

(19) **DANMARK**

(10) **DK/EP 3660237 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **E 04 B 1/58 (2006.01)** **E 04 B 1/18 (2006.01)** **E 04 B 1/24 (2006.01)**
E 04 B 1/30 (2006.01) **E 04 H 9/02 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2021-09-06**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-06-23**
- (86) Europæisk ansøgning nr.: **18891819.7**
- (86) Europæisk indleveringsdag: **2018-04-12**
- (87) Den europæiske ansøgnings publiceringsdag: **2020-06-03**
- (86) International ansøgning nr.: **CN2018082751**
- (87) Internationalt publikationsnr.: **WO2019119686**
- (30) Prioritet: **2017-12-21 CN 201711390229**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Qingdao University of Technology, No. 11 Fushun Road , Shibe District, Qingdao, Shandong 266000, Kina**
- (72) Opfinder: **MOU, Ben, No.11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina**
WANG, Yue, No. 11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
WANG, Junchang, No. 11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
YU, Dehu, No.11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
WANG, Yan, No.11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
QIAO, Qiyun, No. 11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
GE, Beibei, No. 11 Fushun Road, Shibe District, Qingdao, Shandong 266000, Kina
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**
- (54) Benævnelse: **SAMLET, SELVGENOPRETTENDE CIRKULÆRT SAMMENSAT BETONFYLDT STÅLRØRSLED**
- (56) Fremdragne publikationer:
WO-A1-2016/111459
WO-A1-2017/177470
CN-A- 101 525 904
CN-A- 104 032 838
CN-A- 105 888 080
CN-A- 106 049 691
CN-A- 107 237 401
CN-A- 107 338 872
CN-A- 107 893 481
CN-U- 203 878 780

Fortsættes ...

**CN-U- 204 728 481
JP-A- H08 239 902
JP-A- 2002 038 755
KR-A- 20160 078 785**

DESCRIPTION

TECHNICAL FIELD

[0001] The invention relates to the technical field of structural members for buildings, in particular to an assembled self-recovery circular concrete-filled steel-tube composite joint.

BACKGROUND

[0002] Steel structural members constitute a structural system by means of connection joints, and the joint form has a direct influence on the structural integrity and reliability, the construction cycle and the design and construction of accessory members. According to the rotational stiffness, beams and columns of a frame structure are connected in a rigid, flexible, or semi-rigid manner.

[0003] At present, rigid connection is most extensively applied, and rigid joints for the beams and columns of the traditional frame comprise all-welded joints, welded-bolted connection joints, and bolted connection joints. It is discovered through research that the first two connection forms may cause brittle fractures due to the poor quality of welding seams at the ends of the beams and the lack of timely and effective protection in earthquakes; and the traditional joints are difficult to restore or reinforce after being damaged, and consequentially, the reliability of the joints cannot be guaranteed or material waste is caused.

[0004] As a novel earthquake-control structure, the self-recovery functional structure can guarantee the safety of people's life and property during earthquakes and can assist people in getting back a normal life as soon as possible after great earthquakes, thereby pointing out a new ideal direction for the earthquake-resistant design of structures. The self-recovery structural system primarily comprises a replaceable structural member, a swing structure, a self-recovery device, and so on. Research in recent years shows that the swing of the structure can reduce the influence of earthquakes and the requirements for the ductility of the structure, reduce earthquake damage, and reduce the manufacturing cost of the structure. The constraint between the structure and a foundation or between the members is released so that the structure can only be pressed, but not be tensioned on the contact surface with the foundation or on the contact surface between the members, and then the structure can swing in the earthquakes and can restore under the effect of a pre-stressing force, and in this way, a self-recovery structure is formed. The novel structural system can effectively control the maximum deformation of the structure and can reduce the residual deformation of the structure.

