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SCHMIDT(10) **Pub. No.: US 2020/0040593 A1**(43) **Pub. Date: Feb. 6, 2020**(54) **A REINFORCEMENT SYSTEM AND A
METHOD OF REINFORCING A STRUCTURE
WITH A TENDON****Publication Classification**(51) **Int. Cl.**
E04G 23/02 (2006.01)(52) **U.S. Cl.**
CPC E04G 23/0218 (2013.01)(57) **ABSTRACT**

A structure (30), such as a concrete structure, with a reinforcement system configured for anchoring tendons (40) for structurally reinforcing the structure (30), said reinforcement system comprising at least one tendon (40) and at least two anchorages (10), said least one tendon (40) having a first end and a second end, said first end of the at least one tendon (40) being structurally connected to the structure (30) by said at least two anchorages (10), each of said at least two anchorages (10) comprising an anchor (15), said anchors (15) being positioned successively at different positions along the length of said first end of said at least one tendon. Each of said two or more anchorages (10) comprises an anchorage block (11), in said anchorage block (11) is attached to the structure (30), and said anchorage block (11) accommodates said anchor (15).

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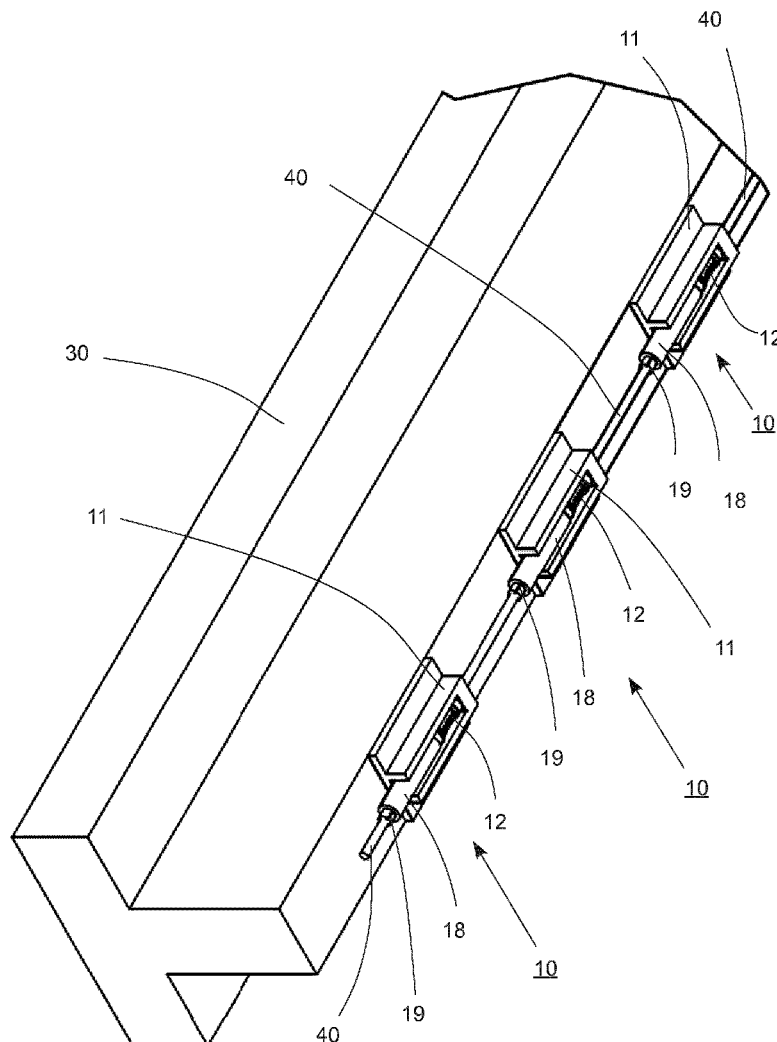


