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(54) ANCHORAGE ASSEMBLY FOR A STRUCTURE, CONCRETE STRUCTURE WITH SUCH AN ASSEMBLY, AND MANUFACTURING METHOD OF SUCH A CONCRETE STRUCTURE

VERANKERUNGSANORDNUNG FÜR EINE STRUKTUR, BETONSTRUKTUR MIT SOLCH EINER ANORDNUNG UND HERSTELLUNGSVERFAHREN SOLCH EINER BETONSTRUKTUR

ENSEMBLE D'ANCRAGE POUR UNE STRUCTURE, STRUCTURE EN BÉTON COMPRENANT UN TEL ENSEMBLE, ET PROCÉDÉ DE FABRICATION D'UNE TELLE STRUCTURE EN BÉTON

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(73) Proprietor: **VSL International AG**
3014 Bern (CH)

(72) Inventors:
- **LIN, Ka Wai Alice**
  Hong Kong (CN)
- **YIP, Yau Chun**
  Hong Kong (CN)

(74) Representative: **P&TS SA (AG, Ltd.)**
Av. J.-J. Rousseau 4
P.O. Box 2848
2001 Neuchâtel (CH)

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Description

Field of the invention

[0001] The present invention concerns an anchorage assembly for a concrete structure, a concrete structure with such an assembly, and a manufacturing method of such a concrete structure.

Description of related art

[0002] In concrete structure with pre-stressed strands, there exists several types of tendons, divided into bonded or unbonded tendons. Generally the tendons are made of individual steel elements that are placed in the structure at a first stage and stressed to a certain force at a later stage.

[0003] In bonded systems, one or more strands are inserted into a metal or plastic channel that is embedded in the concrete. The strand(s) is(are) stressed with a mono or multi-strand jack and anchored in a common anchorage device. The channel is then filled with a cementitious grout that provides corrosion protection to the strand(s) and bonds the tendon to the concrete surrounding the channel. Bonded systems are more commonly used in bridges for the roadway, the piles, the foundation and in building. In buildings, they are typically used in heavily loaded beams such as transfer girders and landscaped plaza decks.

[0004] An unbonded tendon is one in which the prestressing steel is not actually bonded to the concrete that surrounds it except at the anchorages. The two most common unbonded systems are first monostrand tendons and secondly bare strands surrounded by grease. The monostrands are used in slabs and beams for buildings, parking structures and-on-ground, in bridge for external post-tensioning and in several type of a suspended structure with cable stay. A monostrand consists of several steel wires that are coated with a corrosion-inhibiting soft product and encased in an extruded plastic protective sheathing made of plastic material. Then the tendon can be made of one monostrand (for slab) up to several monostrands (external post-tensioning ,cable stays), In some case the monostrand(s) is (are) directly embedded in the concrete; in another case they may be installed in a channel.

The second type of unbonded tendon consists in one to several bare strands that are installed in a channel made of steel or plastic, the channel being embedded in a concrete structure or following a specific layout within a structure. The void is filled with a corrosion-inhibiting soft product allowing the strand to move with respect to the channel and to the structure. The bare strands consist of several steel wires assembled together. The soft products are made of grease or wax. For small units, the anchorage consists of an iron casting and a conical, two-piece or three-piece wedge which grips individually from 1 to 6 or 7 strands. For bigger unit there is an anchor block with two-piece or three-piece wedges, which grips as many strands as necessary. Such anchor block bears on a cast iron piece or steel manufactured part that is embedded in a structure. The channel is generally made of plastic or steel tubes when located outside a structure between several deviation point, and the channel is generally made of corrugated ducts in steel or plastic when embedded in a structure.

[0005] EP0566463 presents such an unbonded system with monostrands, in a modified embodiment where the strands of the tendon are embedded directly in the concrete block forming the concrete structure or in a channel filled with a hardening filler such as cement grout before the strands are stressed. The advantage of such unbonded system is that the steel wires inside the monostrand are protected from any corrosion by the soft filler contained in the plastic sheath. Also the sheath allows to carry out the installation of the strands much in advance during the construction period, reducing therefore the total time of construction with a high level of protection.

[0006] DE20205149, EP1227200 and KR100966457 concerns anchorage assemblies where a first part of individual strands of a tendon pass through individual perforation of an anchor head, a second part of the tendon is placed in a tubular member with the tendon passing in an opening formed in a bearing plate adjacent to the anchor head, and a removable locking system allows to fix the strands in the anchorage.

[0007] With such prior art solutions, to accommodate the tendon length required for tensioning, there is an extra free length of the tendon placed outside the concrete block, namely outside the structure. When there are some maintenance operations such as the full de-tensioning of a tendon it is needed to keep the extra free length during all the life of the structure. Such an arrangement requires specific bulky protection of the unsheathed strands.

Brief summary of the invention

[0008] It is an aim of the present invention to provide an anchorage assembly which mitigates or obviates at least some of the above-mentioned disadvantages.

[0009] The present invention also aims to provide an alternative solution to the known solution which facilitates inspection and re-stressing of the tendons.

[0010] According to the invention, these aims are achieved by means of an anchorage assembly for a structure, comprising a tendon made of strands, the anchorage assembly defining at least two parts:

- a first part with the strands of the end portion of the tendon passed through individual perforations of an anchor head,
- a second part with an intermediate portion of the tendon placed within a first tubular member able to receive a removable protective product. According to

the invention, said second part is suitable to be placed within a structure, with the strands having said end portion passed through on one hand an opening formed in a bearing plate suitable to be disposed within the structure in an adjacent position to the first tubular member outlet, with said first tubular member outlet and said opening connected to each other, and on the other hand said individual perforations of said anchor head which is placed outside of the front face of the structure, wherein the anchor head has an outside diameter smaller than the diameter of said opening of the bearing plate. Also the anchorage assembly further comprises a removable locking system interposed between said anchor head and said bearing plate, the presence of the locking system preventing thereby the anchor head to enter said opening and said second tubular member outlet.. In some case the second part can be placed within a formwork intended to receive the concrete forming the concrete structure. Also, said anchorage assembly further comprises:

- a third part with the running portion of the tendon placed within a second tubular member able to receive a filler compound and within a channel, the outlet of said second tubular member being connected to the inlet of said first tubular member, the inlet of said second tubular member being connected to said channel, wherein said second tubular member and said channel are placed within the structure,
- an abutment plate forming the inlet of the first tubular member and a sealing block able to be placed within said first tubular member, adjacent to said abutment plate, wherein said strands passing through said sealing block and wherein said sealing block is able to seal the inner space of the first tubular member off from the inner space of the second tubular member to form a seal for said filler compound.

[0011] According to the invention, and notably thanks to the fit radial size of the anchor head and the removable locking system, the de-tensioning of the tendon can be implemented while the anchor head has entered within the first tubular member, after removal of the locking system.

Brief Description of the Drawings

[0012] The invention will be better understood with the aid of the description of an embodiment given by way of example and illustrated by the figures, in which:

Fig. 1 shows a schematic longitudinal view of an embodiment of the anchorage assembly in a first step, the upper part being a section and the lower part being outside view, when the strands have been installed in the channel and in the different tubular parts without any anchorage accessories,

Fig.2 shows the same view of the anchorage assembly of Fig.1, in a further step including injection of a filler compound in the third part,

Fig. 3 illustrates the same anchorage assembly after mounting of the locking device, with a schematic representation of jack that is applying a force to the tendon,

Fig.4 illustrates the same anchorage assembly as it would remain during the normal life of the structure with a cap protecting the protruding area of the tendon and a filler protecting the bare strands in the first tubular part and rigid filler in the second tubular part around the monostrand,

Fig. 5 schematically shows a first type of surveillance operation of the tendon, and

Fig.6 schematically shows another second type of surveillance operation of the tendon.

Detailed Description of possible embodiments of the Invention

[0013] In Fig.1 is shown a situation where the tendon 10 is mounted through an anchorage assembly 20 placed partially within a structure 42, and comprising in a linear arrangement a channel 43, a second tubular member 22, a first tubular member 24 and a bearing plate 26.

[0014] The second tubular member 22 is placed within the structure 42 at a distance from the front face 40 of the structure, in a direction orthogonal to the front face 40. The inner diameter of the second tubular member 22 allows the introduction of the tendon 10. At the outlet side, the inner diameter of the second tubular member 22 is D1.

[0015] In the present text, "outlet" means the extremity of any elongated element turned towards the outside of the front face 40 of the structure 42 or the structure 42 (on the left on the figures 1 to 6). In the same way "inlet" means the extremity of any elongated element turned opposite to the front face 40 or (on the right on the figures 1 to 6).