[0005] At present, many experts put forward the solution of arranging pre-stressed cables on frame beams of beam-column joints of a frame structural system to fulfill structural restoration

after earthquakes, wherein short beam sections are connected with the columns through tensioning of the pre-stressed cables in a factory, only intermediate beam sections need to be assembled through all-bolted connection or welded-bolted connection at the construction site like common steel beams, and the pre-stressed cables do not need to be tensioned on site, so that construction is facilitated, the construction quality is improved, and installation time is shortened. However, self-restoration of concrete-filled steel-tube composite joint adopting high-strength steel bars between columns has yet to be researched and developed.

[0006] WO 2017/177470 A1 discloses an assembled self-recovery circular concrete-filled steel-tube composite joint.

SUMMARY

[0007] The objective of the invention is to solve the above technical problems by providing a novel assembled self-recovery circular concrete-filled steel-tube composite joint.

[0008] To fulfill the above objective, the assembled self-recovery circular concrete-filled steel-tube composite joint comprises the features of claim 1. It comprises a circular steel-tube column and H-shaped steel beams, wherein steel bars penetrate through the circular steel-tube column which comprises an upper steel-tube column section, a central inserted-connection column section and a lower steel-tube column section; the upper steel-tube column section is connected with the central inserted-connection column section through an upper sleeve connector, and the central inserted-connection column section is connected with the lower steel-tube column section through a lower sleeve connector.

[0009] Steel bar fixing plates are fixed to the upper end of the upper steel-tube column section and the lower end of the lower steel-tube column section, are centrally provided with through holes, and are provided with steel bar holes around the through holes, the steel bars sequentially penetrate through the steel bar fixing plate at the upper end of the upper steel-tube column section, the circular steel-tube column and the steel bar fixing plate at the lower end of the lower steel-tube column section, and two ends of each steel bar are fixed by means of fasteners;

[0010] The upper sleeve connector comprises a circular tube, a connecting ring plate and an insertion plate, wherein the diameter of the circular tube is smaller than that of the circular steel-tube column, the connecting ring plate is arranged in the middle of the circular tube and comprises at least two end plates, and the insertion plate is fixed below the end plates and is vertically connected with the circular tube and the end plates; the lower sleeve connector is symmetrical with the upper sleeve connector in structure with an insertion plate fixed above end plates.

[0011] The upper end and the lower end of the central inserted-connection column section are provided with slots matched with the insertion plates.

[0012] The middle of a web at an end, connected to the circular steel-tube column, of each H-shaped steel beam is provided with a protrusive plate, wherein the distance between the upper edge of the protrusive plate and the upper flange of the H-shaped steel beam is not less than the height of the insertion plate of the upper sleeve connector, and the distance between the lower edge of the protrusive plate and the lower flange of the H-shaped steel beam is not less than the height of the insertion plate of the lower sleeve connector.

[0013] The circular tube on an upper half of the upper sleeve connector is inserted into the upper steel-tube column section, and the insertion plate of the upper sleeve connector is inserted into the slot in the upper end of the central inserted-connection column section; the circular tube on a lower half of the lower sleeve connector is inserted into the lower steel-tube column section, and the insertion plate of the lower sleeve connector is inserted into the slot in the lower end of the central inserted-connection column section; the protrusive plates of the H-shaped steel beams are inserted between the insertion plate of the upper sleeve connector and the insertion plate of the lower sleeve connector, the protrusive plates are connected with the two sides of each insertion plate in an overlapped manner through web connecting plates, the upper flanges of the H-shaped steel beams are connected with the end plates of the upper sleeve connector in an overlapped manner through flange connecting plates, and the lower flanges of the H-shaped steel beams are connected with the end plates of the lower sleeve connector in an overlapped manner through flange connecting plates.

[0014] Furthermore, the circular steel-tube column is connected with four H-shaped steel beams, and the connecting ring plate comprises four end plates arrayed in a cross shape.

[0015] Furthermore, the circular steel-tube column is connected with three H-shaped steel beams, and the connecting ring plate comprises three end plates arrayed in a T shape.

[0016] Furthermore, the circular steel-tube column is connected with two H-shaped steel beams, and the connecting ring plate comprises two end plates which are arrayed linearly or perpendicularly.

[0017] Furthermore, a gap between the upper steel-tube column section and the central inserted-connection column section and a gap between the lower steel-tube column section and the central inserted-connection column section are filled with rubber materials to prevent concrete from overflowing.

