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(54) A TIE ROD FOR FORMWORK

SCHALUNGSANKER

TIGE D'ENTRETOISE POUR COFFRAGE

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(73) Proprietors:
- **Jurisdictio Berergensis AS**
  4068 Stavanger (NO)
- **Jurisdictio Stavangeris AS**
  4068 Stavanger (NO)

(72) Inventors:
- **SIMONSEN, John A.**
  N-4311 Hommersåk (NO)
- **ERSDAL, Birger**
  N-4017 Stavanger (NO)
- **SKJØRESTAD, Vidar**
  N-4311 Hommersåk (NO)

(74) Representative: **Håmsø Patentbyrå ANS**
Postboks 171
4302 Sandnes (NO)

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Description

[0001] The invention relates to a tie rod for connecting opposite sections of a casting formwork, especially formwork for concrete. More particularly, the invention relates to a tie rod formed with a mid portion which is arranged to form supporting abutment surfaces against the internal surfaces of the formwork to maintain a predetermined distance between the formwork sides, and the mid portion is arranged to be fixed in the set casting material to form anchoring points in the concrete in such a way that good adherence is ensured between the concrete and the tie rod in order to prevent moisture from entering along the rod and cause damage to the concrete, and by good thermal properties to prevent condensation at the end portion of the tie rod, the tie rod being formed in one piece of a non-corrosive material, preferably a composite material.

[0002] In what follows, the casting material is described as "concrete", and in this description there are also used other casting-process-related terms known from the casting of concrete. Nevertheless, the invention is not limited to applying only to formworks, which are to be filled with concrete, but also relates to formworks, which are used when pouring building structures with other casting materials.

[0003] When concrete is poured, tie rods must be used to keep the formwork in position, that is to say to prevent the distance between two opposite sections of formwork which are to define a wall, for example, from changing when the formwork is loaded in the supporting of or by the pressure from the plastic concrete which is filled into the formwork. Tie rods are set with relatively regular spacing and fix the opposite formwork sections with a distance determined by the dimension of the tie rod. At the same time, the tie rods are locked with wedges to braces extending along the external sides of the formwork.

[0004] Prior art tie rods are formed of steel with spacers which are arranged to bear on the internal wall surface of the formwork sections, made of plastic, slipped over the tie rod in the production process and positioned axially on the tie rod, each bearing on a respective widened portion of the tie rod or an equivalent item. After the concrete has set and the formwork is removed, the projecting end portions of the tie rods are broken by bending them at a weakened portion located at the spacers. The surface of fracture is exposed in the wall surface, and the spacers, which are often of a conical shape with their widest portions facing outwards, often fall out. The need arises for trowelling the wall surface at each tie rod, partly in order to cover the surface of fracture, partly to fill the recess from the spacer. This is laborious and costly. Still, the largest drawback of the prior art is that the tie rod or, more accurately, the remainder of the tie rod, which is inside the concrete structure, forms an entry gate for moisture. The moisture penetrates the concrete structure and comes into contact with the reinforcement, which lies, in part, immediately adjacent to or in direct contact with the tie rod. The reinforcement corrodes, the reinforcing strength is weakened, the adherence between the concrete and reinforcement is weakened and the concrete scales off due to corroded steel (rust coating) swelling relative to non-corroded steel. Corrosion also occurs on the tie rod.

[0005] Also in conditions in which a concrete structure is not in direct contact with water, prior art tie rods will be of disadvantage as the thermal properties of the steel will make the tie rod work as a cold bridge, so that at a great temperature gradient across the cross-section of the concrete structure, condensation will easily form on the warm side. This moisture creates various maintenance challenges caused by the moisture directly or by rust formation on the tie rod.

[0006] In concrete structures which are to retain a liquid, that is prevent the liquid from entering or escaping, the tie rods will often be a source of leakage along the tie rods because of, among other things, poor adherence between steel and concrete.

[0007] Another problem of the prior art is the lacking possibility of the tie rods for accurate positioning of reinforcement in the axial direction of the rod when the reinforcement is placed directly on the tie rods. Prior art tie rods lack means for this.

[0008] From US 3,430,914 is known a formwork tie rod of metal provided with diabolo-shaped spacer members, in which the outer part of the spacer member can be removed as required, and the diabolo shape ensures that the spacer member cannot inadvertently come loose from the wall. There is also described a plastic plug for sealing the centre hole of the spacer member after the rod end has been removed in a known manner. There are also described conical filler plugs of wood and ceramics. The rod exhibits the drawbacks described above as regards corrosion.

[0009] From NO 980475 is known a formwork tie rod, in which spacers of plastic exhibit one or more plane partial surfaces in the circumferential surface to bring about good adherence of finishing mortar when the holes from the spacer shims are to be sealed up. The rod exhibits the drawbacks described above as regards corrosion.

[0010] NL 9101666 A discloses a shuttering arrangement for concrete, comprising: two shut-tering walls spaced apart; and one or more rods or wires which are attached to the shuttering walls and are made of an aramid fibre composite. Enlarged end portions are formed to engage with removable fasteners. A separate helix shaped distance element envelope the mid portion of the rod. NL 9101666 A does not disclose integrated abutment surfaces arranged to rest supportingly on the internal side surface of the shuttering.

[0011] The invention has as its object to remedy or reduce at least one of the drawbacks of the prior art.

[0012] The object is achieved through features specified in the description below and in the claims that follow.

[0013] The invention relates to a tie rod formed of non-corrosive materials, preferably composite materials, in

which a mid portion, exhibiting opposite abutment surfaces arranged to rest supportingly on the inside of a formwork section, and a rod stem forms a continuous structure. In addition to exhibiting said abutment surfaces the mid portion may also include supporting and securing portions for other building materials and also include elements, which increase the adherence to the surrounding concrete and/or reduce the possibility for water to enter along the tie rod. After the formwork has been removed, the projecting rod end portions may be cut off at any position with a cutting tool suitable therefore, for example cutting pliers.