[0016] The first tubular member 24 extends the second tubular member 22 in a coaxial manner to the first tubular member 22, in the direction of the orthogonal to the front face 40. Such a first tubular member 24 is usually formed by a trumpet shape elongated member, named as a "trumpet". The inlet of the first tubular member 24 is connected in a water-sealed manner to the outlet of the second tubular member 22. The inner diameter of the first tubular member 24 also allows the introduction of the tendon 10. Generally the inner diameter of the first tubular member 24 is larger than the inner diameter of the second tubular member 22. In a specific manner, at least the inner diameter D2 of the first tubular member 24 at the inlet side (on the right on the figures 1 to 6) is larger than

the inner diameter of the second tubular member 22 D1 at the outlet side, namely D2 > D1.

[0017] The inner diameter D3 of the first tubular member 24 at the outlet side (on the left on the figures 1 to 6) is usually equal to or larger than the inner diameter of the first tubular member 24 at the outlet side D2, namely D3 > or = D2

[0018] The bearing plate 26 is placed at the front face 40 of the structure 42, with a large opening 27 adjacent to the outlet of the first tubular member 24 (see Fig.1), having an inner diameter D4 close to D3.

[0019] During this first step shown on Fig.1, in addition an injection pipe 23 is mounted so as to have fluid communication between the inner space of the second tubular member 22 and the outside of the formwork forming the front face 40 of the structure 42. In a preferred manner, and as shown in Fig .1 and 2, to water seal the connection between the second tubular member 22 and the first tubular member 24, a temporary sealing block 28 having an outer diameter close to D2 but slightly less, is threaded from outside the anchorage assembly 20, into the bearing plate 26 and the first tubular member 24 up to the inlet of the first tubular member 22 onto an abutment plate 41 with an opening. Such a temporary sealing block 28 forms a thick plate having as much holes as strands 12 and is first placed with the tendon passing through, each strand 12 in a corresponding hole of said temporary sealing block 28, before engagement of the temporary sealing block 28 through the opening 27 of the bearing plate 26. The sealing block 28 is made of a sealing pad locked between a pressing pad and a pressing plate. WO2011116828 presents a possible embodiment for such a sealing block 28.

[0020] In this shown embodiment, the tendon 10 is composed of one or a plurality of sheathed and greased strands 12 with sheath 14 within the structure 42 up to the outlet face defined by the abutment plate 41. Namely, the strand(s) is (are) individually wrapped in a outer (Plastic) sheath 14 with interposition of corrosion preventive compound such as grease or wax, which means the metallic strand can slide with respect to the sheath forming the envelope 14 of each strand 12, the corrosion preventive compound forming also a lubricant. In such a tendon 10, there might be up to 127 strands 12 as currently design meaning that there is no limit in the strand number. The preferred thickness of the sheaths 14 is between 1 and 2 mm, a value over 1.5 mm is recommended when the tendon length is over 100 m long of the installation condition are difficult with the tendon deviation having high deviation (over 100 °).

[0021] The invention is not limited to such preferred type of strands 12 and can apply also to other types of strands, such as bare metallic strands (not illustrated) : in such a case, the second tubular member 22 is not to be filed in with cement matrix but with a non-hardening corrosion preventive compound such as wax or grease.

[0022] According to the preferred embodiment with strands 12 that are sheathed and greased, during the second step shown in Fig.2, the second tubular member 22 is filled with a hardening filler by injection of a hardening matrix through the injection pipe 23 into the second tubular member 22 so as to fill in all the interstices between the outer sheath 14 and the second tubular member 22, and between all pairs of adjacent sheathed strands 12. By the setting or hardening of the cement matrix 23a, each strand 12 is locked in a direction perpendicular to the front face of the anchorage 40 by its sheath 14 to the second tubular member 22. After the hardening of the cement matrix, the temporary sealing block 28 is un-tight and removed.

[0023] In order to complete the anchorage assembly 20 before stressing the tendon 10, as shown in Fig.3, an anchor head 30 and a removable locking system 32 are provided. The anchor head 30 is formed by a thick metallic block having as much holes as strands 12. According to an important feature, the anchor head 30 has an outside diameter D5 smaller than said opening (diameter D4) of the bearing plate 26 (see Fig. 3). Also, the outer end of the second tubular member 22 has a diameter D1 smaller than the outer diameter D5 of the anchor head 30. Also, the anchor head 30 has an outside diameter D5 smaller than said inner diameter D3 and D2 of the first tubular member 24 at the outlet side. These important features permit the entrance and sliding of the anchor head 30 within the bearing plate 26 and within the first tubular member 24 for de-stressing of the tendon 10.

[0024] In a first variant, the removable locking system 32 comprises at least one split shim; in Fig.1 two superposed split shims are used, having both an outer diameter larger than the diameter D4 of the opening of the bearing plate 26.

in a second (not shown) variant, the removable locking system 32 comprises a nut able to cooperate with a threaded portion of the outer face of the anchor head 30, with the outer diameter of the nut larger than the diameter D4 of the opening of the bearing plate 26.

In both cases, the removable locking system 32 allows for the reversible locking of the anchor head 30 outside the first tubular member 24 (for tensioning or re-tensioning the tendon 10) and, by unlocking, letting the anchor head 30 circulating in the first tubular member 24 (for de-tensioning the tendon 10) without removing the conical wedges 34.

[0025] Also, according to another important feature of the preferred embodiment, strands 12 are sheathed along their running part up to and within said second tubular member 22, said sheath 14 being thereby able to be embedded within said filler compound (notably locked within cement matrix 23a) in said second tubular member 22, and the sheaths 14 of the said strands 12 are removed in their intermediate and end portions (unsheathed length 12a) extending within said first tubular member 24 up to their extremity outside the front face 40 (or structure 42).This unsheathing operation is generally carried out just before the third step of stressing described below so that the strands are protected from the corrosion until

they are unsheathed and finally stressed.

[0026] Also, during the third step shown in Fig.3, after removing the sheath 14, the intermediate and end portions of said strands 12, and further mounting of the removable locking system 32 and of the anchor head 30, the tendon 10 is stressed. To that end, a stressing jack 50 is mounted and activated between the outer face of the anchor head 30 and the extremity of each individual strand 12 (Fig.3). After this stressing operation, blocking means such as (split) conical wedges 34 are entered into the holes of the anchor head 30, around each strand 12 to fix the stressed state of each strand 12.

[0027] After, the length in excess of the end portion of the strands 12, namely the length extending outside the anchor head 30, beyond a small length adjacent to the anchor head 30, is cut to a shorther length. Next, in the fourth step shown in Fig.4, a cap 36 is mounted in a watertight manner onto the bearing plate 26, for accommodating said removable locking element 32, said anchor head 30 and said end portion of the tendon 10 (the extremity of the strands 12 of the end portion being unsheathed). Said cap 36 is able to receive a removable protective product, namely a non-hardening corrosion preventive compound 38, such as wax or grease.

[0028] The anchorage assembly 20 of the present invention defines, as shown on Fig.4, a first part C, a second part B and a third part A. In the third part A of the anchorage assembly 20 the strands 12 are locked by their sheath 14 with respect to the second tubular member 22, by means of the cement matrix 23a, with the possibility for the individual metallic strands to slide with respect to the corresponding sheath 14. In the second part B, the intermediate unsheathed portion 12a of the strands 12 is protected against corrosion by the corrosion preventive compound 38 contained in the second tubular element 24 . The third part A and the second part B are located within the structure 42. In the first part C, which is disposed outside the front face 40 or the structure 42, the end portion of the unsheathed strands 12a is placed in the removable locking system 32, the anchor head 30 and in the cap 36.

[0029] In an alternative embodiment which is not part of the invention, the third part A of the anchorage assembly is omitted, namely the second tubular member 22 and the channel 43 are not present in the anchorage assembly 20. In that situation, said sealing block 28 and said abutment plate 41 are placed during concreting and said strands 12 are able to be directly embedded in the structure concrete 42 by their sheath 14 while allowing the metallic part of the strand to move longitudinally in the structure. In that situation, the strands remain locked laterally by the concrete matrix. Said strands could be monostrands.

[0030] In the described embodiments, as shown in Fig.4, the strands 12 are in the normal service situation, namely after stressing and filling of the second tubular element 24 and of the cap 36 with grease or any other non-hardening corrosion preventive compound 38 which is in contact with the bare segment 12a of the strands 12. As can see from Fig.4, this corrosion preventive compound 38 is also present in the opening 27 of the bearing plate 26 around the tendon 10, namely between all pairs of adjacent bare strands 12a, between the periphery of the opening 27 and the periphery of the tendon 10, in the opening of the removable locking system 32 and in the perforations of the anchor head 30 so as to wrap all the unsheathed portions 12a of the strands 12.