FIG. 1

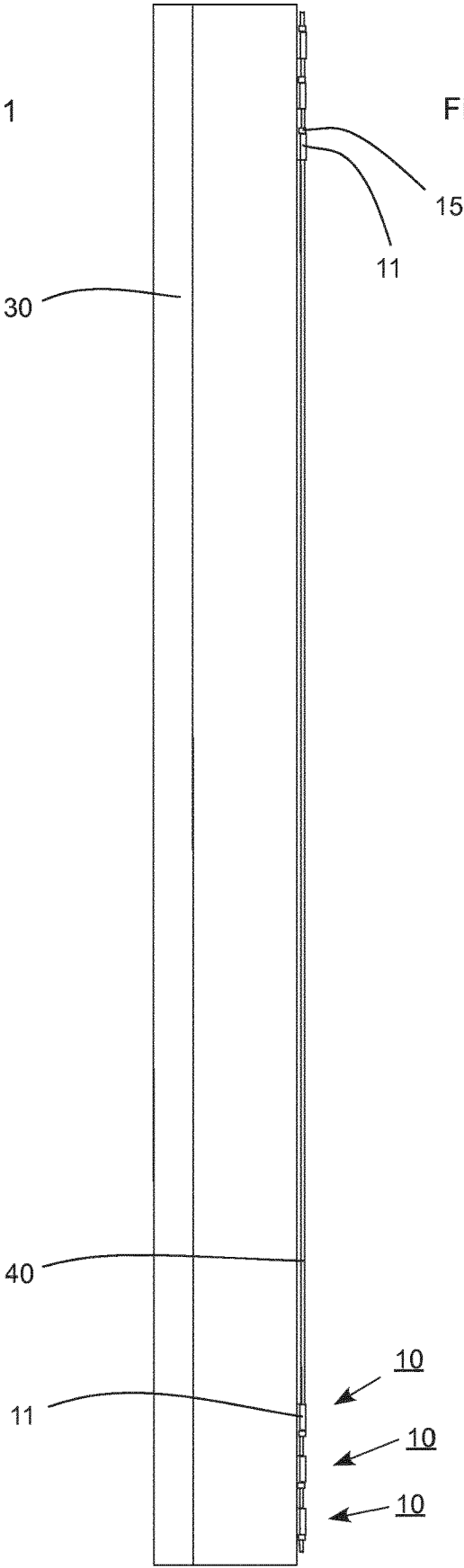


FIG. 2

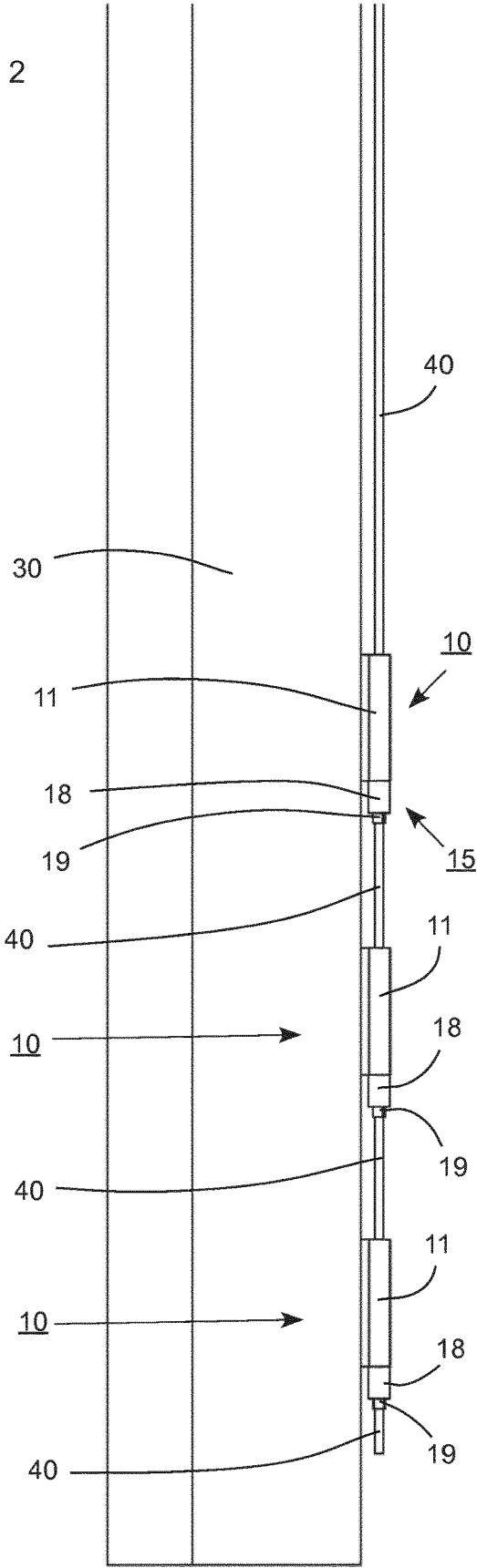


FIG. 3

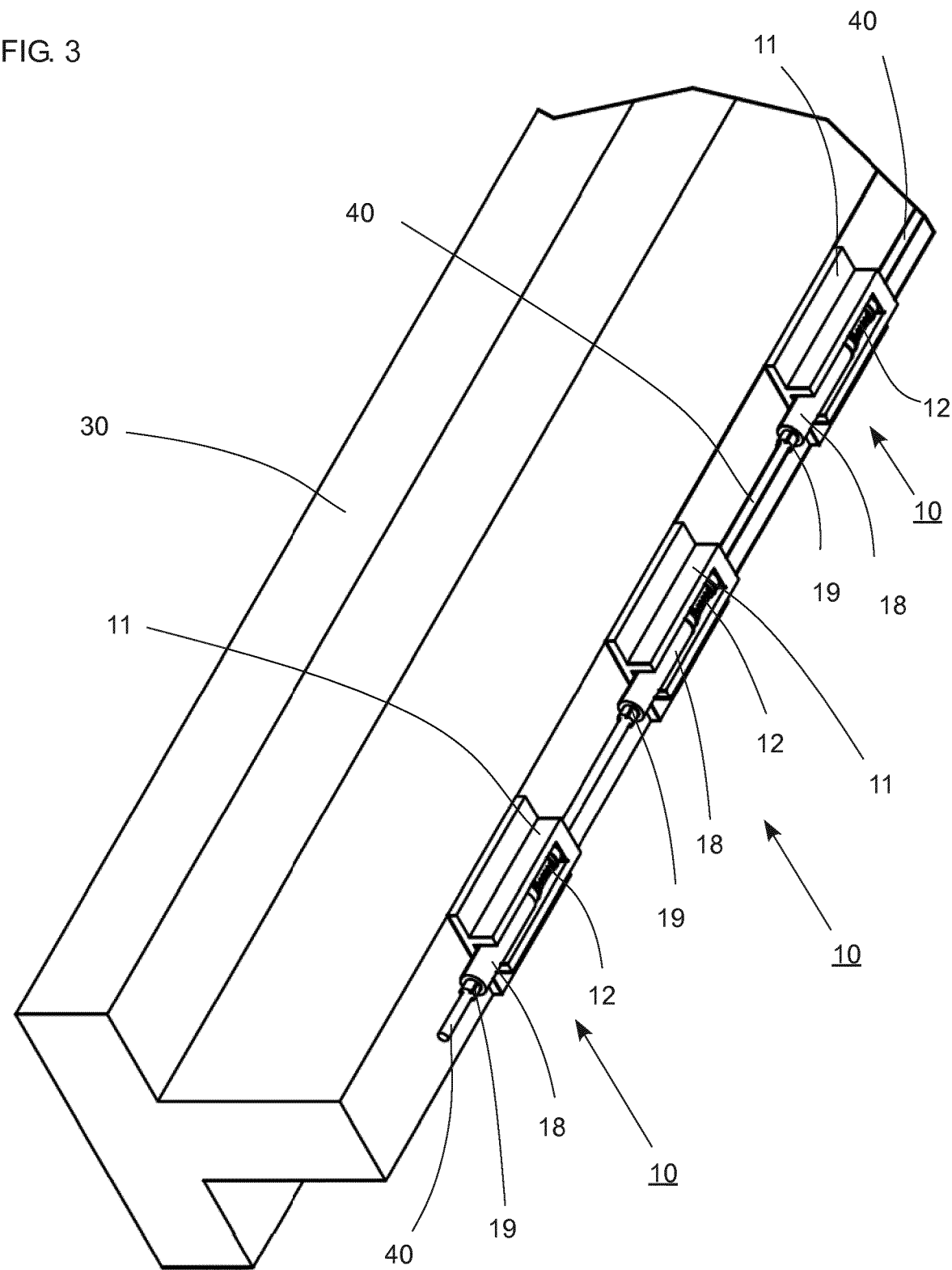