[0018] Furthermore, the insertion plates and the protrusive plates of the H-shaped steel beams are connected with the web connecting plates through high-strength bolts.

[0019] Furthermore, the insertion plates and the upper flange plates and lower flange plates of the H-shaped steel beams are connected with the flange connecting plates through the high-strength bolts.

[0020] The upper steel-tube column section, the central inserted-connection column section, the lower steel-tube column section, the upper sleeve connector, the lower sleeve connector and the H-shaped steel beams are pre-fabricated in a factory and only need to be assembled on site.

[0021] A method for assembling the assembled self-recovery circular concrete-filled steel-tube composite joint comprises the features of claim 8. It comprises the following steps:

1. I. Inserting the upper sleeve connector and the lower sleeve connector into the central inserted-connection column section;
2. II. Connecting the upper steel-tube column section with the upper sleeve connector, and connecting the lower steel-tube column section with the lower sleeve connector;
3. III. Inserting the protrusive plates of the H-shaped steel beams between the insertion plate of the upper sleeve connector and the insertion plate of the lower sleeve connector, and connecting the insertion plates with the two sides of each protrusive plate in the overlapped manner through the web connecting plates;
4. IV. Connecting the upper flanges of the H-shaped steel beams with the end plates of the upper sleeve connector in the overlapped manner through flange connecting plates, and connecting the lower flanges of the H-shaped steel beams with the end plates of the lower sleeve connector in the overlapped manner through the flange connecting plates;
5. V. Inserting the steel bars into the steel bar holes reserved in the steel bar fixing plate at the upper end of the upper steel-tube column section, wherein the steel bars sequentially penetrate through the upper steel-tube column section, the central inserted-connection column section, and the lower steel-tube column section, and finally stretch out of the steel bar holes reserved in the steel bar fixing plate at the lower end of the lower steel-tube column section, and two ends of each steel bar are screwed by means of screw nuts, so that fixed connection is completed.
6. VI. Pouring concrete into the circular steel-tube column via the through holes reserved in the steel bar fixing plates, so that connected parts are engaged to be fastened into a whole.

[0022] The invention has the following beneficial effects:

1. (1) According to the assembled self-recovery circular concrete-filled steel-tube composite joint, all members are machined in the factory and are connected on site through the bolts, so that fully-assembled construction is fulfilled, quality problems probably caused by site welding are avoided, the construction progress is accelerated, and labor productivity is improved.
2. (2) The group of steel bars penetrating through the joint, pre-stressed concrete, and other measures are taken, so that the assembled self-recovery circular concrete-filled steel-tube composite joint effectively overcomes the defects of poor integrity and poor earthquake resistance of the traditional pre-fabricated assembled structure, prevents untimely generation of cracks in concrete, and improves the connection reliability of

vertical members, thereby improving structural integrity, fulfilling good earthquake resistance, and being effectively prevented from being damaged before the members during earthquakes.

3. (3) In small earthquakes, the assembled self-recovery circular concrete-filled steel-tube composite joint has the same functions as those of a common beam-column fixed-connection joint and can resist small earthquakes without being damaged; during moderate earthquakes, the cast-steel inner sleeve connector connected to a column end provides rotational stiffness, the central inserted-connection column section has a tendency to be separated from the upper steel-tube column section and the lower steel-tube column section, but the concrete in the steel-tube columns will not crack too early under the effect of the pre-stressing force from the group of the high-strength steel bars, and high-strength steel bars in the steel-tube columns are in an elastic state all the time when tensioned, and can be restored rapidly to perform the function after being deformed during the earthquakes; and in great earthquakes, the structure may be severely deformed, but will not collapse due to the good structural integrity, and any members damaged can be accurately disassembled and be quickly replaced after the earthquakes.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is an exploded structural view of the invention;

Fig. 2 is an exploded structural view of a circular steel-tube column of the invention;

Fig. 3 is a partial exploded view of part A of the invention;

Fig. 4 is an assembly drawing of the invention.

