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(54) **Mechanical connection for prefabricated reinforced concrete articles, and their production method**

(57) The mechanical connection for prefabricated reinforced concrete articles comprises: a first plate (1) from which first anchoring means (3) project into a first article (30); a second plate (2) from which second anchoring means (4) project into a second article (31); means for fixing the first plate (1) to the second plate (2), comprising at least one female element (10-12) fixed to the second plate (2) such that the second front surface (6) is free, each female element (10-12) being accessible from the

outside and being able to cooperate with a corresponding male element (13-15) removably coupled to the first plate (1) and adapted to cooperate with a corresponding anchoring hole (16-18) provided therein. The anchoring means (3, 4) are separate and are separated from the respective plates (1, 2), connection means (50, 56, 55) being provided, of the type which enables the anchoring means (3, 4) to be connected to the respective plates (1, 2) when necessary.

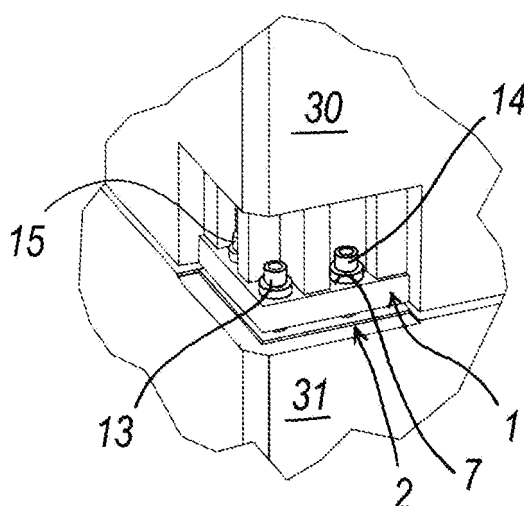


Fig. 4

Description

[0001] The present invention relates to a mechanical connection for prefabricated articles of reinforced concrete (hereinafter known as r.c.), and a method for producing such articles able to be connected together by said mechanical connection.

[0002] It is known to connect together two prefabricated r.c. articles by using a mechanical connection comprising, in a first of these articles, at least one male connection element projecting from said first article and non-removably fixed thereto and, in a second article, a corresponding female connection element provided therein and connectable to said male element.

[0003] In EP-A-1932979, which deals with the known art, it is explained (and is also evident therefrom) that the presence of male connection elements projecting from said first article gives rise to considerable problems when this latter is being connected to said second article.

[0004] These problems are solved by the mechanical connection described in EP-A-1932979.

[0005] In particular, Figures from 1 to 4 herein, taken from EP-A-1932979, show one embodiment of the relative mechanical connection. Specifically:

Figure 1 is a partial perspective view of the mechanical connection alone, the two prefabricated r.c. articles connected together thereby not having been shown (in order to be able to appreciate the component parts of this connection);

Figure 2 is an exploded perspective view of the entire connection means on a reduced scale, seen from another viewpoint;

Figure 3 is a perspective view of two prefabricated r.c. articles (in particular two columns) connected together by four mechanical connections of the type shown in Figures 1 and 2;

Figure 4 is an enlargement of the detail 4 of Figure 3.

[0006] As can be seen, the mechanical connection shown therein comprises:

- a first plate 1 presenting a first front surface 5 and a first rear surface 7 from which first anchoring means 3 rigid with the plate 1 project into a first article 30;
- a second plate 2 presenting a second front surface 6 and a second rear surface 8 from which second anchoring means 4 directly or indirectly integral with the second plate 2 project into a second article 31;
- means for fixing the first plate 1 to the second plate 2, comprising at least one female element (in the specific illustrated example there are three female elements 10, 11, 12, in the form of internally threaded sockets) fixed to the second plate 2 such that the second front surface 6 is free, each female element (i.e. each of the three internally threaded sockets 10, 11, 12) being accessible from the second front surface 6 and being adapted to cooperate with a corre-

sponding male element (in the specific example one of the three male elements 13, 14 and 15, in the form of socket-head screws) associated with the first plate 1, the male element being removably coupled to the first plate 1 and adapted to cooperate with a corresponding anchoring hole (one of the holes 16, 17 and 18 visible in Figure 2) provided therein. In particular (as can be seen from the arrangement represented in the aforesaid figures) the second fixing means 4 are rigid with the corresponding female elements (10-12), and hence indirectly rigid with the second plate 2.