[0031] Preferably, said first part C further comprises immobilisation pieces placed individually around a length of said unsheathed strands 12a at least partially disposed within the outlet of said perforations of the anchor head 30. In the shown embodiment, said immobilisation pieces are split wedges 34.

[0032] If the anchorage assembly 20 is implemented in a concrete structure 42, the pouring and setting of the concrete in the formwork (located at the front face 40) is made initially after the installation of the first and second tubular members 22, 24, the abutment plate 41, the bearing 26 and the injection pipe 23. These elements including the tendon 10 and the compound 23a can therefore be implanted as from the situation shown in fig.2 at any time, namely several weeks, months or years later: with its strands 12 and their sheath 14 the tendon 10 is protected against corrosion all along its length before removing the sheaths 14 and further stressing.

[0033] Also, the present invention concerns a method of lifting-off of the tendon 10 equipped with the previously described anchorage assembly 20, in a structure 42, and also a method for the surveillance of the tendon in such a structure 42. The structure 42 can be a structure made of concrete or steel or with both materials.

[0034] As shown on Fig.5, such a method of lifting-off a tendon 10 in a structure 42 comprises a lift-off step of at least one tendon 10 with the following sub-steps:

- providing with a tension measuring device (lift-off device 60)
- placing said tension measuring device between said anchor head 30 and said bearing plate 26 of the tendon to be lifted-off, and
- measuring the stress level of the tendon 10.

Preferably, the outer radial face of the anchor head is threaded so as to cooperate with a complementary thread of the tension measuring device As an initial step, if the cap 36 cover the outer part of the block or anchor head 30 (as shown in Fig. 4) then it is beforehand removed to give an access to the anchor head 30.
Therefore, a direct lift-off of the tendon 10 is possible without requiring a specific coupler on the strands 12.

[0035] On Fig.6, is shown a method of surveillance of a tendon 10 in a structure, such as a concrete structure, comprising a strand sampling step with the following sub-steps:

- un-mounting of said locking system 32 so as to let

the anchor head 30 entering onto said second tubular member 22, thereby de-tensioning said tendon 10 (preferably by using a jack 62 keeping a grip onto the strand 12a or the anchor head 30 as not detailed here),

- Removing the conical part 34 and inspecting at least one strand 12 from said tendon 10.

During such an inspection, the metallic part of said inspected strand 12 can be removed from its sheath 14 and replaced.

[0036] Preferably, said strand sampling step comprises further the following sub-steps (not shown):,

- placing said anchor head 30 outside said second tubular member 22 (notably with the previously mentioned jack 62),
- locking said locking system 32 between said anchor head 30 and said bearing plate 26, and
- providing a stressing device between the end portion of the tendon 10 and the bearing plate 26 (notably with the previously mentioned jack 62)
- re-tensioning said tendon (notably with the previously mentioned jack 62).

[0037] Then, as shown in Fig 6, by letting the anchor head 30 entering the first tubular element 24, and moving up to the inlet end (on the right in Figs 1 to 6) of the first tubular element 24, the length of the first tubular element 24 serves as strand length available for de-tensioning the tendon 10.

[0038] Therefore, in normal service, as shown on Fig.4, the length of the first part C of the anchorage assembly located outside the outside face 40/ and the structure 42 is greatly reduced, which is advantageous in terms of damage risks, notably limited exposure to fire.

Reference signs used in figures

[0039]

10	Tendon
12	Strand
12a	Unsheathed length of the strand
14	Sheath of the Strand in plastic material (HDPE, PP, RPE)
20	Anchorage assembly
22	Second tubular member
23	Injection pipe
23a	Cement matrix
24	First tubular member
26	Bearing plate
27	Opening
28	Temporary sealing block
30	Anchor head
32	Locking system
34	Wedge
36	Cap
38	Non-hardening corrosion preventive compound
40	Front face of the structure
41	Abutment plate
42	Structure
43	Channel
50	Stressing jack
60	Lift-off device
62	Jack

Claims

1. Anchorage assembly (20) for a structure (42), comprising a tendon (10) made of strands (12), the anchorage assembly (20) defining at least two parts:

- a first part (C) with the strands (12) of the end portion of the tendon (10) passed through individual perforations of an anchor head (30),
- a second part (B) with an intermediate portion of the tendon (10) placed within a first tubular member (24) able to receive a removable protective product (38),

wherein said second part (B) is suitable to be placed within a structure (42), with the strands (12) having said end portion passed through on one hand an opening (27) formed in a bearing plate (26) disposed in an adjacent position to the first tubular member (24) outlet, with said first tubular member (24) outlet and said opening (27) connected to each other, and on the other hand said individual perforations of said anchor head (30) which is placed outside of the front face (40) of the structure (42),
wherein the anchor head (30) has an outside diameter (D5) smaller than the diameter (D4) of said opening (27) of the bearing plate (26),
wherein it further comprises a removable locking system (32) interposed between said anchor head (30) and said bearing plate (26), the presence of the locking system (32) preventing thereby the anchor head (30) to enter said opening (27) and said first tubular member (24) outlet,
characterized in that said bearing plate (26) is suitable to be disposed within the structure (42),
and **characterized in that** said anchorage assembly further comprises:

- a third part (A) with the running portion of the tendon (10) placed within a second tubular member (22) able to receive a filler compound (23a) and within a channel (43), the outlet of said second tubular member (22) being connected to the inlet of said first tubular member (24), the inlet of said second tubular member (22) being connected to said channel (43), wherein said second tubular member (22) and said channel are suitable to be placed within the structure

(42),
- an abutment plate (41) forming the inlet of the first tubular member (24) and a sealing block (28) able to be placed within said first tubular member (24), adjacent to said abutment plate (41), wherein said strands (12) passing through said sealing block (28) and wherein said sealing block (28) is able to seal the inner space of the first tubular member (24) off from the inner space of the second tubular member (22) to form a seal for said filler compound (23a).

2. Anchorage assembly (20) according to any of claim 1,
wherein said locking system (32) comprises either at least one split shim or a nut able to cooperate with a threaded portion of the outer face of the anchor head (30).

3. Anchorage assembly (20) according to any of claims 1 to 2, wherein said tendon (10) is made of sheathed and greased strands (12).

4. Anchorage assembly (20) according to claim 1, wherein said strands (12) are sheathed along their running part up to and within said second tubular member (22), said sheath (14) being thereby able to be embedded within said filler compound (23a) in said channel (43) and in said second tubular member (22), and wherein said strands (12) are unsheathed in their intermediate and end portions (12a) extending within said first tubular member (24) up to their extremity in said first part.

5. Anchorage assembly (20) according to any claims 1 to 4, wherein said filler compound (23a) is cement matrix, said sheathed strand (12) being thereby able to be embedded within said cement matrix.

6. Anchorage assembly (20) according to any of claims 1 to 5, wherein said sealing block (28) and said abutment plate (41) are placed during concreting and wherein said strands (12) are able to be directly embedded in the structure concrete.

7. Anchorage assembly (20) according to any of claims 1 to 6, wherein the outlet end of the first tubular member (24) has an inner diameter (D2) and (D3) bigger than the outer diameter (D5) of the anchor head (30).

8. Concrete structure prestressed by means of a plurality of tendons (10) made of strands (12), the main portion of said tendons (10) being embedded individually in the set concrete forming the main body of the structure, said set concrete forming a block (42) resulting from the pouring and setting of said concrete in a formwork which is removed after setting of said concrete, comprising for each tendon (10) an anchorage assembly (20) defining at least two parts:

- a first part (C) with the strands (12) of the end portion of the tendon (10) passed through individual perforations of an anchor head (30),
- a second part (B) with an intermediate portion of the tendon (10) placed within a first tubular member (24) containing a removable protective product (38),

wherein said second part (B) is placed within said structure (42), with the strands (12) having said end portion passed through on one hand an opening (27) formed in a bearing plate (26) disposed at the outer face of said block in an adjacent position to the first tubular member (24) outlet, with said first tubular member (24) outlet and said opening (27) connected to each other, and on the other hand said individual perforations of said anchor head (30) which is placed outside said block (42),
wherein the anchor head (30) has an outside diameter (D5) smaller than the diameter (D4) of said opening (27) of the bearing plate (26), wherein it further comprises a removable locking system (32) interposed between said anchor head (30) and said bearing plate (26), the presence of the locking system (32) preventing thereby the anchor head (30) to enter said opening and said first tubular member (24) outlet,
characterized in that said anchorage assembly further comprises:

- a third part (A) with the running portion of the tendon (10) placed within a second tubular member (22) able to receive a filler compound (23a) and within a channel (43), the outlet of said second tubular member (22) being connected to the inlet of said first tubular member (24), the inlet of said second tubular member (22) being connected to said channel (43), wherein said second tubular member (22) and said channel are placed within the structure (42),
- an abutment plate (41) forming the inlet of the first tubular member (24) and a sealing block (28) able to be placed within said first tubular member (24), adjacent to said abutment plate (41), wherein said strands (12) passing through said sealing block (28) and wherein said sealing block (28) is able to seal the inner space of the first tubular member (24) off from the inner space of the second tubular member (22) to form a seal for said filler compound (23a).