[0014] Thereby the tie rod according to the invention exhibits improved properties in several areas:

- no corrosion damage will occur in the part of the formwork tie rod which is left in the concrete structure;
- the continuous, non-corrosive tie rod structure with good adherence to the surrounding concrete prevents water from penetrating into or through the concrete structure in channels formed along the tie rod, whereby the tie rod according to the invention thereby contributes to a concrete structure of better watersealing properties and a concrete structure exhibiting less risk of rust formation on the reinforcing steel;
- the mid portion of the tie rod may be shaped at minimal costs to form a large number of positioning and securing details for reinforcement and internal insulation in plate form,
- the mid portion of the tie rod may be formed with radial anchoring elements which prevent the tie rod, under torque strains, from coming loose from the surrounding, set concrete, and the through plug which is formed by the remaining part of the tie rod can thereby function as installation fixtures for external building materials, the through stem of the rod being suitable as a screw attachment, for example
- the thermal conductivity of the rod materials is small in relation to that of the concrete structure, and the problem of condensation at the tie rods is eliminated;
- projecting end portions of the tie rod can be used for mounting external building materials, for example insulation material in plate form, as the material is slipped onto the projecting end portions and secured with locking elements suitable therefore, before excess lengths of the end portions are cut off; and
- after the formwork has been removed, there are no parts of the tie rod that can fall out of the cast structure and thereby create a need for surface repairs by trowelling hollows with mortar, putting in plugs etc.

[0015] Any fasteners for securing building materials to the tie rod are preferably also formed of a non-corrosive material.

[0016] More particularly, the invention relates to a tie rod for joining opposite side sections of a casting formwork, the tie rod being provided with a mid portion and two rod end portions, and there being formed in the transitions between the mid portion and either rod end portion at least one abutment surface which is arranged to bear supportingly on an internal surface of the side sections, the rod end portion including rests for wedges for securing the side sections of the casting formwork, characterized in that the tie rod includes a stem of large tensile strength and a surrounding mantle, the mid portion and the mantle of the stem being formed as a continuous structure, the stem, mantle and mid portion being formed of non-corrosive materials.

[0017] The tie rod is preferably formed of a composite material, the stem being fibrereinforced in the axial direction of the tie rod.

[0018] The mantle and the mid portion are advantageously formed of the same type of material.

[0019] The mantle and the mid portion are preferably joined by fusion of the material forming the mantle and the material forming the mid portion. Alternatively the mantle and the mid portion are joined by gluing.

[0020] The mid portion is preferably provided with means for non-releasable engagement with a surrounding casting material when this has been poured into the formwork and has set.

[0021] The mid portion and the stem portion surrounded by the mid portion is advantageously arranged to form a watertight, non-releasable, through plug in a completed cast structure.

[0022] The abutment surface is preferably formed by the mid portion exhibiting a widened cross-section towards its abutment portions.

[0023] At least one portion of the mid portion advantageously exhibits a cross-section exhibiting, when the cross-section lies perpendicularly to the centre axis of the tie rod, a non-circular shape.

[0024] The mid portion is advantageously provided with a plurality of concentric cross-sectional widenings.

[0025] The mid portion is advantageously arranged to receive and fix one or more locking means for a plate-shaped building material, for example an insulating material, substantially annular grooves being complementary to a portion of the locking means.

[0026] The locking means are preferably formed of a non-corrosive material.

[0027] The mid portion of the tie rod advantageously includes one or more means arranged to receive a reinforcing means, preferably in the form of one or more substantially annular grooves.

[0028] The substantially annular grooves advantageously have a trapezoidal cross-section with the smallest width at the bottom of the groove, the side edges of the groove exhibiting the same angle of inclination relative to the centre axis of the tie rod.

[0029] The mid portion of the tie rod is advantageously arranged to receive one or more securing means for securing the reinforcing means.

[0030] The securing means for securing the reinforcing

means is advantageously formed of a non-corrosive material.

[0031] The rod end portion is preferably arranged to receive one or more securing discs for securing a plate-shaped building material, for example an insulating material.

[0032] The securing disc advantageously includes means for releasable connection to the mantle surface of the rod end portion.

[0033] The securing disc is advantageously provided with a plurality of resilient fingers extending from a circumferential portion and in a radial direction towards a centre opening.

[0034] The securing disc is preferably formed of a non-corrosive material.

[0035] The thermal conductivity of the tie rod is advantageously smaller than the thermal conductivity of the surrounding completed cast structure.

[0036] In what follows is described a non-limiting example of a preferred embodiment which is visualized in the accompanying drawings, in which:

Figure 1 shows a perspective sketch of a tie rod according to the invention;

Figure 2 shows a perspective sketch on a larger scale of a locking disc for the tie rod according to the invention;

Figure 3 shows a perspective sketch of a securing disc for the tie rod according to the invention;

Figure 4 shows a perspective sketch on a smaller scale of a partially assembled formwork, in which the tie rod connects opposite formwork sections and positions reinforcement iron and insulating material;

Figure 5 shows, on a smaller scale, a completed cast wall section, in which a side surface has isolation material applied thereon, fixed by means of the tie rod according to the invention; and

Figure 6 shows a perspective sketch of a further exemplary embodiment of a mid portion of the tie rod according to the invention.

[0037] A tie rod 1 includes a stem 2 with a mantle 2a, a mid portion 3 and two rod end portions 5a, 5b. At either one of the transitions between the mid portion 3 and the rod end portions 5a, 5b the mid portion exhibits a cross-sectional widening 7a, each forming an abutment surface 7.

[0038] The tie rod 1 is formed of a composite material, the stem 2 being reinforced in a manner known in itself with a fibre material of large tensile strength and surrounded by a bonding material forming the mantle 2a of the stem 2. The mid portion 3 may be formed of the same type of material as the mantle 2a.

[0039] In a first embodiment shown in figure 1, the cross-sectional widening forms a frustum of a cone, a bottom surface 7b facing the mid portion 3. The centre axis of the cone coincides with the centre axis of the tie rod 1. A top surface faces the adjacent rod end portion 5a, 5b, respectively, and is placed perpendicularly to the centre axis of the tie rod 1, forming the abutment surface 7. The bottom surface 7b exhibits a non-circular shape, four segment surfaces 7c lying parallel to the centre axis of the tie rod 1 in the direction towards the abutment surface 7 and extending into a side surface 7d. Two by two opposite segment surfaces 7c are parallel to each other, the bottom surface 7b forming a square with rounded corners.

