(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 868 830 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
06.05.2015 Bulletin 2015/19

(21) Application number: **14191389.7**

(22) Date of filing: **31.10.2014**

(51) Int Cl.:
E04C 5/06 *(2006.01)* ***E02D 27/42*** *(2006.01)*
E04B 1/41 *(2006.01)* ***E04C 5/16*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **31.10.2013 TW 102220253**
09.05.2014 TW 103116548

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(54) Pre-embedded piece, method for producing the same, and reinforcing steel structures including the same

(57) A pre-embedded piece includes a reinforcing steel bar (1) and a screw rod (2). The reinforcing steel bar (1) includes a body (11) and an embossed portion (12) formed on an outer periphery of the body (11). An end of the screw rod (2) is connected to an end of the reinforcing steel bar (1). A method for producing a pre-embedded piece includes preparing a reinforcing steel bar (1) and a screw rod (2). The reinforcing steel bar (1) includes a body (11) and an embossed portion (12) formed on an outer periphery of the body (11). The reinforcing steel bar (1) and the screw rod (2) are placed end to end and fused together. A reinforcing steel structure of an embodiment includes a plurality of main bars (3), a plurality of hooped columns (4), and a plurality of pre-embedded pieces. A reinforcing steel structure of another embodiment includes a plurality of hooped columns (4) and a plurality of pre-embedded pieces.

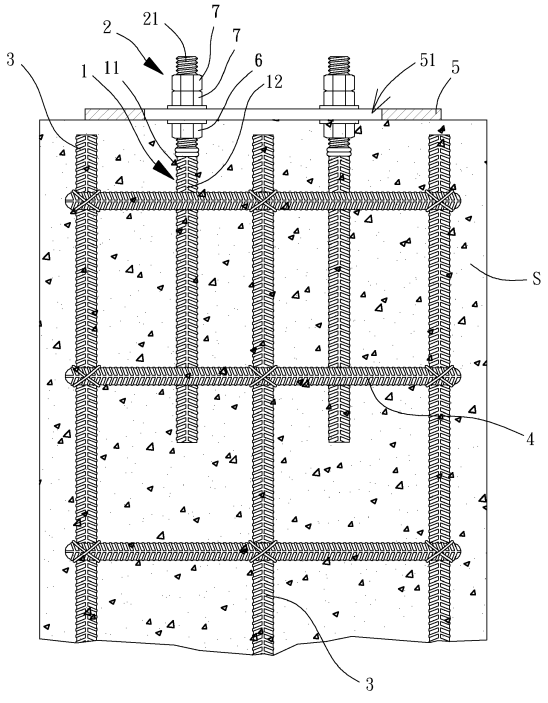

FIG. 5

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a structural element for buildings or civil engineering and, more particularly, to a pre-embedded piece, a method for producing the pre-embedded piece, and reinforcing steel structures including the pre-embedded structure.

2. Description of the Related Art

[0002] Reinforced concrete structures have widely been used in many buildings and civil engineering. With reference to FIG. 1, a reinforcing steel structure 9 is prepared before grouting. The reinforcing steel structure 9 generally includes a plurality of main bars 9, a plurality of hooped columns 92, and a plurality of anchor bolts 93. The main bars 91 are arranged annularly. Each hooped column 92 is wound around the main bars 91 to shape the main bars 91. The anchor bolts 93 are coupled to a measuring board 94 mounted on top of the main bars 91. The measuring board 94 and the anchor bolts 93 are aligned with a space defined by the main bars 91.

[0003] With reference to FIG. 2, each anchor bolt 93 includes a body 931 having a smooth outer periphery. An end of the body 931 is processed to form a threaded portion 932. When each anchor bolt 93 is coupled to the measuring board 94, a nut 95 threadedly engages with the threaded portion 932, and the threaded portion 932 extends through the measuring board 94 such that the body 931 and the nut 95 are located at a bottom side of the measuring board 94. Then, another nut 95 engages with a top end of the threaded portion 932. Thus, each anchor bolt 93 is securely coupled to the measuring board 94, and the nuts 95 at the bottom side of the measuring board 94 are adjusted to level the measuring board 94.

[0004] Next, the reinforcing steel structure 9 is poured with grout. A concrete aggregate mass S is formed after the grout hardens. A portion of the reinforcing steel structure 9 below the measuring board 94 (including the main bars 91, the hooped columns 92, and the bodies 931 of the anchor bolts 93) is covered by the concrete aggregate mass S. The threaded portions 932 of the anchor bolts 93 extending beyond the top side of the measuring board 94 can be coupled to an object on the ground, such as a road lamp, mechanical equipment, or an abutment of a bridge. Furthermore, since the outer periphery of the body 931 of each anchor bolt 93 is smooth, the other end of each anchor bolt 93 without the threaded portion 932 is bent to form a hooked portion 933 to prevent axial loosening of each anchor bolt 93 in the concrete aggregate mass S.

[0005] Although the hooked portions 933 of the anchor bolts 93 can improve the engagement stability with the concrete aggregate mass S, the concrete aggregate mass S almost cannot provide any force gripping and holding the smooth outer periphery of the body 931 of each anchor bolt 93. Furthermore, the body 931, which is generally made of low carbon steel, has a limited bent angle such that the effect of improvement to the engagement stability is limited. In practice, it is not uncommon that the anchor bolts 93 loosen. Furthermore, when each anchor bolt 93 is subjected to a force, the force almost concentrates at the hooked portion 933 and causes breaking in a portion of the concrete aggregate mass S surrounding the hooked portion 933, adversely affecting the safety of the whole reinforcing steel structure 9.

[0006] Regarding the method for producing the anchor bolt 93, since the anchor bolt 93 must include the hooked portion 933 that is formed by bending the other end of the body 931 after formation of the threaded portion 932 on the end of the body 931, the production method for the anchor bolt 93 is not convenient.

[0007] Furthermore, since the threaded portion 932 of each anchor bolt 93 is directly formed on the end of the body 931 by milling or thread rolling, the minimal outer diameter of the threaded portion 932 can only be smaller than the outer diameter of the body 931, leading to a weaker structural strength at the threaded portion 932 of each anchor bolt 93. Namely, only a body 931 having a larger outer diameter can be used to form the threaded portion 932 with the desired structural strength, leading to a waste of the materials of the body 931 covered by the concrete aggregate mass S and leading to difficulties in forming the hooked portion 933 by bending the other end of each anchor bolt 93. Thus, the method for producing the anchor bolt 93 not only has great limitation to the size of the materials but is difficult to increase the yield.

[0008] Furthermore, each anchor bolt 93 is cut from a reinforcing steel bar of a pre-determined length according to the desired length of the anchor bolt 93, and a considerable amount of remainder of an insufficient length is generated during construction. The remainder is generally recycled at a low price and forms reinforcing steel bars of the pre-determined length after melting. Considerable costs and energy are involved in recycling the remainder, including transportation, sorting, and reproduction, which is a heavy burden to the person in the industry and the environment.

[0009] Thus, improvement to the conventional anchor bolts and its production method is needed.