[0024] Reference Signs: 1, circular steel-tube column; 2, H-shaped steel beam; 3, upper steel-tube column section; 4, central inserted-connection column section; 5, lower steel-tube column section; 6, upper sleeve connector; 7, lower sleeve connector; 8, steel bar fixing plate; 9, steel bar; 10, circular tube; 11, connecting ring plate; 12, insertion plate; 13, end plate; 14, slot; 15, protrusive plate; 16, web connecting plate; 17, flange connecting plate.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0025] The invention is further expounded as follows in combination with the accompanying

drawings.

[0026] As shown in Fig. 1, Fig. 2, and Fig. 3, the assembled self-recovery circular concrete-filled steel-tube composite joint comprises a circular steel-tube column 1 and H-shaped steel beams 2, wherein steel bars 9 penetrate through the circular steel-tube column which comprises an upper steel-tube column section 3, a central inserted-connection column section 4 and a lower steel-tube column section 5; the upper steel-tube column section is connected with the central inserted-connection column section through an upper sleeve connector 6, and the central inserted-connection column section is connected with the lower steel-tube column section through a lower sleeve connector 7.

[0027] Steel bar fixing plates 8 are fixed to the upper end of the upper steel-tube column section and the lower end of the lower steel-tube column section, are centrally provided with through holes, and are provided with steel bar holes around the through holes, the steel bars sequentially penetrate through the steel bar fixing plate at the upper end of the upper steel-tube column section, the circular steel-tube column section, and the steel bar fixing plate at the lower end of the lower steel-tube column section, and two ends of each steel bar are fixed by means of fasteners.

[0028] The upper sleeve connector comprises a circular tube 10, a connecting ring plate 11 and an insertion plate 12, wherein the diameter of the circular tube is smaller than that of the circular steel-tube column, the connecting ring plate is arranged in the middle of the circular tube and comprises at least two end plates 13, and the insertion plate is fixed below the end plates and is vertically connected with the circular tube and the end plates; and the lower sleeve connector is symmetrical with the upper sleeve connector in structure with an insertion plate fixed above end plates.

[0029] According to the position of the joint in a building frame, if the circular steel-tube column is connected with four H-shaped steel beams, the connecting ring plate comprises four end plates arrayed in a cross shape; if the circular steel-tube column is connected with three H-shaped steel beams, the connecting ring plate comprises three end plates arrayed in a T shape; or, if the circular steel-tube column is connected with two H-shaped steel beams, the connecting ring plate comprises two end plates which are arrayed linearly or perpendicularly.

[0030] The upper end and the lower end of the central inserted-connection column section are provided with slots 14 matched with the insertion plates.

[0031] The middle of a web at an end, connected to the circular steel-tube column, of each H-shaped steel beam is provided with a protrusive plate 15, wherein the distance between the upper edge of the protrusive plate and the upper flange of the H-shaped steel beam is not less than the height of the insertion plate of the upper sleeve connector, and the distance between the lower edge of the protrusive plate and the lower flange of the H-shaped steel beam is not less than the height of the insertion plate of the lower sleeve connector.

[0032] During connection, the circular tube on an upper half of the upper sleeve connector is inserted into the upper steel-tube column section, and the insertion plate of the upper sleeve connector is inserted into the slot in the upper end of the central inserted-connection column section; the circular tube on a lower half of the lower sleeve connector is inserted into the lower steel-tube column section, and the insertion plate of the lower sleeve connector is inserted into the slot in the lower end of the central inserted-connection column section; the protrusive plates of the H-shaped steel beams are inserted between the insertion plate of the upper sleeve connector and the insertion plate of the lower sleeve connector, the protrusive plates and the insertion plates are connected in an overlapped manner through web connecting plates 16 additionally arranged on the insertion plates and two sides of each protrusive plate, and the insertion plates, the protrusive plates, and the web connecting plates are connected through high-strength bolts; the upper flanges of the H-shaped steel beams are connected with the end plates of the upper sleeve connector in an overlapped manner through additionally-arranged flange connecting plates 17, the lower flanges of the H-shaped steel beams are connected with the end plates of the lower sleeve connector in an overlapped manner through additionally-arranged flange connecting plates 17, and the upper flanges and the lower flanges are connected with the end plates through high-strength bolts. A connection diagram is shown in Fig. 4.

