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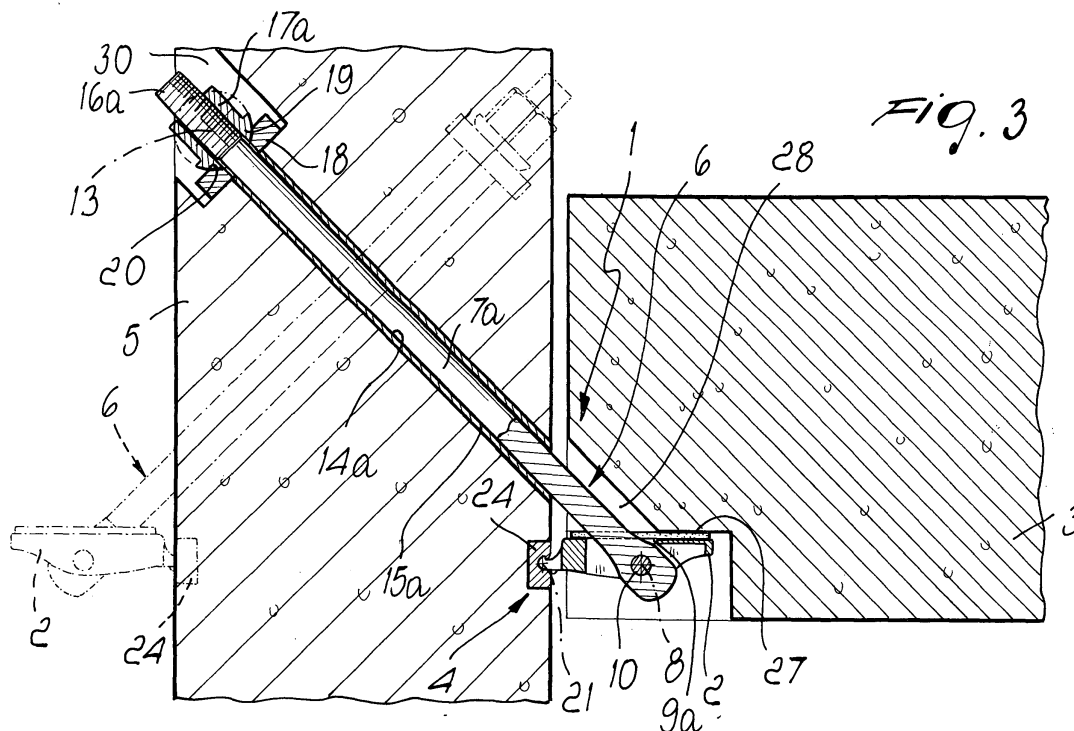
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(54) **Device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements**

(57) A device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements, comprising a bracket (2), which forms, when installed, by means of its upper face, a support for the beam (3), and a first connection (4) for connecting to the pillar (5) the end of the bracket (2) that

is designed to be directed toward the pillar (5), the device further comprising a second connection (6) for connecting a region of the bracket (2), spaced from the end directed toward the pillar (5), to a region of the pillar (5) located above the bracket (2) and arranged on the side of the pillar (5) that lies opposite with respect to the side that bears the bracket (2).



Description

[0001] The present invention relates to a device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements.

[0002] As is known, the connection between a beam and a pillar, in buildings erected with prefabricated concrete components, is achieved by means of brackets which are formed monolithically with the pillar or are applied, for example by means of bolts, to the body of the pillar. These brackets can be made of reinforced concrete or steel and can be external to the dimensions of the beam or, as in the case of the so-called Gerber cantilever, can be accommodated in an appropriately provided seat formed on the lower side of the beam at the end of such beam that is designed to face the pillar.

[0003] In the first case, problems can arise as a consequence of the space occupation entailed by the body of the bracket below the beam.

[0004] In the second case, the seat formed in the body of the beam reduces the resisting cross-section of the beam at the seat, very often forcing an oversizing of the entire beam in order to achieve the required strength.

[0005] Moreover, if the bracket is formed monolithically with the pillar or is preassembled to the body of the pillar, storage and transport problems occur as a consequence of the additional space occupation of the bracket laterally with respect to the pillar.

[0006] The aim of the present invention is to solve the problems described above by providing a device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements, which allows to provide a bracket which, for an equal resistance to loads, can have a considerably reduced height with respect to conventional types of brackets.

[0007] Within this aim, an object of the invention is to provide a device that allows to reduce the vertical dimensions of the seat of the beam optionally designed to accommodate the bracket and accordingly limit the vertical oversizing of the beam.

[0008] Another object of the invention is to provide a device that does not require preassembly of the bracket to the pillar, thus simplifying pillar transport operations.

