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

(11) **EP 2 685 028 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.01.2014 Bulletin 2014/03

(21) Application number: **13003439.0**

(22) Date of filing: **07.07.2013**

(51) Int Cl.:
E04G 17/065 *(2006.01)* ***E04G 17/07*** *(2006.01)*
E04G 17/075 *(2006.01)* ***E04G 17/06*** *(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: **09.07.2012 PL 39987812**

(27) Previously filed application:
09.07.2012 PL 39987812

(71) Applicant: **Pargiela, Stanislaw**
26-200 Konskie (PL)

(72) Inventor: **Pargiela, Stanislaw**
26-200 Konskie (PL)

(74) Representative: **Gizinska-Schohe, Malgorzata**
European Patent Attorney
Helmpertstrasse 11a
80687 München (DE)

(54) **Method for production of shuttering tie rod and shuttering tie rod**

(57) A method for production of a formwork tie rod is described, characterized in that on a homogeneous core **(1)** in a form of a threaded rod, in the middle portion thereof, a longitudinal conical sheath **(2)** having a circular cross-section, made of a readily workable material selected from a group consisting of metals, metal alloys and plastics, is permanently and concentrically fixed, and either the sheath **(2)** is entirely made of metal or entirely made of plastic; or the sheath **(2)** is made of metal conical ending sleeves - the more narrow one **(2C)** and the more wide one **(2D) -** and made of plastic that is filling a space between these two ending sleeves.

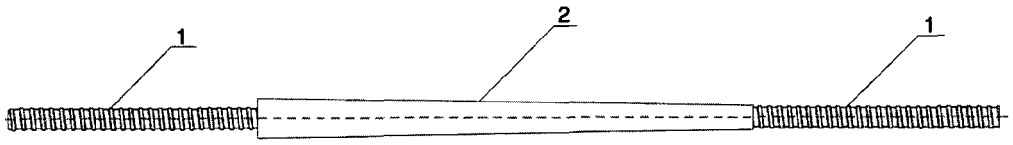

Fig. 1

EP 2 685 028 A2

Description

[0001] Object of the invention is a method for production of a formwork tie rod and the formwork tie rod, which constitutes an element for stabilizing modular formwork kits designed e.g. for shuttering of side walls of buildings, containers, or foundations, or retaining walls for highway engineering, and also for shuttering of any other building structures.

[0002] Formwork boards, especially made of steel, are usually arranged together in pairs and stabilized by means of tie rods connecting them to secure upholding a fixed position of formwork boards while pouring concrete into the space formed between the boards.

[0003] The most simple, commonly used, tie rods are steel threaded rods obtained by hot rolling or cold rolling. The rods can be equipped with a full form thread or a bi-flattened (self-cleaning) thread. Formwork boards are connected in such a way that a length of tie rods is greater than a distance fixed between the boards upon their positioning. Flange nuts of various types are screwed onto protruding end-parts of the tie rods to pull tight the boards. Between the boards, strutting elements can be placed. Upon concrete hardening, the formwork boards are disassembled by removing nuts from the end-parts of the tie rods. It is impossible to recover such tie rods, as they remain within the cast concrete - they are so called "lost rods".

[0004] Such a concept is utilized in more complex mechanisms of various types stabilizing formwork modules as it is for example described in Polish Patent PL175167B1, where a formwork system constituting a tight culvert through a wall, including a threaded tie rod is disclosed, and in PL202347B1, where a formwork including a rod which is only partly threaded for stabilizing a support of a formwork board.

[0005] Recovery of formwork tie rods is possible by means of locating them within a sleeve shielding distance elements. Such elements are placed between the formwork boards, perpendicularly to their surface within the space to be cast then by concrete. Tie rods are placed inside these sleeve distance elements. Upon concrete bracing and removal of nuts from the rods, the tie rods can be then removed, and holes shaped by shielding elements are made within the concrete, which are usually used at further construction stages to conduct wiring systems or water supply systems. In such a variant the said distance elements are lost.

[0006] Another known method of recovery of formwork tie rods is to give them a structure enabling its later "knocking-out" of the concrete construction. To do this, a middle part of the tie rod, located between the formwork boards and to be filled with concrete, is smooth and non-threaded. There are only end-parts of the tie rod protruding outside the formwork boards that are threaded. The non-threaded part of the tie rod has additionally a conical shape to facilitate its knocking-out of the hardened concrete. Additionally, the non-threaded part of the rod is covered with chemical agents to avoid concrete adhering. Such rods are produced from a homogeneous cylinder-shaped cross-section of material, which is subject to machining; on subsequent sections of the rod a thread is formed and a smooth conical shape is given. It is often impossible to subject such rods to fusion welding or welding, their production is time consuming, they are made of more expensive materials, and furthermore, as a result of processing they can include necked-down fragments of poor durability.