9. Concrete structure according to claim 8, wherein said tendon (10) is made of sheathed and greased strands (12).

10. Concrete structure according to any of claims 8 to 9,

wherein said strands (12) are sheathed in a first portion extending along their running part up to and within said second tubular member (22), said sheath (14) being thereby able to be embedded within said filler compound (23a) in said channel (43) and in said second tubular member (22), and wherein said strands (12) are unsheathed in a second portion (12a) extending within said first tubular member (24) up to their extremity.

11. Concrete structure according to claim 10, wherein said filler compound (23a) is cement matrix, said sheath being thereby able to be embedded within said cement matrix in said channel (43) and second tubular member (22).

12. Concrete structure according to any of claims 8 to 11, wherein said locking system (32) comprises either at least one split shim or a nut able to cooperate with a threaded portion of the outer face of the anchor head (30).

13. Concrete structure according to any of claims 8 to 12wherein the outer end of the first tubular member (22) has an inner diameter (D3) and D2 higher than the outer diameter (D5) of the anchor head (30).

14. Concrete structure according to claim 8, wherein said sealing block (28) and said abutment plate (41) are placed during concreting and wherein said strands (12) are able to be directly embedded in the structure concrete.

15. Method of manufacture a concrete structure according to any of claims 8 to 14, comprising the following steps:

- building a structure (42) with said bearing plates (26) placed in said structure (42) at the front face (40) of the structure (42),
- connecting the outlet of said first tubular element (24) in a water tight manner to the opening (27) of said bearing plate (26),
- connecting the inlet of said first tubular element (24) in a water tight manner to the outlet of said second tubular element (22) with an abutment plate (41) forming the inlet of the first tubular member (24) and a sealing block (28) placed within said first tubular member (24), adjacent to said abutment plate (41), ,
- providing with a grouting pipe (23) coming out outside the front face (40) and linked to the second tubular element (22),
- unsheathing said strands (12) along their intermediate and end portions (12a),
- engaging a tendon (10) end portion through said second tubular element (22), said first tubular element (24) and said opening (27) with the end of said strands (12) placed beyond the outer face (40) of the structure (42),
- injecting some cement matrix through the grouting pipe (23) into the second tubular member (22) so as to have all the strands (12) embedded in said cement matrix along a segment of their running portion,
- after the hardening of said cement matrix, removing said sealing block (28),-
- engaging said locking system and said anchor head (30) around the extremity of said end portion of the tendon (10) in the direction of the outer face (40) of the structure (42),
- locking said locking system between said anchor head (30) and said bearing plate (26), and
- providing a stressing device (50) onto the end portion of the tendon (10) and stressing said tendon (10).

16. Method of manufacture a concrete structure according to claim 15, comprising further the following steps:,

- after stressing said tendon (10) putting away said stressing system,
- mounting a cap in a water-tight manner onto the bearing plate (26), said cap accommodating said removable locking element, said anchor head (30) and said end portion of the tendon (10), and
- injecting into said cap and into said second tubular member (24) said removable protective product (38).

Patentansprüche

1. Verankerungsbaugruppe (20) für eine Konstruktion (42), umfassend ein Spannkabel (10), das aus Litzen (12) hergestellt ist, wobei die Verankerungsbaugruppe (20) mindestens zwei Teile definiert:

- einen ersten Teil (C), wobei die Litzen (12) des Endabschnitts des Spannkabels (10) durch einzelne Perforationen eines Ankerkopfs (30) geführt werden,
- einen zweiten Teil (B), wobei ein Zwischenabschnitt des Spannkabels (10) in einem ersten röhrenförmigen Bauteil (24) positioniert ist, der ein entfernbares Schutzprodukt (38) aufnehmen kann,

wobei der zweite Teil (B) geeignet ist, in einer Konstruktion (42) positioniert zu werden, wobei die Litzen (12), die den Endabschnitt aufweisen, einerseits durch eine Öffnung (27), die in einer Lagerplatte (26) ausgebildet ist, welche in einer angrenzenden Position zum Ausgang des ersten röhrenförmigen Bau-

teils (24) angeordnet ist, wobei der Ausgang des ersten röhrenförmigen Bauteils (24) und die Öffnung (27) miteinander verbunden sind, und andererseits durch die einzelnen Perforationen des Ankerkopfs (30), der außerhalb der Vorderseite (40) der Konstruktion (42) positioniert ist, geführt werden,
wobei der Ankerkopf (30) einen Außendurchmesser (D5) aufweist, der kleiner ist als der Durchmesser (D4) der Öffnung (27) der Lagerplatte (26),
wobei er ferner ein entfernbares Verriegelungssystem (32) umfasst, das zwischen dem Ankerkopf (30) und der Lagerplatte (26) angeordnet ist, wobei das Vorhandensein des Verriegelungssystems (32) dadurch verhindert, dass der Ankerkopf (30) in die Öffnung (27) und in den Ausgang des ersten röhrenförmigen Bauteils (24) eindringt, **dadurch gekennzeichnet, dass** die Lagerplatte (26) geeignet ist, in der Konstruktion (42) angeordnet zu werden,
und **dadurch gekennzeichnet, dass** die Verankerungsbaugruppe ferner Folgendes umfasst:

- einen dritten Teil (A), wobei der laufende Abschnitt des Spannkabels (10) in einem zweiten röhrenförmigen Bauteil (22), das eine Füllmasse (23a) aufnehmen kann, und in einem Kanal (43) positioniert ist, wobei der Ausgang des zweiten röhrenförmigen Bauteils (22) mit dem Eingang des ersten röhrenförmigen Bauteils (24) verbunden ist, wobei der Eingang des zweiten röhrenförmigen Bauteils (22) mit dem Kanal (43) verbunden ist, wobei das zweite röhrenförmige Bauteil (22) und der Kanal geeignet sind, in der Konstruktion (42) positioniert zu werden,
- eine Gegenplatte (41), die den Eingang des ersten röhrenförmigen Bauteils (24) ausbildet, und einen Dichtblock (28), der in dem ersten röhrenförmigen Bauteil (24) angrenzend an die Gegenplatte (41) positionierbar ist, wobei die Litzen (12) durch den Dichtblock (28) verlaufen und wobei der Dichtblock (28) den Innenraum des ersten röhrenförmigen Bauteils (24) von dem Innenraum des zweiten röhrenförmigen Bauteils (22) abdichten kann, um eine Abdichtung für die Füllmasse (23a) auszubilden.

2. Verankerungsbaugruppe (20) nach Anspruch 1, wobei das Verriegelungssystem (32) entweder mindestens eine geteilte Unterlegscheibe oder eine Mutter umfasst, die mit einem Gewindeabschnitt der Außenseite des Ankerkopfs (30) zusammenwirken können.

3. Verankerungsbaugruppe (20) nach einem der Ansprüche 1 bis 2, wobei das Spannkabel (10) aus umhüllten und gefetteten Litzen (12) hergestellt ist.

4. Verankerungsbaugruppe (20) nach Anspruch 1, wobei die Litzen (12) entlang ihres laufenden Teils bis zum und innerhalb des zweiten röhrenförmigen Bauteils (22) umhüllt sind, wobei die Hülle (14) dadurch in die Füllmasse (23a) in dem Kanal (43) und in dem zweiten röhrenförmigen Bauteil (22) eingebettet werden kann und wobei die Litzen (12) in ihren Zwischen- und Endabschnitten (12a), die sich in dem ersten röhrenförmigen Bauteil (24) bis zu ihrem Endpunkt im ersten Teil erstreckt, nicht umhüllt sind.

5. Verankerungsbaugruppe (20) nach einem der Ansprüche 1 bis 4, wobei die Füllmasse (23a) eine Zementmatrix ist und die umhüllte Litze (12) dadurch in die Zementmatrix eingebettet werden kann.

6. Verankerungsbaugruppe (20) nach einem der Ansprüche 1 bis 5, wobei der Dichtblock (28) und die Gegenplatte (41) während des Betonierens positioniert werden und wobei die Litzen (12) unmittelbar in den Beton der Konstruktion eingebettet werden können.