[0009] Another object of the invention is to provide a device that allows to recover any errors in the coupling between the beam and the pillar.

[0010] Another object of the invention is to provide a device that is simple and quick to install.

[0011] This aim and these and other objects which will become better apparent hereinafter are achieved by a device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements characterized in that it comprises:

- a bracket, which forms, when installed, by means of its upper face, a support for the beam;

- first means for connecting to the pillar the end of said bracket that is designed to be directed toward the pillar;
- second means for connecting a region of said bracket, which is spaced from said end, to a region of the pillar which is located above said bracket and is arranged on the side of said pillar that lies opposite with respect to the side that bears said bracket.

[0012] Further characteristics and advantages of the invention will become better apparent from the description of a preferred but not exclusive embodiment of the device according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the device according to the invention after installation, with the pillar and the beam shown in phantom lines;

Figure 2 is a perspective view of the device according to the invention after installation, taken from a different angle with respect to Figure 1, with the pillar shown in phantom lines;

Figure 3 is a partially sectional view of the device according to the invention, taken along a vertical plane;

Figure 4 is an enlarged-scale sectional view, taken along a vertical plane, of a portion of the device according to the invention;

Figure 5 is an exploded perspective view of components of the device according to the invention.

[0013] With reference to the figures, the device according to the invention, generally designated by the reference numeral 1, comprises a bracket 2, which forms by means of its upper face, once installed, a support for a beam 3. The device further comprises first connection means 4 for connecting to a pillar 5 the end of the bracket 2 that is designed to be directed toward the pillar 5 and second connection means 6 for connecting a region of the bracket 2 which is spaced from said end to a region of the pillar 5 which is arranged above the bracket 2 and on the side of the pillar 5 that lies opposite with respect to the side that bears the bracket 2.

[0014] The second connection means 6 comprise at least one tension member 7a, 7b, which is connected, by means of its lower end, to the bracket 2 and, by means of its upper end, to a region of the pillar 5 that is arranged above the bracket 2. The tension member 7a, 7b is preferably a tension member of the rigid type, constituted for example by a steel bar.

[0015] The lower end of the tension member 7a, 7b is pivoted to the bracket 2 about a substantially horizontal first pivoting axis 8, which, once the bracket is installed, is parallel to the face of the pillar 5 that is directed toward the bracket 2.

[0016] The lower end of the tension member 7a, 7b can have conveniently a teardrop shape, and pivoting to

the bracket 2 is preferably performed below the supporting surface for the beam 3 and below the upper face of the bracket 2 by providing in said bracket appropriate passages 9a, 9b for the tension member 7a, 7b. Pivoting between the tension member 7a, 7b and the bracket 2 is provided by means of a first connection with a pivot 10, the axis whereof determines the pivoting axis 8, which passes through the end of the tension member 7a, 7b and mates in seats 11a, 11b provided appropriately in the body of the bracket 2.

[0017] The bracket 2 has stiffening ribs 12, preferably on its lower face, and the seats 11a, 11b can be formed in said stiffening ribs 12.

[0018] The second connection of the upper end of the tension member 7a, 7b to the pillar 5 also is preferably constituted by a connection of the type provided with a hinge in which the second pivoting axis 13 is substantially horizontal, when the bracket 2 is installed, and parallel to the face of the pillar 5 that is directed toward the bracket 2.

[0019] More particularly, the tension member 7a, 7b passes through a through passage 14a, 14b, which is formed in the pillar 5 and is connected to the side of the pillar 5 that lies opposite with respect to the side provided with the bracket 2.

[0020] The passage 14a, 14b is formed by a tubular body 15a, 15b, which is incorporated beforehand in the body of the pillar 5 during its manufacture.

[0021] Advantageously, tension means for tensioning the tension member 7a, 7b are provided. The tension member 7a, 7b in fact has at least one portion thereof 16a, 16b, starting from its end that lies opposite with respect to the bracket 2, which is threaded and mates with a nut 17a, 17b, that form the tension means which once installed rests against a plate 18, which in turn rests against the side of the pillar 5 that lies opposite the side provided with the bracket 2.

[0022] The threading of the tension members 7a, 7b can be performed by chip-forming machining or by rolling or can be constituted by helical ribs that are already present on the lateral surface of the tension members, for example by using as tension members reinforcement bars which already have helical ribs for increasing grip on the concrete, which can be used as threads.

[0023] Preferably, the plate 18 is accommodated in a recess 30 which is provided for this purpose in the body of the pillar 5.

