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

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 December 2009 (30.12.2009)

PCT

(10) International Publication Number
WO 2009/156586 A1

(51) **International Patent Classification**:
E04B 1/21 (2006.01) *E04B 1/19* (2006.01)
E04B 1/58 (2006.01)

(21) **International Application Number**:
PCT/FI2009/050560

(22) **International Filing Date**:
24 June 2009 (24.06.2009)

(25) **Filing Language**: English

(26) **Publication Language**: English

(30) **Priority Data**:
20085658 27 June 2008 (27.06.2008) FI

(71) **Applicant** *(for all designated States except US)*: **PEIKKO GROUP OY** [FI/FI]; Voimakatu 3, FI-15170 Lahti (FI).

(72) **Inventor; and**
(75) **Inventor/Applicant** *(for US only)*: **PELTONEN, Simo** [FI/FI]; Välitie 9, FI-47400 Kouvola (FI).

(74) **Agent**: **KOLSTER OY AB**; (Iso Roobertinkatu 23), P.O.Box 148, FI-00121 Helsinki (FI).

(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, CL, 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, KR, 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, PE, 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, MK, 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).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

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

[Continued on next page]

(54) **Title**: METHOD FOR FORMING CONNECTING STRUCTURE BETWEEN PILLAR AND BEAM, AND CONNECTING STRUCTURE BETWEEN PILLAR AND BEAM

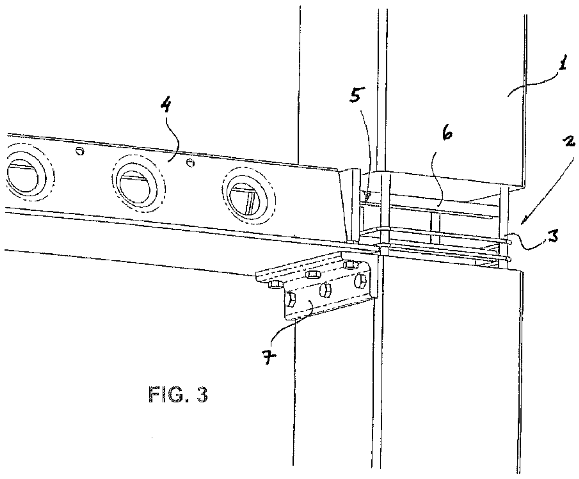

FIG. 3

(57) **Abstract**: The invention relates to a method for forming a connecting structure between a pillar and beam, the method comprising prefabricating multi-storey reinforced concrete pillars or multi-storey composite pillars (1) and single-span beams (4) and transporting them to a construction site, mounting the pillars in place, and connecting the beams and pillars to each other at the construction site to form a connection, and to a connecting structure between a beam and pillar. In the invention, the multi-storey reinforced concrete pillars or multistorey composite pillars are prefabricated in such a manner that reinforcement and/or other steel parts (3) are visible at the connecting point (2) of beam and pillar. The single-span beams (4) are prefabricated in such a manner that both ends of the beams have a connector (5). The beams (4) are mounted and supported between stationary pillars (1) in such a manner that the connectors (5) at the ends of the beams or their action extends inside the pillar at the connecting point (2) of the beam and pillar. In the area of the end of the beam (4) reinforcing steel fittings (6) extending through the pillar (1) at the connecting point (2) are mounted, and the beam (4) and connecting point (2) are concreted together.

WO 2009/156586 A1

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Method for forming connecting structure between pillar and beam, and connecting structure between pillar and beam

[0001] The invention relates to a method for forming a connecting structure between a pillar and beam, in which method multi-storey reinforced concrete pillars or multi-storey composite pillars and single-span beams are prefabricated and transported to the construction site, the pillars are mounted in place, and the beams and pillars connected at the construction site to form a connection. The invention further relates to a connecting structure between a pillar and beam.

[0002] In construction, framework systems are continuously developed that differ from each other in the dimensions of components, materials, prefabrication degree, mounting manner, load transmission manner, and various other matters. The invention relates to a framework system having as load-bearing structures pillars, beams, and slabs. Such frameworks may be constructed entirely at the construction site, constructed entirely from prefabricated elements or by using composite structures, whereby cast-in-place structures, that is, structures obtained by concreting at the construction site, are connected to prefabricated elements that also serve as moulds.

[0003] On-site casting generally means slow moulding work, reinforcement work, lots of supporting work, and other corresponding work phases, which means that a completely cast-in-place structure is today rare owing to its expensiveness.

[0004] Full prefabricated building in turn sets high requirements on the connections between the elements in terms of their load-transmission capability, tightness, sound-proofing capability, and appearance.

[0005] Today, it is becoming more common to use structures with prefabricated steel, reinforced concrete, or composite structures and to combine them at the site with some casting. This way, it is possible to combine the speed of prefabricated building, while the prefabricated elements serve as moulds at the same time, and the advantages derived from on-site casting.

[0006] Pillars are vertical structures to which primary horizontal structures, or beams, supporting secondary horizontal structures, or slabs, are supported. The pillars may be of different lengths, as high as one storey, that is, single-storey pillars, or as high as several storeys, that is, multi-storey pillars.

[0007] The beams may also be of different lengths, in other words, single-span beams that extend to adjacent pillars at both ends or continuous beams that extend over several pillars. A double-span beam extends from one pillar over an adjacent pillar to a third one.

[0008] With multi-storey pillars, single-span beams are generally used, and they support themselves to consoles in the pillars and are, thus, disposed between the pillars.

[0009] With single-storey pillars, continuous beams are generally used, and the pillars of the next storey support themselves on the top surface of the beam.