7. Verankerungsbaugruppe (20) nach einem der Ansprüche 1 bis 6, wobei das Ausgangsende des ersten röhrenförmigen Bauteils (24) einen Innendurchmesser (D2) und (D3) aufweist, der größer ist als der Außendurchmesser (D5) des Ankerkopfs (30).

8. Betonkonstruktion, die mittels mehrerer aus Litzen (12) hergestellter Spannkabel (10) vorgespannt ist, wobei der Hauptabschnitt der Spannkabel (10) einzeln in dem abgebundenen Beton, der den Hauptkörper der Konstruktion ausbildet, eingebettet ist, wobei der abgebundene Beton einen Block (42) ausbildet, der sich aus dem Gießen und dem Abbinden des Betons in einer Schalung ergibt, die nach dem Abbinden des Betons entfernt wird, die für jedes Spannkabel (10) eine Verankerungsbaugruppe (20), die mindestens zwei Teile definiert, umfasst:

- einen ersten Teil (C), wobei die Litzen (12) des Endabschnitts des Spannkabels (10) durch einzelne Perforationen eines Ankerkopfs (30) geführt werden,
- einen zweiten Teil (B), wobei ein Zwischenabschnitt des Spannkabels (10) in einem ersten röhrenförmigen Bauteil (24) positioniert ist, das ein entfernbares Schutzprodukt (38) enthält,

wobei der zweite Teil (B) in der Konstruktion (42) positioniert ist, wobei die Litzen (12), die den Endabschnitt aufweisen, einerseits durch eine Öffnung (27), die in einer Lagerplatte (26) ausgebildet ist, welche an der Außenseite des Blocks in einer angrenzenden Position zum Ausgang des ersten röhrenförmigen Bauteils (24) angeordnet ist, wobei der Ausgang des ersten röhrenförmigen Bauteils (24) und die Öffnung (27) miteinander verbunden sind, und andererseits durch die einzelnen Perforationen des

Ankerkopfs (30), der außerhalb des Blocks (42) angeordnet ist, geführt werden, wobei der Ankerkopf (30) einen Außendurchmesser (D5) aufweist, der kleiner ist als der Durchmesser (D4) der Öffnung (27) der Lagerplatte (26),
wobei er ferner ein entfernbares Verriegelungssystem (32) umfasst, das zwischen den Ankerkopf (30) und die Lagerplatte (26) angeordnet ist, wobei das Vorhandensein des Verriegelungssystems (32) dadurch verhindert, dass der Ankerkopf (30) in die Öffnung und in den Ausgang des ersten röhrenförmigen Bauteils (24) eindringt,
dadurch gekennzeichnet, dass die Verankerungsbaugruppe ferner Folgendes umfasst:

- einen dritten Teil (A), wobei der laufende Abschnitt des Spannkabels (10) in einem zweiten röhrenförmigen Bauteil (22), das eine Füllmasse (23a) aufnehmen kann, und in einem Kanal (43) positioniert ist, der Ausgang des zweiten röhrenförmigen Bauteils (22) mit dem Eingang des ersten röhrenförmigen Bauteils (24) verbunden ist, der Eingang des zweiten röhrenförmigen Bauteils (22) mit dem Kanal (43) verbunden ist, wobei das zweite röhrenförmige Bauteil (22) und der Kanal in der Konstruktion (42) positioniert sind,
- eine Gegenplatte (41), die den Eingang des ersten röhrenförmigen Bauteils (24) ausbildet, und einen Dichtblock (28), der in dem ersten röhrenförmigen Bauteil (24) angrenzend an der Gegenplatte (41) positionierbar ist, wobei die Litzen (12) durch den Dichtblock (28) verlaufen und wobei der Dichtblock (28) den Innenraum des ersten röhrenförmigen Bauteils (24) von dem Innenraum des zweiten röhrenförmigen Bauteils (22) abdichten kann, um eine Abdichtung für die Füllmasse (23a) auszubilden.

9. Betonkonstruktion nach Anspruch 8, wobei das Spannkabel (10) aus umhüllten und gefetteten Litzen (12) hergestellt ist.

10. Betonkonstruktion nach einem der Ansprüche 8 bis 9, wobei die Litzen (12) in einem ersten Abschnitt, der sich entlang ihres laufenden Teils bis zum und innerhalb des zweiten röhrenförmigen Bauteils (22) erstreckt, umhüllt sind, wobei die Hülle (14) dadurch in die Füllmasse (23a) in dem Kanal (43) und in dem zweiten röhrenförmigen Bauteil (22) eingebettet werden kann und wobei die Litzen (12) in einem zweiten Abschnitt (12a), der sich in dem ersten röhrenförmigen Bauteil (24) bis zu ihrem Endpunkt erstreckt, nicht umhüllt sind.

11. Betonkonstruktion nach Anspruch 10, wobei die Füllmasse (23a) Zementmatrix ist, wobei die Hülle dadurch in die Zementmatrix in dem Kanal (43) und dem zweiten röhrenförmigen Bauteil (22) eingebettet werden kann.

12. Betonkonstruktion nach einem der Ansprüche 8 bis 11, wobei das Verriegelungssystem (32) entweder mindestens eine geteilte Unterlegscheibe oder eine Mutter umfasst, die mit einem Gewindeabschnitt der Außenseite des Ankerkopfs (30) zusammenwirken kann.

13. Betonkonstruktion nach einem der Ansprüche 8 bis 12, wobei das äußere Ende des ersten röhrenförmigen Bauteils (22) einen Innendurchmesser (D3) und (D2) aufweist, der größer ist als der Außendurchmesser (D5) des Ankerkopfs (30) .

14. Betonkonstruktion nach Anspruch 8, wobei der Dichtblock (28) und die Gegenplatte (41) während des Betonierens positioniert werden und wobei die Litzen (12) unmittelbar in den Beton der Konstruktion eingebettet werden können.

15. Verfahren zur Herstellung einer Betonkonstruktion nach einem der Ansprüche 8 bis 14, umfassend die folgenden Schritte:

- Bauen einer Konstruktion (42), wobei die Lagerplatten (26) in der Konstruktion (42) an der Vorderseite (40) der Konstruktion (42) positioniert sind,
- wasserdichtes Verbinden des Ausgangs des ersten röhrenförmigen Elements (24) mit der Öffnung (27) der Lagerplatte (26),
- wasserdichtes Verbinden des Eingangs des ersten röhrenförmigen Elements (24) mit dem Ausgang des zweiten röhrenförmigen Elements (22) mit einer Gegenplatte (41), welche den Eingang des ersten röhrenförmigen Bauteils (24) ausbildet, und einem Dichtblock (28), der in dem ersten röhrenförmigen Bauteil (24) angrenzend an die Gegenplatte (41) positioniert ist,
- Bereitstellen mit einem Injektionsrohr (23), das aus der Vorderseite (40) heraustritt und mit dem zweiten röhrenförmigen Element (22) gekoppelt ist,
- Beseitigen der Hüllen der Litzen (12) entlang ihrer Zwischen- und Endabschnitte (12a),
- in Eingriff bringen eines Endabschnitts eines Spannkabels (10) durch das zweite röhrenförmige Element (22), wobei das erste röhrenförmige Element (24) und die Öffnung (27) mit dem Ende der Litzen (12) über die Außenseite (40) der Konstruktion (42) hinweg positioniert sind,
- Injizieren von etwas Zementmatrix durch das Injektionsrohr (23) in das zweite röhrenförmige Bauteil (22), sodass alle Litzen (12) in der Zementmatrix entlang eines Segments ihres laufenden Abschnitts eingebettet sind,

- nach dem Aushärten der Zementmatrix, Entfernen des Dichtblocks (28),
- in Eingriff bringen des Verriegelungssystems und des Ankerkopfes (30) um den Endpunkt des Endabschnitts des Spannkabels (10) in Richtung der Außenseite (40) der Konstruktion (42),
- Verriegeln des Verriegelungssystems zwischen dem Ankerkopf (30) und der Lagerplatte (26) und
- Bereitstellen einer Spannvorrichtung (50) auf dem Endabschnitt des Spannkabels (10) und Spannen des Spannkabels (10).

16. Verfahren zur Herstellung einer Betonkonstruktion nach Anspruch 15, das ferner die folgenden Schritte umfasst:

- nach Spannen des Spannkabels (10), Wegräumen des Spannsystems,
- wasserdichtes Montieren einer Abdeckkappe auf der Lagerplatte (26), wobei die Abdeckkappe das entfernbare Verriegelungselement, den Ankerkopf (30) und den Endabschnitt des Spannkabels (10) beherbergt, und
- Injizieren des entfernbaren Schutzprodukts (38) in die Abdeckkappe und in das zweite röhrenförmige Bauteil (24).

