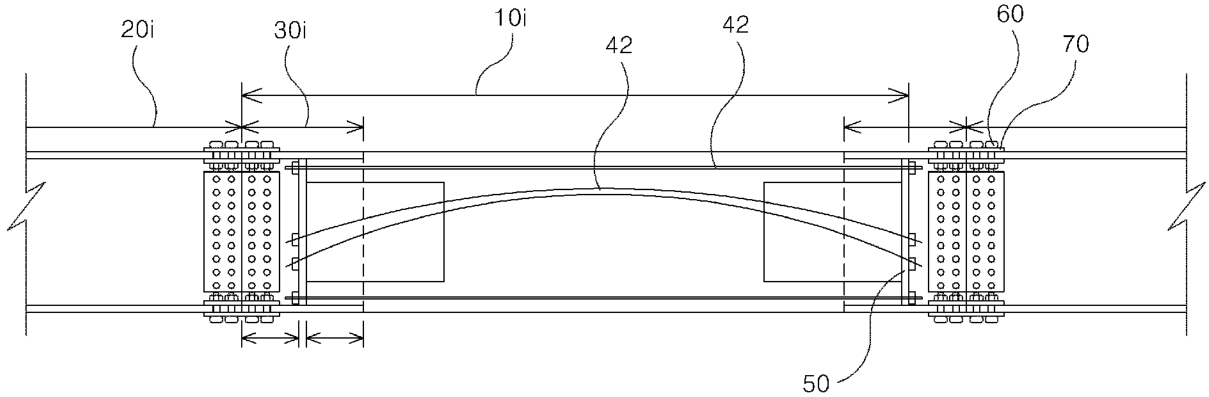
[Fig. 14]



[Fig. 15]



[Fig. 16]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2008/006470

A. CLASSIFICATION OF SUBJECT MATTER

E01D 2/00(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC8 : E01D 21/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Korean Utility Models and applications for Utiluity Modela since 1975
Japanese Utility Models and applications for Utiluity Modela since 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

eKIPASS(KIPO internal) "hybrid", "girder"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	HUH, TAIK NYUNG et al. 'Nonlinear Finite Element Analysis of Mixed Structure Connection Types' In : 2006 KSCE Anual Conference. Seoul : KSCE, 30 OCTOBER 2006 See page 702 ~ 705, fig 1	1
A	JP H13-140217 A(YOSIKAWAENPI Ltd.) 22 MAY 2001 See the whole document, fig 1	1
A	JP H11-107214 A (NKK) 20 APRIL 1999 See the whole document, fig 1	1
A	US5,978,997 A (Stanley J. Grossman) 9 NOVEMBER 1999 See the whole document, fig 3	1

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 JUNE 2009 (22.06.2009)	**22 JUNE 2009 (22.06.2009)**

Name and mailing address of the ISA/KR
Korean Intellectual Property Office
Government Complex-Daejeon, 139 Seonsa-ro, Seo-gu, Daejeon 302-701, Republic of Korea
Facsimile No. 82-42-472-7140

Authorized officer
CHOI, Byoung Suk
Telephone No. 82-42-481-5797

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001-140217	22.05.2001	NONE	
JP 11-107214 A	20.04.1999	NONE	
US 5978997	09.11.1999	NONE	