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(11) **EP 1 004 720 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.05.2000 Bulletin 2000/22

(51) Int. Cl.⁷: **E04C 5/02**, E04C 5/16,
E04G 21/12

(21) Application number: **99203982.6**

(22) Date of filing: **26.11.1999**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **26.11.1998 NL 1010661**

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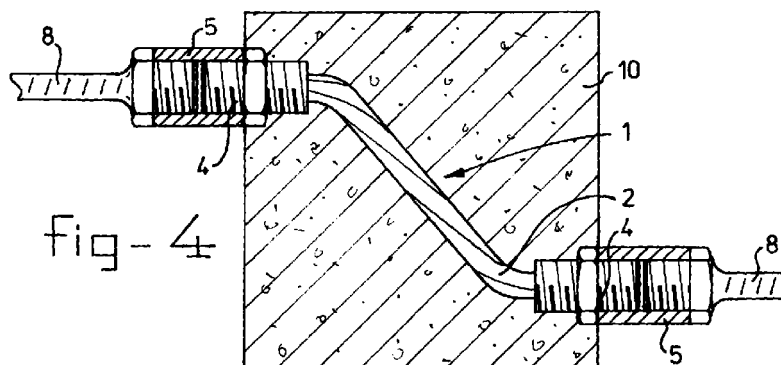
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(54) **Reinforcement system and concrete structure**

(57) Reinforcement system comprising at least two rigid reinforcement elements (6,8) which are not arranged in line with respect to one another but are to be connected. To achieve this, a flexible part (1) is used as the reinforcement element, making the position of

the free ends with respect to one another of subordinate importance. This structure is used in reinforcements which are not prestressed.



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Description

[0001] The present invention relates to a reinforcement system according to the preamble of Claim 1. More particularly, the present invention relates to a reinforcement system which is not prestressed or to be subsequently stressed, i.e. generally composed of reinforcing iron bars with a tensile strength of less than 700 N/mm², more particularly approximately 500 N/mm². Reinforcement elements of this nature are in very widespread use in the manufacture of all types of concrete structures. In "difficult structures", it is often necessary to join together two reinforcement elements which are not in line with one another. In practice, this is carried out by using curved bars.

[0002] In construction projects, the position of the reinforcement is often specified by the designer. This position becomes increasingly critical as the structure becomes more "lightweight". This means that as the thickness of the walls of the structure decreases, the position of the reinforcement material becomes ever more important. In many projects, the reinforcement is bent in advance in the factory, transported to the site and then put in place. Transporting reinforcement bars with complicated curvatures is difficult, and the parts in question often become entangled with one another, making it unclear which reinforcement part is to be placed where. It has been found that inaccuracy is forever arising while the bars are being put in place. For this reason, corrective bending work is often used on site, but the conditions under which this takes place are far from optimum, while current employment legislation forms an increasing obstacle.

[0003] The object of the present invention is to provide a reinforcement system which makes the dimensional accuracy of other reinforcement less critical, can also be used in a thin-walled structure and allows simple adaptation on site. It must be possible to connect a reinforcement system of this nature to other parts of the reinforcement in a simple manner, and the system must have sufficient strength after the concrete or other material which is poured around the reinforcement has set.

[0004] This object is achieved, in a reinforcement system as described above, by means of the characterizing features of Claim 1.

[0005] By using a flexible part, and more particularly a cable, it is possible to achieve a high tolerance during manufacture of the reinforcement and to make structures which were hitherto impossible with a rigid reinforcement of solid steel. It is important that the reinforcement elements are only subjected to tensile loads, and a flexible part or cable, after it has been surrounded by set material, has amply sufficient strength.

[0006] It should be noted that the use of flexible cables as such is known in reinforcement technology. Reinforcement cables of this nature are used for prestressed concrete or concrete which is to be stressed

after curing. Examples are found in GB-2,034,857-A, GB-1,312,246-B and DE-2,644,210-A. In this case, the ends of the rigid elements between which the stressing cable is attached always lie in line with one another.

[0007] The present invention relates to structures which are not prestressed or to be subsequently stressed, i.e. conventional reinforcements, where the ends of the "rigid" elements are not in line. The term "rigid elements" is understood to mean all elements which cannot easily be bent by hand. These elements generally consist of reinforcing steel. According to the invention, the third reinforcement element comprises a flexible part or cable and may comprise any material which is known in the prior art, such as high-strength plastic or metallic material. A cable may be composed of a number of intertwined strands, each comprising a high-strength material, optionally with different properties.