Revendications

1. Ensemble d'ancrage (20) pour une structure (42), comprenant un tendon (10) constitué de torons (12), l'ensemble d'ancrage (20) définissant au moins deux parties :

- une première partie (C) avec les torons (12) de la partie d'extrémité du tendon (10) traversant des perforations individuelles d'une tête d'ancrage (30),
- une deuxième partie (B) avec une partie intermédiaire du tendon (10) placée à l'intérieur d'un premier élément tubulaire (24) capable de recevoir un produit protecteur amovible (38),

dans lequel ladite seconde partie (B) est apte à être placée à l'intérieur d'une structure (42), les torons (12) faisant passer ladite partie d'extrémité d'une part à travers une ouverture (27) formée dans une plaque de support (26) disposée dans une position adjacente à la sortie du premier élément tubulaire (24), avec ladite sortie du premier élément tubulaire (24) et ladite ouverture (27) reliées entre elles, et d'autre part dans lesdites perforations individuelles de ladite tête d'ancrage (30) qui est placée à l'extérieur de la face avant (40) de la structure (42),
dans lequel la tête d'ancrage (30) a un diamètre extérieur (D5) inférieur au diamètre (D4) de ladite ouverture (27) de la plaque de support (26), dans lequel il comprend en outre un système de verrouillage amovible (32) interposé entre ladite tête d'ancrage (30) et ladite plaque de support (26), la présence du système de verrouillage (32) empêchant ainsi la tête d'ancrage (30) d'entrer dans ladite ouverture (27) et ladite sortie du premier élément tubulaire (24), **caractérisé en ce que** ladite plaque de support (26) est apte à être disposée à l'intérieur de la structure (42),
et **caractérisé en ce que** ledit ensemble d'ancrage comprend en outre :

- une troisième partie (A) avec la partie courante du tendon (10) placée à l'intérieur d'un second élément tubulaire (22) capable de recevoir un composé de remplissage (23a) et à l'intérieur d'un canal (43), la sortie dudit second élément tubulaire (22) étant reliée à l'entrée dudit premier élément tubulaire (24), l'entrée dudit second élément tubulaire (22) étant reliée audit canal (43), dans lequel ledit second élément tubulaire (22) et ledit canal sont aptes à être placés dans la structure (42),
- une plaque de butée (41) formant l'entrée du premier élément tubulaire (24) et un bloc d'étanchéité (28) pouvant être placé à l'intérieur dudit premier élément tubulaire (24), adjacent à ladite plaque de butée (41), dans lequel lesdits torons (12) traversant ledit bloc d'étanchéité (28) et dans lequel ledit bloc d'étanchéité (28) est capable de rendre étanche l'espace intérieur du premier élément tubulaire (24) de l'espace intérieur du second élément tubulaire (22) pour former un joint d'étanchéité pour ledit composé de remplissage (23a).

2. Ensemble d'ancrage (20) selon l'une quelconque de la revendication 1, dans lequel ledit système de verrouillage (32) comprend soit au moins une cale fendue soit un écrou capable de coopérer avec une partie filetée de la face extérieure de la tête d'ancrage (30).

3. Ensemble d'ancrage (20) selon l'une quelconque des revendications 1 à 2, dans lequel ledit tendon (10) est constitué de torons gainés et graissés (12).

4. Ensemble d'ancrage (20) selon la revendication 1, dans lequel lesdits torons (12) sont gainés le long de leur partie courante jusqu'au et dans ledit second élément tubulaire (22), ladite gaine (14) pouvant ainsi être noyée dans ledit composé de remplissage (23a) dans ledit canal (43) et dans ledit second élément tubulaire (22), et dans lequel lesdits torons (12) sont non gainés dans leurs parties intermédiaire et d'extrémité (12a) qui se prolonge dans ledit premier élément tubulaire (24) jusqu'à leur extrémité dans

ladite première partie.

5. Ensemble d'ancrage (20) selon l'une quelconque des revendications 1 à 4, dans lequel ledit composé de remplissage (23a) est une matrice de ciment, ledit toron gainé (12) pouvant ainsi être noyé dans ladite matrice de ciment.

6. Ensemble d'ancrage (20) selon l'une quelconque des revendications 1 à 5, dans lequel ledit bloc d'étanchéité (28) et ladite plaque de butée (41) sont placés pendant le bétonnage et dans lequel lesdits torons (12) peuvent être directement noyés dans le béton de la structure.

7. Ensemble d'ancrage (20) selon l'une quelconque des revendications 1 à 6, dans lequel l'extrémité de sortie du premier élément tubulaire (24) a un diamètre intérieur (D2) et (D3) supérieur au diamètre extérieur (D5) de la tête d'ancrage (30).

8. Structure en béton précontrainte au moyen d'une pluralité de tendons (10) constitués de torons (12), la partie principale desdits tendons (10) étant noyée individuellement dans le béton durci formant le corps principal de la structure, ledit béton durci formant un bloc (42) résultant du coulage et de la prise dudit béton dans un coffrage qui est retiré après prise dudit béton, comprenant pour chaque tendon (10) un assemblage d'ancrage (20) définissant au moins deux parties :

- une première partie (C) avec les torons (12) de la partie d'extrémité du tendon (10) traversant des perforations individuelles d'une tête d'ancrage (30),
- une deuxième partie (B) avec une partie intermédiaire du tendon (10) placée dans un premier élément tubulaire (24) contenant un produit protecteur amovible (38),

dans laquelle ladite seconde partie (B) est placée à l'intérieur de ladite structure (42), les torons (12) ayant ladite partie d'extrémité passée à travers d'une part une ouverture (27) formée dans une plaque de support (26) disposée à la face extérieure dudit bloc dans une position adjacente à la sortie du premier élément tubulaire (24), ladite sortie du premier élément tubulaire (24) et ladite ouverture (27) étant reliées entre elles et d'autre part lesdites perforations individuelles de ladite tête d'ancrage (30) qui est placée en dehors dudit bloc (42),
dans laquelle la tête d'ancrage (30) a un diamètre extérieur (D5) inférieur au diamètre (D4) de ladite ouverture (27) de la plaque de support (26),
dans laquelle il comprend en outre un système de verrouillage amovible (32) interposé entre ladite tête d'ancrage (30) et ladite plaque de support (26), la présence du système de verrouillage (32) empêchant ainsi la tête d'ancrage (30) d'entrer dans ladite ouverture et dans ladite sortie du premier élément tubulaire (24),
caractérisé en ce que ledit ensemble d'ancrage comprend en outre :

- une troisième partie (A) avec la partie courante du tendon (10) placée à l'intérieur d'un second élément tubulaire (22) capable de recevoir un composé de remplissage (23a) et à l'intérieur un canal (43), la sortie dudit second élément tubulaire (22) étant reliée à l'entrée dudit premier élément tubulaire (24), l'entrée dudit second élément tubulaire (22) étant reliée audit canal (43), dans laquelle ledit second élément tubulaire (22) et ledit canal sont placés dans la structure (42),
- une plaque de butée (41) formant l'entrée du premier élément tubulaire (24) et un bloc d'étanchéité (28) pouvant être placé à l'intérieur dudit premier élément tubulaire (24), adjacent à ladite plaque de butée (41), dans lequel lesdits torons (12) traversant ledit bloc d'étanchéité (28) et dans lequel ledit bloc d'étanchéité (28) est capable de rendre étanche l'espace intérieur du premier élément tubulaire (24) de l'espace intérieur du second élément tubulaire (22) pour former un joint d'étanchéité pour ledit composé de remplissage (23a).

9. Structure en béton selon la revendication 8, dans laquelle ledit tendon (10) est constitué de torons gainés et graissés (12).

10. Structure en béton selon l'une quelconque des revendications 8 à 9, dans laquelle lesdits torons (12) sont gainés dans une première partie s'étendant le long de leur partie courante jusqu'au et dans ledit second élément tubulaire (22), ladite gaine (14) pouvant ainsi être noyée dans ledit composé de remplissage (23a) dans ledit canal (43) et dans ledit second élément tubulaire (22), et dans laquelle lesdits torons (12) sont non gainés dans une seconde partie (12a) s'étendant dans ledit premier élément tubulaire (24) jusqu'à leur extrémité.

11. Structure en béton selon la revendication 10, dans laquelle ledit composé de remplissage (23a) est une matrice de ciment, ladite gaine pouvant ainsi être noyée dans ladite matrice de ciment dans ledit canal (43) et dans ledit second élément tubulaire (22).

12. Structure en béton selon l'une quelconque des revendications 8 à 11, dans laquelle ledit système de verrouillage (32) comprend soit au moins une cale fendue, soit un écrou capable de coopérer avec une partie filetée de la face extérieure de la tête de fixa-

tion (30).