FIG. 4

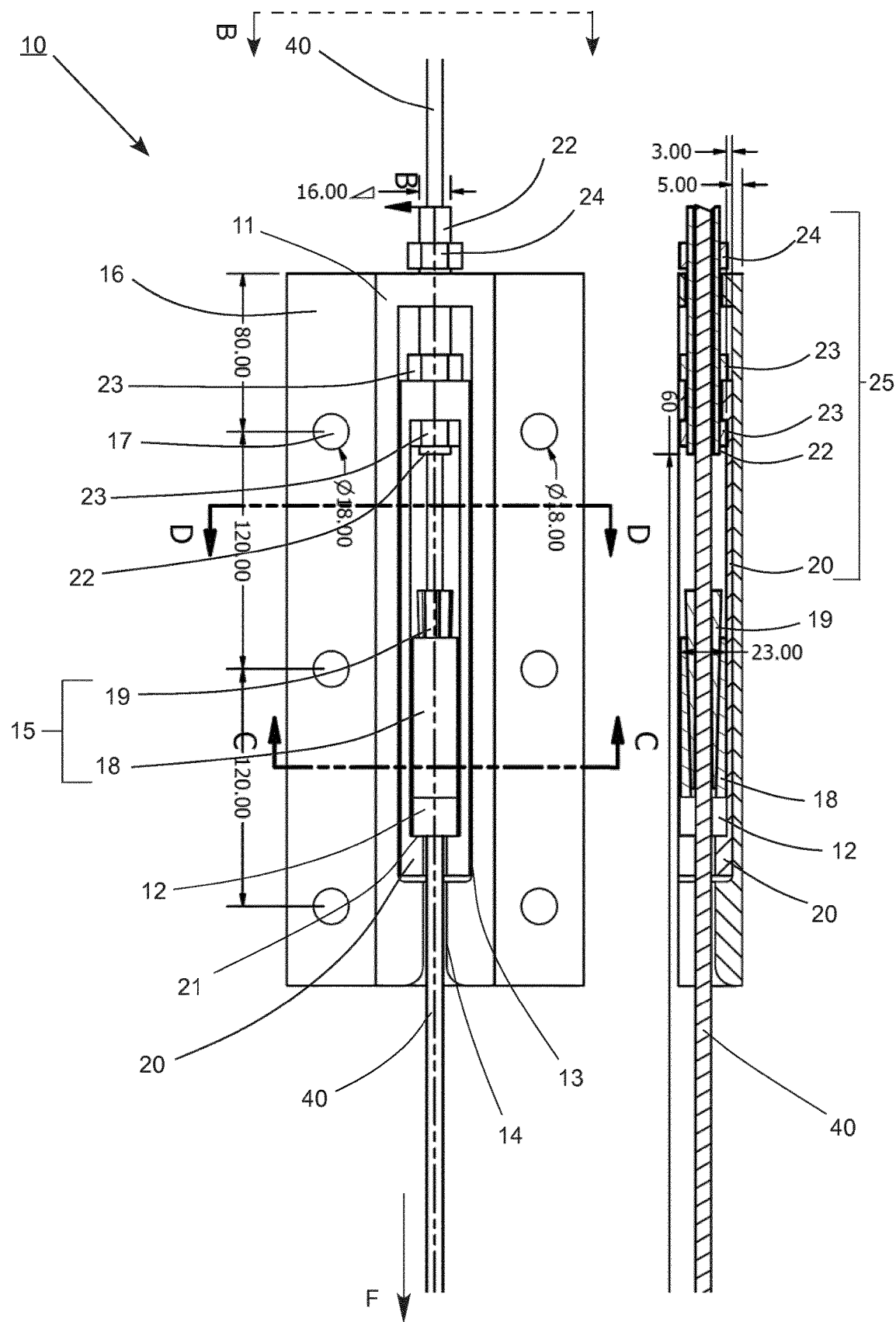


FIG. 5

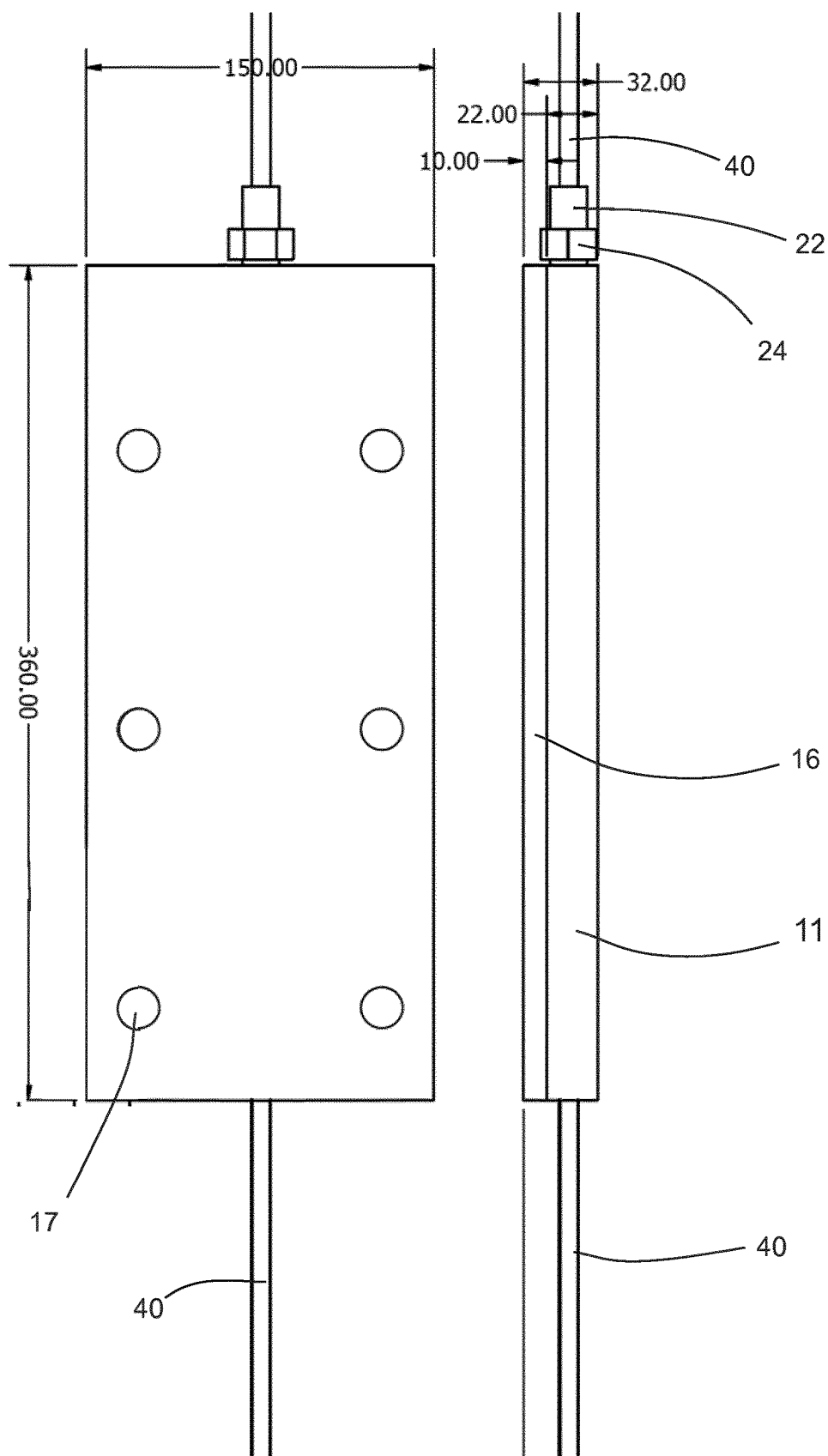


FIG. 6