[0010] An advantage of the multi-storey pillars is that the number of pillars is small and there are no extension connectors. Correspondingly, their disadvantages are the consoles that cause extra costs and also the fact that static dimensioning of multi-storey pillars is arduous.

[0011] An advantage of the single-storey pillars is that there are no consoles and static dimensioning is simple. Their disadvantages are in turn the extension connectors of the pillars and the large number of pillars.

[0012] An advantage of a continuous beam is that its structure is lower and the fact that less beams are required. Another advantage is a good dynamic damping capacity of the structure. A disadvantage is in turn the fact that static dimensioning is arduous and also that a continuous beam requires reinforcements at the pillar.

[0013] An advantage of a single-span beam is that static dimensioning is simple and that no reinforcements are required at the pillar. A disadvantage is that the beam is higher and the number of beams is high. A structure formed by a single-span beam also has a poor damping capacity.

[0014] The number of pillars makes it necessary to cast, move, transport, and mount each pillar separately. If the number of such steps increases, both the total costs and total time consumed increases significantly. One three-storey high pillar contains a third of these steps in comparison with the steps required by three single-storey pillars.

[0015] The extension connectors of pillars are generally bolts and pillar shoes or steel plates. When using extension connectors, the amount of steel in the pillar increases, which adds to the costs.

[0016] The consoles in the pillar are either concrete consoles protruding from the pillar or steel consoles protruding from the pillar that are fastened after casting. When using concrete consoles, openings need to be made in the mould of the pillar, and the console protruding from the pillar needs to be moulded separately. This is slow and, therefore, also expensive. When using steel consoles, no holes need necessarily be made in the mould, but the amount of steel in the pillar increases, thus increasing the costs of the pillar. Using consoles also affects the strain of the pillars. When a support reaction of a beam arrives at a console protruding from a pillar, its point of action is outside the cross-section of the pillar. This eccentricity, in other words, the distance between the point of action of the load and the centre of gravity of the pillar, causes a bending moment in the pillar, which needs to be taken into consideration in the static dimensioning of the pillar. The pillar has to endure this bending moment without buckling, for example. The bending moment increases the strain on the pillar and, thus, increases the cross-section and/or amount of steel in the pillar. This, in turn, increases the costs of the pillar. Many console solutions of pillars are also so high that they often extend below the bottom surface of the beam. This is an architecturally poor solution and also complicates piping and partition wall work in the building.

[0017] Static dimensioning of a multi-storey pillar is somewhat more arduous than the dimensioning of a single-storey pillar. This is due to the increase in the number of load alternatives and a more complex operational model of the pillar.

[0018] A hinge-supported single-span beam is able to turn freely when bending on a support. This leads to needing a sufficiently rigid cross-section for the beam so that the bending in the middle of the beam does not become too large for the use of the building. This is why single-span beams are high. An increase in the height of the beam affects not only material consumption and increases the weight of the structure, but also increases the total building height and the space to be heated. In addition, a high beam extends below the floor and impedes piping and partition wall work and other mounting work in the building. All these add to the costs of the building. In addition, beams extending below the floor impede later alteration work in the building, thus reducing its adaptability to change.

[0019] The number of beams makes it necessary to cast, move, transport, and mount each beam separately. If the number of such steps increases, both the total costs and total time consumed increases significantly.

One double-span beam contains half of these steps in comparison with the steps of two pieces of single-span beams.

[0020] The damping capacity of a structure refers to the ability of the structure to absorb vibration energy. If the damping capacity of a structure is low, the movements of the structural parts may during vibration become stronger in the building when the frequency of the vibration is in range with the frequency of the structure. In such a case, the structures may be damaged or collapse. The damping capacity of a structure is significant when building in an area where tremors and vibration may take place.

[0021] A continuous beam generally needs reinforcements at the pillar line so that loads from the pillar above can be transmitted to the pillars below through the beam. This usually means additional steel parts in the beam. These increase the cost of the beam. Additional steel parts also cause local stress centres in the pillars which, therefore, need additional reinforcing fittings, for instance, to prevent splitting.

[0022] Static dimensioning of single-span beams is somewhat simpler than that of continuous beams. This is due to the fact that single-span beams are generally designed hinge-supported at their ends.

[0023] As an example of solutions known in the art is the console solution discloses in Finnish patent application No. 20060075, in which a concrete console mounted later on the pillar is used. The drawbacks of this solution are steel parts in the console that add to the cost of the pillar. The load coming to the console is also far from the centre of gravity of the pillar and, thus, adds to the loads coming to the pillar. This results in an increase in the cross-section and cost of the pillar. The solution is also only suitable for use with hinge-supported single-span beams.

[0024] Another example of known solutions is the console solution disclosed in EP 1 405 957, in which a steel console mounted later on the pillar is used. This solution has the same drawbacks as the solution of the Finnish application No. 20060075.

[0025] Continuous beams are made either very long or else by connecting shorter beams to each other with bolted joints, for instance, at the construction site. Extensions are slow to make at the site and require exact manufacturing and mounting tolerances. A connecting joint often also remains visible as an aesthetic flaw and causes a special point for fire protection. A connection may also be done at the site by welding, which is slow and expensive and requires good quality assurance. Continuous structures are also made by on-site casting, whereby the work is very slow with many work phases including moulding, reinforcing, supporting, casting, and the like.

[0026] It is an object of the invention to provide a method and structure with which the drawbacks of the prior-art solutions may be eliminated. This is achieved with the method and structure of the invention. The method of the invention is characterised in that the reinforcing steel fittings (6) are arranged to extend into a hole/notch at the end of the beam and to support on its rim.