13. Structure en béton selon l'une quelconque des revendications 8 à 12dans laquelle l'extrémité extérieure du premier élément tubulaire (22) a un diamètre intérieur (D3) et D2 supérieur au diamètre extérieur (D5) de la tête de fixation (30).

14. Structure en béton selon la revendication 8, dans laquelle ledit bloc d'étanchéité (28) et ladite plaque de butée (41) sont placés pendant le bétonnage et dans laquelle lesdits torons (12) peuvent être directement noyés dans le béton de la structure.

15. Procédé de fabrication d'une structure en béton selon l'une quelconque des revendications 8 à 14, comprenant les étapes suivantes:

- la construction d'une structure (42) avec lesdites plaques d'appui (26) placées dans ladite structure (42) sur la face avant (40) de la structure (42),
- relier la sortie dudit premier élément tubulaire (24) de manière étanche à l'eau à l'ouverture (27) de ladite plaque de support (26),
- relier l'entrée dudit premier élément tubulaire (24) de manière étanche à l'eau à la sortie dudit deuxième élément tubulaire (22) avec une plaque de butée (41) formant l'entrée du premier élément tubulaire (24) et un bloc d'étanchéité (28) placé dans ledit premier élément tubulaire (24), adjacent à ladite plaque de butée (41), ,
- fournir un tuyau d'injection (23) sortant à l'extérieur de la face avant (40) et relié au deuxième élément tubulaire (22),
- retirer la gaine desdits torons (12) le long de leurs parties intermédiaire et terminale (12a),
- engager une partie d'extrémité de tendon (10) à travers ledit deuxième élément tubulaire (22), ledit premier élément tubulaire (24) et ladite ouverture (27) avec l'extrémité desdits torons (12) placée au-delà de la face externe (40) de la structure (42),
- injecter une matrice de ciment à travers le tuyau d'injection (23) dans le deuxième élément tubulaire (22) de manière à ce que tous les torons (12) soient noyés dans ladite matrice de ciment le long d'un segment de leur partie courante,
- après le durcissement de ladite matrice de ciment, enlever ledit bloc d'étanchéité (28),-
- engager ledit système de verrouillage et ladite tête d'ancrage (30) autour de l'extrémité de ladite partie d'extrémité du tendon (10) dans la direction de la face externe (40) de la structure (42),
- verrouiller ledit système de verrouillage entre ladite tête d'ancrage (30) et ladite plaque de support (26), et
- fournir un dispositif de mise en contrainte (50) sur la partie d'extrémité du tendon (10) et mettre en contrainte ledit tendon (10).

16. Procédé de fabrication d'une structure en béton selon la revendication 15, comprenant en outre les étapes suivantes :,

- après avoir mis en contrainte ledit tendon (10) retirer ledit système de mise en contrainte,
- monter de manière étanche un capuchon sur la plaque de support (26), ledit capuchon recevant ledit élément de verrouillage amovible, ladite tête d'ancrage (30) et ladite partie d'extrémité du tendon (10), et
- injecter dans ledit capuchon et dans ledit second élément tubulaire (24) ledit produit protecteur amovible (38).

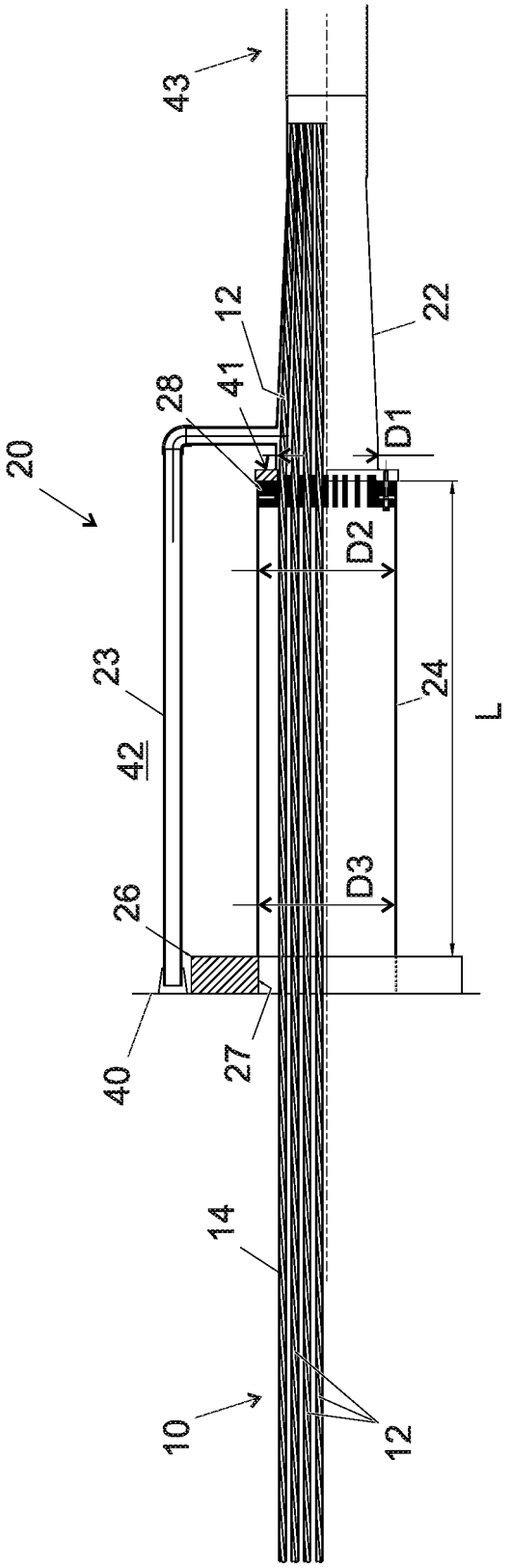
43
12
22
28
41
D1
20
D2
23
24
L
42
D3
26
40
27
14
10
12

Fig.1

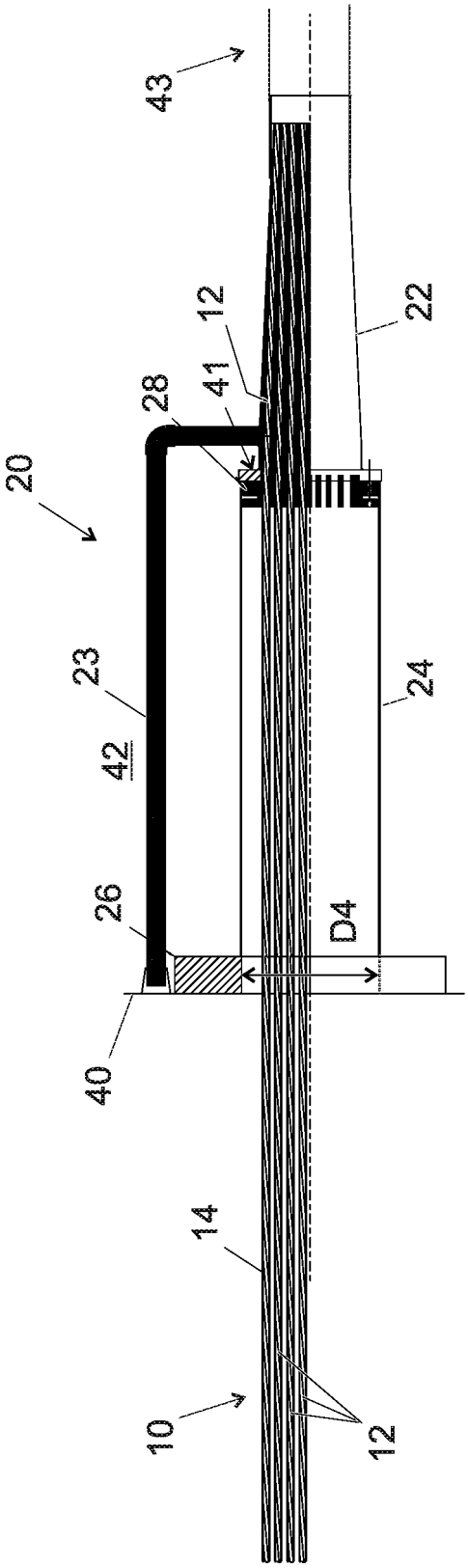
43
12
22
28
41
20
23
24
42
26
D4
40
14
10
12