[0040] In another embodiment shown in figure 6 the abutment surface 7 is formed as a first four-armed cross 57b. A second four-armed cross 57a of larger arm length is formed at a distance from the first cross 57b, and four ribs 58a projecting radially and diametrically opposite, extend axially between the arms 59a, 59b of the crosses 57a, 57b. In addition this embodiment exhibits several concentric, circular cross-sectional widenings forming securing and sealing ribs 58b.

[0041] The mid portion 3 is joined in a sealing manner to the stem 2, liquid, for example water, being unable to enter in an axial direction from the end portion 5a, 5b towards the mid portion 3 due to the passage of the stem 2 through the mid portion 3 forming a tight connection. The tight connection is formed by fusion of the materials of the mantle 2a and the mid portion 3 in the production, or by joining them with, for example, glue forming a watertight joint between the stem 2 and the mid portion 3.

[0042] Either rod end portion 5a, 5b is provided at its outer end with a projecting rest 9 for a wedge device 11 for securing the side sections 23a, 23b of a formwork 21.

[0043] The mid portion 3 is provided with several grooves 3a extending round the entire periphery of the mid portion and arranged to receive a locking disc 13 for positioning and fixing a plate-shaped cast-in material 15, for example an insulating material.

[0044] The locking disc 13 is arranged to be slipped onto the mid portion 3, preferably in a radial direction, as a sector opening 13a leads in to a circular centre hole 13b positioned substantially centrically. To ensure that the locking disc 13 will not fall off after having been fitted on the tie rod 1, the thickness of the locking disc 13 forms, at least at the centre hole 13b, a press fit with the side edges of groove 3a of the mid portion 3, or the periphery of the centre hole 13b forms a press fit with the bottom surface of the groove 3a.

[0045] The mid portion 3 is also provided with several grooves 3b extending round the entire periphery of the mid portion and having a transversal profile which is arranged to receive a reinforcing means 25 in the form of reinforcing steel or similar, the cross-section of the groove being trapezoidal, for example.

[0046] The tie rod 1 may expedient also include a securing disc 17 which is arranged to be secured to a cut rod end portion 5a, 5b projecting from a set casting material 31, for example a concrete wall, after the formwork 21 has been removed, the securing disc 17 being provided with a number of radially oriented, resilient fingers 17a extending from a circumferential portion 17b and in a radial direction towards a centre opening 17c, each finger 17a being separated from an adjacent finger by a slot 17d extending in a radial direction from the centre opening 17c to a circular opening 17e in the circumferential portion 17b of the securing disc. The centre opening 17c exhibits a diameter, which is smaller than the diameter of the rod end portions 5a, 5b to ensure that the securing disc 17 is retained in a prescribed position on the rod end portion 5a, 5b in that the fingers 17a are under tension.

[0047] At least the projections 9 and the stem 2 of the tie rod 1, that is to say the rod end portions 5a, 5b and the through core of the mid portion 3, are formed of a composite material of a tensile strength which is great enough for absorbing the relevant tensile loads to which the tie rod 1 for a formwork 21 is subjected during installation and during pouring of the casting material 31, for example concrete, into the formwork gap. The composite material has fibre reinforcement and a binder material, which do not convey water or corrode. The mid portion 3 and stem 2 are formed of a material which is suitable for securing a fastener, for example a nail or screw. The rod end portions 5a, 5b are arranged to be cut at any point between the projection 9 and the abutment surface 7 by means of a tool suitable therefore.

[0048] The entire tie rod 1 with projections 9 and mid portion 3 may be formed in one forming operation.

[0049] The locking disc 13 and the securing disc 17 are advantageously formed of a non-corroding material, for example a plastics material.

[0050] The tie rod 1 is installed in a manner known *per se* as the formwork 21 is being built, side sections 23a being put together before the reinforcing means 25 then being positioned and locked relative to each other and the formwork 21. Insulating material 15, if any, for casting in, is fixed by means of the locking discs 13 before the opposite side sections 23b are mounted and the formwork is closed and secured by fitting the wedge devices 11 to the tie rods 1 within the projections 9 and tightening the tie rods 1. In the tightening the abutment surface 7 rests supportingly on an internal side surface 23c of the side sections 23a, 23b of the formwork 21.

[0051] After the casting material 31, for example the concrete, has been filled into the formwork and has set, the formwork 21 is removed in a manner known *per se,* and the projecting rod end portions 5a, 5b of the tie rods 1 are cut off.

[0052] If the rod end portions 5a, 5b are to be used for securing plate-shaped building materials 33, for example insulating plates, on one or both sides of the completed cast structure 31, these are secured by slipping the securing discs 17 onto the rod end portions 5a, 5b into abutment on the plates 33 after the projection 9 and suitable lengths of the rod end portions 5a, 5b have been cut off.

[0053] If building materials are to be secured by screwing or nailing, for example, this may be done by securing the fasteners to the mid portion 3 through the centre of the abutment surface 7 which is level with the outer surface of the cast structure 31 and formed by the cut stem 2. Due to the unbroken axial extent and partly non-circular cross-section of the mid portion 3 they are held in a secure grip in the set casting material 31, both in axial strain and radial rotational strain.

[0054] Due to the choice of material the tie rod 1 will not corrode and lead water in to the cast-in reinforcement or through the cast structure. The means 3a, 3b, 13 ensure a better positioning of the insulating materials 15 and reinforcement 25 in the cast structure, which leads to a more efficient utilization of the materials and better quality of the cast structure.

[0055] The possibility of using the rod end portions 5a, 5b of the tie rod and the abutment surface 7 of the mid portion when fitting external building materials, adds favourable additional functions to the tie rod 1.