[0007] In the specific illustrated example, at each anchoring hole 16, 17 and 18 there is also provided a washer 19, 20 and 21 disposed between the head of the socket-head screws 13, 14 and 15, and the plate 1.

[0008] In the specific example said first anchoring means 3 comprise five substantially parallel anchoring bars disposed in pairs in proximity to each of the two anchoring holes 17 and 18, and one disposed in proximity to the anchoring hole 16. The near end of the anchoring bars 3 is welded to the face 7 of a first plate 1.

[0009] In the specific example said second anchoring means 4 also comprise five substantially parallel bars, of which four are welded in pairs to each of the two sockets 11 and 12 and one to the corner socket 10.

[0010] The bars 3 and 4 are normally of steel, of the improved r.c. adherence type.

[0011] To mechanically connect the two prefabricated r.c. columns 30 and 31 (Figures 3 and 4) together by means of four mechanical connections such as that of Figures 1 and 2, they are aligned such that each first plate 1 of the column 30 is superposed on a corresponding second plate of the columns 31. When the washers 19-21 have been disposed at the anchoring holes 16-18, the socket-head screw 13-15 is then inserted into each of these holes and screwed into the relative threaded socket 10-12, then tightened to complete the connection operation.

[0012] It should be noted that as the bars of the second anchoring means 4 are welded directly to the sockets 10-12, the second plate 2 can have a considerably smaller thickness than the first plate 1.

[0013] The bars of the first (3) and second (4) anchoring means must have a length such as to enable them to be superposed on the reinforcement rods of the relative article by an amount sufficient to enable these to receive by transmission those forces acting on the anchoring bars 3 and 4 (so-called transmission by bar superposing).

[0014] The aforescribed mechanical connection (falling within the scope of protection of EP-A-1932979) presents however non-negligible drawbacks. In particular, when the first (30) and the second (31) article are produced, a first assembly, formed from the first plate 1 and the first anchoring bars 3 welded to it, is positioned inside the casting form, together with a second assembly, formed from the second plate 2 with the sockets 10-12

secured to it plus the second anchoring bars 4 welded to the corresponding sockets. It is easy to imagine that the not inconsiderable distance which said first (3) or second (4) anchoring bars project inwards from the forms makes it quite difficult to insert the (normally preassembled) reinforcement for the article 30 or 31 into the relative form (this operation being followed by pouring the concrete into the forms).

[0015] Another drawback is due to the fact that said first and second assembly can have a considerable weight exceeding the maximum which an operative is allowed to lift by current safety regulations.

[0016] The object of the present invention is to obviate the aforescribed drawbacks.

[0017] This object is attained by virtue of the mechanical connection according to the present invention, which is of the aforescribed type and is characterised in that the first and second anchoring means are different and are separated respectively from the first and second plate, and are provided with connection means of the type which enables the first and second anchoring means to be connected respectively to the first and second plate when necessary, for example after the first and/or second plate and the reinforcements of the relative article have been positioned in the respective casting forms. In this respect, as the first and/or second anchoring means are not yet present in the forms when the respective totally or partially preassembled reinforcements are inserted into them, no difficulties are encountered in effecting this insertion.

[0018] Moreover, as the anchoring means are produced separated from the relative plates, they and the plates can be handled individually, with the advantage of being of decidedly lesser weight than said first and second assemblies comprising the anchoring means rigid with the relative plates from the start.