[0033] The upper steel-tube column section, the central inserted-connection column section, the lower steel-tube column section, the upper sleeve connector, the lower sleeve connector, and the H-shaped steel beams are prefabricated in a factory and just need to be assembled on site.

[0034] A method for assembling the assembled self-recovery circular concrete-filled steel-tube composite joint comprises the following steps:

1. I. The upper sleeve connector and the lower sleeve connector are respectively inserted into the central inserted-connection column section;
2. II. The upper steel-tube column section is connected with the upper sleeve connector, and the lower steel-tube column section is connected with the lower sleeve connector;
3. III. The protrusive plates of the H-shaped steel beams are inserted between the insertion plate of the upper sleeve connector and the insertion plate of the lower sleeve connector, and the insertion plates are connected with the two sides of each protrusive plate in the overlapped manner through web connecting plates;
4. IV. The upper flanges of the H-shaped steel beams are connected with end plates of the upper sleeve connector in the overlapped manner through the flange connecting plates, and the lower flanges of the H-shaped steel beams are connected with the end plates of the lower sleeve connector in the overlapped manner through the flange connecting plates;
5. V. The steel bars are inserted into the steel bar holes reserved in the steel bar fixing plate at the upper end of the upper steel-tube column section, wherein the steel bars sequentially penetrate through the upper steel-tube column section, the central inserted-connection column section, and the lower steel-tube column section, and finally stretch

out of steel bar holes reserved in the steel bar fixing plate at the lower end of the lower steel-tube column section, and two ends of each steel bar are screwed by means of screw nuts, so that fixed connection is completed.

6. VI. Concrete is poured into the circular steel-tube column via the through holes reserved in the steel bar fixing plates, so that connected parts are engaged to be fastened into a whole; and in order to prevent concrete from overflowing, a gap between the upper steel-tube column section and the central inserted-connection column section and a gap between the lower steel-tube column section and the central inserted-connection column section are filled with rubber materials.

[0035] The above embodiments are only preferred ones of the invention, and are not intended to limit the invention. Those skilled in this field are permitted to make various changes and transformations, and all modifications, equivalent replacements, improvements, within the scope of the appended claims.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- [WO2017177470A1 \[0006\]](#)

Patentkrav

1. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled, der omfatter en cirkulær stålrørssøjle (1) og H-
5 formede stålbjælker (2), hvor stålstænger (9) trænger igennem den cirkulære stålrørssøjle (1), der omfatter en øvre stålrørssøjledel (3), en midterst indsat forbindelsessøjledel (4) og en nedre stålrørssøjledel (5); den øvre stålrørssøjledel (3) er forbundet med den midterste indsatte
10 forbindelsessøjledel (4) gennem en øvre forbindelsesbøsning (6), og den midterste indsatte forbindelsessøjledel (4) er forbundet med den nedre stålrørssøjledel (5) gennem en nedre forbindelsesbøsning (7); stålstang-fastgørelsesplader (8) er fastgjort til en øvre ende af den øvre stålrørssøjledel (3) og
15 en nedre ende af den nedre stålrørssøjledel (5), er forsynet i midten med gennemgående huller og er forsynet med stålstangshuller omkring de gennemgående huller, og stålstængerne (9) trænger sekventielt igennem stålstang-fastgørelsespladen (8) i den øvre ende af den øvre
20 stålrørssøjledel (3), den cirkulære stålrørssøjledel (1) og stålstang-fastgørelsespladen (8) i den nedre ende af den nedre stålrørssøjledel (5); den øvre forbindelsesbøsning (6) omfatter et cirkulært rør (10), en ringformet forbindelsesplade (11) og en indsatsplade (12), hvor en
25 diameter af det cirkulære rør (10) er mindre end den cirkulære stålrørssøjles (1) diameter, den ringformede forbindelsesplade (11) er anbragt i midten af det cirkulære rør (10) og omfatter mindst to endeplader (13), og indsatspladen (12) er fastgjort under endepladerne (13) og er lodret forbundet med det
30 cirkulære rør (10) og endepladerne (13); den nedre forbindelsesbøsning (7) er symmetrisk med den øvre forbindelsesbøsning (6) i sin struktur med en indsatsplade (12), der er fastgjort over endeplader (13) en øvre ende og en nedre ende af den midterste indsatte
35 forbindelsessøjledel (4) er forsynet med slidser (14), der er tilpasset indsatspladerne (12) midten af et bånd i en ende, der er forbundet med den cirkulære stålrørssøjledel (1), af hver H-formet stålbjælke