[0008] The coupling means may comprise any part which is known in the prior art. A simple embodiment comprises a male or female screw thread which can be clamped onto a cable or other flexible part with the aid of the sleeve. Another design is a sleeve provided with a union nut making it possible to form a connection to a further structure.

[0009] The invention also relates to a concrete structure, comprising a reinforced concrete section, with a reinforcement as described above. The invention moreover relates to a bearing device for a concrete section, comprising an engagement means, arranged on the outside, for a hook or the like, such as a lifting eyelet, connected to a reinforcement-like structure which extends inside the concrete section, the said reinforcement-like structure comprising the reinforcement system according to the invention. This provides particular advantages when transporting reinforced concrete sections made in the factory. After all, a concrete section of this nature no longer has to be provided with a projecting reinforcement which is cast into a concrete section produced on site. It is possible to provide a smooth finish, and further reinforcement elements and the like can be connected to the coupling means on site. This makes transport more efficient. With the coupling means described above, it is possible to produce a connection without having to increase the temperature or use other unfavourable conditions. For example, welding often has an adverse effect on the strength of the reinforcement bars.

[0010] If a metallic material is used for the cable and/or coupling means, this may be any metal which is known in the prior art. An example for high-grade applications is stainless steel.

[0011] The invention will be explained in more detail below with reference to a number of exemplary embodiments. These exemplary embodiments in no way limit the scope of the present application. In the drawing:

Fig. 1 shows a first embodiment of the reinforce-

ment element according to the invention;

Fig. 2 shows a second embodiment of the reinforcement element according to the invention;

Fig. 3 shows the use of the reinforcement element shown in Fig. 2 in a building structure;

Fig. 4 shows the use of the reinforcement element shown in Fig. 1 in a building structure;

Fig. 5 shows a further reinforcement element according to the invention;

Fig. 6 shows the use of the reinforcement element shown in fig. 2 attached to part of a building structure;

Fig. 7 shows a further use of the reinforcement element shown in fig. 1;

Fig. 8 shows another use of the reinforcement element shown in Fig. 1;

Fig. 9 shows, in cross section, a plan view of the connection between a column and a number of walls using the reinforcement element shown in one of the above figures;

Fig. 10 shows a cross section through a coupling between various reinforcement bars; and

Fig. 11 diagrammatically shows the arrangement of the connection of a floor and column.

[0012] In Fig. 1, the reinforcement element according to the invention is denoted overall by 1. It comprises an elongate part 2, wherein both ends are provided with sleeves 3 with an external screw thread 4. The elongate part 2 is designed as a cable comprising intertwined strands. These strands may each comprise metallic or non-metallic material which provides the final structure with sufficient strength.

[0013] A variant on Fig. 1 is shown in Fig. 2, in which the reinforcement element is denoted overall by 11. This element again comprises an elongate element 2 which is provided at one end with the above-described sleeve 3 provided with an external screw thread 4.

[0014] The other end is provided with a sleeve 12 which is clamped onto the cable and is provided with an internal screw thread 13. It will be understood that sleeve 3 or 12 may be attached in any manner which is known in the prior art, for example by clamping.

[0015] Fig. 3 shows a first use of the reinforcement element shown in Fig. 2. This element is cast, in the position shown in Fig. 3, inside a concrete structure which is denoted by 10. A sleeve 9 which is provided with an internal screw thread is in this case screwed onto the external screw thread 4. After it has set, the concrete structure can be moved to the site, and further reinforcement elements, such as solid bars 6 and 8, can be put in place on site. These further reinforcement elements are provided with external screw thread 7 which can be screwed into sleeve 12 or thickened section 9 provided with an internal screw thread. With a structure of this nature, it is possible to transport the concrete section 10 to its place of use without projecting parts. It should be understood that this is a structure which is not

prestressed.

[0016] Another coupling of forces is shown in Fig. 4. In this case, the reinforcement element 1 from Fig. 1 is used, and the concrete is poured in such a way that external screw thread 4 projects slightly. It is then possible to use reinforcement bars 8 which are provided with a coupling sleeve 5 for attaching to the external screw thread 4. After the concrete has set, it will then only be possible to insert a tensile strength on the reinforcement element 1 shown in Fig. 4. The compressive forces are in principle absorbed by the concrete.

[0017] Fig. 5 shows a variant of the reinforcement element according to the invention, which is denoted overall by 21. In this case too, a flexible cable 2 which is provided with clamping sleeves 22 in the vicinity of its ends is used. These sleeves are provided with a shoulder 24, behind which a union nut 23 can engage, which nut engages, by way of the internal screw thread arranged therein, on the external screw thread 7 of rigid reinforcement bar 6. In this way, coupling can be effected easily without it being necessary for the mutually opposite reinforcement bars to be able to rotate with respect to one another.