[0024] The nut 17a, 17b, in addition to the portion that is directed away from the plate 18 and is contoured so as to be handled with conventional fastening tools, for example of the hexagonal prism-like type, is provided with a portion 19 shaped like a spherical dome, which mates with a corresponding spherical dome-shaped seat 20 formed within the plate 18. The mating between the nut 17a, 17b and said spherical dome-shaped seat 20 allows the tension member 7a, 7b to perform small rotations and provides said hinged connection between the upper end of the tension member 7a, 7b and the plate

18 or pillar 5.

[0025] Conveniently, the second connection means comprise two tension members 7a, 7b, which are arranged side by side and parallel to each other and are pivoted by means of their lower end to the bracket 2, preferably about a same pivoting axis 8, and, by means of their upper end, to the pillar 5, preferably about a same pivoting axis 13, which is formed by the coupling between the spherical dome-shaped portions 19 of the nuts 17a, 17b and the spherical dome-shaped seats 20.

[0026] The first connecting means can provide a connection of the interlocking type, for example by bolting the bracket 2 to the pillar 5.

[0027] Preferably, the first connection means 4 also provide an additional connection between the bracket 2 and the pillar 5 with an additional pivoting axis 21 which is substantially horizontal and likewise parallel to the face of the pillar 5 that is directed toward the bracket 2.

[0028] Said first connection means 4 preferably comprise a protrusion 22 of the bracket 2, which protrudes toward the pillar 5 and engages a seat 23 formed in an insert 24, which is preferably incorporated in the body of the pillar 5. The protrusion 22 and the seat 23 are contoured so as to provide a hinge-like connection, i.e., so that the protrusion 22 and therefore the bracket 2 can rotate with respect to the insert 24, i.e., with respect to the pillar 5, about the pivoting axis 21.

[0029] Conveniently, the protrusion 22 has retention teeth 25a, 25b, which can engage in abutments 26a, 26b provided on the insert 24 in order to limit the rotation, during installation, of the bracket 2 with respect to the pillar 5 about the pivoting axis 21.

[0030] Preferably, on the upper face of the bracket 2 there is a layer 27 made of elastically deformable material, for example neoprene, rubber or similar material, so as to achieve a uniform and coplanar distribution of the forces exchanged between the beam 3 and the bracket 2.

[0031] The end region of the beam 3 that rests against the bracket 2 can be recessed so as to eliminate the space occupation of the bracket 2 below the beam 3. Moreover, the beam 3 has hollows 28 for the passage of the tension members 7a, 7b.

[0032] It should be noted that the pillar 5 can bear brackets 2 on two opposite sides thereof. In this case, the tension members 7a, 7b that support the two brackets 2 are conveniently offset and crossed within the pillar 5, as shown in Figure 3.

[0033] In practice, the device according to the invention, thanks to the fact that the bracket 2 is supported in an intermediate region by at least one tension member which connects it to a region of the pillar 5 that lies above said bracket 2, is capable of withstanding intense loads despite a height of the bracket 2 that is considerably reduced with respect to the height of brackets used in traditional types of pillar-beam connections. This fact allows to minimize the space occupation of the bracket 2 below the beam 3. Moreover, if the bracket 2, as in the illustrated embodiment, is accommodated in a recess 29 provided

in the lower face of the beam 3, thanks to the reduced height of the bracket 2 the oversizing of the beam can be reduced or may even be unnecessary.

[0034] Moreover, it should be noted that the device according to the invention allows to have no lateral protrusions on the pillar before its installation, thereby facilitating its transport.

[0035] Another advantage of the device according to the invention is that it allows, by tightening the nuts 17a, 17b, to adjust the position of the bracket 2 with respect to the pillar 5, allowing to correct any positioning errors between the beam 3 and the pillar 5.

[0036] In practice it has been found that the device according to the invention fully achieves the intended aim, since for an equal resistance to loads it allows to reduce considerably the height of the bracket with respect to the height required for brackets in known types of beam-pillar connections.

[0037] The device thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0038] In practice, the materials used, as well as the dimensions, may be any according to requirements and to the state of the art.

[0039] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A device for connecting beams and pillars or similar structural elements, particularly for prefabricated concrete structural elements, **characterized in that** it comprises:

- a bracket (2), which forms, when installed, by means of its upper face, a support for the beam (3);
- first connection means (4) for connecting to the pillar (5) the end of said bracket (2) that is designed to be directed toward the pillar (5);
- second connection means (6) for connecting a region of said bracket (2), which is spaced from said end, to a region of the pillar (5) which is located above said bracket (2) and is arranged on the side of said pillar (5) that lies opposite with respect to the side that bears said bracket (2).