[0027] The connecting structure of the invention is, in turn, characterised in that the reinforcing steel fittings (6) are arranged to extend into a hole/notch at the end of the beam and to support to its rim.

[0028] Thus, the invention provides a structure made of a multi-storey pillar without consoles and a continuous beam made of single-span beams, and a method for forming it. The invention has the advantages of a multi-storey pillar without the drawbacks caused by the consoles and the advantages of a continuous beam without reinforcements at the pillars. The invention provides the advantage that the number of pillars remains low and there are no extensions and consoles. The structure of the invention is also low. There are only a few beams at the site, and the damping capacity of the structure is good. The solution of the invention also does not require reinforcements at the pillar.

[0029] In the following, the invention will be described in more detail by means of the working examples disclosed in the drawings, in which

Figure 1 is a general perspective view of a possible pillar of a connection of the invention,

Figure 2 is a general side view of the basic principle of a connecting structure of the invention,

Figures 3 to 4 are general perspective views of a connecting structure of the invention with several different solutions for supporting a beam,

Figure 5 is a general perspective view of the example of Figure 4 in a situation in which slabs are mounted on the beam, and

Figures 6 to 8 are general perspective views of various embodiments of a connecting structure of the invention.

[0030] As stated above, the invention relates to a method for forming a connecting structure between a pillar and beam, and to a connecting structure. In the invention, multi-storey reinforced concrete pillars or multi-storey composite pillars and single-span beams are prefabricated and transported to a construction site, the pillars are mounted in place, and the beams and pillars are connected to each other at the construction site to form a connection. Thus, the invention is a combination of a multi-storey pillar without consoles and a continuous beam made of single-span beams. This solution provides the advantages of a multi-storey pillar without the drawbacks caused by the consoles and the advantages of a continuous beam without reinforcements at the pillars.

[0031] According to the essential idea of the invention, multi-storey reinforced concrete pillars or multi-storey composite pillars made at a prefabrication factory and having reinforcement and/or other steel parts visible at the connecting points of the beams are transported to the site and mounted in place. Figure 1 is a general view of an embodiment of the above-mentioned pillars. The pillar is marked with reference number 1. The connecting point of the beams is marked with reference number 2. The reinforcement and/or other steel parts visible at the connecting point are marked with reference number 3.

[0032] In the embodiment of Figure 1, the reinforcement and/or other steel parts of the pillar are completely visible, in other words, the connecting point only has the reinforcement and/or other steel parts. In large pillars, there may be a concrete neck in the middle of the pillar.

[0033] As stated above, the connecting points 2 of the pillar and beam have not been concreted when they are brought to the construction site. Single-span beams 4 with a connector 5 at both ends are also brought to the construction site. The connector 5 may be made of a metal material, such as a steel material. The beam may be a reinforced concrete composite beam. The figures show the steel part of the beam. The basic principle of the connecting structure of the invention is shown in Figure 2.

[0034] According to the essential idea of the method of the invention, the method comprises steps for prefabricating multi-storey reinforced concrete pillars or multi-storey composite pillars 1 in such a manner that there is only reinforcement 3 at the connecting point 2 of the beam and pillar. Single-span beams 4 are prefabricated in such a manner that both ends of the beams have a connector 5. The beams are mounted and supported between stationary pillars 1 in such a manner that the connectors 5 at the ends of the beams or their action extend inside the pillar 1 at the connecting point 2 of the beam and pillar. Reinforcing steel fittings 6 extending through the pillar 1 at the connecting point 2 are mounted in the area of the beam end. Finally, the beam 4 and connecting point 2 are concreted together.

[0035] Thus, the beams 4 are mounted between the pillars 1 at a correct height on a support in such a manner that the ends of the beams are in a way embedded into the pillar 1. The support of the beam 4 may be a part 7 fastened to the pillar 1 and later removed, as shown in Figure 3, for example. The beam may also be supported from below by means of support members 8, as shown in Figure 4. The beam 4 is only supported at its ends.

[0036] Reinforcing steel fittings 6 extending through the pillar at the connecting point are mounted at the connecting point of the pillar and beam to provide a connection. The above-mentioned reinforcing steel fittings 6 extending through the beam and parallel thereto are separate elements to be mounted on site, for instance deformed reinforcing steel bars. The reinforcing steel fittings 6 may extend through a hole or notch at the end of the beam and support on its rim as shown in Figures 6 to 8, for instance. The holes or notches may either be in the connector 5 or in a flange at the end of the beam or in both as shown in the figures. The reinforcing steel fittings 6 may also extend to the side of the beam 4 as shown in Figure 7, or inside the beam as shown in Figure 8. At this stage, it is also possible to mount slabs 9 on the beam as shown in Figures 5 and 6.

[0037] The reinforcing steel fittings 6 may preferably be bound to the reinforcements and/or structures of the pillar 1 and beam 4.

[0038] The beam 4 is concreted at the same time as the slabs 9, in other words, the steel part of the beam 4 is also filled with concrete and, at the same time, the connecting point 2 is concreted. After the concrete is hardened, the mounting supports of the beam may be removed. After this, the reinforcing steel fittings 6 extending through the pillar at the end of the beam serve as extension steel fittings and form continuous structures of the beams 4. The above-mentioned reinforcing steel fittings mounted on site do not require any special skills or conditions.

[0039] The connection between the pillar 1 and beam 4 remains completely hidden inside the concreting, so it is already fire protected by concrete and a separate protecting phase with special materials is not needed. The connection is also invisible, so the visible structure is neat and clean and does not require covering. The bottom surface of the beam is uniform along the entire length of the beam. It does not have a downward-opening slot for a console, for instance, which would be visible from a finished structure as an irregularity.