(2) er forsynet med en fremspringende plade (15), hvor en afstand mellem en øvre kant af den fremspringende plade (15) og en øvre flange på den H-formede stålbjælke (2) ikke er mindre end en højde af indsatspladen (12) på den øvre forbindelsesbøsning (6), og en afstand mellem en nedre kant af den fremspringende plade (15) og en nedre flange af den H-formede stålbjælke (2) er ikke mindre end en højde af indsatspladen (12) på den nedre forbindelsesbøsning (7); og det cirkulære rør (10) på en øvre halvdel af den øvre forbindelsesbøsning (6) er indsat i den øvre stålrørssøjledel (3), og indsatspladen (12) på den øvre forbindelsesbøsning (6) er indsat i slidsen (14) i den øvre ende af den midterste indsatte forbindelsessøjledel (4); det cirkulære rør (10) på en nedre halvdel af den nedre forbindelsesbøsning (7) er indsat i den nedre stålrørssøjledel (5), og indsatspladen (12) på den nedre forbindelsesbøsning (7) er indsat i slidsen (14) i den nedre ende af den midterste indsatte forbindelsessøjledel (4); de fremspringende plader (15) på de H-formede stålbjælker (2) er indsat mellem indsatspladen (12) på den øvre forbindelsesbøsning (6) og indsatspladen (12) på den nedre forbindelsesbøsning (7), indsatspladerne (12) er forbundet med to sider af hver fremspringende plade (15) på en overlappet måde gennem båndforbindelsesplader (16), de øvre flanger på de H-formede stålbjælker (2) er forbundet med endepladerne (13) på den øvre forbindelsesbøsning (6) på en overlappet måde gennem flangeforbindelsesplader (17), og de nedre flanger på de H-formede stålbjælker (2) er forbundet med endepladerne (13) på den nedre forbindelsesbøsning (7) på en overlappet måde gennem flangeforbindelsesplader (17).

30

2. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled, ifølge krav 1, hvor den cirkulære stålrørssøjle (1) er forbundet med fire H-formede stålbjælker (2), og den ringformede forbindelsesplade (11) omfatter fire endeplader (13), der er anbragt i krydsform.

35

3. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled ifølge krav 1, hvor den cirkulære stålrørssøjle

(1) er forbundet med tre H-formede stålbjælker (2), og den ringformede forbindelsesplade (11) omfatter tre endeplader (13), der er anbragt i en T-form.

5 4. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled ifølge krav 1, hvor den cirkulære stålrørssøjle (1) er forbundet med to H-formede stålbjælker (2), og den ringformede forbindelsesplade (11) omfatter to endeplader (13), der er anbragt lineært eller vinkelret.

10

5. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled ifølge krav 1, hvor et mellemrum mellem den øvre stålrørssøjledel (3) og den midterste indsatte forbindelsessøjledel (4) og et mellemrum mellem den nedre 15 stålrørssøjledel (5) og den midterste indsatte forbindelsessøjledel (4) er fyldt med gummimaterialer for at forhindre, at beton flyder over.

6. Samlet, selvgenoprettende cirkulært sammensat betonfyldt 20 stålrørsled ifølge krav 1, hvor indsatspladerne (12) og de fremspringende plader (15) på de H-formede stålbjælker (2) er forbundet med båndforbindelsespladerne (16) gennem højstyrkebolte.