[0018] Fig. 6 shows a further variant, in which a reinforcement element 11 is connected to an outside wall panel 14. As an alternative to outside wall panel 14, it is possible to use any other structure which is known in the prior art. A support plate 15 provided with a threaded stub 16 is attached to outside wall panel 14 in some way. The sleeve 12 of reinforcement element 11 can be screwed onto this threaded stub, and then the concrete can be poured in. It is also possible, even before the coupling to outside wall panel 14 or other element has taken place, to form the concrete structure around reinforcement element 11, in which case a certain amount of space is left free in the vicinity of sleeve 12. It is also possible to place a temporary plastic plug in the space inside sleeve 12, and after the formwork and this plug have been removed, the threaded opening is free to accommodate threaded stub 16. It will be clear to the person skilled in the art that numerous variants on the above are possible for a person skilled in the art.

[0019] Fig. 7 shows a structure in which the reinforcement element 1 not only serves as a reinforcement element in the subsequent concrete structure, but can also be used for the attachment of a lifting eyelet 27. For this purpose, the reinforcement element 1 is cast inside the concrete material 17, which element is supported via a washer 18 and nut 19 arranged on the external screw thread 4. On the other side, the reinforcement element is provided with a nut-like structure provided with a head 26 under which to lips of a hook 27 can engage and which can be connected to a crane or the like via attachment 28.

[0020] Fig. 8 shows a variant. In this case, a reinforcement element as shown in Figs. 1 or 2 is used, and the exposed male screw thread is provided with a sleeve 30 and the concrete is then poured in.

[0021] After the formwork has been removed and the internal screw thread of either sleeve 30 or sleeve 12 has been freed, it is possible to screw in a threaded stub of lifting eyelet 31, and the concrete structure 29 in question can then be moved.

[0022] This means that during transport there are no projecting parts, yet it is ensured that the forces are introduced correctly.

[0023] Fig. 9 shows the structure in which reinforcement elements 1, 11 or 21 are used. These elements are connected to rigid reinforcement elements or bars 47 arranged in three walls 33 which are to be connected to one another. The connection between the walls is formed by a column 32 provided with a cavity 34. The flexible nature of steel cable 2 allows any desired shape to be bent and allows forces to be transmitted in an optimum manner. It will be understood that steel cable 2 can be supplied in different lengths, resulting in a type of modular structure, with the result that it is easy for the user to create the appropriate flexible connection on site.

[0024] By correctly selecting the direction in which the strands of the steel cable are twisted and the diameter of the separate thin wires forming each strand, it is possible to obtain an extremely flexible cable even with comparatively large diameters. By way of example, it is possible to use a diameter of approximately 3 cm which is still easy to bend by hand. In the case of a solid structure, of course, such an arrangement is not possible.

[0025] Fig. 10 shows the connection between two walls 36 and 37. Rigid reinforcement rods 39, 40 are present. However, these may also be replaced by flexible reinforcement elements 1, 11, 21, which are coupled together via a T-piece 38 which is provided with two openings with an internal screw thread 41 and one opening 38 for accommodating bar 39. By screwing on reinforcement bars 40 which, in the vicinity of the ends, are provided with an external screw thread which engages inside the internal screw thread 41, bar 39 is clamped inside the opening 38. Of course, it is also possible to provide opening 38 with a screw thread into which bar 39 can be screwed. It will be clear that the T-piece 38 described above can be used independently of the reinforcement elements described above.

[0026] As an alternative to opening 38, it is possible to use a hook-shaped recess 44 as shown in Fig. 11. This figure shows the connection of a column 42 to floors, walls or other structures which are not illustrated. The T-piece 43 shown in Fig. 11 is otherwise similar to the T-piece 38 shown in the preceding figure. It will be clear that with this structure it is possible, even after the column has been produced, possibly followed by arranging a structure above it, to fit reinforcement 45 by pushing the hook-shaped recess 44 around the reinforcement bars which are shown in a vertical position in the drawing. Of course, it will be understood that the orientation shown in Fig. 11 may be changed. Thread part 46 is provided with a shoulder 47 and extends beyond

this shoulder. This is indicated by 48 and clamps the vertical bar in place.

[0027] The figures only show a number of examples of the many possible applications of the reinforcement elements and the T-piece according to the invention. A person skilled in the art will immediately discover further embodiments of the reinforcement element according to the invention which lie within the scope of the present application. The reinforcement elements described above may be used in combination with all accessories which are known in the prior art, such as spacer blocks.