[0040] The above embodiments of the invention are not intended to restrict the invention in any way, but the invention may be varied freely within the scope of the claims. The dimensioning of the structure of the invention and the number and design of various elements may differ considerably from the examples of the figures.

Claims

1. A method for forming a connecting structure between a pillar and beam, the method comprising prefabricating multi-storey reinforced concrete pillars or multi-storey composite pillars (1) and single-span beams (4) and transporting them to a construction site, mounting the pillars in place, and connecting the beams and pillars to each other at the construction site to form a connection, the method comprising the following steps of:

– prefabricating the multi-storey reinforced concrete pillars or multi-storey composite pillars in such a manner that reinforcement and/or other steel parts (3) are visible at the connecting point (2),

– prefabricating the single-span beams (4) in such a manner that both ends of the beams have a connector (5).

– mounting and supporting the beams (4) between stationary pillars (1) in such a manner that the connectors (5) at the ends of the beams or their action extends inside the pillar (1) at the connecting point (2) of the beam and pillar,

– mounting in the area of the end of the beam (4) reinforcing steel fittings (6) extending through the pillar (1) at the connecting point (2), and

– concreting the beam (4) and connecting point (2) together, characterised in that the reinforcing steel fittings (6) are arranged to extend into a hole/notch at the end of the beam and to support on its rim.

2. A method as claimed in claim 1, characterised in that the holes/notches at the end of the beam are arranged to the connector (5) and/or a flange at the end of the beam.

3. A method as claimed in claim 1, characterised in that the multi-storey reinforced concrete pillars or multi-storey composite pillars are prefabricated in such a manner that there is only reinforcement and/or other steel parts (3) at the connecting point (2) of the beam and pillar.

4. A method as claimed in claim 1, characterised in that the reinforcing steel fittings (6) are bound to the reinforcement/structures of the pillar and beam in such a manner that the reinforcing steel fittings (6) connect the beams to each other through the pillar.

5. A method as claimed in claim 1, characterised in that the mounting-time supports (7, 8) of the beam are removed after the concrete has hardened.

6. A method as claimed in claim 1, c h a r a c t e r i s e d in that the reinforcing steel fittings (6) are also arranged to extend to the sides of the beam (4).

7. A method as claimed in claim 1, c h a r a c t e r i s e d in that slabs (9) are mounted on the beams (4) and that the beam (4) and the connecting point (2) between the beam and pillar are concreted together at the same time as the slab seams are concreted.

8. A connecting structure between a pillar and beam, in which prefabricated multi-storey reinforced concrete pillars or multi-storey composite pillars (1) and single-span beams (4) are connected to each other to form a connection, whereby the prefabricated multi-storey reinforced concrete pillars or multi-storey composite pillars (1) are made in such a manner that reinforcement and/or other steel parts (3) are visible at the connecting point (2) of the beam and pillar and the ends of the beam have connectors (5), that the beam is mounted and supported on the pillar in such a manner that the connectors (5) at the ends of the beam or their action extends inside the pillar at the connecting point (2) of the beam and pillar, that reinforcing steel fittings (6) extending through the pillar (1) at the connecting point (2) are mounted in the area of the end of the beam, and that the beam (4) and connecting point (2) are concreted, whereby after the concrete has hardened, the reinforcing steel fittings (6) extending through the pillar serve as extension steel fittings and form continuous structures of the beams (4), c h a r a c t e r i s e d in that the reinforcing steel fittings (6) are arranged to extend into a hole/notch at the end of the beam and to support to its rim.

9. A connecting structure as claimed in claim 8, c h a r a c t e r i s e d in that the holes/notches at the end of the beam are arranged to the connector (5) and/or a flange at the end of the beam.

10. A connecting structure as claimed in claim 8, c h a r a c t e r i s e d in that there is only reinforcement and/or other steel parts (3) at the connecting point of the beam and pillar.

11. A connecting structure as claimed in claim 8, c h a r a c t e r i s e d in that the reinforcing steel fittings (6) are bound to the reinforcement/structures of the pillar and beam and that the reinforcing steel fittings (6) are arranged to connect the beams to each other through the pillar.

12. A connecting structure as claimed in claim 8, characterised in that the reinforcing steel fittings (6) are arranged to extend to the sides of the beam (4).

13. A connecting structure as claimed in claim 8, characterised in that the connectors (5) at the ends of the beams are parts made of a metal material.