Claims

1. A tie rod (1) for joining together opposite side sections (23a, 23b) of a formwork (21), the tie rod (1) being provided with a mid portion (3) and two rod end portions (5a, 5b) and there being formed, in the transitions between the mid portion (3) and either rod end portion (5a, 5b), at least one abutment surface (7) which is arranged to rest supportingly on an internal side surface (23c) of the side sections (23a, 23b), and the rod end portions (5a, 5b) including rests (9) for wedge devices (11) for securing the side sections (23a, 23b) of the casting formwork (21), **characterized in that** the tie rod (1) includes a stem (2) of great tensile strength with a surrounding mantle (2a), the mid portion (3) and the mantle (2a) of the stem (2) being formed as a continuous structure, the stem (2), the mantle (2a) and mid portion (3) being formed of non-corrosive materials.

2. The tie rod (1) in accordance with claim 1, **characterized in** that the tie rod (1) is formed of a composite material.

3. The tie rod (1) in accordance with claims 1-2, **characterized in** that the stem (2) is fibre-reinforced in the axial direction of the tie rod (1).

4. The tie rod (1) in accordance with claims 1-2, **characterized in that** the mantle (2a) and the mid portion (3) are formed of the same type of material.

5. The tie rod (1) in accordance with claims 1-4, **char-**

acterized in that the mantle (2a) and the mid portion (3) are joined by fusion of the material forming the mantle (2a) and the material forming the mid portion (3).

6. The tie rod (1) in accordance with claim 1, **characterized in that** the mantle (2a) and the mid portion (3) are joined by gluing.

7. The tie rod (1) in accordance with claim 1, **characterized in that** the mid portion (3) is provided with means (7c, 7d, 57a, 57b, 58a, 58b) for non-releasable engagement with a surrounding casting material (31) when this has been filled into the casting formwork (21) and has set.

8. The tie rod (1) in accordance with claim 1, **characterized in that** the mid portion (3) and the stem portion surrounded by the mid portion (3) is arranged to form a watertight, non-releasable, through plug in a completed cast structure (31).

9. The tie rod (1) in accordance with claim 1, **characterized in that** the abutment surface (7) is formed by the mid portion (3) exhibiting, towards its end portion, a widened cross-section (7a, 57b).

10. The tie rod (1) in accordance with claim 1,**characterized in that** at least one portion of the mid portion (3) exhibits a cross-section exhibiting, when the cross-section lies perpendicularly to the centre axis of the tie rod (1), a non-circular shape.

11. The tie rod (1) in accordance with claim 1, **characterized in that** the mid portion (3) is provided with a plurality of concentric cross-sectional widenings (58b).

12. The tie rod (1) in accordance with claim 1, **characterized in that** the mid portion (3) includes one or more substantially annular grooves (3a) which are arranged to receive and fix in the radial and axial directions one or more locking means (13) for a plate-shaped building material (15), for example an insulating material, the substantially annular grooves (3a) being complementary to a portion (13b) of the locking means (13).

13. The tie rod (1) in accordance with claim 12, **characterized in** that the locking means (13) are formed of a non-corrosive material.

14. The tie rod (1) in accordance with claim 1, characterized i n that the mid portion (3) of the tie rod (1) includes one or more means (3b) arranged to receive a reinforcing means (25).

15. The tie rod (1) in accordance with claim 1, **characterized in that** the mid portion (3) is provided with one or more substantially annular grooves (3b).

16. The tie rod (1) in accordance with claim 15, **characterized in that** the substantially annular grooves (3b) have a trapezoidal cross-section with the smallest width at the bottom of the groove (3b), and the side edges of the groove (3b) exhibit the same angle of inclination relative to the centre axis of the tie rod (1).

17. The tie rod (1) in accordance with claim 1, c h a r a c t e r i z e d i n that the mid portion (3) of the tie rod (1) is arranged to receive one or more securing means for securing the reinforcing means (25).

18. The tie rod (1) in accordance with claim 17, c h a r a c t e r i z e d in that the securing means for securing the reinforcing means (25) is formed of a non-corrosive material.

19. The tie rod (1) in accordance with claim 1, c h a r a c t e r i z e d i n that the rod end portion (5a, 5b) is arranged to receive one or more securing discs (17) for securing a plate-shaped building material (33), for example an insulating material.

20. The tie rod (1) in accordance with claim 19, **characterized in** that the securing disc (17) includes means (17a) for releasable connection to the mantle surface of the rod end portion (5a, 5b).

21. The tie rod (1) in accordance with claim 19, **characterized in** that the securing disc (17) is provided with a plurality of resilient fingers (17a) extending from a circumferential portion (17b) and in a radial direction towards a centre opening (17c).

22. The tie rod (1) in accordance with claim 19, **characterized in that** the securing disc (17) is formed of a non-corrosive material.

23. The tie rod (1) in accordance with claim 1, **characterized in that** the thermal conductivity of the tie rod (1) is smaller than the thermal conductivity of the surrounding completed cast structure.

Patentansprüche

1. Ankerstab (1) für die Verbindung von zwei gegenüberliegenden Seitenabschnitten (23a, 23b) einer Schalung (21), wobei der Ankerstab (1) einen mittleren Bereich (3) und zwei Stab-Endbereiche (5a, 5b) aufweist und in den Übergängen zwischen dem mittleren Bereich (3) und dem einen und/oder anderen Stab-Endbereich (5a, 5b) mindestens eine Auflagefläche (7) gebildet ist, welche angeordnet ist, um in stützender Weise an einer inneren Seitenfläche

(23c) der Seitenbereiche (23a, 23b) anzuliegen, und wobei die Stab-Endbereiche (5a, 5b) Stützen (9) für die Keilelemente (11) aufweisen, zur Sicherung der Seitenbereiche (23a, 23b) der Guss-Schalung (21), **dadurch gekennzeichnet, dass** der Ankerstab (1) einen Stamm (2) von grosser Zugfestigkeit aufweist, mit einem umgebenden Mantel (2a), wobei der mittlere Bereich (3) und der Mantel (2a) des Stamms (2) als eine zusammenhängende Struktur geformt sind, wobei der Stamm (2), der Mantel (2a) und der mittlere Bereich (3) aus korrosionsbeständigen Materialien geformt sind.

2. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Ankerstab (1) aus einem Verbundwerkstoff gebildet ist.

3. Ankerstab (1) nach einem der Ansprüche 1-2, **dadurch gekennzeichnet, dass** der Stamm (2) in der axialen Richtung des Ankerstabs (1) faserverstärkt ist.

4. Ankerstab (1) nach einem der Ansprüche 1-2, **dadurch gekennzeichnet, dass** der Mantel (2a) und der mittlere Bereich (3) aus dem gleichen Materialtyp geformt sind.

5. Ankerstab (1) nach einem der Ansprüche 1-4, **dadurch gekennzeichnet, dass** der Mantel (2a) und der mittlere Bereich (3) durch eine Fusion des Materials, das den Mantel (2a) bildet, und des Materials, das den mittleren Bereich (3) bildet, miteinander verbunden sind.

6. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Mantel (2a) und der mittlere Bereich (3) durch Kleben miteinander verbunden sind.

7. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) Mittel (7c, 7d, 57a, 57b, 58a, 58b) aufweist zur nicht-lösbaren Verbindung mit einem umgebenden Gusswerkstoff (31) nachdem dieser in die Gussschalung (21) gefüllt wurde und sich gesetzt hat.

8. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) und der vom mittleren Bereich (3) umgebene Bereich des Stamms angeordnet ist, um einen wasserdichten, nicht-lösbaren Durchgangsstopfen in einer fertiggestellten Gussstruktur (31) zu bilden.

9. Ankerstange (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Auflagefläche (7) gebildet ist durch den mittleren Bereich (3), der zu seinem Endbereich hin einen erweiterten Querschnitt (7a, 57b) aufwiest.

10. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** mindestens ein Teil des mittleren Bereichs (3) einen Querschnitt aufweist, der nichtkreisförmig ausgestaltet ist, wenn der Querschnitt senkrecht zur Mittelachse des Ankerstabs (1) liegt.

11. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) eine Vielzahl von konzentrischen Erweiterungen (58b) des Querschnitts aufweist.

12. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) eine oder mehrere im Wesentlichen ringförmige Nuten (3a) aufweist, welche angeordnet sind, um in den radialen und axialen Richtungen ein oder mehrere Verschlussmittel (13) für ein plattenförmiges Baumaterial (15), beispielsweise ein Isoliermaterial, aufzunehmen und zu befestigen, wobei die im Wesentlichen ringförmigen Nuten (3a) komplementär zu einem Bereich (13b) der Verschlussmittel (13) sind.

13. Ankerstab (1) nach Anspruch 12, **dadurch gekennzeichnet, dass** die Verschlussmittel (13) aus einem korrosionsbeständigen Material ausgebildet sind.

14. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) des Ankerstabs (1) ein oder mehrere Mittel (3b) zur Aufnahme eines Verstärkungsmittels (25) aufweist.

15. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) eine oder mehrere im Wesentlichen ringförmige Nuten (3b) aufweist.

16. Ankerstab (1) nach Anspruch 15, **dadurch gekennzeichnet, dass** die im Wesentlichen ringförmigen Nuten (3b) einen trapezförmigen Querschnitt aufweisen, dessen kleinste Breite sich am Boden der Nut (3b) befindet, und dass die Seitenränder der Nut (3b) denselben Neigungswinkel relativ zur Mittelachse des Ankerstabs (1) aufweisen.

17. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der mittlere Bereich (3) des Ankerstabs (1) ausgebildet ist, ein oder mehrere Sicherungsmittel aufzunehmen, zur Sicherung des Verstärkungsmittels (25).

18. Ankerstab (1) nach Anspruch 17, **dadurch gekennzeichnet, dass** das Sicherungsmittel zur Sicherung des Verstärkungsmittels (25) aus einem korrosionsbeständigen Material ausgebildet ist.

19. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** der Stab-Endbereich (5a, 5b) ausgebildet ist, eine oder mehrere Sicherungsscheiben

(17) zur Sicherung eines plattenförmigen Baumaterials (33), beispielsweise ein Isoliermaterial aufzunehmen.

20. Ankerstab (1) nach Anspruch 19, **dadurch gekennzeichnet, dass** die Sicherungsscheibe (17) Mittel (17a) zur lösbaren Verbindung mit der Manteloberfläche des Stab-Endbereichs (5a, 5b) aufweist.

21. Ankerstab (1) nach Anspruch 19, **dadurch gekennzeichnet, dass** die Sicherungsscheibe (17) eine Vielzahl von elastischen Fingern (17a) aufweist, die sich von einem umfangsseitigen Bereich (17b) her und in einer radialen Richtung zu einer zentralen Öffnung (17c) hin erstrecken.

22. Ankerstab (1) nach Anspruch 19, **dadurch gekennzeichnet, dass** die Sicherungsscheibe (17) aus einem korrosionsbeständigen Material gebildet ist.

23. Ankerstab (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Wärmeleitfähigkeit des Ankerstabs (1) kleiner ist als die Wärmeleitfähigkeit der umgebenden fertiggestellten Gussstruktur.

Revendications

1. Une tige d'entretoise (1) servant à joindre des sections latérales opposées (23a, 23b) d'un coffrage de béton (21), la tige d'entretoise (1) étant dotée d'une partie médiane (3) et de deux parties d'extrémité de tige (5a, 5b) et y étant formé, dans les transitions entre la partie médiane (3) et l'une ou/et l'autre partie d'extrémité de tige (5a, 5b), au moins une surface de butée (7) étant agencée pour reposer, de façon à réaliser un appui, sur une surface latérale interne (23c) des sections latérales (23a, 23b), et les parties d'extrémité de tige (5a, 5b) comprenant des appuis (9) pour des dispositifs de cales (11) servant à fixer les sections latérales (23a, 23b) du coffrage de béton (21), **caractérisée en ce que** la tige d'entretoise (1) comprend une barre (2) à forte résistance à la traction et une gaine l'enveloppant (2a), la partie médiane (3) et la gaine (2a) de la barre (2) étant réalisées en structure continue, la barre (2), la gaine (2a) et la partie médiane (3) étant réalisées en matériaux non corrosifs.

2. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la tige d'entretoise (1) est réalisée en matériau composite.

3. La tige d'entretoise (1) selon les revendications 1-2, **caractérisée en ce que** la barre (2) est renforcée de fibres en direction axiale de la tige d'entretoise (1).

4. La tige d'entretoise (1) selon les revendications 1-2, **caractérisée en ce que** la gaine (2a) et la partie médiane (3) sont réalisées du même type de matériau.

5. La tige d'entretoise (1) selon les revendications 1-4, **caractérisée en ce que** la gaine (2a) et la partie médiane(3) sont jointes par fusion du matériau formant la gaine (2a) et le matériau formant la partie médiane(3).

6. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la gaine (2a) et la partie médiane (3) sont jointes par collage.

7. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) est munie de moyens (7c, 7d, 57a, 57b, 58a, 58b) pour l'engagement non-libérable avec le matériau de moulage entourant (31) quand celui-ci a été versé dans le coffrage pour coulage (21) et a fait prise.

8. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) et la partie de barre entourée par la partie médiane (3) est disposée pour former un bouchon étanche, non-libérable, dans une structure de coulage complétée (31).

9. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la surface de butée (7) est formée par la partie médiane(3) présentant, vers sa partie d'extrémité, une section transversale élargie (7a, 57b).

10. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce qu'**au moins une partie de la partie médiane (3) présente une section transversale présentant, quand la section transversale est perpendiculaire à l'axe de centre de la tige d'entretoise (1), une forme non circulaire.

11. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) est munie d'une pluralité d'élargissements concentriques transversales (58b).

12. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) inclut une ou plusieurs rainures essentiellement annulaires (3a) qui sont disposées pour recevoir et fixer dans les directions radiale et axiale un ou plusieurs moyens de verrouillage (13) pour un matériau de construction en forme de plaque (15), pour exemple un matériau d'isolation, les rainures essentiellement annulaires (3a) étant complémentaires à une partie (13b) des moyens de verrouillage (13).

13. La tige d'entretoise (1) selon la revendication 12, **ca-**

ractérisée en ce que les moyens de verrouillage (13) sont réalisés en matériau non corrosif.

14. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) de la tige d'entretoise (1) inclut un ou plusieurs moyens (3b) disposés pour recevoir un moyen de renforcement (25).

15. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) est munie d'une ou plusieures rainures essentiellement annulaires (3b).

16. La tige d'entretoise (1) selon la revendication 15, **caractérisée en ce que** les rainures essentiellement annulaires (3b) ont une section transversale trapézoïde avec la plus petite largeur au fond de la rainure (3b), et les bords latéraux de la rainure (3b) présentent le même angle d'inclinaison relatif l'axe de centre de la tige d'entretoise (1).

17. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie médiane (3) de la tige d'entretoise (1) est disposée pour recevoir un ou plusieurs moyens de sécurisation pour sécuriser le moyen de renforcement (25).

18. La tige d'entretoise (1) selon la revendication 17, **caractérisée en ce que** le moyen de sécurisation pour sécuriser le moyen de renforcement (25) est réalisé en matériau non corrosif.

19. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la partie d'extrémité de tige (5a, 5b) est disposée pour recevoir un ou plusieurs disques de sécurisation (17) pour sécuriser un matériau de construction en forme de plaque (33), par exemple un matériau d'isolation.

20. La tige d'entretoise (1) selon la revendication 19, **caractérisée en ce que** le disque de sécurisation (17) inclut un moyen (17a) pour la connexion libérable à la surface de la gaine de la partie d'extrémité de tige (5a, 5b).

21. La tige d'entretoise (1) selon la revendication 19, **caractérisée en ce que** le disque de sécurisation (17) est muni d'une pluralité de taquets élastiques (17a) s'étendant depuis la partie circonférentielle (17b) et dans une direction radial vers une ouverture centrale (17c).

22. La tige d'entretoise (1) selon la revendication 19, **caractérisée en ce que** le disque de sécurisation (17) est réalisé en matériau non corrosif.

23. La tige d'entretoise (1) selon la revendication 1, **caractérisée en ce que** la conductibilité thermique de la tige d'entretoise (1) est inférieure à la conductibilité thermique de la structure entourante de coulage complétée.