Fig.2

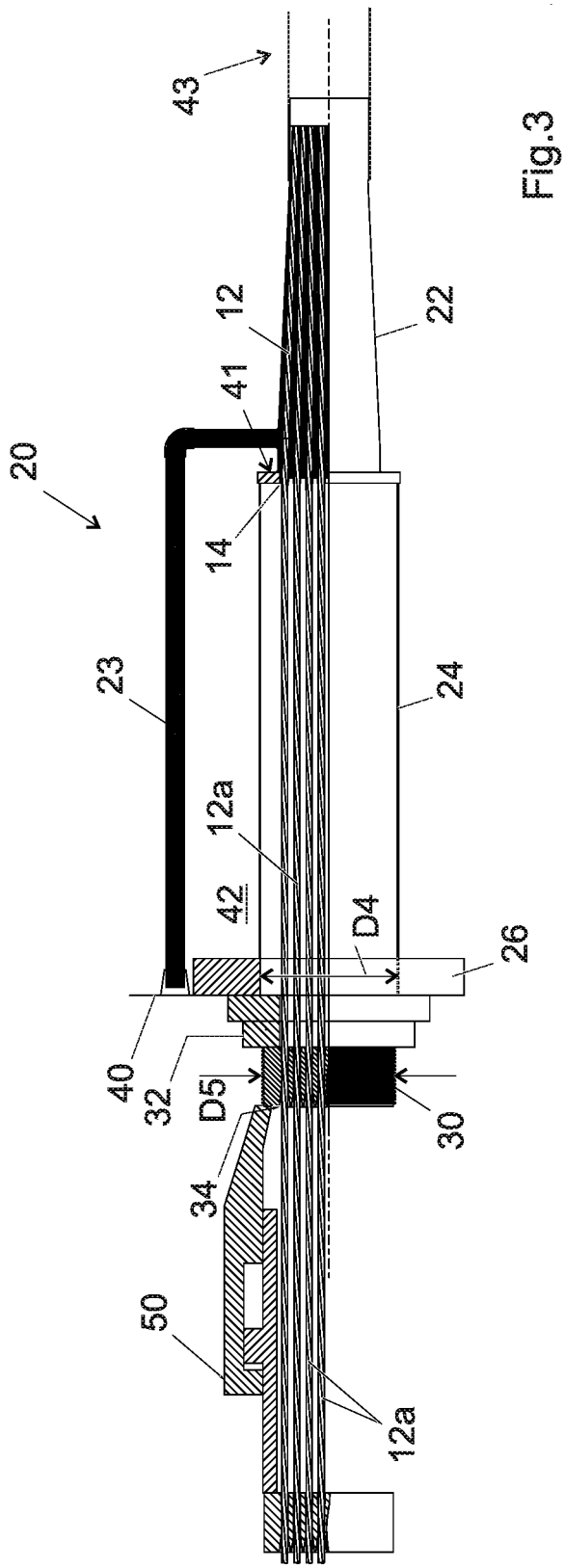
43
12
22
41
20
14
23
24
12a
42
D4
26
40
32
D5
30
34
50
12a

Fig.3

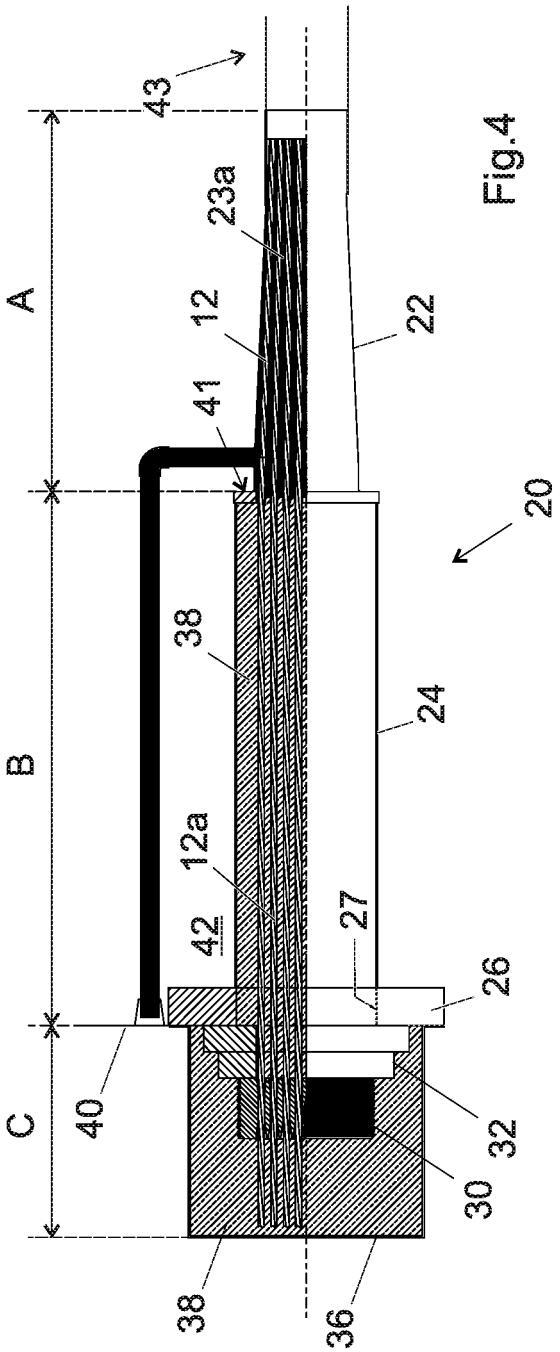
43
23a
A
12
22
41
20
38
B
24
12a
27
42
26
C
40
32
30
38
36

Fig.4

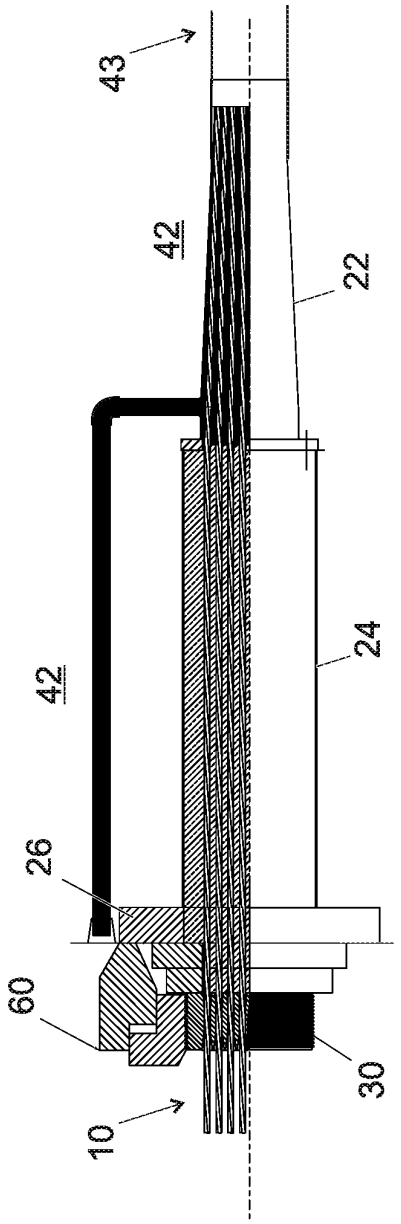

Fig.5

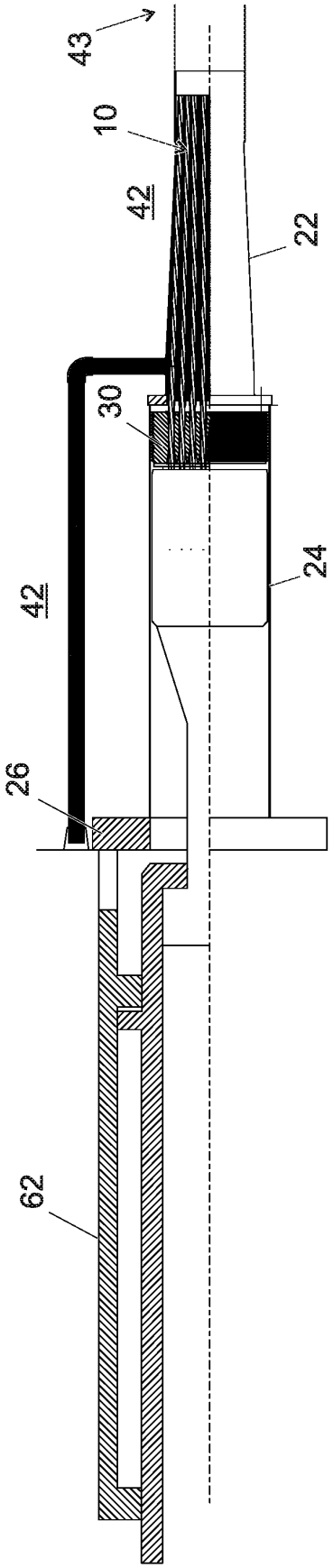

Fig.6

REFERENCES CITED IN THE DESCRIPTION

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