Claims

1. Reinforcement system, comprising at least two rigid reinforcement elements, the free ends of which are connected to one another via a third reinforcement element, the free ends being arranged out of line with respect to one another characterized in that the third reinforcement element comprises a flexible part (2).
2. Reinforcement system according to Claim 1, in which the said flexible part comprises a cable.
3. Reinforcement system according to one of the preceding claims, in which the tensile strength of the said rigid elements is less than 700 N/mm².
4. Reinforcement system according to one of the preceding claims, which is unstressed.
5. Reinforcement system according to one of the preceding claims, in which the said free end and the said flexible part are each provided with coupling means which interact with one another.
6. Concrete structure, comprising a reinforced concrete section, the said reinforcement comprising the reinforcement system according to one of the preceding claims.
7. Bearing device for a concrete section, comprising an engagement means, arranged on the outside, for a hook or the like, such as a lifting eyelet, connected to a reinforcement-like structure which extends in the concrete section, the said reinforcement-like structure comprising the reinforcement system according to one of Claims 1-5.
8. Flexible cable provided at its ends with coupling means which are to be used in a reinforcement system according to one of Claims 1-5.

fig - 1

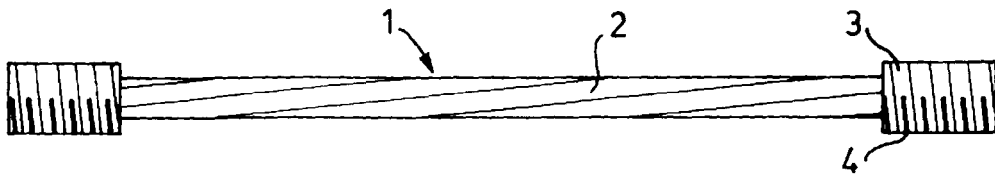


fig - 2

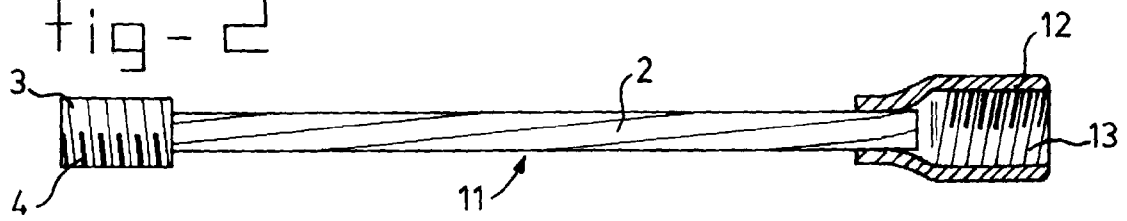


fig - 3

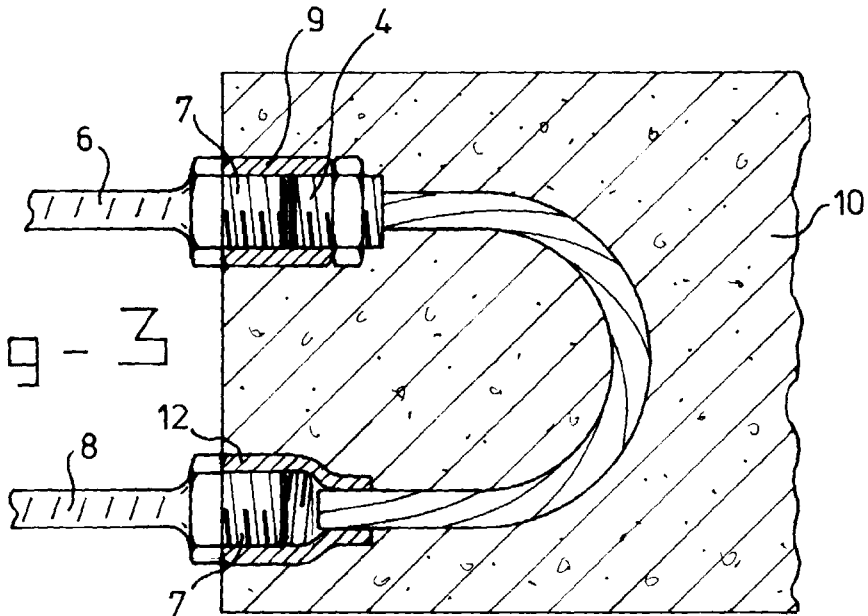
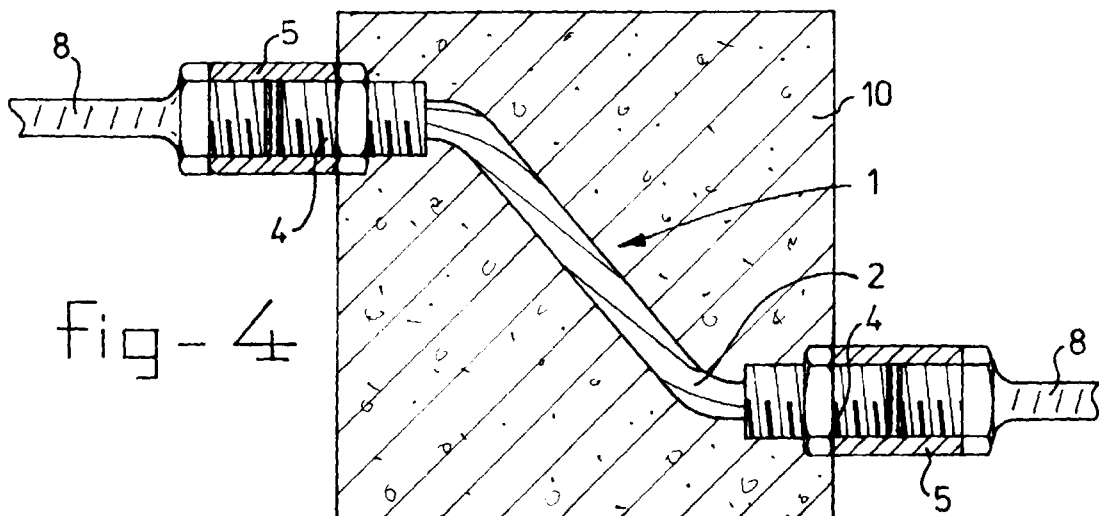
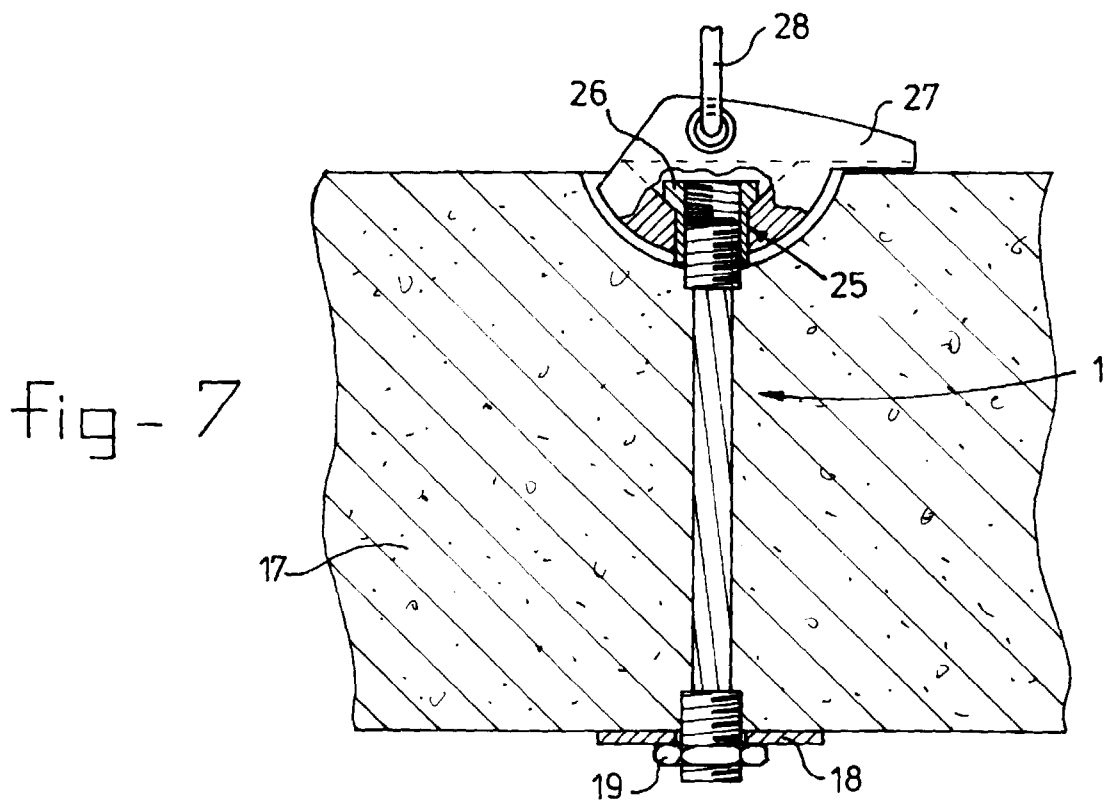
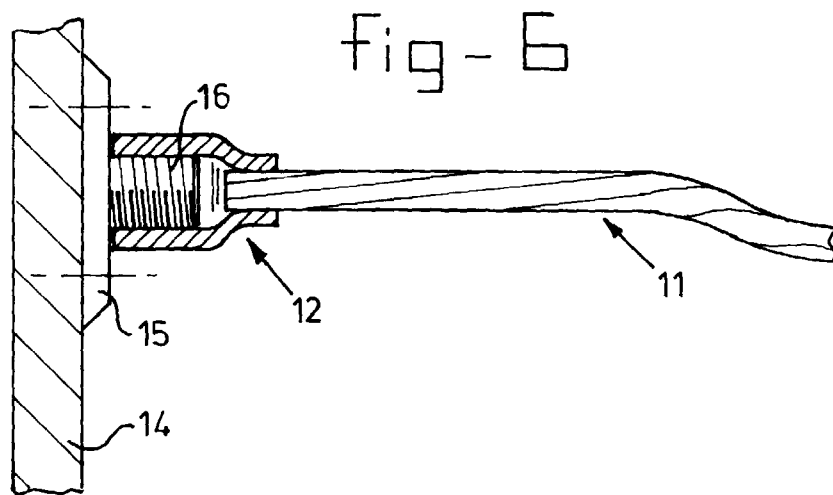
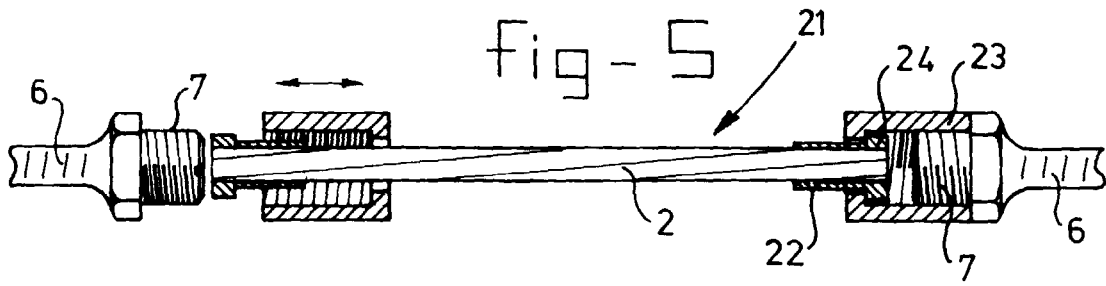