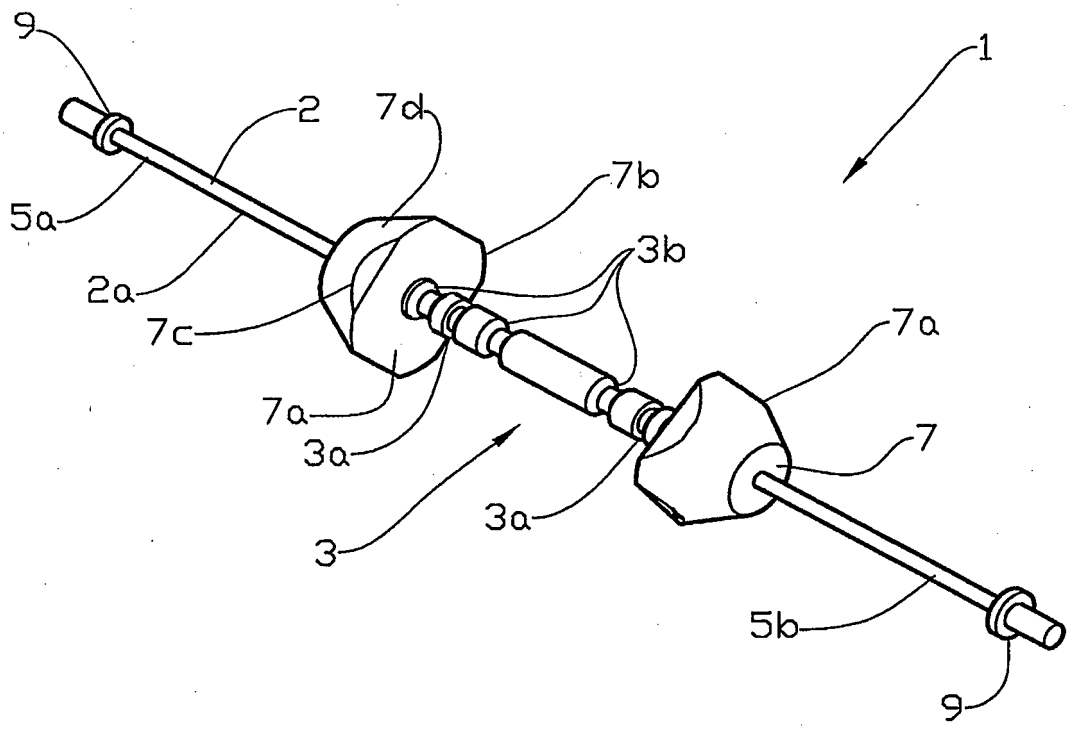


Fig. 1

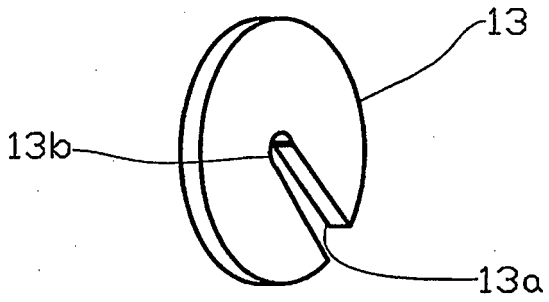


Fig. 2

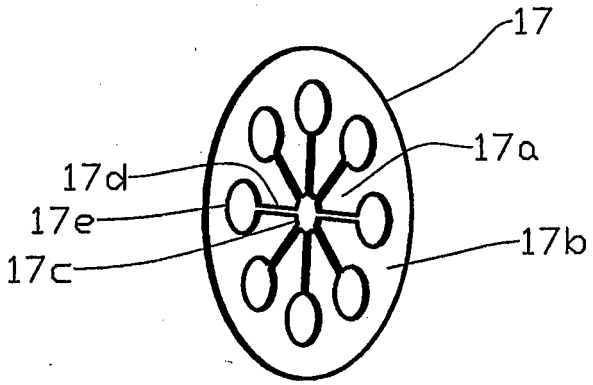


Fig. 3

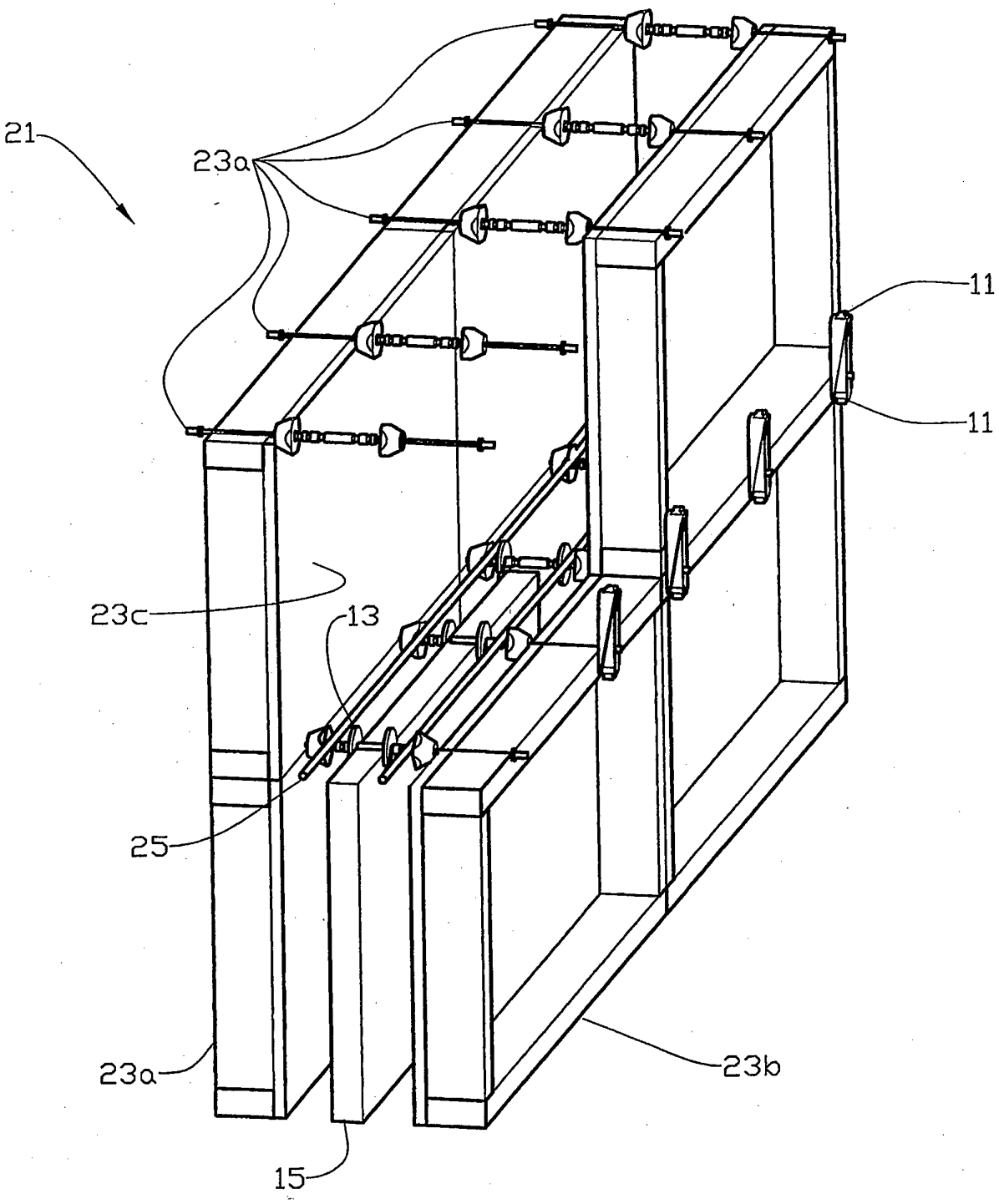


Fig. 4