[0007] Aim of the invention is to develop of a formwork tie rod of high durability recoverable upon being used, enabling simple and inexpensive production and including a non-threaded middle part.

[0008] Object of the invention is a method for production of a formwork tie rod, **characterized in that** a longitudinal conical sheath having a circular cross-section, made of a readily workable material selected from a group consisting of metals, metal alloys and plastics, is permanently and concentrically mounted on a middle portion of a homogeneous core in a form of a threaded rod, whereas

a) if the sheath is made entirely of metal, in that case a metal sleeve is placed on the core and fixed to it by pressing, and then it is subjected to mechanical processing to form a conical external surface;
b) if the sheath is made entirely of plastic, in that case it is formed on the core by injection moulding;
c) if the sheath is made of metal conical ending sleeves - the more narrow one and the more wide one - and of plastic, in that case either the ending sleeves are threaded inside, and then they are screwed on the threaded core, positioned there, and then the middle part of the sheath made of plastic is formed by injection moulding between the ending sleeves, or the ending sleeves are not threaded inside, and then they are placed on the core and positioned there, and then a middle part of the sheath made of plastic is formed by injection moulding between the ending sleeves, fixing at the same time the ending sleeves.

[0009] Preferably, in this method the inclination angle of the conical external surface of the sheath to the axle of the rod amounts from 0.1° to 3°, preferably from 0.1° to 1°.

[0010] The formwork tie rod of the present invention is composed of a homogeneous core having a form of a threaded rod, on which, in its middle portion, a longitudinal conical sheath having a circular cross-section is permanently and concentrically fixed, and either the sheath is entirely made of workable metals or metal alloys or of plastic, or the sheath is not homogeneous and composed of two conical ending sleeves - made of metal or metal alloy - the more narrow one and the more wide one, between which there is the middle part of the sheath made of plastic.

[0011] Preferably, in this tie rod the inclination angle of the conical external surface of the sheath to the axle of the rod amounts from 0.1° to 3°, preferably from 0.1° to 1°.

[0012] The invention in its embodiment is shown on a drawing, on which Fig. 1 shows a general lateral view of the tie rod having the non-threaded middle conical part, Fig. 2 shows in a longitudinal section and a cross-section, the first step of production of the tie rod of Fig. 1, Fig. 3 shows in a longitudinal section and a cross-section the second step of production of the tie rod of Fig. 1, Fig.4 shows a longitudinal section of the finished rod of Fig. 1, Fig. 5 shows the second embodiment, in which the conical part is composed of the middle part made of plastic and of two metal ending parts, and Fig.6 shows a scheme of example mechanism stabilizing formwork boards, the mechanism including the formwork tie rod of the invention.

[0013] The tie rod in the embodiment is composed of a homogeneous threaded core **1,** on the middle portion of which, a longitudinal conical sheath **2** is permanently and concentrically fixed around the core, having a greater cross-section diameter than the core diameter. The threaded core **1** has equal diameter along its whole length, whereas the middle, non-threaded conical portion having a form of the sheath **2** has a variable diameter - increasing towards one of non-shielded rod ending parts. The conical portion of the rod along its whole length has retained the equal angle between its external surface and the longitudinal axle of the core. The conical sheath **2** can be in its first embodiment of the invention made of workable homogeneous material, e.g. from steel or plastic, or in its second embodiment it can consist of the middle part **8** made of plastic, having on its both ends, ending sleeves **2C i 2D** made of metal, as shown on Fig. 5. In a second variant of the invention, all the three said elements of the conical part of the tie rod (of the sheath) have a mutually adjusted conical shape, such that it forms a smooth uniform surface and the surface of the entire middle part of the rod has the same inclination angle to the longitudinal axle of the rod so the external dimensions and the whole surface of the sheath **2** in both embodiments of the invention are the same.

[0014] An inclination angle of the conical external surface of the sheath to the axle of the rod amounts from 0.1° to 3°, preferably from 0.1° to 1°.

[0015] The tie rod of the invention is manufactured in such a way that as a raw material - core, a homogeneous metal threaded rod obtained by rolling is used, and onto the rod - an additional layer of steel or plastic or - in the second embodiment - a layer of a combination of steel and plastic, is permanently fixed (mounted). The internal core can be a typical tie rod of a known type equipped with a full thread or with a flattened thread. Placing an additional conical middle portion of the rod (i.e. the sheath) on the core is in the first embodiment of the invention carried out by means of pressing a cylindrical sleeve on the threaded core, and then that part is subject to mechanical processing to form a conical external surface. The sleeve (and next the sheath) should be made of readily workable metal alloys used in building industry. As schematically shown on Fig. 2 and Fig. 3, the metal sleeve is placed on the core and pressed (side drawing on Fig. 3) on the core, thus joining it permanently with the threaded core, and next the conical shape is formed during the further mechanical processing.