2. The device according to claim 1, **characterized in that** said second connection means (6) comprise at

least one tension member (7a,7b), which is connected, by way of its lower end, to said bracket (2) and, by way of its upper end, to said region of the pillar (5) that lies above said bracket and is arranged on the side of said pillar (5) that lies opposite with respect to the side that bears said bracket (2).

3. The device according to claims 1 and 2, **characterized in that** said tension member (7a,7b) is substantially rigid.

4. The device according to one or more of the preceding claims, **characterized in that** the connection between said lower end of the tension member (7a,7b) and said bracket (2) is a connection of the hinged type with a pivoting axis (8) which, when the bracket (2) is installed, is substantially horizontal and parallel to the face of the pillar (5) that is directed toward the bracket (2).

5. The device according to one or more of the preceding claims, **characterized in that** the connection between said upper end of the tension member (7a,7b) and the pillar (5) is a connection of the hinged type, with a pivoting axis (13) which, when the bracket (2) is installed, is substantially horizontal and parallel to the face of the pillar (5) that is directed toward the bracket (2).

6. The device according to one or more of the preceding claims, **characterized in that** the region for connecting said tension member (7a,7b) to said bracket (2) is located below said upper face of the bracket (2), a passage (9a,9b) for said tension member being formed within said bracket (2).

7. The device according to one or more of the preceding claims, **characterized in that** said tension member (7a,7b) passes through a passage (14a,14b) which is formed in said pillar (5) and is connected to the side of said pillar (5) that lies opposite the side that bears said bracket.

8. The device according to claim 7, **characterized in that** the passage (14a,14b) in said pillar (5) for said tension member (7a,7b) is formed by a tubular body (15a,15b) which is embedded in the body of said pillar (5).

9. The device according to one or more of the preceding claims, **characterized in that** it comprises tension means (16a,17a,16b,17b) for tensioning said tension member (7a,7b).

10. The device according to one or more of the preceding claims, **characterized in that** said tension member (7a,7b) has at least one portion (16a,16b), starting from its end that lies opposite with respect to the end

connected to said bracket (2), which is threaded and engages a nut (17a,17b) which abuts against said pillar (5), and can be tightened in order to tension said tension member (7a,7b).

11. The device according to claim 10, **characterized in that** a portion (19) of said nut (17a,17b) that is directed toward the pillar (5) is shaped like a spherical dome and mates with a complementarily shaped seat (20), which is formed in an abutment plate (18) which rests against said pillar (5) and is crossed by said tension member (7a,7b).
12. The device according to one or more of the claims 2-11, **characterized in that** said at least one tension member comprises a pair of tension members (7a, 7b).
13. The device according to claim 12, **characterized in that** said tension members (7a,7b) are substantially parallel.
14. The device according to claim 13, **characterized in that** the pivoting axes (8) for the pivoting of said tension members (7a,7b) to said bracket (2) coincide.
15. The device according to one or more of the preceding claims, **characterized in that** the pivoting axes (13) for the pivoting of said tension members (7a,7b) to said pillar (5) coincide.
16. The device according to one or more of the preceding claims, **characterized in that** said first connection means (4) provide an additional connection of the hinged type between said bracket (2) and the pillar (5) with a pivoting axis (21) which, when the bracket (2) is installed, is substantially horizontal and parallel to the face of the pillar (5) that is directed toward the bracket (2).
17. The device according to one or more of the preceding claims, **characterized in that** said first connection means (4) comprise a protrusion (22) of said bracket (2) which protrudes toward the pillar (5) and can engage a seat (23) formed by an insert (24) which is embedded in said pillar (5).
18. The device according to claim 17, **characterized in that** said protrusion (22) has at least one retention tooth (25a,25b), which can engage an abutment (26a,26b) provided on said insert (24) in order to limit the rotation of said bracket (2) with respect to said pillar (5) about the corresponding pivoting axis (21).
19. The device according to one or more of the preceding claims, **characterized in that** a layer (27) of elastically flexible material is arranged on the upper face of said bracket (2).

20. The device according to one or more of the preceding claims, **characterized in that** said bracket (2) has stiffening ribs (12) on its lower face.

- 5 21. The device according to one or more of the preceding claims, **characterized in that** the region (29) for the support of the beam (3) on said bracket (2) is recessed.
- 10 22. The device according to one or more of the preceding claims, **characterized in that** the beam is provided with hollows (28) for the passage of said tension members.