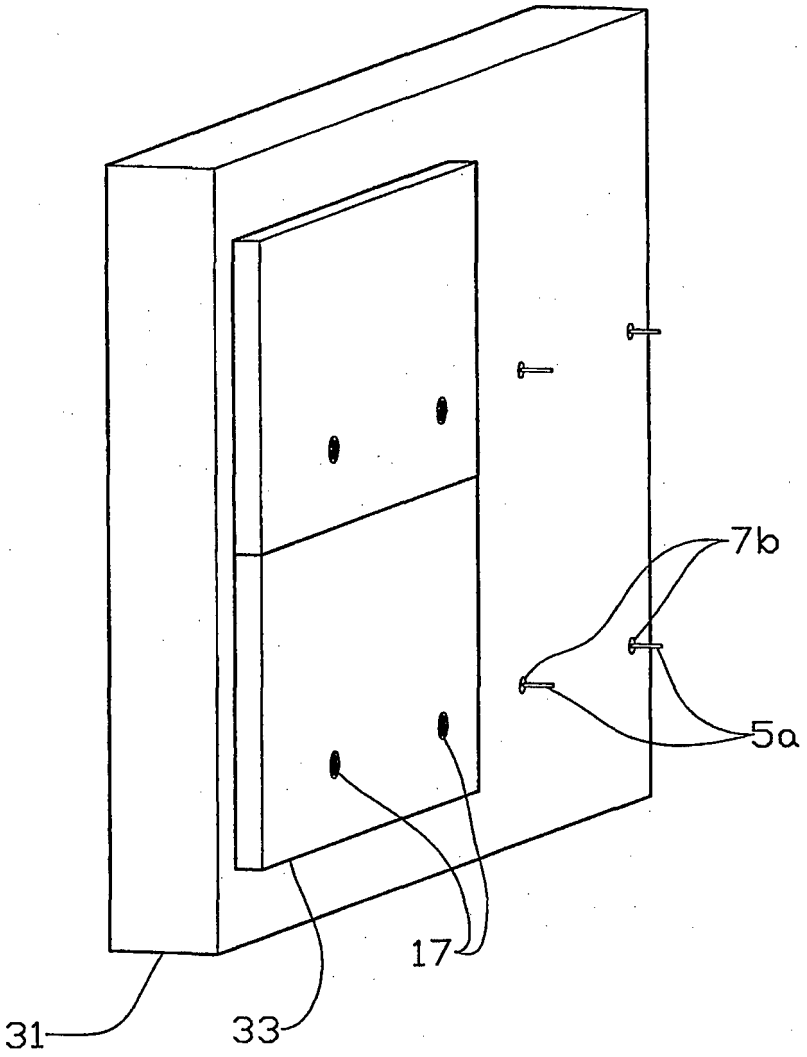


Fig. 5

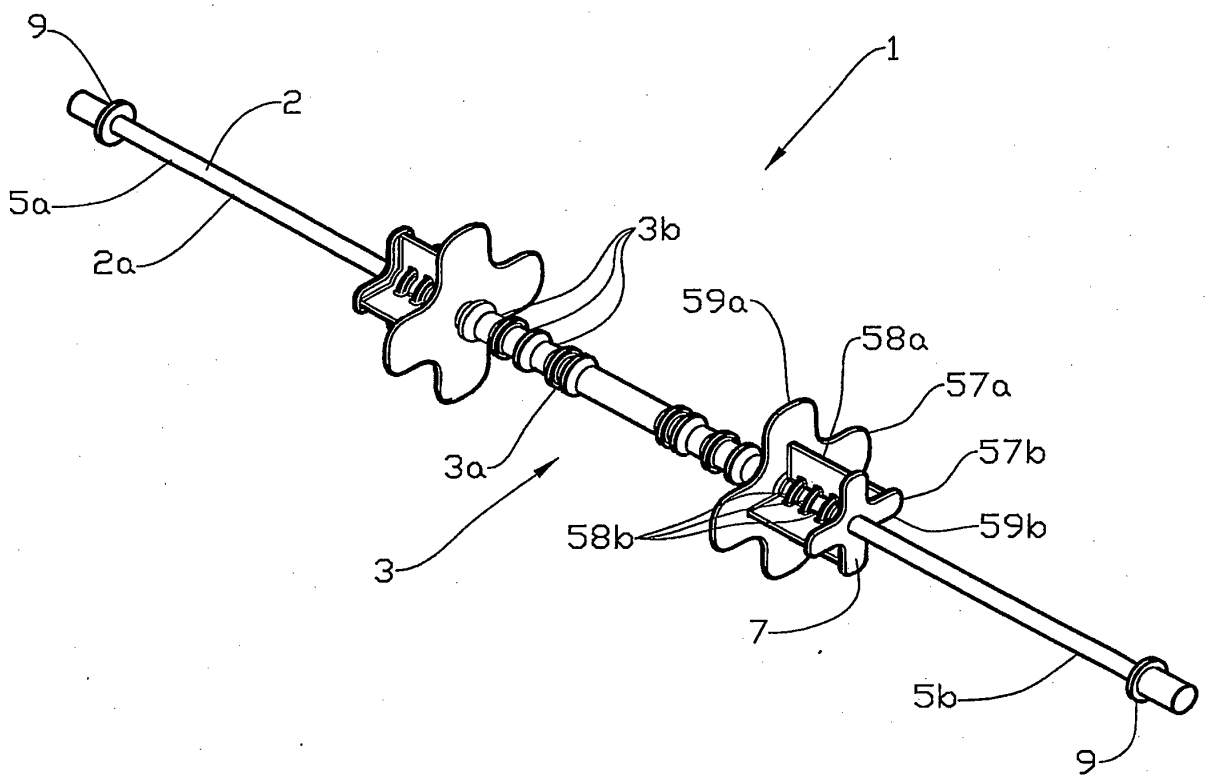


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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