fig - 4





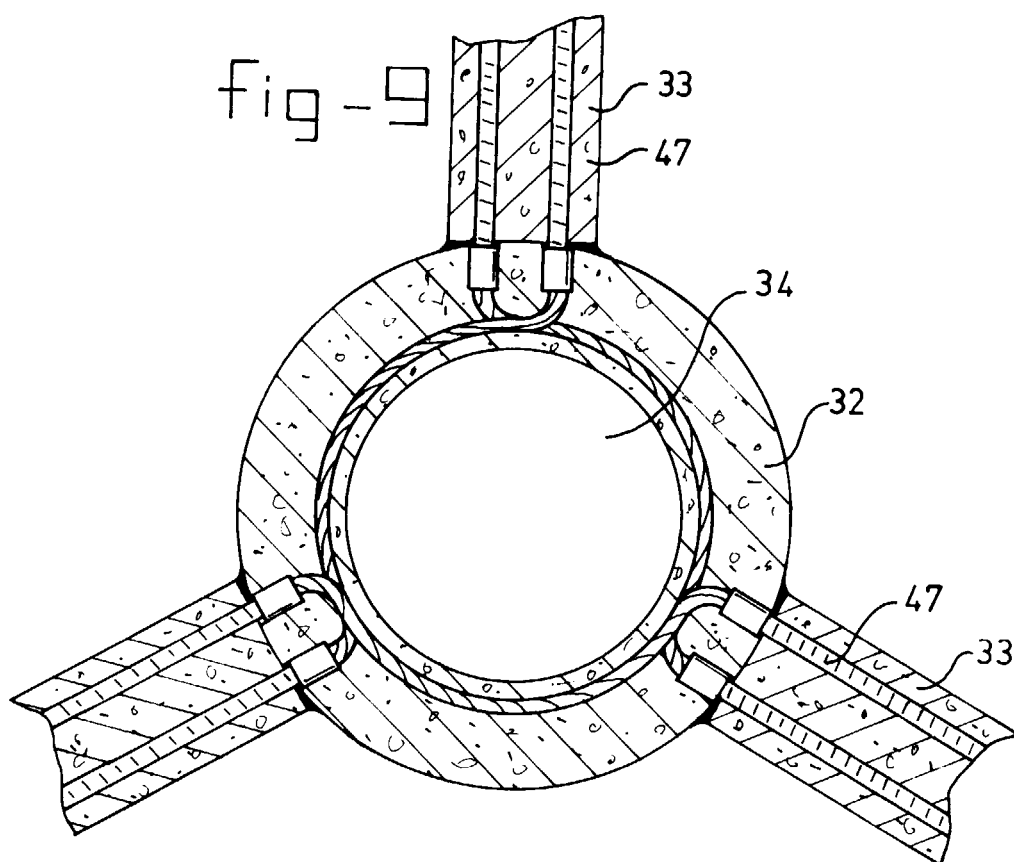
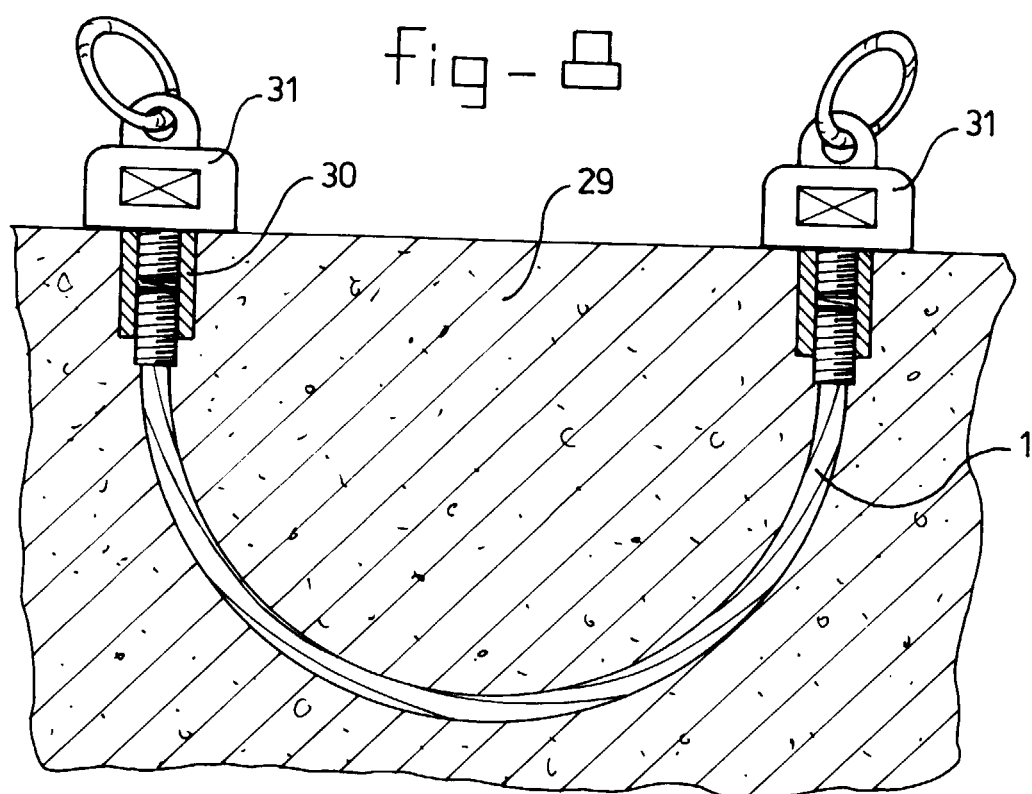