25 7. Samlet, selvgenoprettende cirkulært sammensat betonfyldt stålrørsled ifølge krav 1, hvor indsatspladerne (13) og de øvre flangeplader og nedre flangeplader på de H-formede stålbjælker (2) er forbundet med båndforbindelsespladerne (17) gennem højstyrkebolte.

30

8. Fremgangsmåde til samling af det samlede, selvgenoprettende cirkulære sammensatte betonfyldte stålrørsled ifølge krav 1-7, hvilken fremgangsmåde omfatter de følgende trin:

35 I. Forbindelse af den øvre forbindelsesbøsning (6) og den nedre forbindelsesbøsning (7) i den midterste indsatte forbindelsessøjledel (4)

II. Forbindelse af den øvre stålrørssøjledel (3) med den øvre

forbindelsesbøsning (6) og forbindelse af den nedre stålrørssøjledel (5) med den nedre forbindelsesbøsning (7)

III. Indsættelse af de fremspringende plader (15) på de H-formede stålbjælker (2) mellem indsatspladen (12) på den øvre forbindelsesbøsning (6) og indsatspladen (12) på den nedre forbindelsesbøsning (7) og forbindelse af indsatspladerne (12) med de to sider af hver fremspringende plade (15) på den overlappede måde gennem båndforbindelsespladerne (16);

IV. Forbindelse af de øvre flanger på de H-formede stålbjælker (2) med endepladerne (13) på den øvre forbindelsesbøsning (6) på den overlappede måde gennem flangeforbindelsespladerne (17) og forbindelse af de nedre flanger på de H-formede stålbjælker (2) med endepladerne (13) på den nedre forbindelsesbøsning (7) på den overlappede måde gennem flangeforbindelsespladerne (17)

V. Indsættelse af stålstængerne (9) i de reserverede stålstangshuller i stålstang-fastgørelsespladen (8) i den øvre ende af den øvre stålrørssøjledel (3), hvor stålstængerne (9) sekventielt trænger igennem den øvre stålrørssøjledel (3), den midterste indsatte forbindelsessøjledel (4) og den nedre stålrørssøjledel (5) og til slut strækker sig ud af de reserverede stålstangshuller i stålstang-fastgørelsespladen (8) i den nedre ende af den nedre stålrørssøjledel (5), og to ender af hver stålstang (9) skrues ved hjælp af skruemøtrikker, således at den faste forbindelse fuldføres.

VI. Hældning af beton i den cirkulære stålrørssøjle (1) gennem de reserverede gennemgående huller i fastgørelsespladerne (8) i stålstangen, således at de tilsluttede dele går i indgreb for at blive fastgjort til en helhed.