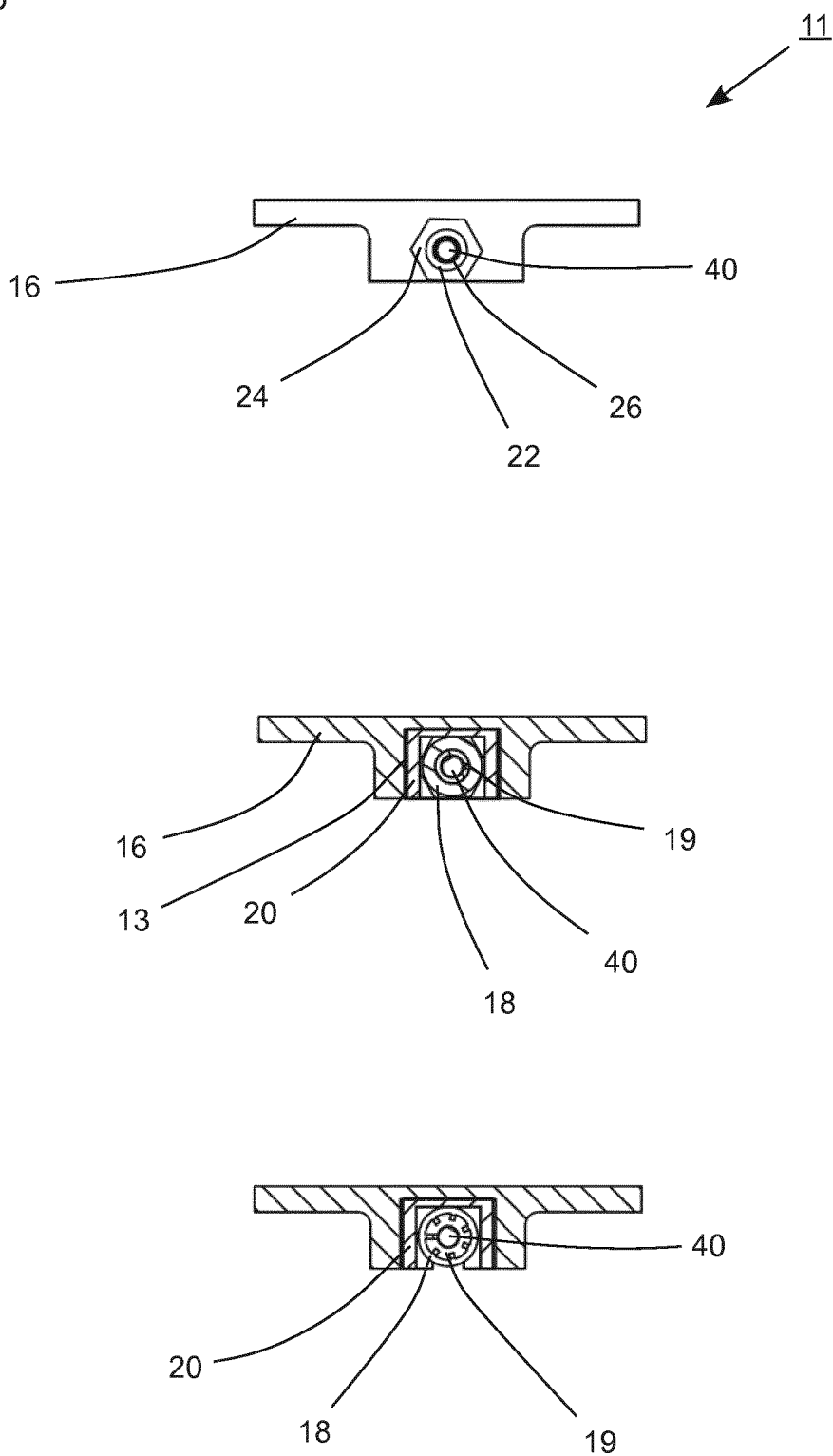


FIG. 7

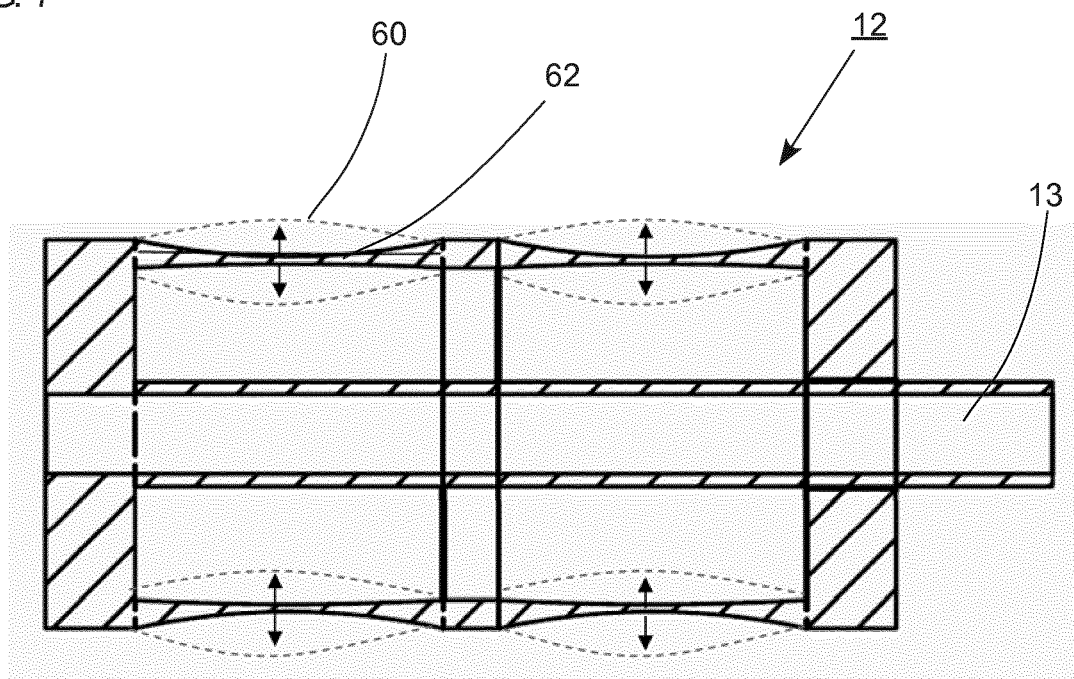
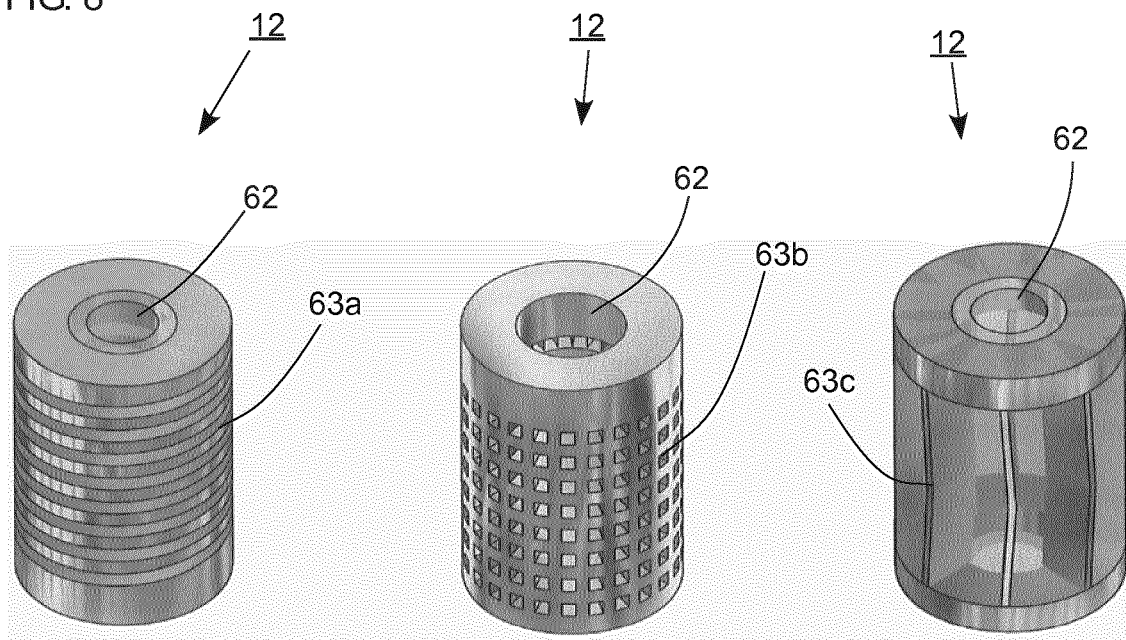