[0016] The sheath can also be entirely made of plastic and in such a case, the sheath is formed on the core by means of e.g. injection moulding with a use of known methods of plastics processing. One can use plastics based on e.g. polyethylene and polypropylene, and monomers of higher molecular weight (homopolymers and copolymers of PP, PS and its copolymers, PVC, PA and other).

[0017] In the second embodiment of the invention, the sheath is composed of two metal ending sleeves opposing each other, between which there is a part made of plastic. The metal sleeves are made separately in advance, using known methods and their external surfaces are shaped to obtain a conical shape exhibiting an inclination angle consistent with an angle to be obtained for the whole sheath. As shown on Fig. 5, the rod of the invention can be made on the basis on the same threaded core, but the conical part of the rod is made by means of integrating the plastic layer with the core, the ends of the conical part constituting conical ending sleeves **2C** (the more narrow one) and **2D** (the more wide one) made of metals and alloys, and the middle part made of plastic being placed between them. In such embodiment, the ending sleeves **2C** and **2D** can be threaded inside, screwed on the core from both sides and positioned in a suitable position, to form a space between them which has to be filled with plastic by means of injection moulding. A uniform conical part having a constant inclination angle of the conical surface to the rod axle is obtained. It is also possible to provide an embodiment of the tie rod such that the ending sleeves **2C** and **2D** are not threaded inside, but they are suitably placed in an injection mould on the core to constitute end elements of the conical part and the free space between them is filled with plastic to form a uniform conical part. Injection of the plastic provides at the same time the permanent fixing (sealing and integrating) of the ending sleeves **2C** and **2D** to the internal core.

[0018] The tie rod of the invention constitutes an element of an illustrative mechanism stabilizing formwork construction as shown on Fig. 6. The tie rods stabilize formwork boards **A** equipped with assembly holes sealed with pieces **D** of the greater hole diameter and **D'** of the smaller hole diameter, and within these holes tie rods are placed, onto which, outside of boards **A** distance elements **B** are put. Onto both threaded end-parts of the rod (end-parts of the core) nuts **C** are screwed. Disassembling the mechanism stabilizing formwork is carried out in the reverse sequence - nuts are removed, after that - distance elements, and the tie rod is knocked out of that

side where the conical part is more narrow, to enable its pulling-out from the more wide side.

Claims

1. A method for production of a formwork tie rod, **characterized in that** a longitudinal conical sheath **(2)** having a circular cross-section, made of a readily workable material selected from a group consisting of metals, metal alloys and plastics, is permanently and concentrically mounted on a middle portion of a homogeneous core **(1)** in a form of a threaded rod, whereas

   a) if the sheath **(2)** is made entirely of metal, **in that** case a metal sleeve is placed on the core **(1)** and fixed to it by pressing, and then it is subjected to mechanical processing to form a conical external surface;
   b) if the sheath **(2)** is made entirely of plastic, **in that** case it is formed on the core **(1)** by injection moulding;
   c) if the sheath **(2)** is made of metal conical ending sleeves - the more narrow one **(2C)** and the more wide one **(2D) -** and of plastic, **in that** case either the ending sleeves **(2C, 2D)** are threaded inside, and then they are screwed on the threaded core **(1),** positioned there, and then the middle part **(8)** of the sheath **(2)** made of plastic is formed by injection moulding between the ending sleeves **(2C, 2D),** or the ending sleeves **(2C, 2D)** are not threaded inside, and then they are placed on the core **(1)** and positioned there, and then a middle part **(8)** of the sheath **(2)** made of plastic is formed by injection moulding between the ending sleeves **(2C, 2D),** fixing at the same time the ending sleeves **(2C, 2D).**

2. The method according to Claim 1, **characterized in that** the conical external surface of the sheath **(2)** has an inclination angle to the axle of the rod that amounts from 0.1 to 3°, preferably 0.1° to 1°.

3. A formwork tie rod, **characterized in that**, it is composed of a homogeneous core **(1)** in a form of a threaded rod, on which, within its middle portion, a longitudinal conical sheath **(2)** having a circular cross-section is permanently and concentrically mounted, and either the sheath **(2)** is entirely made of workable metals or metal alloys or of plastics, or the sheath **(2)** is not homogeneous and composed of two conical, made of metal or metal alloy, conical ending sleeves - the more narrow one **(2C)** and the more wide one **(2D),** between which there is a middle part **(8)** of the sheath **(2)** made of plastic.

4. The tie rod according to Claim 3, **characterized in that** the inclination angle of the conical external surface of the sheath **(2)** to the axle of the rod amounts from 0.1° to 3°, preferably from 0.1° to 1°.