SUMMARY OF THE INVENTION

[0010] An objective of the present invention is to provide a pre-embedded piece permitting a concrete aggregate mass to provide an excellent gripping force on the pre-embedded piece. Furthermore, after the pre-embedded piece engages with the concrete aggregate mass, the force acting on the pre-embedded piece can be dispersed to avoid breaking in the concrete aggregate mass.

[0011] Another objective of the present invention is to

provide a reinforcing steel structure including the pre-embedded piece for reliable engagement with the concrete aggregate mass to well maintain the use safety.

[0012] A further objective of the present invention is to provide a method for producing the pre-embedded piece. By end-to-end connection of the reinforcing steel bar and the screw rod, the production is easy, and there is no limitation to the size of the reinforcing steel bar and the screw rod. Particularly, remainder of reinforcing steel bars can be used as the material for the reinforcing steel bar, such that the remainder of reinforcing steel bars can efficiently be used.

[0013] A pre-embedded piece according to the present invention includes a reinforcing steel bar and a screw rod. The reinforcing steel bar includes a body and an embossed portion formed on an outer periphery of the body. An end of the screw rod is connected to an end of the reinforcing steel bar.

[0014] The reinforcing steel bar and the screw rod can be made of different materials.

[0015] The screw rod can be made of stainless steel.

[0016] The other end of the reinforcing steel bar not connected to the screw rod can be bent to form a hooked portion.

[0017] The screw rod can include an outer threaded portion having a plurality of peaks and a plurality of roots. The screw rod has a maximum outer diameter at the plurality of peaks and a minimal outer diameter at the plurality of roots. In a case that the reinforcing steel bar and the screw rod are made of the same material, the minimal outer diameter of the screw rod is substantially equal to an outer diameter of the body of the reinforcing steel bar.

[0018] The embossed portion can include a plurality of annular ridges and at least one longitudinal rib. The plurality of annular ridges is parallel to each other. The at least one longitudinal rib extends in a longitudinal direction of the reinforcing steel bar and connects the plurality of annular ridges.

[0019] A method for producing a pre-embedded piece according to the present invention includes preparing a reinforcing steel bar and a screw rod. The reinforcing steel bar includes a body and an embossed portion formed on an outer periphery of the body. The reinforcing steel bar and the screw rod are placed end to end and fused together.

[0020] The reinforcing steel bar and the screw rod can be bonded by friction welding.

[0021] In preparation of the reinforcing steel bar, the steel material can be obtained from remainder of reinforcing steel bars.

[0022] A reinforcing steel structure of a first embodiment according to the present invention includes a plurality of main bars, a plurality of hooped columns, and a plurality of pre-embedded pieces. The plurality of main bars is arranged annularly. Each of the plurality of hooped columns is mounted around the plurality of main bars. The plurality of pre-embedded pieces is located in a space defined by the plurality of main bards. Each of the plurality of pre-embedded pieces includes a reinforcing steel bar and a screw rod. The reinforcing steel bar and the screw rod are connected end to end. The reinforcing steel bar includes a body and an embossed portion formed on an outer periphery of the body.

[0023] The plurality of main bars can include more than three main bars, and each of the plurality of hooped columns can be polygonal, circular, or elliptic.

[0024] The plurality of pre-embedded pieces can be coupled to a measuring board including a grouting opening and a plurality of through-holes surrounding the grouting opening. The screw rod of each of the plurality of pre-embedded pieces extends through one of the plurality of through-holes. An adjusting member threadedly engages with an outer threaded portion of the screw rod of each of the plurality of pre-embedded pieces. The adjusting members are located between the reinforcing steel bars of the plurality of pre-embedded pieces and the measuring board.

[0025] A reinforcing steel structure of a second embodiment according to the present invention includes a plurality of hooped columns and a plurality of pre-embedded pieces. Each of the plurality of pre-embedded pieces includes a reinforcing steel bar and a screw rod. The reinforcing steel bar and the screw rod are connected end to end. The reinforcing steel bar includes a body and an embossed portion formed on an outer periphery of the body. Each of the plurality of hooped columns is mounted around the plurality of pre-embedded pieces.

[0026] The plurality of pre-embedded pieces can be coupled to a measuring board including a grouting opening and a plurality of through-holes surrounding the grouting opening. The screw rod of each of the plurality of pre-embedded pieces extends through one of the plurality of through-holes. An adjusting member threadedly engages with an outer threaded portion of the screw rod of each of the plurality of pre-embedded pieces. The adjusting members are located between the reinforcing steel bars of the plurality of pre-embedded pieces and the measuring board.

[0027] In the pre-embedded piece of the second embodiment according to the present invention can be used to directly replace the main bars. Namely, the reinforcing steel structure of the second embodiment according to the present invention includes a plurality of hooped columns and a plurality of pre-embedded pieces. Each pre-embedded piece includes a reinforcing steel bar and a screw rod. The reinforcing steel bar and the screw rod are connected end to end. The reinforcing steel bar includes a body and an embossed portion formed on an outer periphery of the body. Each of the plurality of hooped columns is mounted around the plurality of pre-embedded pieces.

[0028] Thus, the pre-embedded piece and the reinforcing steel structure including the pre-embedded piece permits the concrete aggregate mass to provide an excellent gripping force to the pre-embedded piece. Furthermore, after engagement between the pre-embedded piece and

the concrete aggregate mass, the force acting on the pre-embedded piece can be dispersed to avoid breaking in the concrete aggregate mass. Thus, use safety of the reinforced concrete structure can well be maintained.

[0029] In the method for producing the pre-embedded piece, by end-to-end connection of the reinforcing steel bar and the screw rod, the production is easy, and there is no limitation to the size of the reinforcing steel bar and the screw rod. Thus, the reinforcing steel bar and the screw rod of an appropriate size can be selected according to the material properties and the needs in use, permitting easy control on the structural strength and the costs of the pre-embedded piece. Particularly, when using remainder of reinforcing steel bars as the material for the reinforcing steel bar, the remainder of reinforcing steel bars can efficiently be used to reduce the burden to people in the industry and the environment, meeting the developing trend of green energy.

[0030] The present invention will become clearer in light of the following detailed description of illustrative embodiments of this invention described in connection with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The illustrative embodiments may best be described by reference to the accompanying drawings where:

FIG. 1 is a partial, cross sectional view of a conventional reinforced concrete structure.

FIG. 2 is a partial, perspective view of a conventional anchor bolt.

FIG. 3 is a partial, perspective view of a pre-embedded piece according to the present invention.

FIG. 4 is a partial, exploded, perspective view of a reinforcing steel structure of a first embodiment according to the present invention.

FIG. 5 is a partial, cross sectional view of a reinforced concrete structure including the reinforcing steel structure of FIG. 4 with a distal end of each pre-embedded piece not bent.

FIG. 6 is a partial, cross sectional view of another reinforced concrete structure including the reinforcing steel structure of FIG. 4 with a distal end of each pre-embedded piece bent.

FIG. 7 is a partial, exploded, perspective view of a reinforcing steel structure of a second embodiment according to the present invention.

FIG. 8 is a partial, cross sectional view of a reinforced concrete structure including the reinforcing steel structure of FIG. 7.