FIG. 8



A REINFORCEMENT SYSTEM AND A METHOD OF REINFORCING A STRUCTURE WITH A TENDON

[0001] The present invention relates to a reinforcement system configured for anchoring tendons for structurally reinforcing a structure such as a concrete structure, said reinforcement system comprises at least one tendon and at least two anchorages, said anchorages are adapted to anchoring said at least one tendon to said structure, said at least one tendon comprises a first end and a second end.

BACKGROUND OF THE INVENTION

[0002] Reinforcement systems for new structures or existing old concrete structures, like bridges, buildings, silos, which need strengthening in order to sustain increasing demand loads is well known.

[0003] Reinforcement systems comprise reinforcement elements of steel or fibers, such as FRP cable or rods, e.g. carbon, aramid or glass fiber reinforced polymer. FRP fibers have been proven to be an attractive alternative to steel. The FRP alternatives are typically of the types of carbon (CFRP), glass (GFRP) or aramid (AFRP) fiber reinforced polymers. The FRP fibers have the advantages of high strength, light weight and excellent corrosion resistance compared to conventional reinforcing steel. However since FRP fibers by themselves can withstand a high level of tensile stress the behavior of the anchorage of the FRP fibers becomes very important. Thus, an effective anchorage of the FRP fibers is necessary for exploit the potential strengthening capacity of such FRP fibers.

[0004] However, the application of fiber reinforced polymer (FRP) reinforcement has a problem, as FRP have a low strain capacity and linear elastic stress-strain behavior up to rupture without yielding. Also, the weak properties in the transverse direction of the fibers are a major challenge, since it makes the tendon difficult to anchor and often a premature failure is the outcome.

[0005] One of the mayor challenges using fiber reinforced polymers (FRP) and fiber material in constructions such as concrete is to get an optimal interaction between such anchoring systems and a reinforced construction.

[0006] The component, such as an anchor, of an anchoring system has a crucial importance since it is the contact between the FRP tendon and the surrounding concrete construction. If the anchor does not work optimal and provide a stable interaction between the FRP tendons and the construction the anchoring system fails to work as desired. The anchorage is typically the weakest link.

[0007] U.S. Pat. No. 6,082,063 discloses an anchorage for a tendon that includes a sleeve having a smooth tapered interior bore and a compressible wedge disposed in the sleeve. The compressible wedge has a smooth exterior tapered surface tapering from a wider end to a narrower end and one or more interior channels for receiving a tendon. The taper angle of the compressible wedge is greater than the taper angle of the bore. Thus, upon insertion of the compressible wedge into the sleeve, the wider end of the compressible wedge forms a wedge contact with the sleeve before the narrower end forms a wedge contact with the sleeve. Hereby is achieved an appropriate anchorage system for FRP tendons.

[0008] JP 2 884465 B2 discloses an anchorage for a FRP reinforcing material. The anchorage has a number of anchors

attached successively at different positions along one end of a FRP reinforcing tendon. The anchors are interconnected by means of respective springs and thereby form a stack, one end of which abuts the structure at a point where the tendon is inserted through a hole in structure.

[0009] WO 2016/079214 A2 discloses a reinforcement system for anchoring tendons to a structure by means of a single anchorage, including a ductility element, at either end of the tendon.

[0010] Another drawback by the application of high strength steel reinforcement or FRP fibers in concrete structures is due to the lower degree of strain hardening and smaller elongation of the tensile reinforcement.

[0011] Also ductility of structures is important to ensure large deformation and give sufficient warning while maintaining an adequate load capacity before structure failure.

[0012] Concrete is a semi-brittle material. Concrete structures rely largely on the deformation and yielding of the tensile reinforcement to satisfy the ductility demand.

[0013] The application of high strength steel reinforcement in concrete structures has less ductility due to the lower degree of strain hardening and smaller elongation of the tensile reinforcement.

[0014] Thus, the ductility of concrete members reinforced with low-ductile tendons, especially FRP reinforced concrete members, decreases due to the tensile reinforcement deforms less and hence a lower deformability and ductility is achieved.

[0015] Due to high strength reinforcements, the anchoring systems have become relatively large, which is undesirable as different types of fractures both within the reinforcement system or the structure to be reinforced can be difficult to control.

[0016] It is desirable to provide an anchoring system that can transfer high loads between reinforcement elements of steel or fibers and a structure in a simple and reliable controllable way.

BRIEF DESCRIPTION OF THE INVENTION

[0017] The object of the present invention is to provide a reinforcement system that in a controlled way distributes the loads to the structure as to avoid undesirable peak loads, premature and brittle ruptures.

[0018] This is achieved by said reinforcement system, wherein each of said at least two anchorages comprises an anchor, said anchors are positioned subsequently at different positions along the length of said first end of said at least one tendon, said first end of the at least one tendon is structurally connected to the structure by said at least two anchorages.

[0019] Hereby is achieved that relatively small anchors may be used together in an anchoring system which provides transfer of high loads between tendon(s) and a structure in a simple and reliable controllable way.

[0020] Additionally in many cases, it is desirable to provide an improved structural ductility of high strength steel or FRP reinforced concrete members.