[0019] Various connection means can be used for this purpose according to the present invention. In the case of the aforescribed first and second anchoring means of bar type, said connection means can even consist of welding the anchoring bars to the respective first and second plate, the welding being done only when required, for example after positioning the first and/or second plate on the relative casting form and having also inserted the respective reinforcement of the actual article to be prefabricated.

[0020] According to a normally more convenient variant, said connection means comprise outwardly flared though holes provided in the first and second plate, to insertingly receive from the outside (through a hole provided in the casting form) the corresponding anchoring bar, which has its outer end shaped as a flared head to be received in the corresponding said flared through hole. In an improved variant, the flared through hole presents a longitudinal cut enabling a tooth present on the lateral surface of the bar to pass through such as to form a connection of bayonet type between said bar and the relative plate.

[0021] The invention also relates to a method for producing prefabricated r.c. articles able to be connected together by the aforescribed mechanical connection, this method comprising the following steps:

- positioning the first plates and/or the second plates with their female elements in the required position in the form used to obtain the relative article;
- arranging the totally or partially preassembled reinforcements for the respective article inside the form;
- connecting the first and/or second anchoring means to the first and/or second plates respectively;
- pouring the concrete into the form.

[0022] The invention will be more apparent from the ensuing description of one embodiment thereof given by way of example. In this description reference is made to Figures 5-8 of the accompanying drawings, in which:

Figure 5 is a front view of a portion of a first or second plate, in this plate portion a through hole being present forming part of the connection means between the plate and, respectively, first or second anchoring means;

Figure 6 is a rear view of the same plate portion visible in Figure 5;

Figure 7 is a cross-section therethrough taken on the line 7-7 of Figures 5 and 6;

Figure 8 is a side view of the end head adapted to cooperate with the through hole, shown in Figures 5-7, of an anchoring bar forming part of the first or second anchoring means.

[0023] As stated, Figures 5-7 show only a small portion of the first (1) or second (2) plate (normally of steel) forming part of a mechanical connection of the type described in EP-A-1932979, namely that plate portion in which an end part of an anchoring bar 3 or 4 (Figure 8), forming part respectively of said first (3) or second (4) anchoring means, is connected to the relative plate 1 or 2. In particular, this plate portion presents a through hole 50 which, in the specific illustrated example, presents (proceeding from the front surface 5, 6 to the rear surface 7, 8) a first cylindrical part 51, followed by a coaxial frustoconical part 52 which enables the diameter of the remaining cylindrical coaxial part 53 of the hole 50 to be narrowed. From Figures 5-7 it can also be seen that the smaller diameter part 53 of this hole is provided with a longitudinal groove 54. This groove enables a tooth 55 (Figure 8) projecting laterally from the anchoring bar 3, 4 to pass beyond the plate 1, 2 when that end of an anchoring bar 3, 4 opposite that shown in Figure 8 is inserted into the hole 50 by its greater diameter part 51. To achieve this, a through hole must evidently be provided in the corresponding position in the casting form wall. This operation of positioning the bar 3, 4 is carried out when the first (1) and/or second (2) plates forming part of said mechanical connection plus the reinforcement (normally to-

tally or partially preassembled) of the relative article 30, 31 to be produced have already been applied in a predetermined position to the casting form (not shown) for forming a relative prefabricated article 30, 31. In this manner, this reinforcement can be positioned easily and rapidly without encountering obstacles, with consequent simplification of production and shortening of the relative times.

[0024] As can be seen from Figure 8, that end 56 of the bar 3, 4 close to the tooth 55 is shaped with a head and comprises a cylindrical part 58 connected to the rest of the bar by a frusto-conical part 57. As will be apparent observing Figures 7 and 8, the head 56 is able to be received within the cylindrical part 51 and frusto-conical part 52 of the hole 50 when a bar 3, 4 is completely inserted into this hole. As the tooth 55 is spaced from the head 56 by a distance just greater than the length of the lesser diameter part 53 of the hole 50, it will also be apparent that, by rotating the bar 3, 4 about its axis through an angle which brings the tooth 55 out of alignment with the groove 54, the bar 3, 4 remains locked in position, so that it has no tendency to escape from the hole 50, even when the concrete is being poured into the form.