DETAILED DESCRIPTION OF THE INVENTION

[0032] FIG. 3 shows a pre-embedded piece of an embodiment according to the present invention. The pre-embedded piece includes a reinforcing steel bar 1 and a screw rod 2. The reinforcing steel bar 1 and the screw rod 2 are connected end to end.

[0033] The reinforcing steel bar 1 includes a body 11 and an embossed portion 12. The body 11 is elongated. The embossed portion 12 is formed on an outer periphery of the body 11. In this embodiment, the embossed portion 12 includes a plurality of annular ridges 121 spaced from each other. The annular ridges 121 can be parallel to each other and can be spaced from each other by regular intervals. Preferably, the embossed portion 12 further includes the at least one longitudinal rib 122 extending in a longitudinal direction of the reinforcing steel bar 1 and connecting the annular ridges 121.

[0034] The screw rod 2 includes an outer threaded portion 21. The screw thread of the outer threaded portion 21 can be, but not limited to, triangular, trapezoidal, or square. The material of the screw rod 2 can be the same or different from that of the reinforcing steel bar 1. Specifically, since most portion of the screw rod 2 is exposed to the air during use of the pre-embedded piece and is, thus, liable to rust, both of the reinforcing steel bar 1 and the screw rod 2 can be made of stainless steel. Alternatively, only the screw rod 2 is made of stainless steel to avoid rusting while controlling the material costs of the pre-embedded piece.

[0035] The outer threaded portion 21 has a plurality of peaks and a plurality of roots. The screw rod 2 has a maximum outer diameter at the peaks and a minimal outer diameter at the roots.

[0036] In the pre-embedded piece, the reinforcing steel bar 1 and the screw rod 2 can have the desired size and length according to needs. Namely, the outer diameter of the body 11 of the reinforcing steel bar 1 can be equal to or not equal to the minimal outer diameter of the screw rod 2. The present invention is not limited by this. As an example, in a case that the reinforcing steel bar 1 and the screw rod 2 are made of the same material or made of materials having similar properties, the minimal outer diameter of the embossed portion 12 can be substantially the same as the outer diameter of the body 11 of the reinforcing steel bar 1. In another case that the reinforcing steel bar 1 and the screw rod 2 are much different in the material properties, a reinforcing steel bar 1 and a screw rod 2 of an appropriate diameter can be selected according to the different material properties and the forces acting on the reinforcing steel bar 1 and the screw rod 2, and the reinforcing steel bar 1 and the screw rod 2 are then connected end to end, which can easily be appreciated and made by one having ordinary skill in the art.

[0037] A method for producing a pre-embedded piece according to the present invention will now be set forth. The method includes preparing a reinforcing steel bar 1 and a screw rod 2. The reinforcing steel bar 1 includes a body 11 and an embossed portion 12. The embossed portion 12 is formed on an outer periphery of the body 11. Then, the reinforcing steel bar 1 and the screw rod 2 are placed end to end, and the reinforcing steel bar 1 and the screw rod 2 are fused together.

[0038] In preparation of the reinforcing steel bar 1, the steel material can be obtained from remainder of reinforcing steel bars to reduce the amount of remainder to be recycled. Thus, the considerable costs for transportation, sorting, and reproduction can be saved to reduce the burden to people in the industry. Of more importance, the emission of carbon during the production can be reduced to greatly relieve the burden to the environment, meeting the developing trend of green energy.

[0039] The reinforcing steel bar 1 and the screw rod 2 can be bonded by friction welding that can easily be operated. Thus, the reinforcing steel bar 1 and the screw rod 2 can be fused together to reduce the production costs for the pre-embedded piece while increasing the production efficiency and the yield.

[0040] With reference to FIG. 4, in an example of use of the pre-embedded piece according to the present invention, a plurality of pre-embedded pieces are cooperated with a plurality of main bars 3 and a plurality of hooped columns 4 to form a reinforcing steel structure for grouting purposes. Specifically, the main bars 3 are arranged annularly. Each hooped column 4 is mounted around the main bars 3 to shape the main bars 3. In this embodiment, the plurality of main bars 3 includes three main bars 3 or more than three main bars 3, and each hooped columns 4 is bent to a polygonal, circular, or elliptic form.

[0041] With references to FIGS. 4 and 5, the pre-embedded pieces are coupled to a measuring board 5 mounted on top of the main bars 3. The pre-embedded pieces are aligned with a space defined by the main bars 3. In this embodiment, the measuring board 5 includes a grouting opening 51 and a plurality of through-holes 52 surrounding the grouting opening 51. When each pre-embedded piece is coupled to the measuring board 5, an adjusting member 6 threadedly engages with the outer threaded portion 21 of the screw rod 2, and the screw rod 2 extends through one of the through-holes 52. Thus, the adjusting members 6 and the reinforcing steel bars 1 are located at a bottom side of the measuring board 5. The adjusting members 6 are located between the reinforcing steel bars 1 and the measuring board 5. Furthermore, at least one fastener 7 is mounted on a section of the outer threaded portion 21 of each screw rod 2 at the top side of the measuring board 5, such that each pre-embedded piece can securely be coupled to the measuring board 5 while leveling the measuring board 5. The adjusting members 6 and the fasteners 7 can be nuts.

[0042] Grout is poured through the grouting opening 51 of the measuring board 5 to the reinforcing steel structure, and a concrete aggregate mass S is formed after the grout hardens. Thus, the reinforcing steel structure and the concrete aggregate mass S are securely bonded. The measuring board 5 can be removed or left. The screw rod 2 of each pre-embedded piece partially extends beyond the concrete aggregate mass S for coupling with an object on the ground.

[0043] Since the reinforcing steel bar 1 of each pre-embedded piece includes the embossed portion 12, the annular ridges 121, the longitudinal rib 122, and the outer periphery of the body 11 can define a space for receiving the grout, greatly increasing the contact area between each pre-embedded piece and the concrete aggregate mass S such that the concrete aggregate mass S can sufficiently cover the reinforcing steel bar 1 of each pre-embedded piece to provide each pre-embedded piece with a better gripping force.

[0044] By such an arrangement, even if the reinforcing steel bar 1 of each pre-embedded piece is not bent, reliable engagement between the pre-embedded piece and the concrete aggregate mass S can be assured, and loosening of each pre-embedded piece will not occur even after a long period of time of use. Furthermore, the production processes of the pre-embedded piece can be simplified. Only end-to-end connection of the reinforcing steel bar 1 and the screw rod 2 is required. Bending of the distal end of the reinforcing steel bar 1 is not required. The production efficiency and use convenience are enhanced.

[0045] Furthermore, after engagement between each pre-embedded piece and the concrete aggregate mass S, the embossed portion 12 of the reinforcing steel bar 1 of each pre-embedded piece assists in dispersion of the force acting on each pre-embedded piece, avoiding stress concentration on certain areas, which is helpful in prolong the service life of each pre-embedded piece and, hence, enhancing the use safety of the whole reinforcing steel structure.

[0046] With reference to FIG. 6, if it is desired to further increase the structural strength provided by the engagement between the pre-embedded pieces according to the present invention and the concrete aggregate mass S, the other end of the reinforcing steel bar 1 not connected to the screw rod 2 can be bent to form a hooked portion 13.