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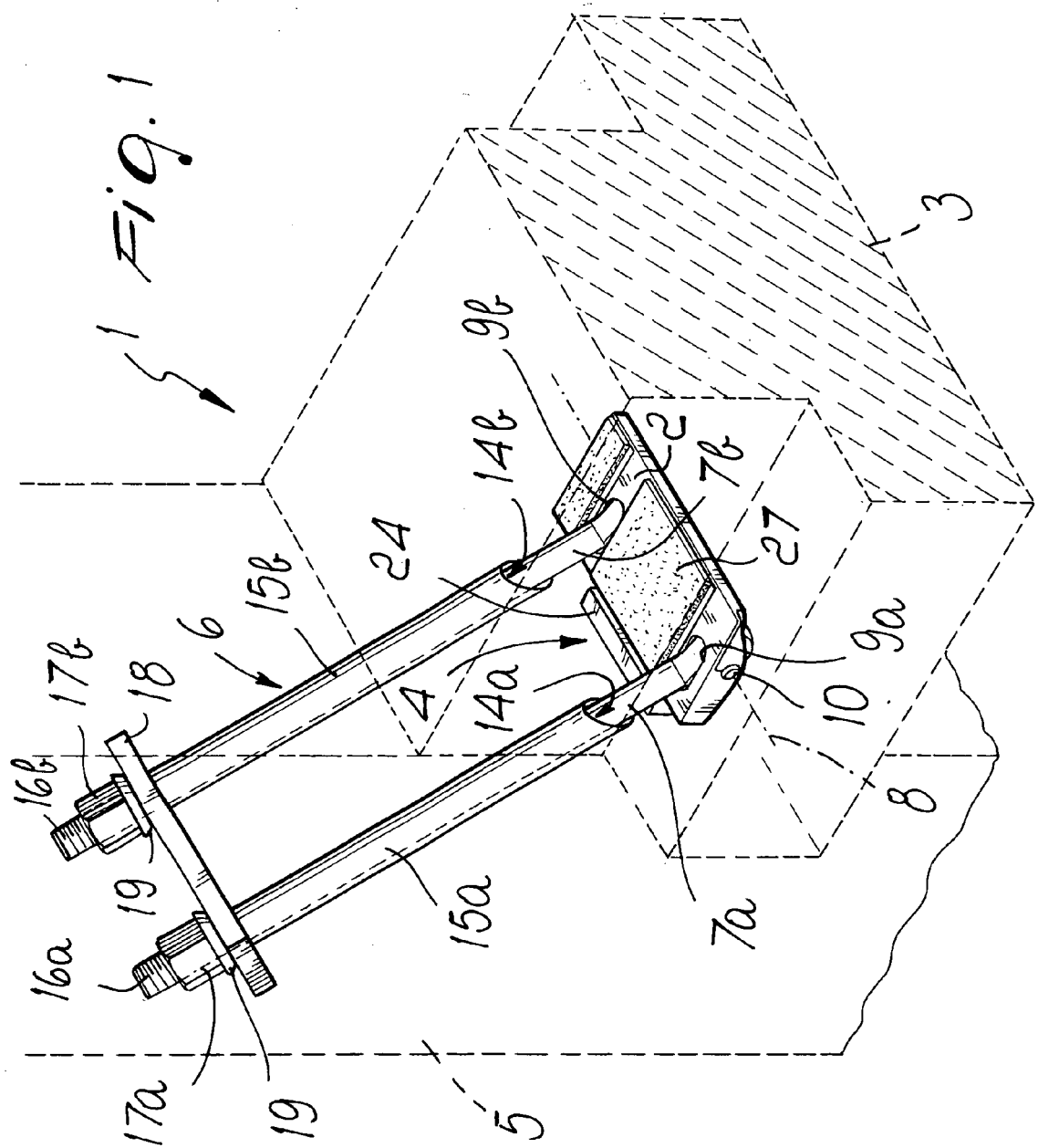
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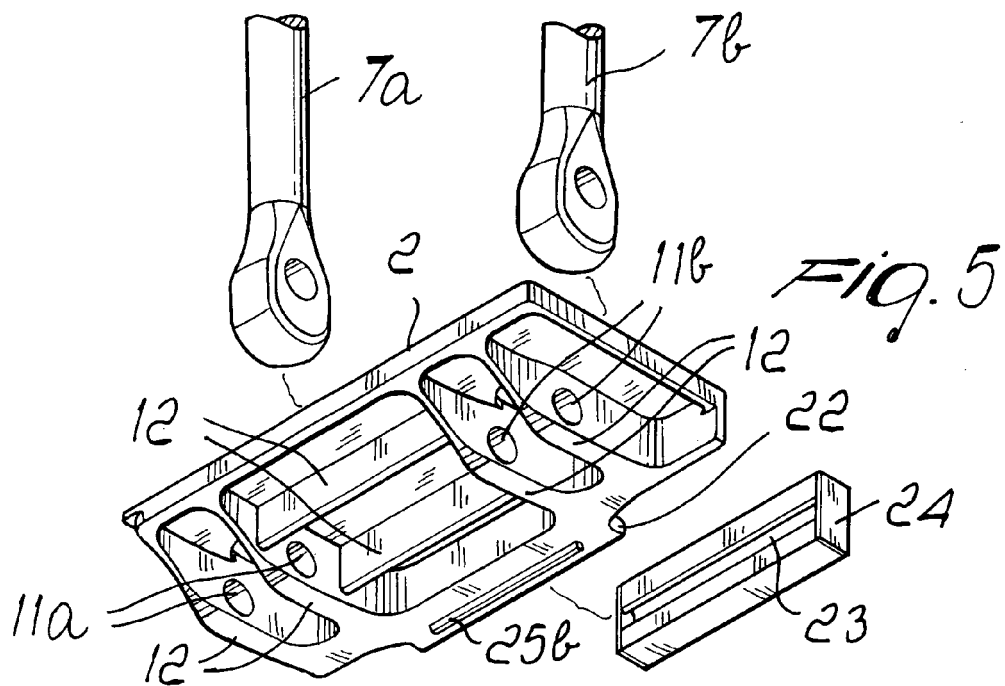