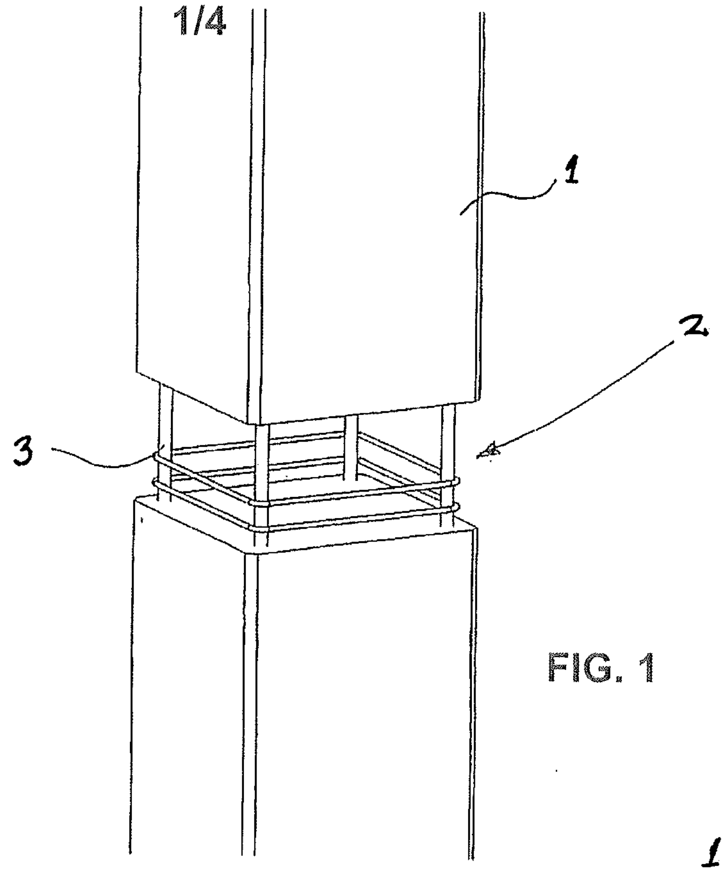

FIG. 1

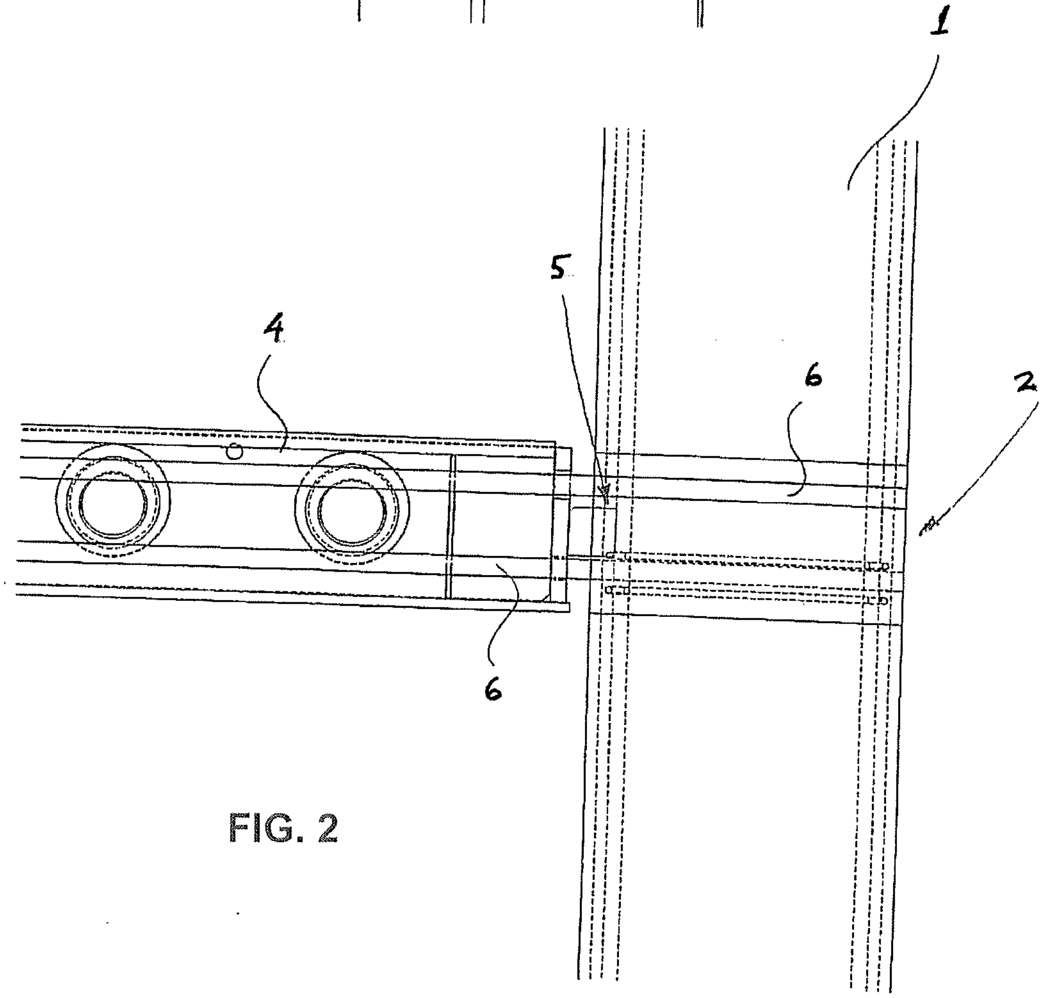

FIG. 2

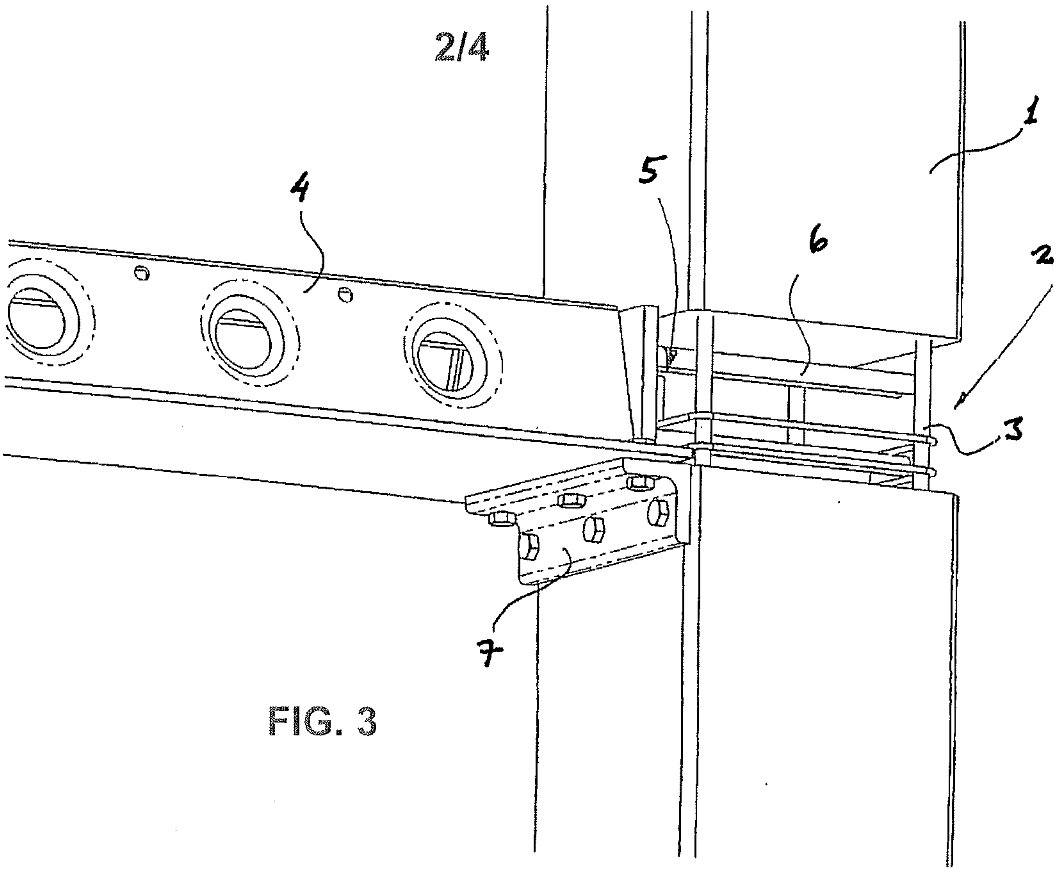

FIG. 3

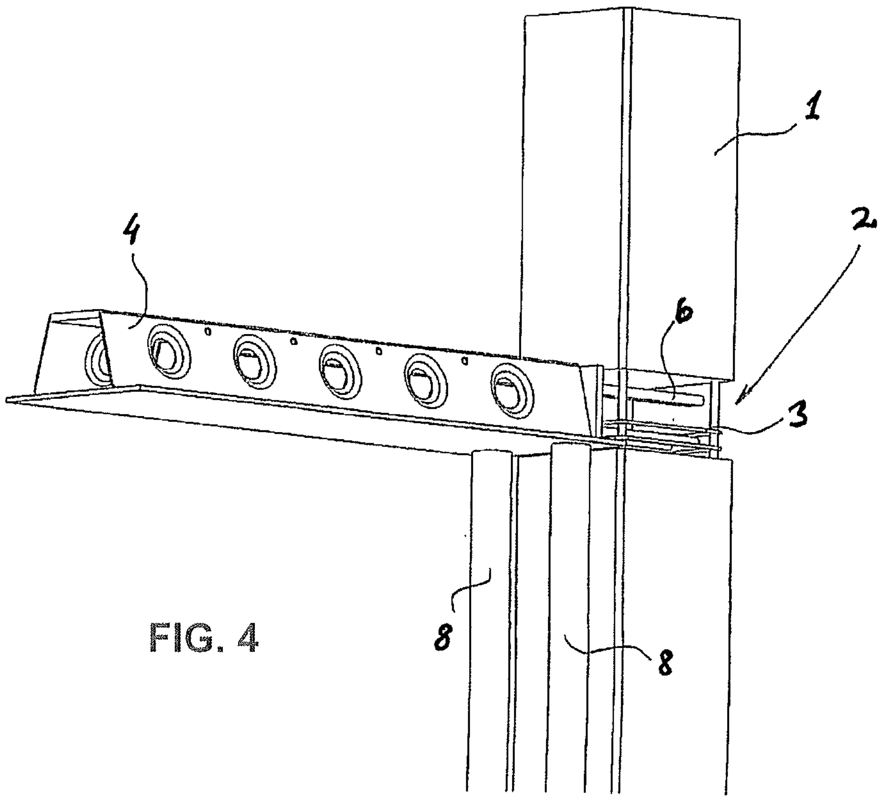

FIG. 4

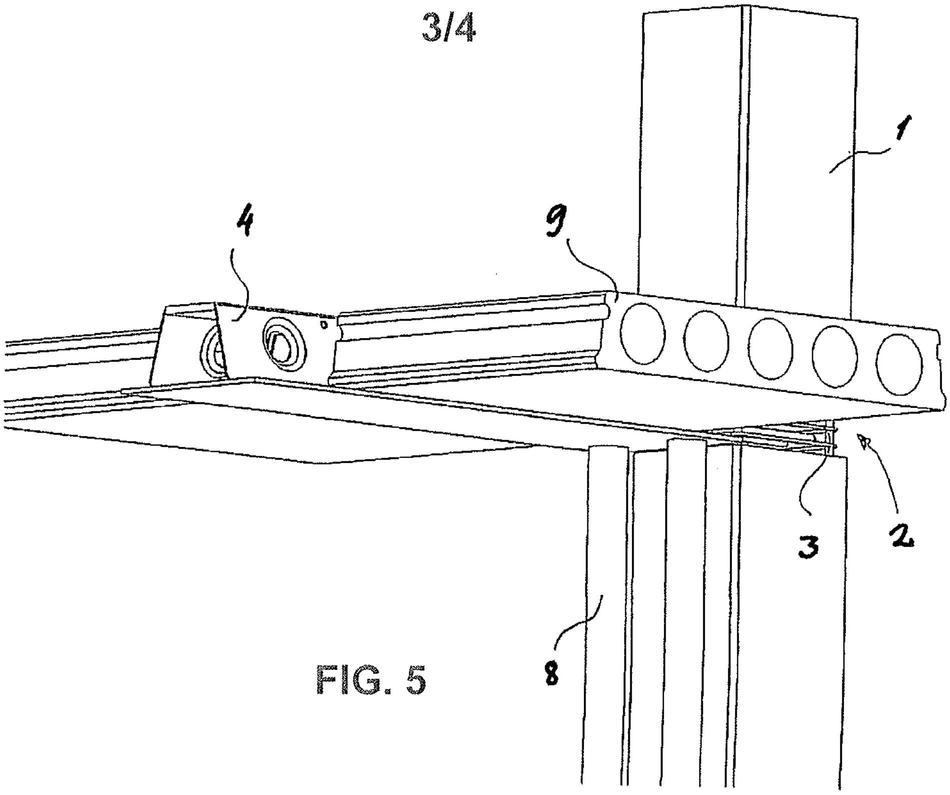

FIG. 5

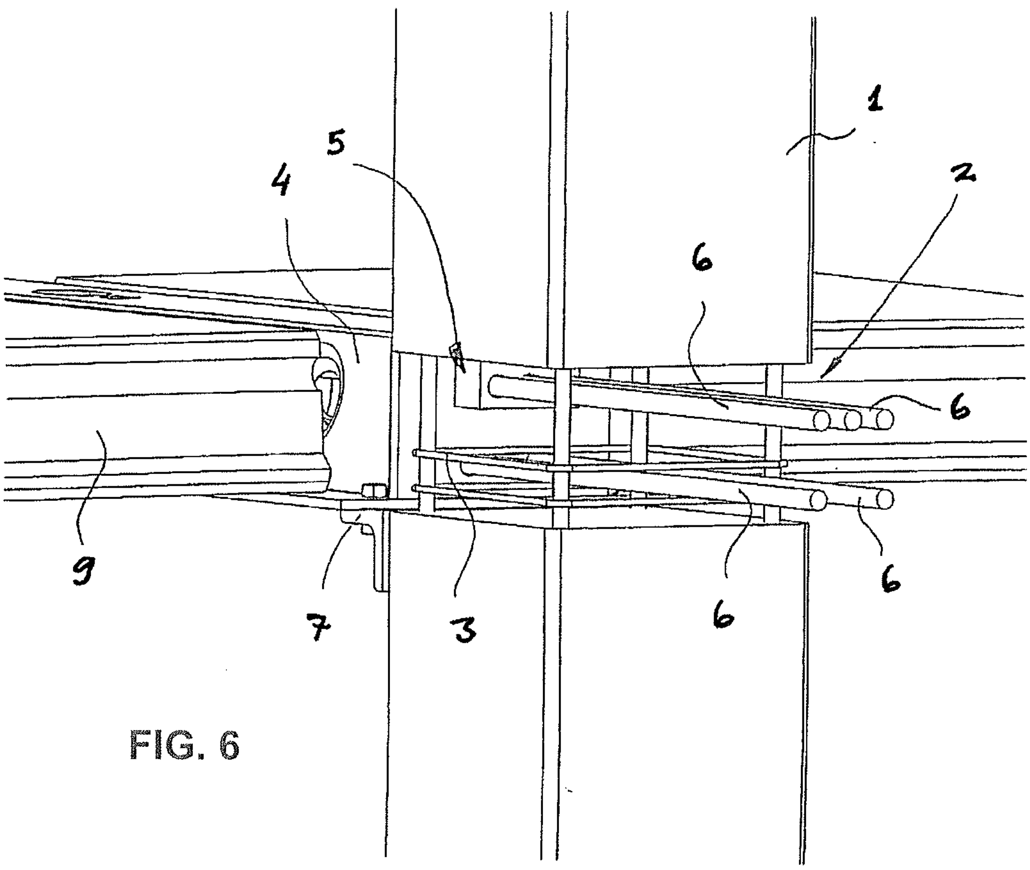

FIG. 6

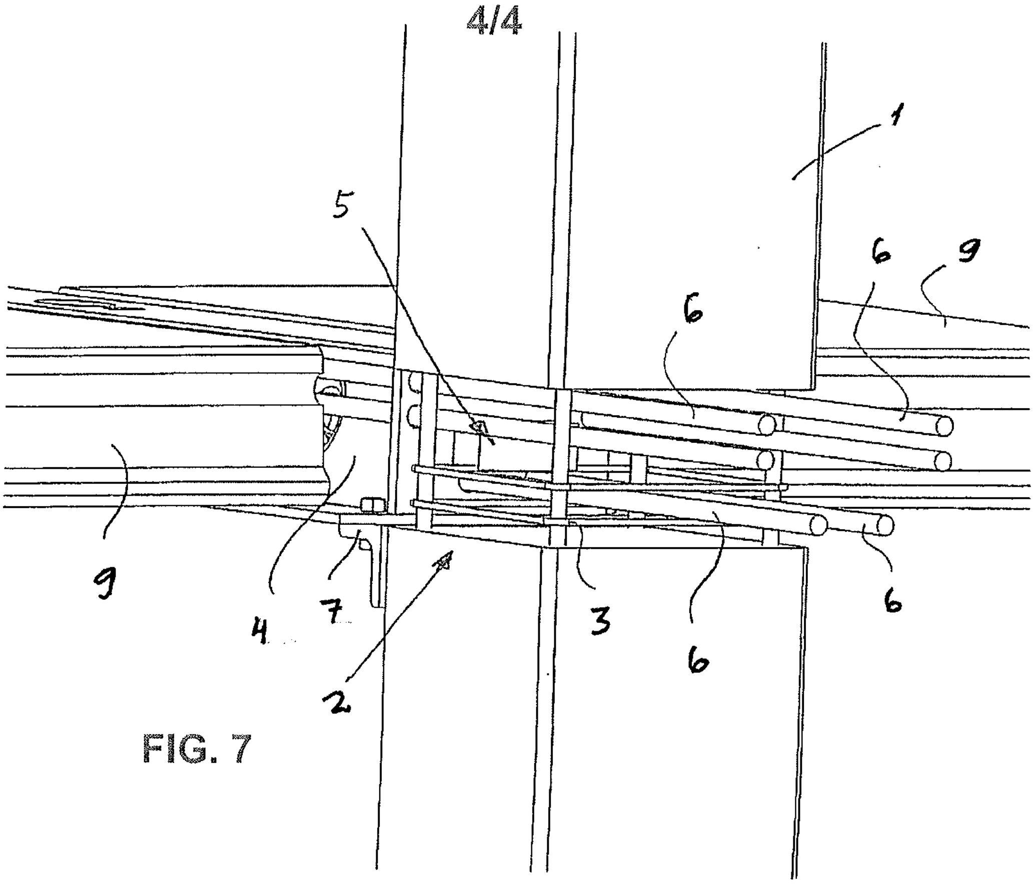

FIG. 7

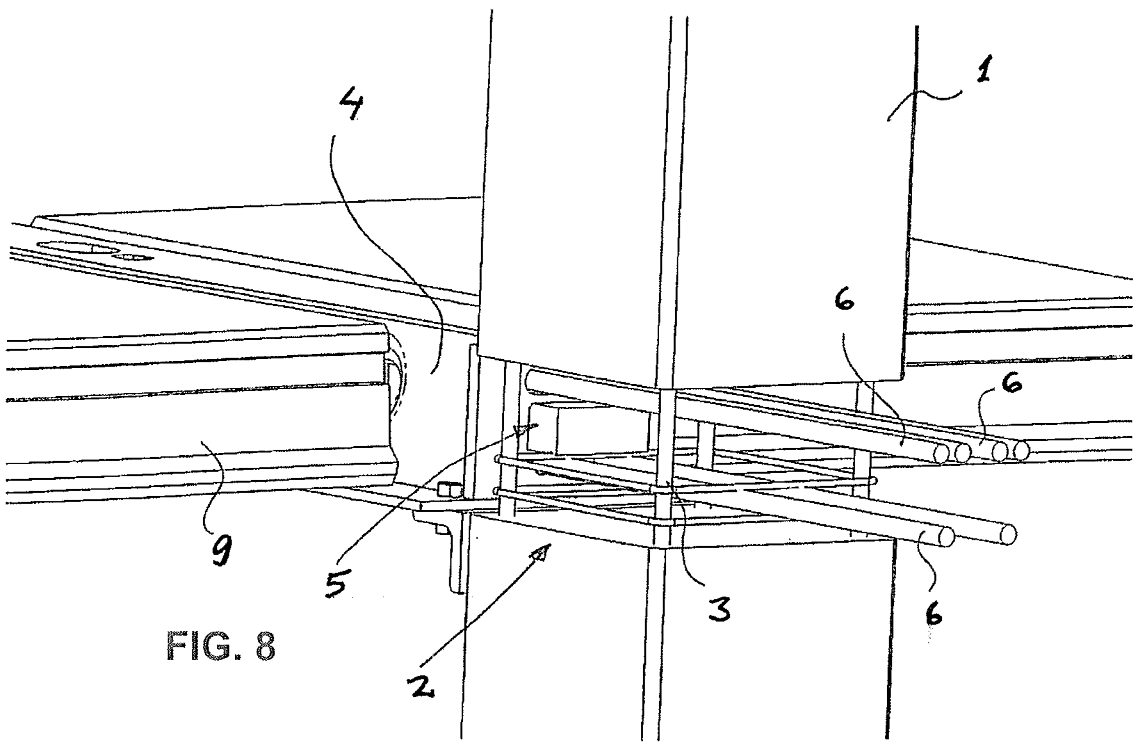

FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI2009/050560