[0025] Although the solution comprising the tooth 55 can be seen to be convenient, it is apparent that the tooth 55 can also be omitted, other means evidently being able to be used to prevent escape of the bar 3, 4 during casting.

[0026] Although normally not convenient, a solution (already mentioned) for connecting the anchoring bar 3, 4 to the relative first (1) or second (2) plate such that the forces are transmitted from said bars to the plate and vice versa can also consist of simply welding the corresponding end of the bars 3, 4 to the respective plate 1, 2. It should be noted that this welding is carried out only when it is required, i.e. after those connection components relative to an article have been positioned in the corresponding casting form and before pouring the concrete into the form to cast the relative prefabricated article.

[0027] Other means for making this connection can evidently be used for the purpose, provided that the connection between the bars 3, 4 and the relative plates 1, 2 can be carried out after these plates have been positioned on the form and the reinforcement for the relative article has been inserted into this latter. For example, in the plate 1, 2 a threaded through hole can be provided into which the corresponding threaded end of the anchoring bars 3, 4 is screwed.

Claims

1. A mechanical connection for prefabricated reinforced concrete articles, comprising:

- a first plate (1) presenting a first front surface (5) and a first rear surface (7) from which first

anchoring means (3) project into a first article (30);

- a second plate (2) presenting a second front surface (6) and a second rear surface (8) from which second anchoring means (4) project into a second article (31);

- means for fixing the first plate (1) to the second plate (2), comprising at least one female element (10-12) fixed to the second plate (2) such that the second front surface (6) is free, each female element (10-12) being accessible from the second front surface (6) and being adapted to cooperate with a corresponding male element (13-15) associated with the first plate (1), the male element (13-15) being removably coupled to the first plate (1) and adapted to cooperate with a corresponding anchoring hole (16-18) provided therein, **characterised in that** the first (3) and second (4) anchoring means are different and are separated respectively from the first (1) and second (2) plate, connection means (50, 56, 55) being provided, of the type which enables the first (3) and second (4) anchoring means to be connected respectively to the first (1) and second (2) plate when necessary.

2. A mechanical connection as claimed in claim 1, wherein both the first and the second anchoring means comprise at least one bar (3, 4), the bars (3, 4) having a length such as to enable them to be superposed on the reinforcement rods of the relative article (30, 31) by an amount sufficient to enable these latter to receive, by transmission, those forces acting on the anchoring bars (3, 4).

3. A mechanical connection as claimed in claim 2, wherein the connection means comprise:

- a head (56) at that end of each anchoring bar (3, 4) to be connected to the plate (1, 2);

- for each anchoring bar (3, 4), a through hole (50) provided in the plate (1, 2), the first part (51, 52) of this hole (50), on the front surface (5, 6) of the plates (1, 2), being shaped to receive the head (56) of the relative anchoring bar (3, 4), the remaining part (53) of the hole (50) having dimensions which enable the anchoring bar (3, 4) to pass but not the head (56).

4. A mechanical connection as claimed in claim 3, wherein in the remaining part (53) of the hole (50) a longitudinal groove (54) is provided which, when the bar (3, 4) is inserted into the hole (50) from the side comprising the front surface (5, 6), enables passage of a tooth (55) projecting laterally from the anchoring bar (3, 4) and located at a distance from the relative head (56) which is just greater than the length of the remaining part (53) of the hole (50), the head (56)

having a shape which, when received in the first part (51, 52) of the hole (50), enables the anchoring bar (3, 4) to be rotated about its axis through an angle which prevents its withdrawal.

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5. A mechanical connection as claimed in claim 2, wherein the connection means comprise a weld which fixes the corresponding end of each anchoring bar (3, 4) to the relative plate (1, 2), the weld being only when required.