[0047] With reference to FIGS. 7 and 8, in another example, the pre-embedded piece according to the present invention can be used to directly replace the main bars. Namely, the reinforcing steel structure of the second embodiment according to the present invention includes a plurality of hooped columns 4 and a plurality of pre-embedded pieces. In assembly, an adjusting member 6 threadedly engages with the outer threaded portion 21 of the screw rod 2 of each pre-embedded piece, and the screw rod 2 extends through one of the through-holes 52. Thus, the adjusting members 6 and the reinforcing steel bars 1 are located at the bottom side of the measuring board 5. The adjusting members 6 are located between the reinforcing steel bars 1 and the measuring board 5. Next, each hooped column 4 is mounted around the reinforcing steel bars 1 of the pre-embedded pieces. Furthermore, at least one fastener 7 is mounted on a section of the outer threaded portion 21 of each screw rod 2 at the top side of the measuring board 5, such that each pre-embedded piece can securely be coupled to the measuring board 5 while leveling the measuring

board 5. The adjusting members 6 and the fasteners 7 can be nuts.

[0048] Grout is poured through the grouting opening 51 of the measuring board 5 to the reinforcing steel structure, and a concrete aggregate mass S is formed after the grout hardens. Thus, the reinforcing steel structure and the concrete aggregate mass S are securely bonded. The measuring board 5 can be removed or left. The screw rod 2 of each pre-embedded piece partially extends beyond the concrete aggregate mass S for coupling with an object on the ground.

[0049] Thus, the pre-embedded piece of the second embodiment of the present invention can be used to directly replace a main bar. In addition to the above advantages, the pre-embedded piece can further reduce the components of the reinforcing steel structure, reducing the material costs, simplifying the assembling procedures, and increasing the construction efficiency.

[0050] In view of the foregoing, the pre-embedded piece and the reinforcing steel structure including the pre-embedded piece permits the concrete aggregate mass S to provide an excellent gripping force to the pre-embedded piece. Furthermore, after engagement between the pre-embedded piece and the concrete aggregate mass S, the force acting on the pre-embedded piece can be dispersed to avoid breaking in the concrete aggregate mass S. Thus, use safety of the reinforced concrete structure can well be maintained.

[0051] In the method for producing the pre-embedded piece, by end-to-end connection of the reinforcing steel bar 1 and the screw rod 2, the production is easy, and there is no limitation to the size of the reinforcing steel bar 1 and the screw rod 2. Thus, the reinforcing steel bar 1 and the screw rod 2 of an appropriate size can be selected according to the material properties and the needs in use, permitting easy control on the structural strength and the costs of the pre-embedded piece. Particularly, when using remainder of reinforcing steel bars as the material for the reinforcing steel bar 1, the remainder of reinforcing steel bars can efficiently be used to reduce the burden to people in the industry and the environment, meeting the developing trend of green energy.

[0052] Thus since the invention disclosed herein may be embodied in other specific forms without departing from the spirit or general characteristics thereof, some of which forms have been indicated, the embodiments described herein are to be considered in all respects illustrative and not restrictive. The scope of the invention is to be indicated by the appended claims, rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are intended to be embraced therein.

Claims

1. A pre-embedded piece, **characterized in** comprising:

   a reinforcing steel bar (1) including a body (11) and an embossed portion (12), with the embossed portion (12) formed on an outer periphery of the body (11); and

   a screw rod (2) including an end, with the end of the screw rod (2) connected to an end of the reinforcing steel bar (1).

2. The pre-embedded piece as claimed in claim 1, **characterized in that** the reinforcing steel bar (1) and the screw rod (2) are made of different materials.

3. The pre-embedded piece as claimed in claim 2, **characterized in that** the screw rod (2) is made of stainless steel.

4. The pre-embedded piece as claimed in claim 1, **characterized in that** the reinforcing steel bar (1) includes another end not connected to the screw rod (2), and with the other end of the reinforcing steel bar (1) bent to form a hooked portion (13).

5. The pre-embedded piece as claimed in claim 1, **characterized in that** the screw rod (2) includes an outer threaded portion (21) having a plurality of peaks and a plurality of roots, with the screw rod (2) having a maximum outer diameter at the plurality of peaks and a minimal outer diameter at the plurality of roots, with the reinforcing steel bar (1) and the screw rod (2) made of a same material, and with the minimal outer diameter of the screw rod (2) equal to an outer diameter of the body (11) of the reinforcing steel bar (1).

6. The pre-embedded piece as claimed in claim 1, **characterized in that** the embossed portion (12) includes a plurality of annular ridges (121) and at least one longitudinal rib (122), with the plurality of annular ridges (121) parallel to each other, and with the at least one longitudinal rib (122) extending in a longitudinal direction of the reinforcing steel bar (1) and connecting the plurality of annular ridges (121).

7. A method for producing a pre-embedded piece, **characterized in** comprising:

   preparing a reinforcing steel bar (1) and a screw rod (2), with the reinforcing steel bar (1) including a body (11) and an embossed portion (12), with the embossed portion (12) formed on an outer periphery of the body (11);

   placing the reinforcing steel bar (1) and the screw rod (2) end to end; and

   fusing the reinforcing steel bar (1) and the screw rod (2) together.

8. The method for producing a pre-embedded piece as claimed in claim 7, **characterized in that** the rein-

forcing steel bar (1) and the screw rod (2) are bonded by friction welding.

9. The method for producing a pre-embedded piece as claimed in claim 7, **characterized in that** preparing the reinforcing steel bar (1) includes obtaining steel material from remainder of reinforcing steel bars (1).

10. A reinforcing steel structure comprising:

a plurality of main bars (3), a plurality of hooped columns (4), and a plurality of pre-embedded pieces, with the plurality of main bars (3) arranged annularly, wherein the reinforcing steel structure is **characterized in that** each of the plurality of hooped columns (4) is mounted around the plurality of main bars (3), with the plurality of pre-embedded pieces located in a space defined by the plurality of main bards (3), with each of the plurality of pre-embedded pieces including a reinforcing steel bar (1) and a screw rod (2), with the reinforcing steel bar (1) and the screw rod (2) connected end to end, with the reinforcing steel bar (1) including a body (11) and an embossed portion (12), and with the embossed portion (12) formed on an outer periphery of the body (11).

11. The reinforcing steel structure as claimed in claim 10, **characterized in that** the plurality of main bars (3) includes three main bars (3) or more than three main bars (3), and wherein each of the plurality of hooped columns (4) is polygonal, circular, or elliptic.

12. The reinforcing steel structure as claimed in claim 10, **characterized in that** the plurality of pre-embedded pieces is coupled to a measuring board (5), with the measuring board (5) including a grouting opening (51) and a plurality of through-holes (52) surrounding the grouting opening (51), with the screw rod (2) of each of the plurality of pre-embedded pieces extending through one of the plurality of through-holes (52), with an adjusting member (6) threadedly engaged with an outer threaded portion (21) of the screw rod (2) of each of the plurality of pre-embedded pieces, and with the adjusting members (6) located between the reinforcing steel bars (1) of the plurality of pre-embedded pieces and the measuring board (5).