[0021] In an embodiment, said at least two anchorages comprises a ductility element, said ductility element is positioned in structural connection between said at least one tendon and said anchors, said ductility element comprising weakened deformation zones being deformable and thereby allowing the length of deformation zones on the ductility element to increase or decrease in an axial direction along the length of said at least one tendon, when the stress on the

ductility element exceeds a certain level, the ductility element comprises weakened deformation zones being weaker than the other components of the reinforcement system, the ductility element being adapted to deform before the other components of the reinforcement system.

[0022] This results in the ductility element by elongation or compression increases the ductility in the reinforcement system, thus providing an improved ductility of reinforced structural members.

[0023] In an embodiment, the reinforcement system comprises two or more ductility elements adapted to deform at different axial loads.

[0024] In an embodiment, the ductility elements are adapted to deform at loads being about 30-95%, preferably 70-95%, of the stress required for rupturing of said at least one tendon.

[0025] In an embodiment, the ductility element is an integrated part of said anchor.

[0026] In an embodiment, each of said two or more anchorages comprises an anchorage block, said anchorage block adapted to be attached to the structure, the anchorage block is adapted to accommodate said anchor.

[0027] In an embodiment, the anchorage block comprises a tightening assembly, said tightening assembly is adapted to adjust the tensioning of the at least one tendon relative to the anchorage block.

[0028] In an embodiment, the anchorage block comprises a recess in the longitudinal direction of the anchorage block, the recess is adapted to accommodate at least part of the tightening assembly, a part of the at least one tendon, the ductility element and at least partly the anchor.

[0029] In an embodiment, the anchor comprises a barrel having a tapered interior bore and a compressible wedge adapted to be disposed in said barrel.

[0030] In an embodiment, the reinforcement system comprises additionally at least two or more anchorages adapted for anchoring the second end of the at least one tendon, the second end of the at least one tendon is structurally connected to the structure by the additionally at least two anchorages.

[0031] The present invention further relates to a method of reinforcing a structure with at least one tendon according to the reinforcement system, wherein the method comprises the steps of; fixing at least two anchorages to a first end of the at least one tendon, said at least one tendon is connected to each anchorage successively, mounting said at least two anchorages to the structure.

[0032] In an embodiment of the method, the method further comprises the step of; placing a ductility element at the first end of the at least one tendon in structural connection to each of said at least two anchorages.

[0033] In an embodiment, the method further comprises the steps of; attaching at least two anchorage blocks to the structure, fixing two or more sets of a ductility element followed by an anchor subsequently onto the first end of the at least one tendon, the two or more ductility elements and anchors are positioned subsequent in an axial direction along the length of said at least one tendon, positioning said two or more sets of ductility elements and anchors into the recesses of the at least two anchorage blocks.

[0034] In an embodiment, the method comprises the step of providing two or more ductility elements adapted to deform at different axial loads.

[0035] In an embodiment, the method comprises the step of adjusting the tightening assemblies for adjusting the tensioning of the at least one tendon relative to the anchorage block.

[0036] The term tendon should be understood as any type of reinforcement element of steel or fibers, such as FRP cable or rods, e.g. carbon, aramid or glass fiber reinforced polymer, although other material also may be used.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Embodiments of the invention will be described in the following with reference to the drawings wherein

[0038] FIG. 1 is a side view of a T-shaped structure and a reinforcement system,

[0039] FIG. 2 is an enlarged side view of the T-shaped structure and a reinforcement system,

[0040] FIG. 3 is a perspective view of the T-shaped structure and the reinforcement system as illustrated in FIG. 2,

[0041] FIG. 4 is a top view and a cross sectional view of an anchorage block,

[0042] FIG. 5 is a bottom view and a side view of the anchorage block,

[0043] FIG. 6 is two cross sectional views and an end view of the anchorage block,

[0044] FIG. 7 is a side view of a ductility element,

[0045] FIG. 8 illustrates three embodiments of the ductility element.

DETAILED DESCRIPTION OF THE INVENTION WITH REFERENCE TO THE FIGURES

[0046] The present invention relates to a reinforcement system for anchoring tendons for structurally reinforcing a structure such as a concrete structure.

[0047] Generally, the reinforcement system may be cast directly into a structure, such as a concrete structure, or applied to the structure afterwards. Furthermore, the reinforcement system may be used inside a concrete structure as well as on the outside of the structure, and as the tendons and ductility element may be made of non-corrosive material, thus it is suitable for being used in more aggressive environments.

[0048] FIG. 1 illustrates a reinforcement system which comprises six anchorages **10** attached to a structure **30**. The anchorages **10** anchor a tendon **40** to the structure **30**.

[0049] Three anchorages **10** are positioned at the first extremity of the structure **30**. The three anchorages are positioned successively at different positions in an axial direction along the length of a first end of the tendon **40**.

[0050] Another three anchorages **10** are positioned at the second extremity of the structure **30**, and likewise these three anchorages are positioned successively in an axial direction along the length of a second end of the tendon **40**. Generally, any suitable number of anchorages may be positioned successively at different positions in the axial direction along the length of either one of the first or the second end of the tendon **40**.

[0051] The anchorages are adapted to fasten the tendon to a structure **30**.

[0052] FIG. 2 illustrates an enlarged view of the first end of the tendon **40** and one extremity of the structure **30**. The reinforcement system is attached to the T-shaped structure.

Three anchorages **10** attach the tendon **40** to the T-shaped structure **30**. The three anchorages are positioned subsequent along the length of a first end of the tendon **40**. An anchorage **10** comprises an anchorage block **11** and an anchor **15**. The anchor comprises a barrel **18** having a tapered interior bore and a compressible wedge **19**. Other types of anchors may be used.

[0053] This is also illustrated in FIG. 3 in a perspective view.

[0054] As seen in the figures, and according to the present invention in general, the respective anchors **15** are individually connected to the structure by means of respective anchorages **10** attached to the structure successively at different positions along the respective end of the tendon **40**, and at least one end of the tendon **40** is fixed independently at different positions to the structure. Each anchorage **10** is individually connected directly to the structure by means of a respective separate anchorage block **11** which is directly mounted on or in the structure, for instance by being moulded into the structure or by being mounted by means of screws or in any other suitable way known to the skilled person. By means of this arrangement, the load of the tendon **40** is distributed over the respective anchorages **10** at the at least one end of the tendon **40**. In prior art structures, on the other hand, the load of a tendon is transferred to the structure by means of only one anchorage at an end of the tendon. However, the connection of the anchor to the tendon is typically the weakest point of a reinforcing structure, due to the wedge of the anchor pressing on the tendon. Therefore, according to the present invention, by distributing the load of the tendon **40** over the respective anchorages **10**, each anchor may take up only a part of the total load, and thereby these anchors do not constitute the weakest points of a reinforcing structure. Furthermore, if the structure to be reinforced has weakened areas, such as for instance a cut-out or a hole in a concrete structure, the load from an end of a tendon may be distributed accordingly over the structure, for instance by arranging more anchors in areas without weakened areas and fewer anchors in the weakened areas, or for instance by arranging anchors in the weakened areas with associated ductility elements having relatively more weakened deformation zones (**63**) and by arranging anchors in the not weakened areas with associated ductility elements having relatively less weakened deformation zones (**63**).