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6. A mechanical connection as claimed in claim 2, wherein the connection means comprise a thread formed at that end of the anchoring bars (3, 4) to be connected to the plate (1, 2), these threaded ends being screwable into corresponding threaded holes provided in the plate (1, 2).

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7. A method for producing prefabricated reinforced concrete articles (30, 31) able to be connected together by the mechanical connection claimed in any one of the preceding claims, this method comprising the following steps:

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- positioning the first plates (1) and/or the second plates (2) with their female elements (10-12), in the required position in a form used to obtain the relative article (30, 31);
- arranging the totally or partially preassembled reinforcements for the respective article inside the form;
- connecting the first (3) and/or second (4) anchoring means to the first (1) and/or second (2) plates respectively;
- pouring the concrete into the form.

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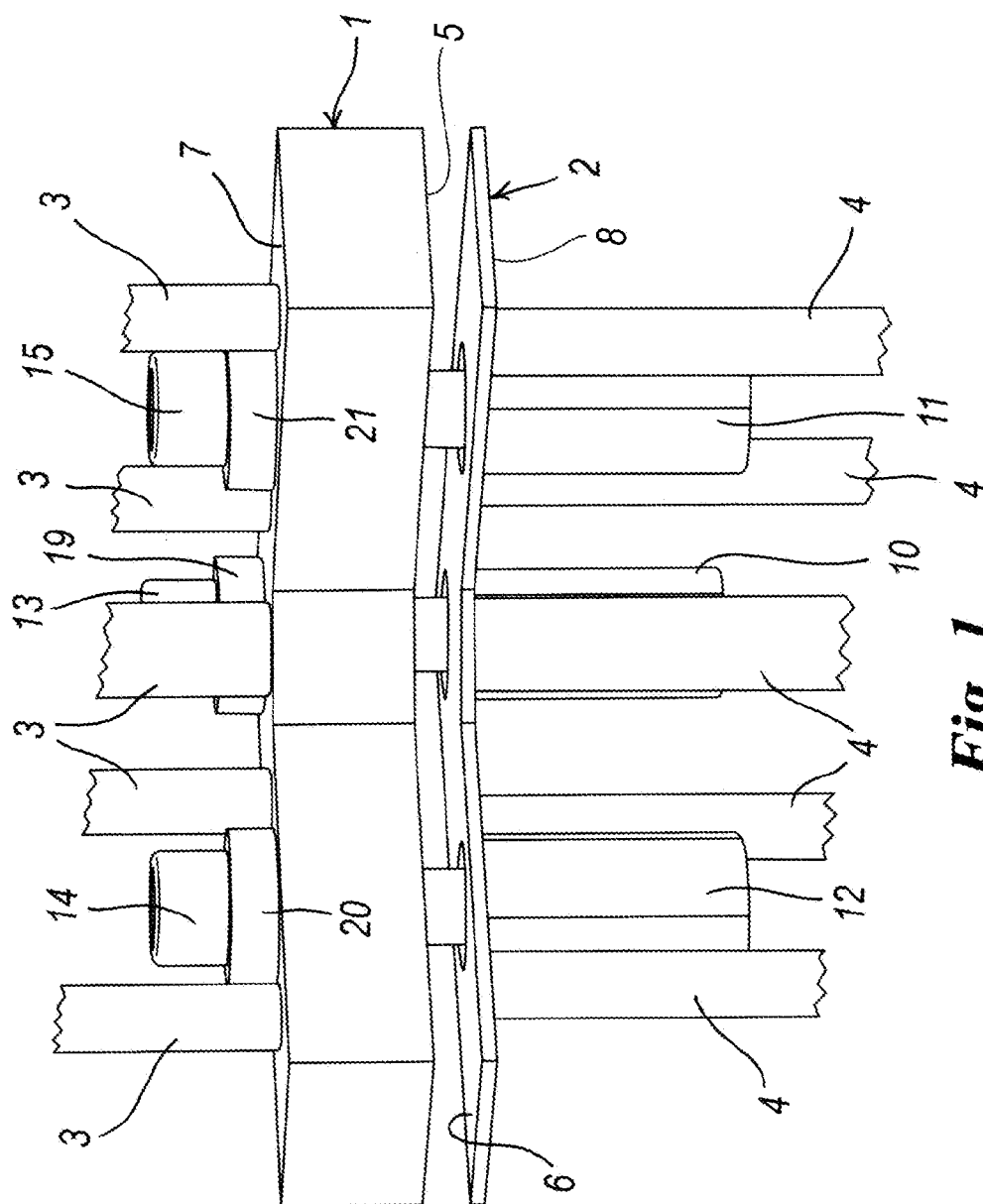