13. A reinforcing steel structure, **characterized in** comprising:

a plurality of hooped columns (4) and a plurality of pre-embedded pieces, with each of the plurality of pre-embedded pieces including a reinforcing steel bar (1) and a screw rod (2), with the reinforcing steel bar (1) and the screw rod (2) connected end to end, with the reinforcing steel bar (1) including a body (11) and an embossed portion (12), with the embossed portion (12) formed on an outer periphery of the body (11), and with each of the plurality of hooped columns (4) mounted around the plurality of pre-embedded pieces.

14. The reinforcing steel structure as claimed in claim 13, **characterized in that** the plurality of pre-embedded pieces is coupled to a measuring board (5), with the measuring board (5) including a grouting opening (51) and a plurality of through-holes (52) surrounding the grouting opening (51), with the screw rod (2) of each of the plurality of pre-embedded pieces extending through one of the plurality of through-holes (52), with an adjusting member (6) threadedly engaged with an outer threaded portion (21) of the screw rod (2) of each of the plurality of pre-embedded pieces, and with the adjusting members (6) located between the reinforcing steel bars (1) of the plurality of pre-embedded pieces and the measuring board (5).

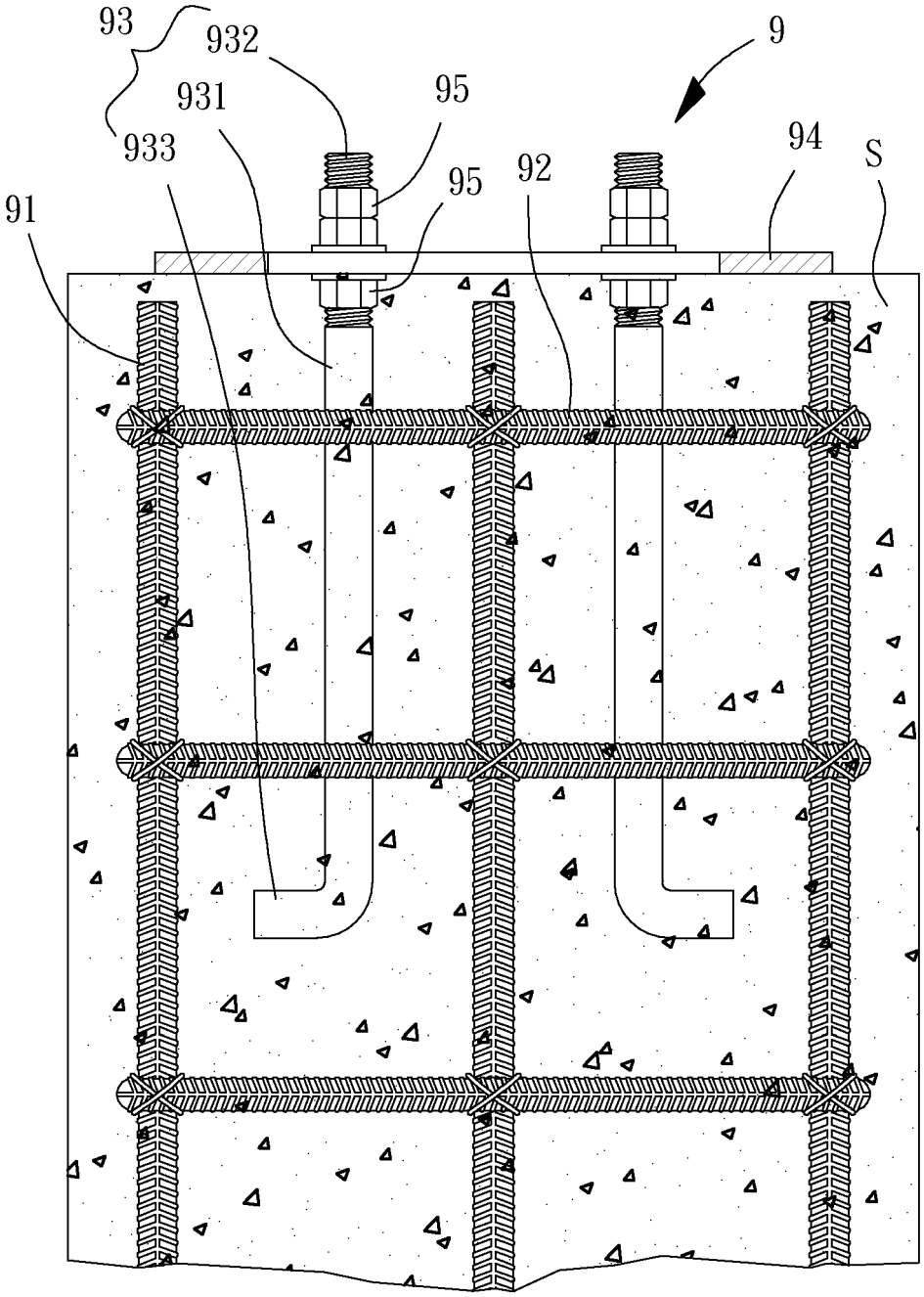

FIG. 1
PRIOR ART

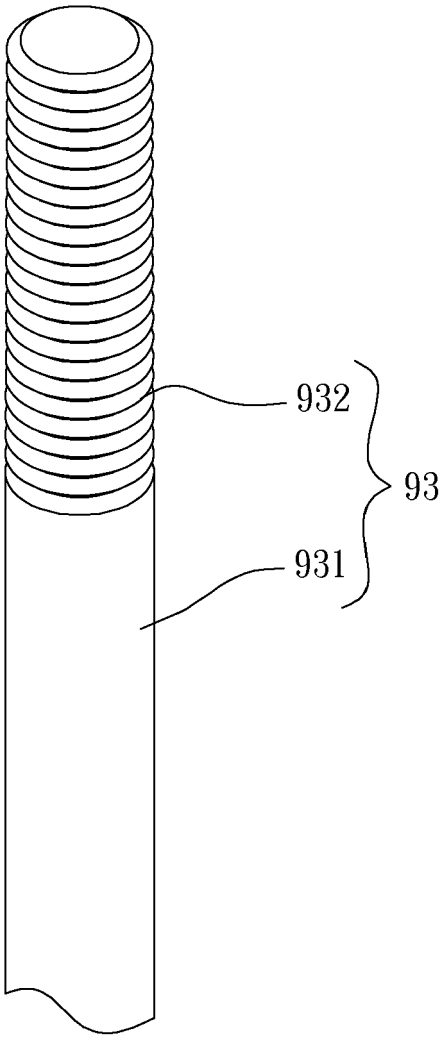

FIG. 2
PRIOR ART

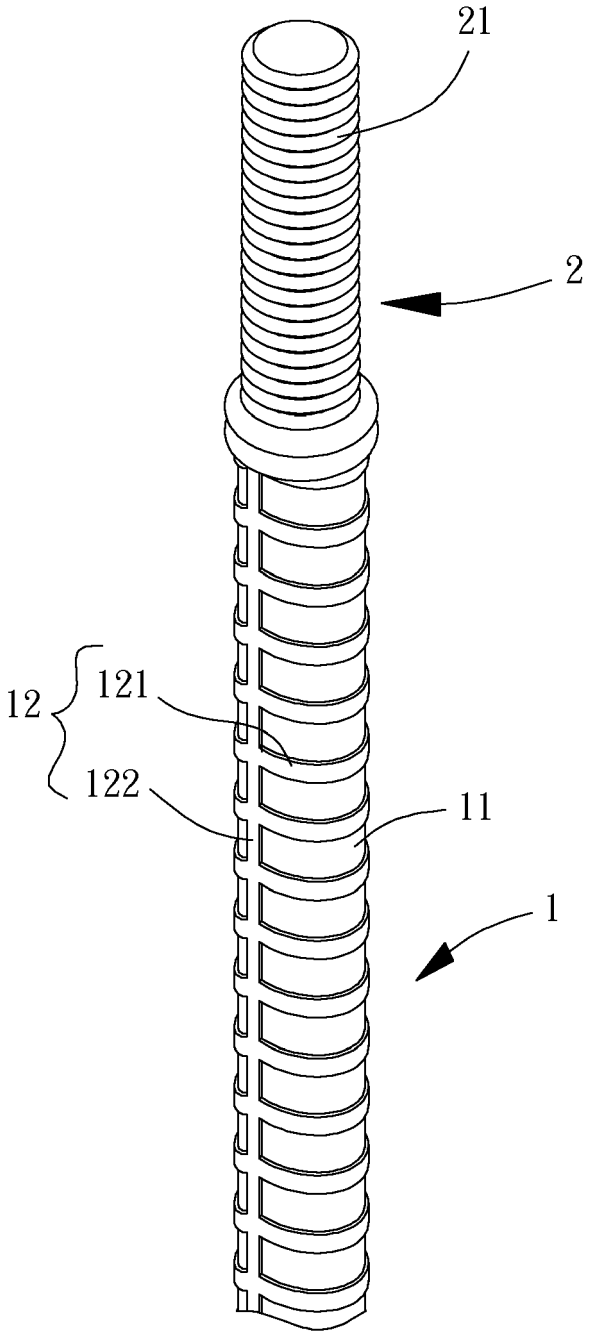

FIG. 3