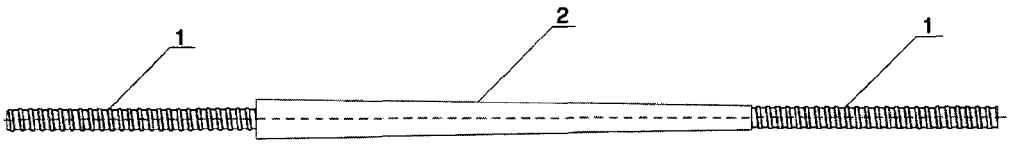

Fig. 1

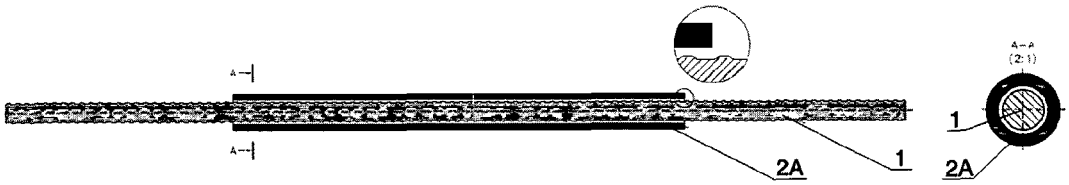

Fig. 2

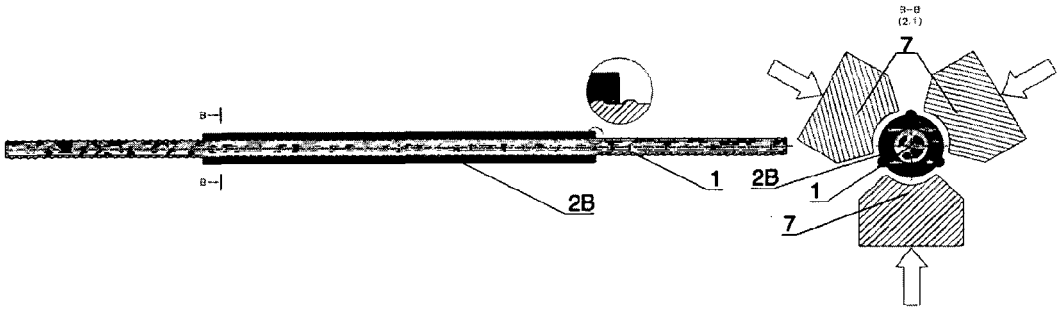

Fig. 3

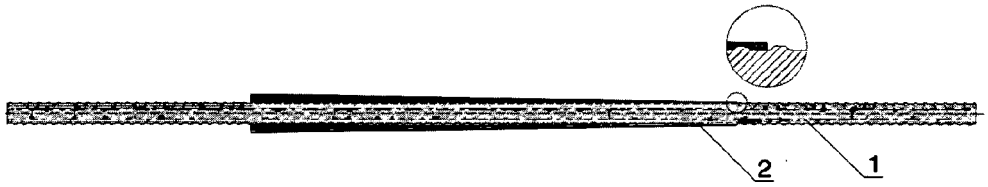

Fig. 4

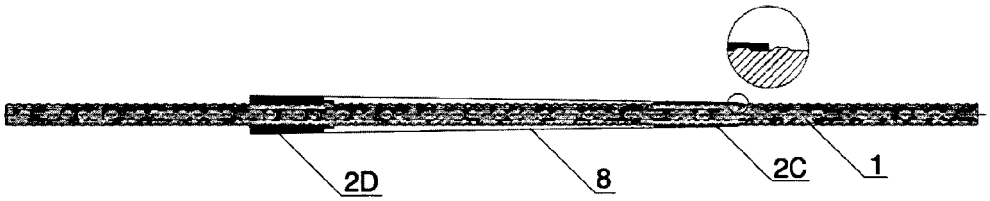

Fig. 5

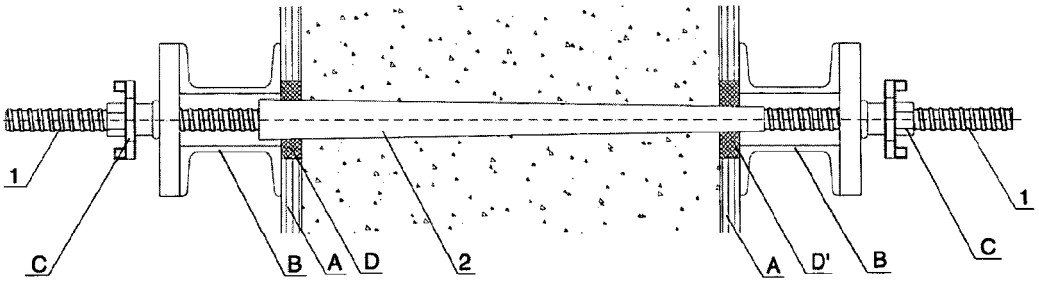

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- PL 175167 B1 **[0004]**
- PL 202347 B1 **[0004]**