DRAWINGS

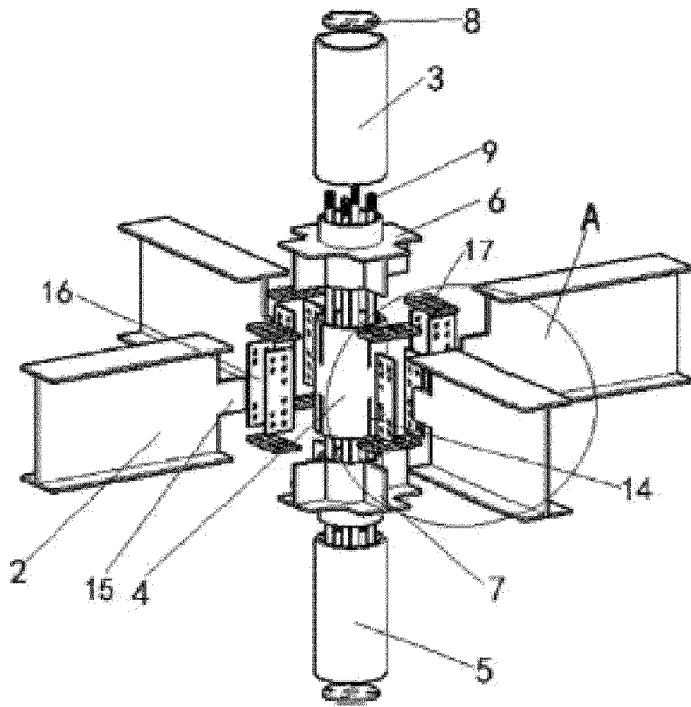


Fig. 1

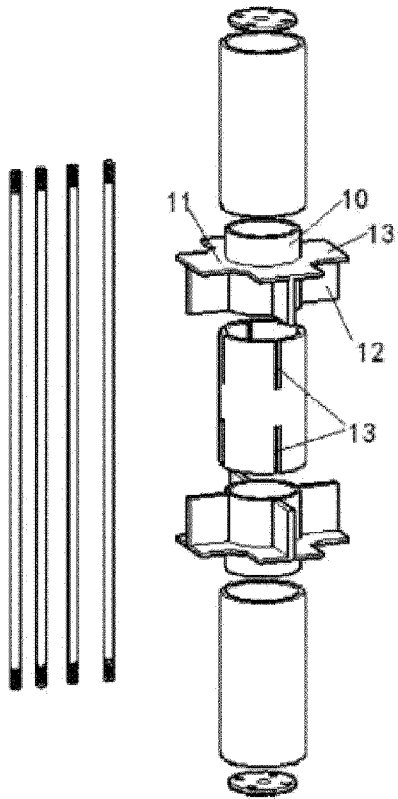


Fig. 2

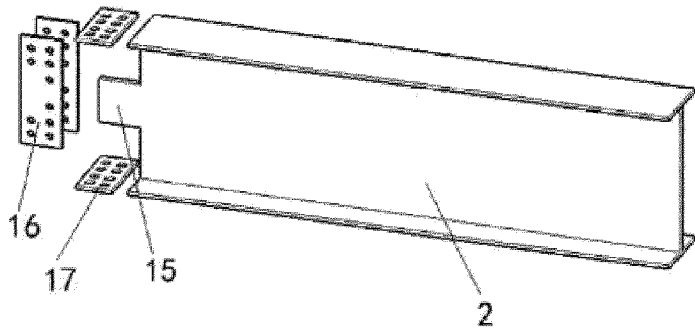


Fig. 3

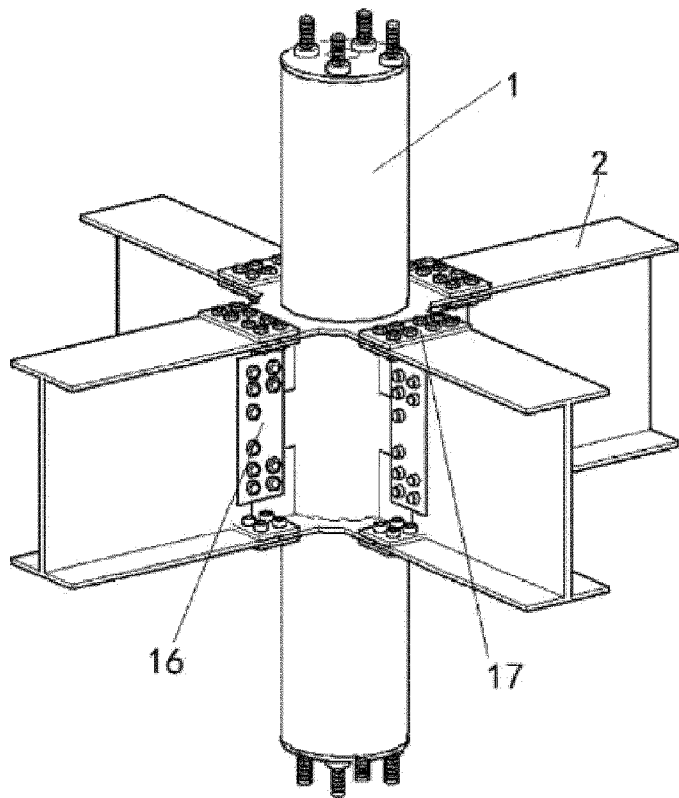


Fig. 4