[0055] Each anchorage **10** illustrated in FIG. 3 comprises an anchorage block **11**, a ductility element **12** and an anchor **15**. The anchors comprise a barrel **18** having a tapered interior bore and a compressible wedge **19** adapted to be disposed in said barrel **18**, thus the anchors are adapted to affix the tendon **40**.

[0056] An anchorage **10** in more details is illustrated in FIG. 4.

[0057] The anchorage **10** comprises an anchorage block **11**, a ductility element **12** and an anchor **15**. The anchor **15** comprises a barrel **18** having a tapered interior bore and a compressible wedge **19**. The dimensions are given in millimeter.

[0058] The anchorage block **11** comprises a recess **13** and a subsequent narrower recess **14**. The recesses **13,14** are positioned in continuation in the longitudinal direction of the anchorage block. The recess **13** is adapted to accommodate the anchor, and the recess **14** is adapted to accommodate the tendon **40**.

[0059] The anchorage block **11** comprises two parallel positioned flanges **16** extending in the longitudinal direction of the anchorage block **11**. The flanges **16** are positioned opposite each other on each side of the recess **13**. The flanges comprise mounting means **17**. The mounting means **17** are adapted to be attached to the structure **30**.

[0060] The anchorage block **11** comprises a tightening assembly **25**. The tightening assembly **25** comprises an elongated frame shaped structure **20**. The elongated frame shaped structure **20** is adapted to abut the inner surfaces of the recess **13** and accommodate the anchor **15** and the ductility element **12** within the elongated frame shaped structure **20**.

[0061] The narrow inner contact face **21** of the elongated frame shaped structure **20** abuts the ductility element **12**, and the ductility element **12** abuts the barrel **18** of the anchor **15**.

[0062] The reinforcement system comprises a ductility element **12**, which is positioned in structural connection, between said tendon **40** and said anchor **15**, said ductility element **12** comprises weakened deformation zones **63** being deformable in axial direction along the length of said tendon. The deformation zones are weakened in relation to the other part of the ductility element. When comparing FIGS. 1 and 2 with FIG. 3, it is understood that although the ductility element **12** is positioned between at least the main part of said tendon **40** and said anchor **15** comprising a barrel **18** having a tapered interior bore and a compressible wedge **19**, said ductility element **12** has a first end abutting said anchorage block **11** and a second end abutting said anchor **15**. Said ductility element comprises between its first end and its second end said weakened deformation zones **63** being deformable.

[0063] The recess **13** is adapted to accommodate the elongated frame shaped structure **20**, which encircles a part of the tendon **40**, the ductility element **12** and at least part of the anchor **15**, and the recess **14** is adapted to accommodate a part of the tendon **40**.

[0064] A ductility element **12** is positioned abutting the anchor **15** within the recess **13**.

[0065] The tightening assembly **25** comprises adjustment unit **24**, attachment parts **23** and a sleeve **22**. The tightening assembly **25** is adapted to move the ductility element **12** and the anchor **15** relative to the anchorage block **11** to provide tension to the tendon **40** in the longitudinal direction. The tightening assembly **25** is adapted to adjust the tensioning of the tendon **40** relative to the anchorage block (**11**).

[0066] The adjustment unit **24** may comprise screw thread adapted to adjust the reinforcement system. When the adjustment unit **24** is activated the inner contact face **21** of the elongated frame shaped structure **20** abuts the ductility element **12**, and the ductility element **12** and the anchor **15** is moved coaxially along the tendon **40**.

[0067] The method of reinforcing a structure **30** with at least one tendon **40** according to the reinforcement system comprises the steps of; attaching at least two anchorage blocks **11** to the structure **30**, fixing two or more sets of a ductility element **12** followed by an anchor **15** subsequently onto the first end of the at least one tendon **40**, the two or more ductility elements **12** and anchors **15** are positioned subsequent in an axial direction along the length of said at least one tendon, positioning said two or more sets of ductility elements and anchors into the recesses **13** of the at least two anchorage blocks **11**. Furthermore the method comprises the step of adjusting the tightening assemblies **25**

for adjusting the tensioning of the at least one tendon 40 relative to the anchorage block 11.

[0068] The anchor 15 is schematically illustrated as a known type of an anchor comprising a barrel 18 and wedge 19. The barrel has a tapered interior bore and the compressible wedge being adapted to be coaxially disposed in the barrel. The tendon 40 extends through the center of the wedge, which is wedged coaxially inside the barrel for clamping the tendon 40, and thereby anchoring the tendon to a structure 30.

[0069] FIG. 5 illustrates the anchorage block 11 in a bottom view and a side view. The figure shows a part of the sleeve 21 encircling the tendon 40. The anchorage block 11 comprises flange 16, which comprises mounting means 17. The mounting means 17 are adapted to be attached to the structure 30.

[0070] The dimensions in the figures are given in millimeter. The length of the shown embodiment of the anchorage block is 360 mm, the width of the anchorage block is 150 mm, and the height is 32 mm.

[0071] FIG. 6 illustrates an end view of the anchorage block and two cross sectional views. The views are indicated in FIG. 4 by the lines marked B, C and D, respectively.

[0072] The first cross sectional view, as indicated in FIG. 4 by the line marked B, illustrates the anchorage block comprising two flanges 16.

[0073] The adjustment unit 24 comprises a hexagon outer shape as a bolt adapted to be turned for adjusting the reinforcement system. Coaxial the tendon 40 is arranged within the sleeve 22. A cylindrical cavity 26 between the tendon 40 and the sleeve 22 enables the tendon 40 to slide within the sleeve 22 when the anchorage is adjusted.

[0074] The second cross sectional view, as indicated in FIG. 4 by the line marked C, illustrates the anchorage block and the anchor 15. The anchorage block 11 comprises two flanges 16. The anchor comprises the barrels 18 and the wedge 19. The elongated frame shaped structure 20 is arranged between the outer surface of the barrel 18 and the inner surface of the recess 13 on both sides of the barrel 18. The elongated frame shaped structure 20 comprises a U-shaped cross section, the elongated frame shaped structure 20 adapted to abut the inner surfaces of the recess 13.

[0075] The third cross sectional view, as indicated in FIG. 4 by the line marked D, illustrates the anchorage block and the end of the anchor comprising the barrel 18 and the wedge 19.

[0076] The wedge 19 comprises recesses extending from the outer surface of the wedge radially towards the tendon 40.

[0077] FIG. 7 illustrates an embodiment of the ductility element 12.

[0078] The ductility element is cylindrical and comprises a first end and a second end. Two deformable walls 62 are positioned between the first and second end and encircles a through going channel 13 which extends centrally internal through the ductility element. The through going channel 13 is adapted for receiving a tendon.