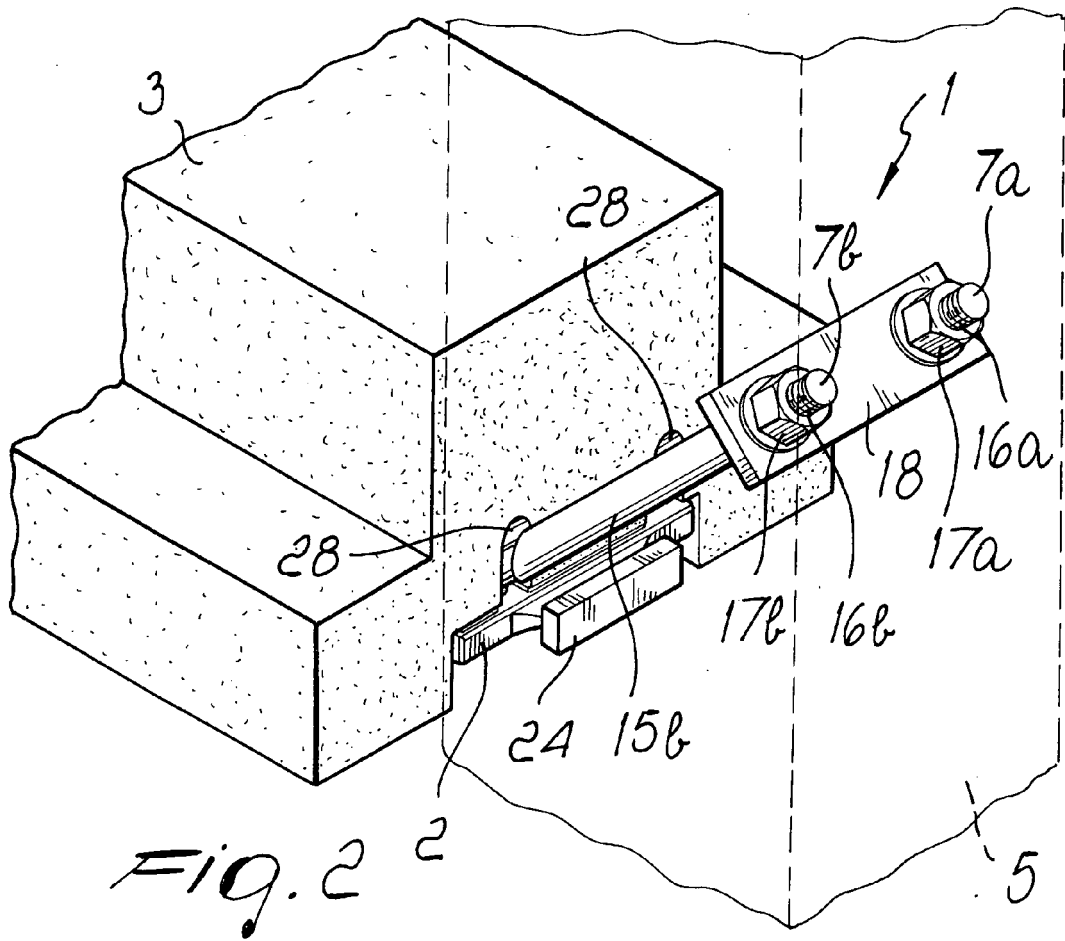
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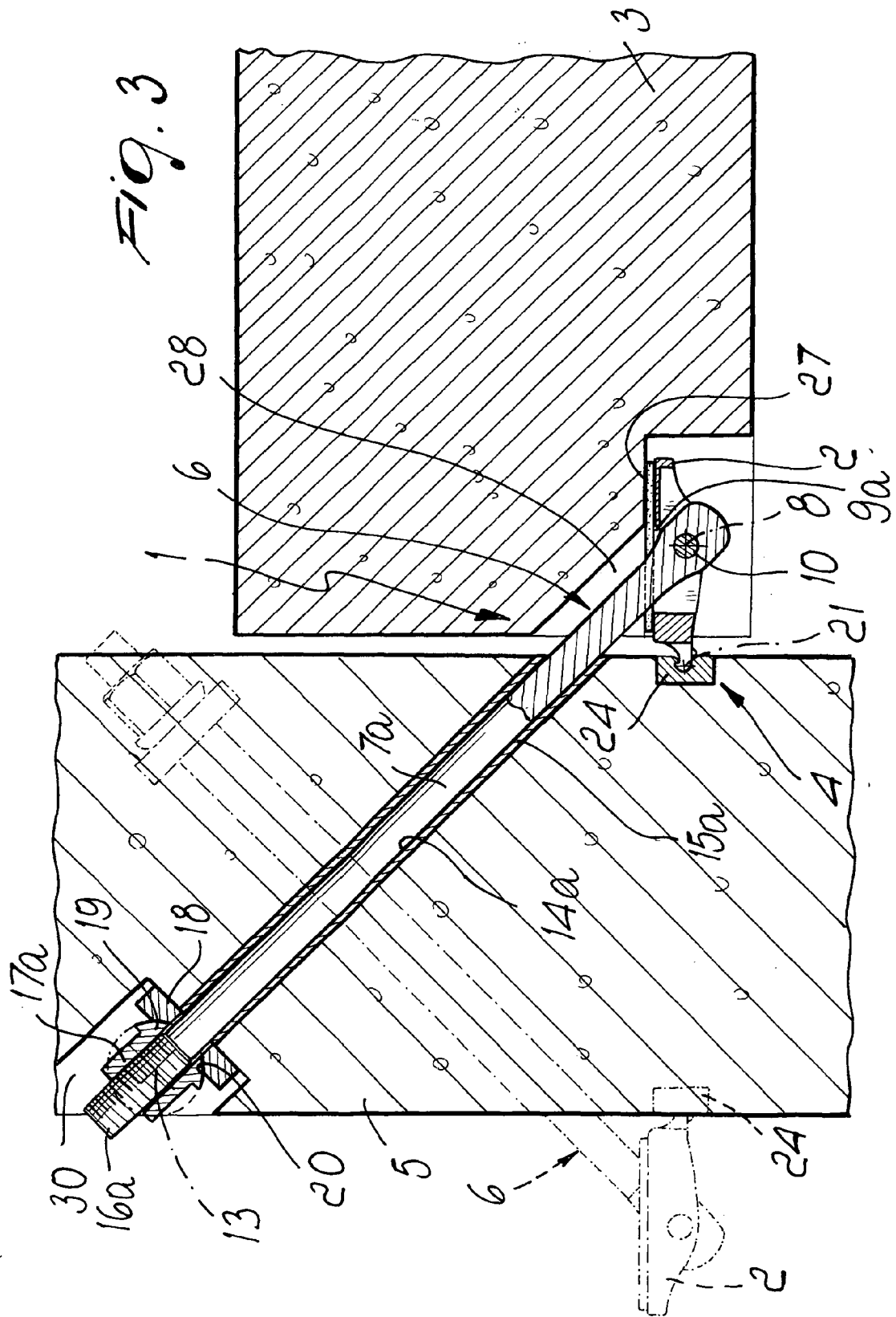