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: E04B

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

FI, SE, NO, DK

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

EPO-internal, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	ES 2220236 A1 (HORMIGONES PREFABRICADOS DE ES) 01 December 2004 (01.12.2004) figs. 4-6, 10, 11	1-13
A	PT 9318 T (PRETENSADOS DEL LOURO SA) 30 April 1998 (30.04.1998) figs. 1-4	1-13
A	KR 20060098555 A (HANBAT NAT UNIVERSITY INDUSTRY et al.) 19 September 2006 (19.09.2006) figs. 2 and 8	1-13

☐ 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 another 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
19 November 2009 (19.11.2009)	25 November 2009 (25.11.2009)

Name and mailing address of the ISA/FI
National Board of Patents and Registration of Finland
P.O. Box 1160, FI-00101 HELSINKI, Finland
Facsimile No. +358 9 6939 5328

Authorized officer
Susanna Rajakoski
Telephone No. +358 9 6939 500

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/FI2009/050560

Patent document cited in search report	Publication date	Patent family members(s)	Publication date
ES 2220236 A1	01/12/2004	None	
PT 9318 T	30/04/1998	None	
KR 20060098555 A	19/09/2006	None	

CLASSIFICATION OF SUBJECT MATTER

Int.Cl.
E04B 1/21 (2006.01)
E04B 1/58 (2006.01)
E04B 1/19 (2006.01)