[0079] As the two deformable walls 62 have varying thickness, the ductility element is able to deform upon loads. The weakened deformable walls 62 are able to deform in radial direction in respect of the centerline of the ductility element and the fluctuation of the deformable wall are illustrated by dotted lines 60 in FIG. 7.

[0080] The deformation of the weakened deformable walls is illustrated in FIG. 7 by dotted lines. During increasing pressure the ductility element will, when threshold for elastic deformation is reached, start to deform followed by a deformation resulting in a collapse.

[0081] The ductility element 12 has a ductile phase in axial load less than the tensile strength of the tendons, thus making the ductility element the weakest link in the reinforcement system, and the ductility element 12 will reach its strength before the other components of the reinforcement system.

[0082] The ductility element will deform when the stress exceeds the threshold of the ductility element, and it thus provides ductility to the reinforcement system. Thus ductility is achieved by applying a ductility element to the reinforcement system.

[0083] FIG. 8 illustrates three embodiments of a ductility element 12. The ductility element 12 comprises weakened deformable zones 63.

[0084] The weakened deformation zones may be provided by slits 63a, holes 63b, such as voids or bubbles, varying thickness of the deformable walls, as illustrated in FIG. 7, and/or by use of a material providing a deformable zone.

[0085] The deformation walls 63c may be adapted to deform along the periphery of the ductility element in tangential direction.

[0086] The weakened deformation zones 63 are weakened in relation to the other parts of the ductility element 12. The weakened deformation zones may also be provided by suitable choice of material.

[0087] The ductility element 12 may be made of metal such as steel or aluminum, cementitious material, plastics, or elastic material such as rubber, composite material or in combination thereof.

[0088] The ductility element is configured such that the force required for deformation of the ductility element in axial load is less than the force required for deformation of the tendon. Thus, the ductility element 12 has a ductile phase in axial load less than the tensile strength of the tendons, thus making the ductility element the weakest link in the reinforcement system. The ductility element 12 will reach its strength before the other components of the reinforcement system. When the stress exceeds the threshold of the ductility of the ductility element, the ductility element will deform and it thus provide ductility to the reinforcement system.

[0089] As concrete is a semi-brittle material. Concrete structures rely on the deformation and yielding of the tensile reinforcement to satisfy the ductility demand.

[0090] By employing a ductility element in combination with tendons made of high strength steel or fiber lacking of sufficient ductility an increased ductility is provided by allowing the ductility element to deform.

[0091] In an embodiment the reinforcement system comprises two or more ductility elements 12 which are adapted to deform at different axial loads.

[0092] Generally, the ductility elements 12 are adapted to deform at loads being about 30-95%, preferably 70-95% of the stress required to rupture the at least one tendon 40.

1. A concrete structure with a reinforcement system configured for anchoring tendons for structurally reinforcing the structure, said reinforcement system comprising:

at least one tendon; and

at least two anchorages, said at least one tendon having a first end and a second end, said first end of the at least

one tendon being structurally connected to the structure by said at least two anchorages, each of said at least two anchorages comprising an anchor, said anchors being positioned successively at different positions along the length of said first end of said at least one tendon, each of said two or more anchorages comprising an anchorage block attached to the structure, and accommodating said anchor.

2. The structure with a reinforcement system according to claim 1, wherein each of said at least two anchorages comprises a ductility element, said ductility element having a first end abutting said anchorage block and a second end abutting said anchor, said ductility element comprising between its first end and its second end weakened deformation zones being deformable and thereby allowing the length of deformation zones on the ductility element to increase or decrease in an axial direction along the length of said at least one tendon, when the stress on the ductility element exceeds a certain level, the ductility element comprising weakened deformation zones being weaker than the other components of the reinforcement system, the ductility element being adapted to deform before the other components of the reinforcement system.

3. The structure with a reinforcement system according to claim 1, wherein said at least two anchorages comprises a ductility element, said ductility element is positioned in structural connection, between said at least one tendon and said anchors, said ductility element comprising weakened deformation zones being deformable and thereby allowing the length of deformation zones on the ductility element to increase or decrease in an axial direction along the length of said at least one tendon, when the stress on the ductility element exceeds a certain level, the ductility element comprises weakened deformation zones being weaker than the other components of the reinforcement system, the ductility element being adapted to deform before the other components of the reinforcement system.

4. The structure with a reinforcement system according to claim 1, wherein said reinforcement system comprises two or more ductility elements adapted to deform at different axial loads.

5. The structure with a reinforcement system according to claim 1, wherein said ductility elements are adapted to deform at loads being about 30-95%, preferably 70-95% of the stress required for rupturing of said at least one tendon.

6. The structure with a reinforcement system according to claim 1, wherein the ductility element is an integrated part of said anchor.

7. The structure with a reinforcement system according to claim 1, wherein said anchorage block comprises a tightening assembly adapted to adjust the tensioning of the at least one tendon relative to the anchorage block.

8. The structure with a reinforcement system according to claim 1, wherein said anchorage block comprises a recess in the longitudinal direction of the anchorage block, the recess adapted to accommodate at least part of the tightening assembly, a part of the at least one tendon, the ductility element and at least partly the anchor.

9. The structure with a reinforcement system according to claim 1, wherein said anchor comprises a barrel having a tapered interior bore and a compressible wedge adapted to be disposed in said barrel.

10. The structure with a reinforcement system according to claim 1, wherein the reinforcement system comprises additionally at least two or more anchorages adapted for anchoring said second end of the at least one tendon, said second end of the at least one tendon structurally connected to the structure by said additionally at least two anchorages.

11. The structure with a reinforcement system according to claim 1, wherein the at least one tendon comprises fiber-reinforced polymer (FRP), including carbon, aramid, or glass fiber reinforced polymer.

12. A method of reinforcing a structure with at least one tendon and a reinforcement system, the method comprising: fixing at least two anchorages to a first end of the at least one tendon, said at least one tendon being connected to each anchorage successively, mounting said at least two anchorages to the structure, attaching at least two anchorage blocks to the structure, fixing two or more sets of a ductility element followed by an anchor subsequently onto the first end of the at least one tendon, the two or more ductility elements and anchors positioned subsequent in an axial direction along the length of said at least one tendon, and positioning said two or more sets of ductility elements and anchors into the recesses of the at least two anchorage blocks.

13. The method of reinforcing a structure with at least one tendon according to claim 12, the method further comprising:

placing a ductility element at the first end of the at least one tendon in structural connection to each of said at least two anchorages.

14. The method of reinforcing a structure with at least one tendon according to claim 12, further comprising the step of: adjusting the tightening assemblies for adjusting the tensioning of the at least one tendon relative to the anchorage block.

15. The method of reinforcing a structure with at least one tendon according to claim 13, further comprising:

adjusting the tightening assemblies for adjusting the tensioning of the at least one tendon relative to the anchorage block.

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