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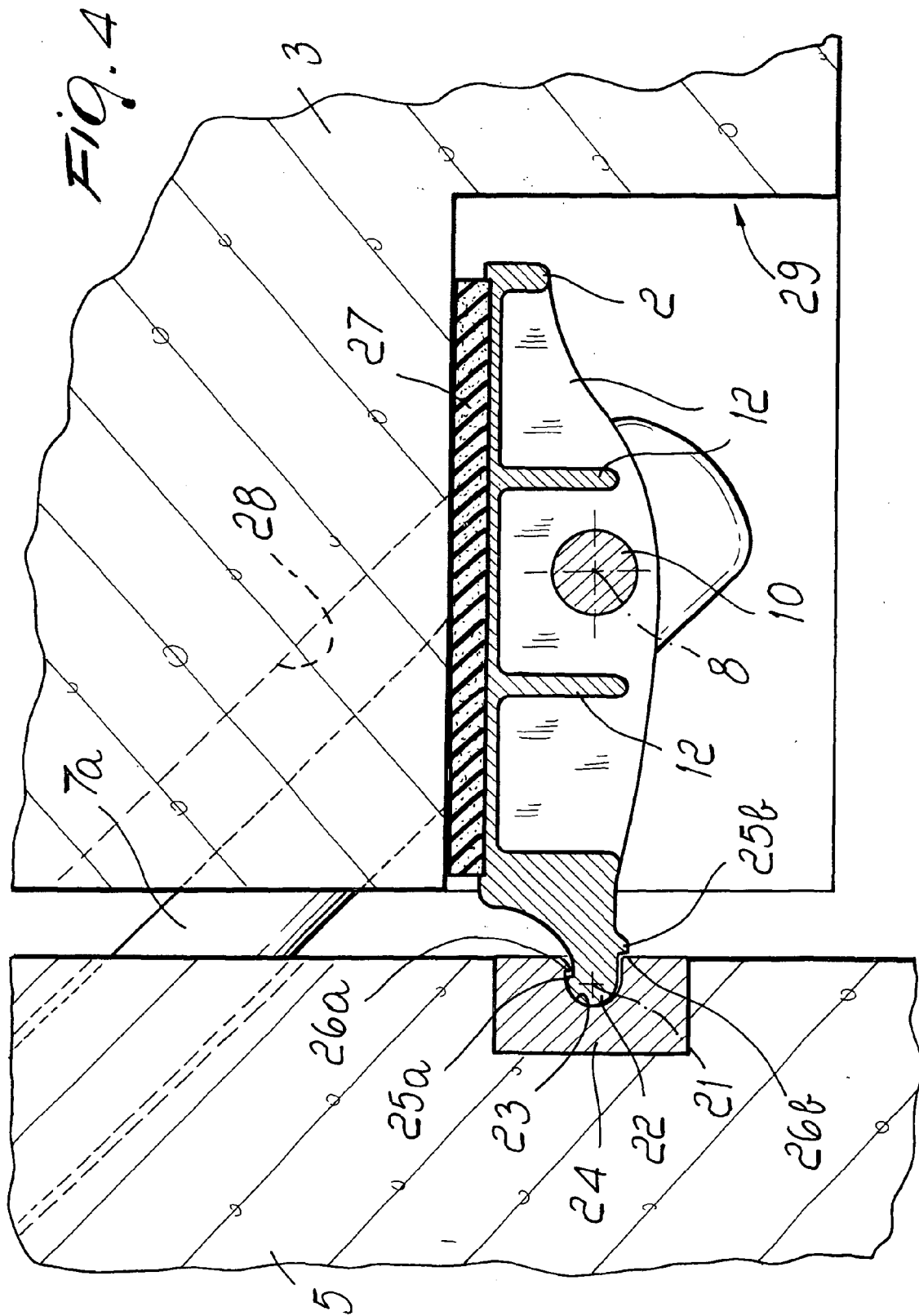
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EUROPEAN SEARCH REPORT