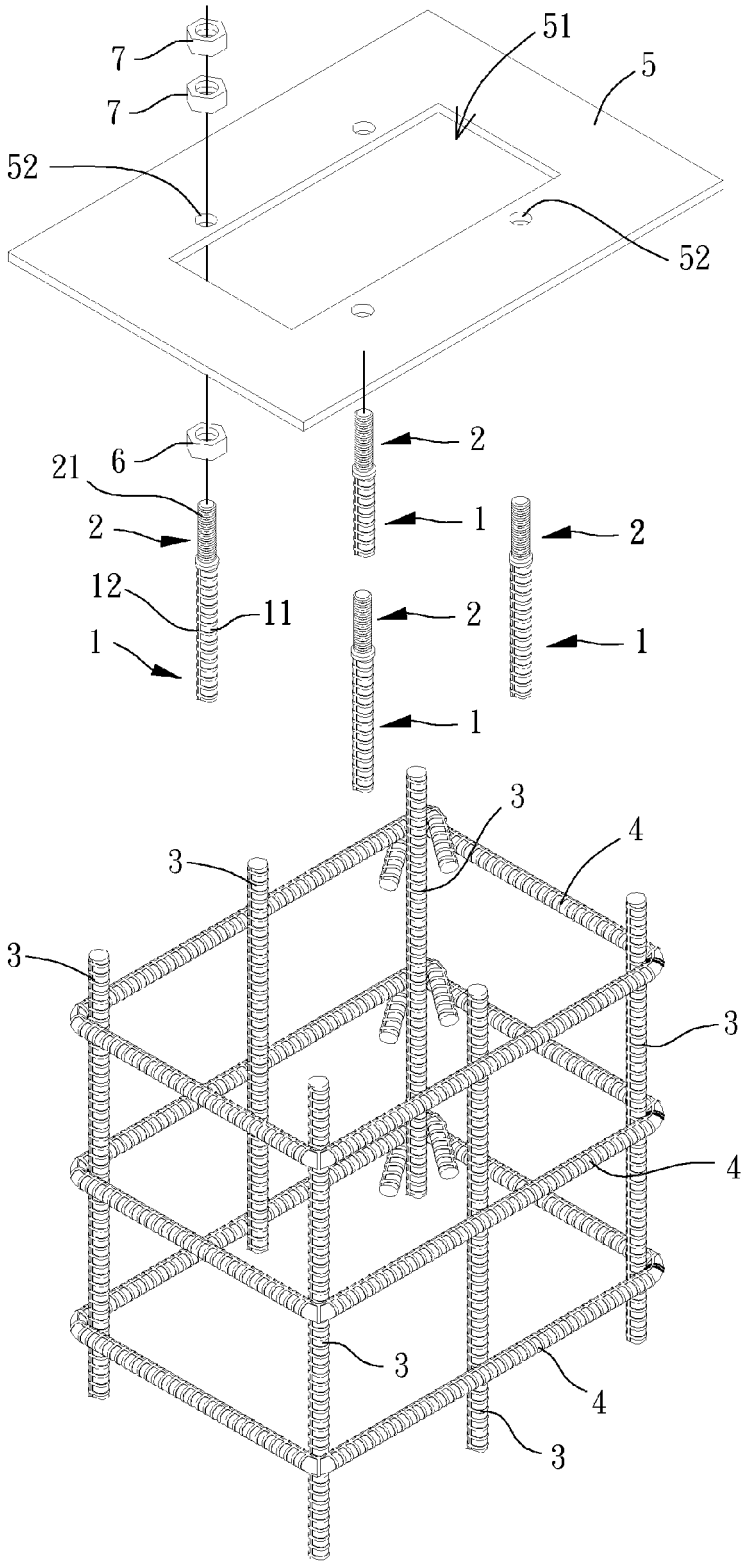

FIG. 4

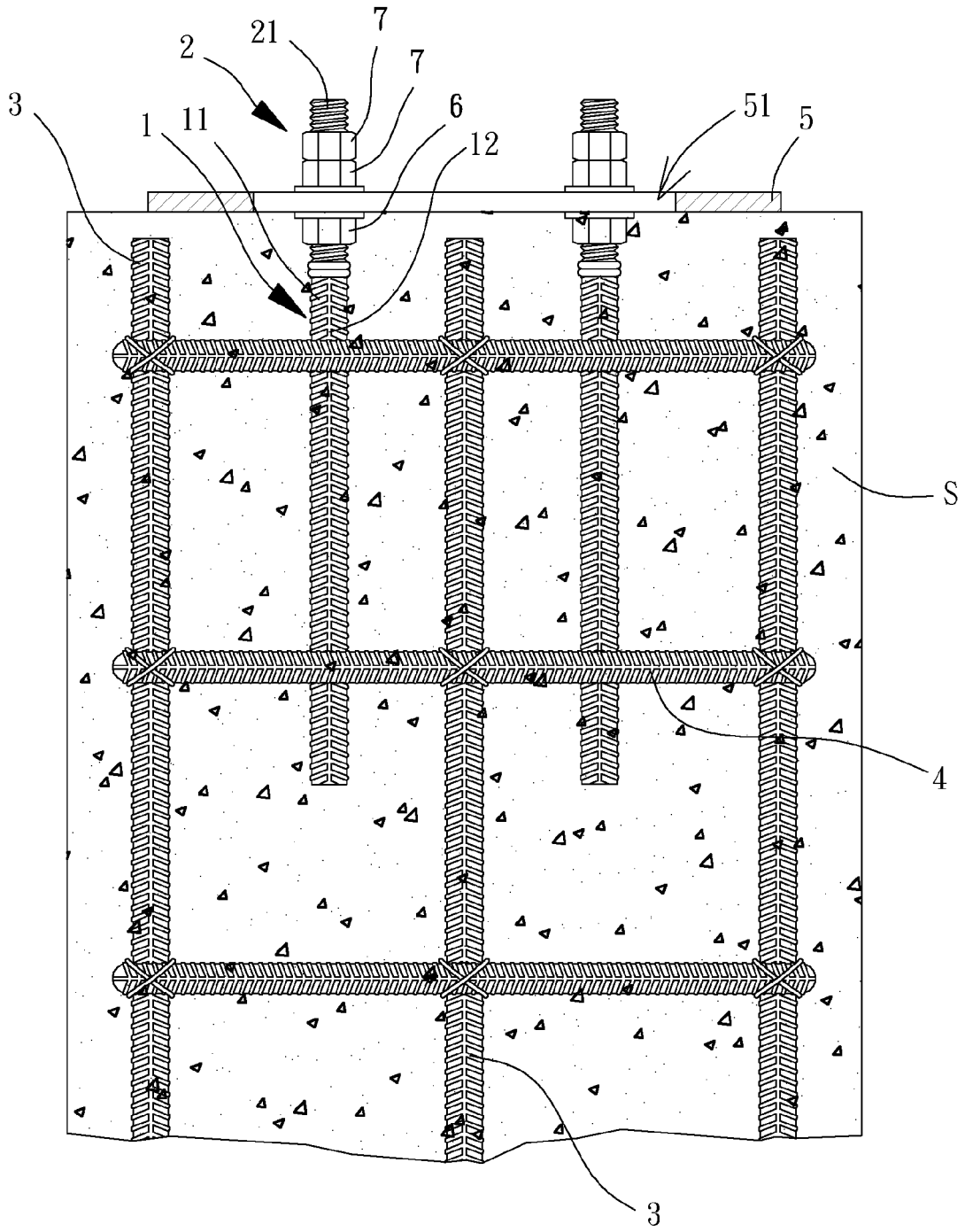

FIG. 5

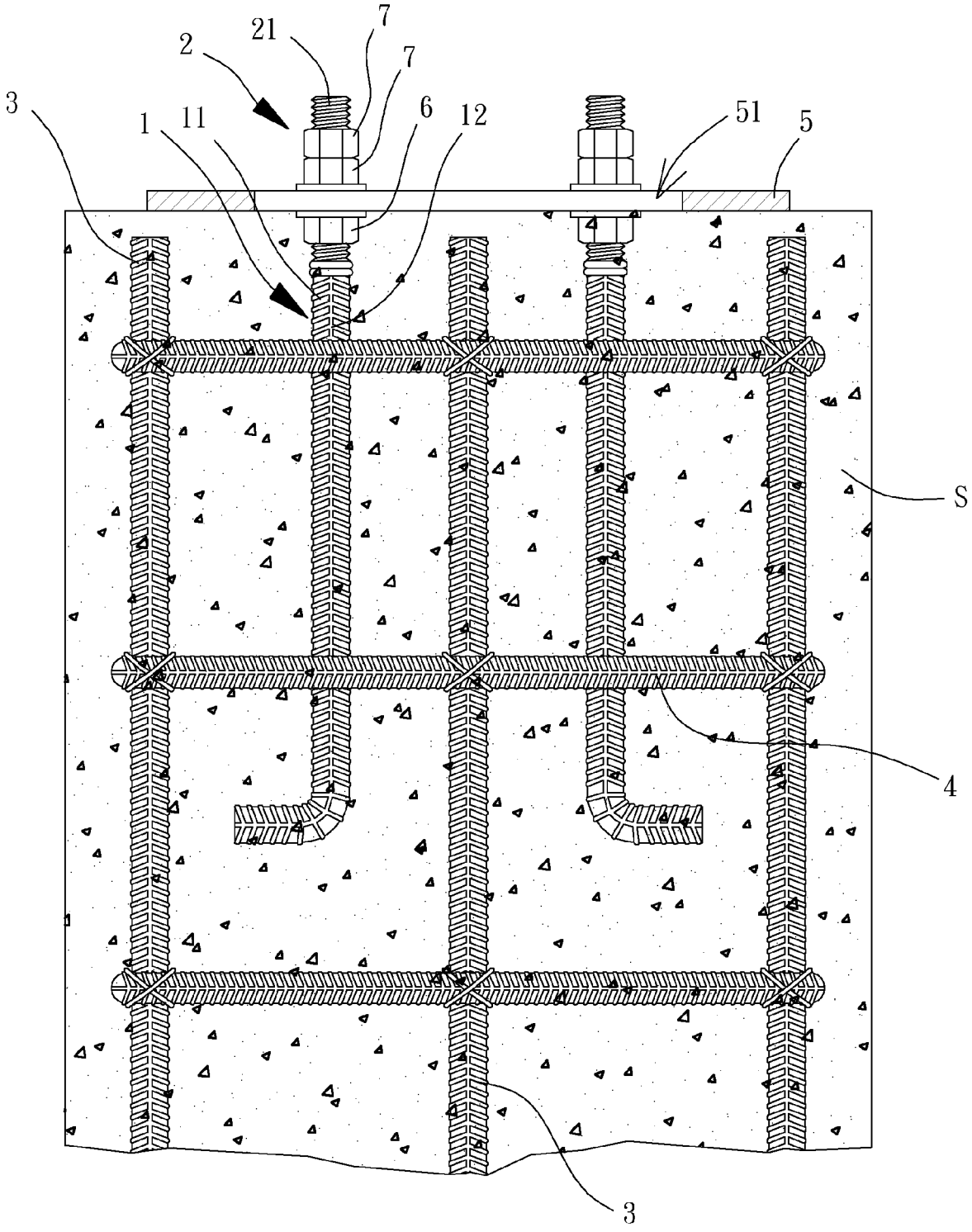

FIG. 6

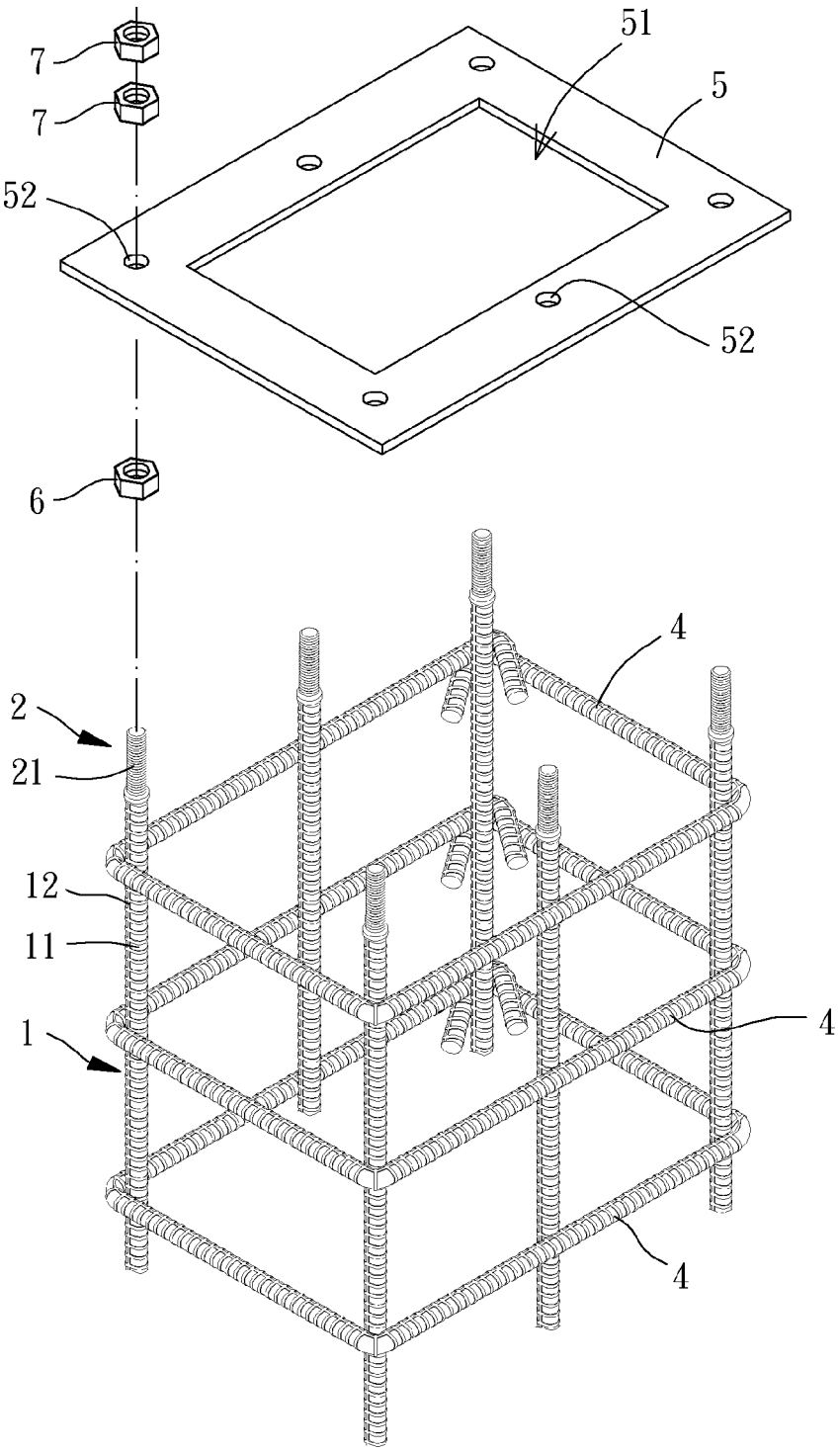

FIG. 7

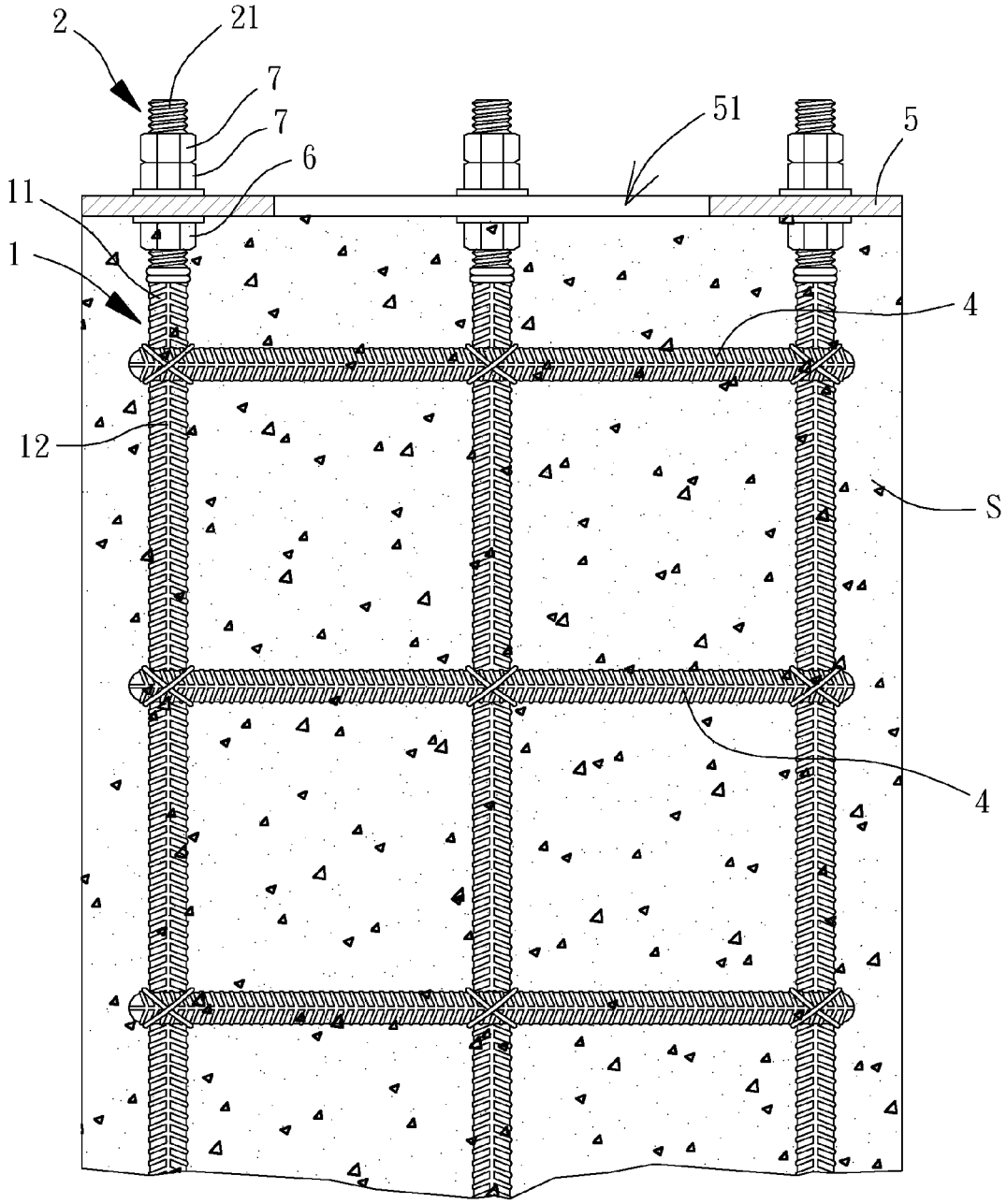

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 14 19 1389

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E04C
E02D
E04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 March 2015	Bauer, Josef

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