fig-10

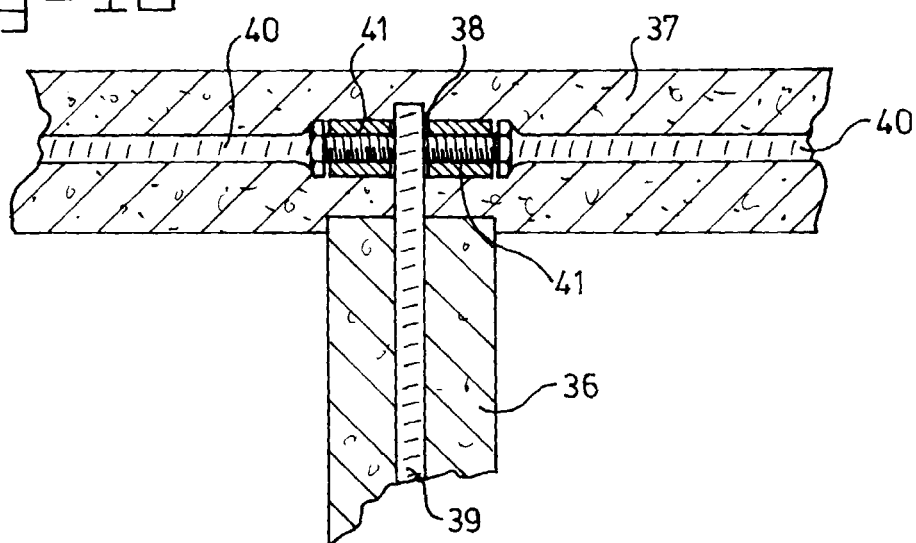
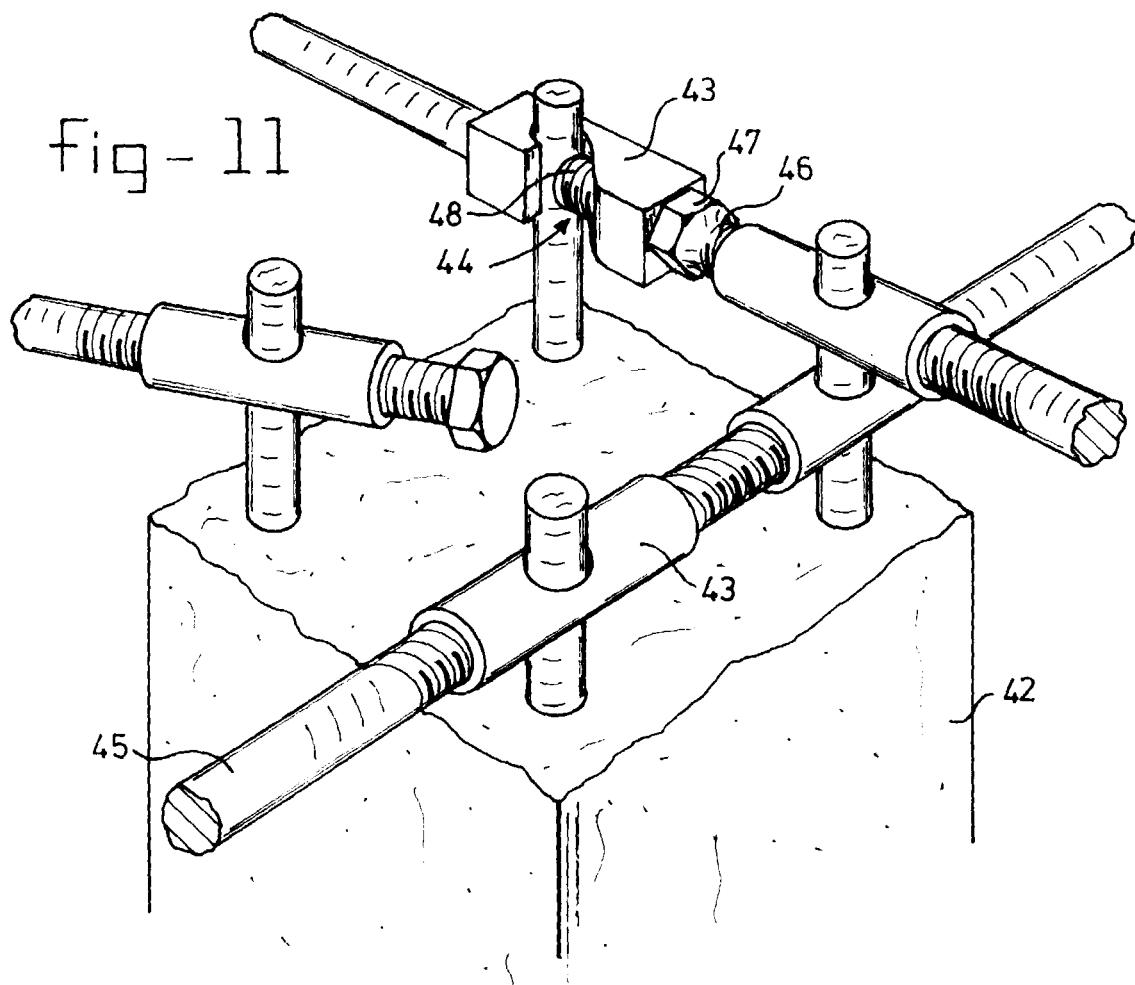


fig-11





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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 3982

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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Y	* page 3, paragraph 3 - page 4, paragraph 1; figures 6-8 *	5,7	
A	* page 4, line 28 - line 31 * * page 7, paragraph 1 * * page 9, paragraph 4 * * page 10, paragraph 2 *	3	
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The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 3 March 2000	Examiner Demeester, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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