Application Number
EP 05 01 7043

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 092 814 A (ZAMBELLI, SERGIO; ZAMBELLI, BENITO) 18 April 2001 (2001-04-18)	1-3, 7-10,12, 13,17, 19-22	E04B1/21 E04B1/22
Y	* figures 4-6 * -----	11	
Y	US 5 669 189 A (LOGIADIS ET AL) 23 September 1997 (1997-09-23) * figures 1,2 *	11	
A	GB 2 179 115 A (OY * PARTEK AB) 25 February 1987 (1987-02-25) * figures 1,2 * -----	15	
			TECHNICAL FIELDS SEARCHED (IPC)
			E04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 December 2005	Examiner Rosborough, J
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EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 05 01 7043

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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09-12-2005

Patent document cited in search report		Publication date		Patent family member(s)		Publication date
EP 1092814	A	18-04-2001	AT	298385 T		15-07-2005
			DE	60020925 D1		28-07-2005
			IT	MI992129 A1		12-04-2001
			US	6647678 B1		18-11-2003

US 5669189	A	23-09-1997	AU	675817 B2		20-02-1997
			AU	5713694 A		19-07-1994
			EP	0690948 A1		10-01-1996
			WO	9415047 A1		07-07-1994
			GR	1001450 B		30-12-1993
			JP	2944217 B2		30-08-1999
			JP	7508080 T		07-09-1995
			NZ	259020 A		24-03-1997

GB 2179115	A	25-02-1987	FI	72369 B		30-01-1987
			SE	464363 B		15-04-1991
			SE	8603353 A		13-02-1987