Fig. 1

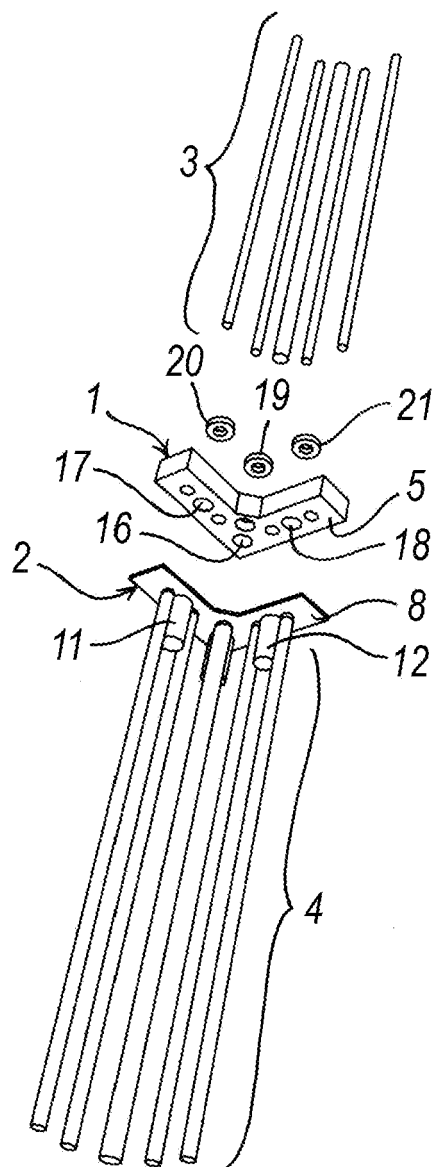


Fig. 2

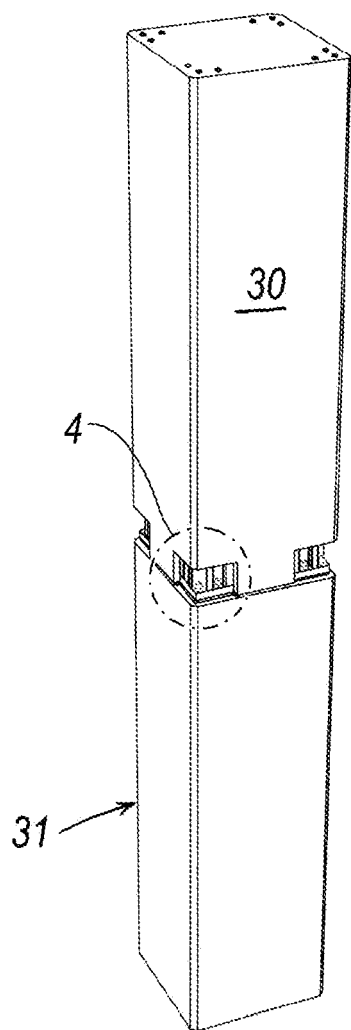


Fig. 3

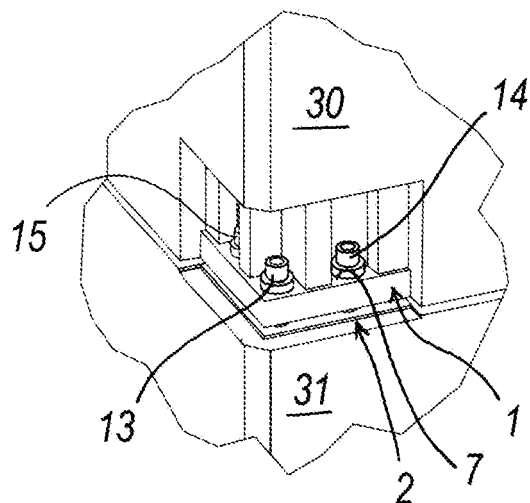


Fig. 4

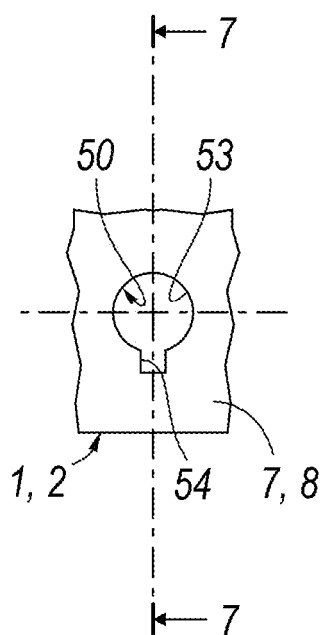


Fig. 5

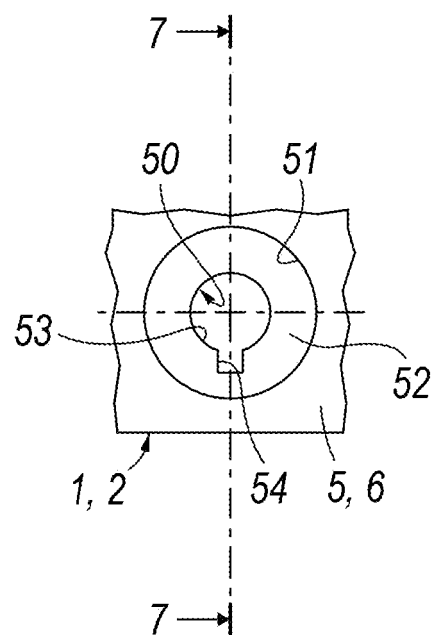


Fig. 6

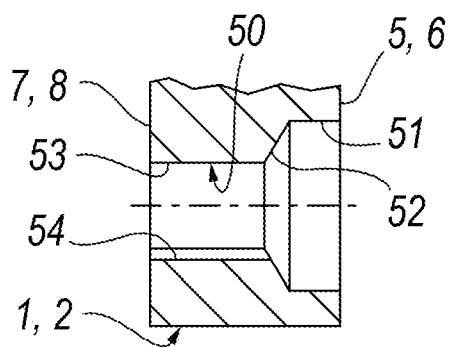


Fig. 7

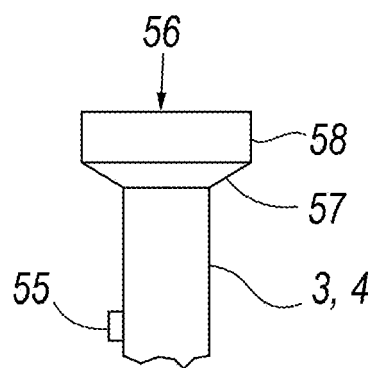


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 11 16 2573

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	EP 1 857 602 A2 (KRUMMEL GERHARD [DE]; SCHMIDT PATRICK [DE]) 21 November 2007 (2007-11-21) * paragraph [0017]; figure 1 *	1,2,5-7	
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			TECHNICAL FIELDS SEARCHED (IPC)
			E04C E04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 June 2011	Examiner Vratsanou, Violandi
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 16 2573

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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10-06-2011

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REFERENCES CITED IN THE DESCRIPTION

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