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(54) **Tie rod for reinforced concrete formworks**

(57) The present invention refers to a tie rod for formworks with a central section, that is to say the sec-

tion embedded in the cement wall cast in the formwork, totally or partially coated with a layer of hydro-expansible material.

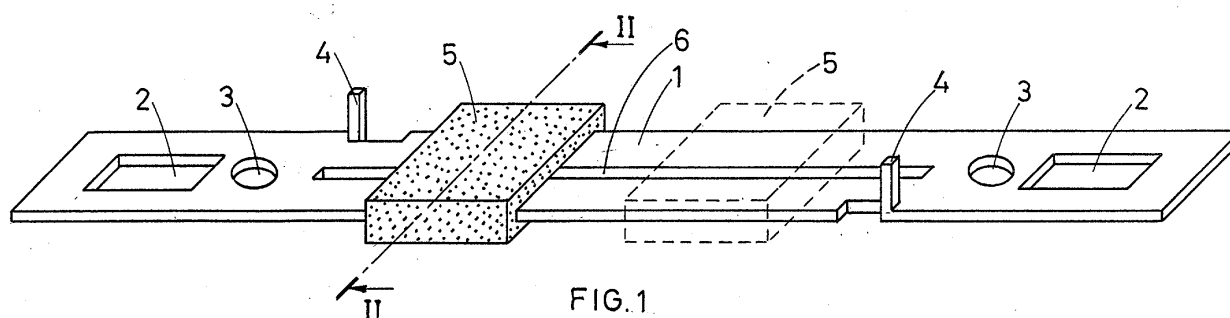


FIG.1

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Description

[0001] The present patent application refers to a tie rod for formworks, provided with one or more plates of hydro-expansive material.

[0002] The construction system of formworks used in the building industry has been known for a long time. Formworks are wooden structures in which cement is cast and solidifies, embedding and incorporating metal forms arranged inside them.

[0003] These structures are basically composed of cases with vertical walls, whose parallel sides are formed of wooden boards aligned and overlapped edge-ways. In order to provide stability to such a structure, a stable connection between opposite walls and between the overlapped boards of each vertical wall must be created.

[0004] According to the current technology, the opposite parallel walls of the formwork are joined by means of horizontal metal tie rods to prevent the lateral collapse of walls when concrete is cast.

[0005] The most common model of tie rod is characterised by extremely thin, flat surface, which allows the two ends of the tie rod to be placed flat, with reduced volume and without creating undesired gaps between the upper edge of the board below and the lower edge of the board above in the same vertical wall.

[0006] More precisely, the two ends of the tie rod are provided with eyelets and protrude from the opposite walls of the formwork, in such a way that the external eyelets engage suitable wedge-shaped uprights designed to create a stable connection of the overlapped boards that form the opposite walls of the formwork.

[0007] It must be noted that the most popular model of horizontal tie rods is provided with an opposite pair of perpendicular tabs located in internal position with respect to each end with eyelet and placed in vertical position during operation, so as to act as stop element for the internal sides of the two overlapped boards that are located immediately below and above the corresponding tie rod on the formwork wall.

[0008] The tabs allows for placing the overlapped boards of each vertical wall in perfectly aligned position, as long as the overlapped boards touch the tabs of the horizontal tie rods that are located between them.

[0009] When the formwork is ready, cement is cast in the internal side of the formwork walls. Once cement has solidified, the formwork must be removed.

[0010] To do this, the vertical uprights and the boards of the vertical walls are removed, respectively. Then the ends of the tie rods with eyelets that protrude from the solidified sides of the cement manufacture, after removing the boards, are cut off.

[0011] After eliminating the protruding ends with eyelets, the sides of the cement manufacture can become perfectly planar. It must be noted, however, that the ends of each tie rod remain visible in the cement mass and flush with it, that is to say in a position that does not

impair the aesthetics or surface continuity of the cement manufacture.

[0012] The fact that the tie rods are embedded in the cement wall causes a great disadvantage, meaning that the wall is not perfectly protected against water penetration.

[0013] As a matter of fact, during solidification, the cement mass cannot adhere perfectly and uniformly to the tie rod wall, thus forming an irregular series of communicating gaps extending from one end to the other of the tie rod, being a possible passage way for water penetration.

[0014] The inconvenience as illustrated above becomes intolerable when the wall is buried and designed to ensure water-tightness of the underground space. In this case, the water coming from the ground cannot be stopped and penetrates through the gaps extending from one side to the other of the wall near the tie rods.

[0015] The new tie rod of the invention has been devised based on the aforementioned drawback. While functional and easy to use, this model can prevent the inconvenience as illustrated above.

[0016] The tie rod of the present invention is characterised in that the central section, that is to say the section embedded in cement casting, is totally or partially coated with a layer of hydro-expansive material, that is to say a material capable of increasing its volume in contact with water and returning to its original volume when water or humidity disappears.

[0017] A material with good hydro-expansive properties is, for example, sodium bentonite that can be used alone or with the addition of other substances capable of retarding expansion and contraction phases.

The presence of the coating layer of hydro-expansive material provides total protection of the wall against water penetration near the tie rods embedded in the wall. In case of penetration through the gaps, water comes immediately in contact with the coating layer, causing the expansion of the hydro-expansive material that fills in and obstructs even the smallest gap near the tie rod, thus preventing water penetration.

[0018] For major clarity the description of the present invention continues with reference to the enclosed drawings, which are intended for purposes of illustration and not in a limiting sense, whereby

- Fig. 1 is an axonometric view of the tie rod of the invention;
- Fig. 2 is the cross-section of Fig. 1 with plane II-II.

[0019] With reference to the enclosed figures, the tie rod of the invention consists in a strip (1) with monolithic structure, configured as a thin long rod, having two eyelets (2) at the ends, which are designed to receive the wedge-shaped uprights that provide external support to the overlapped series of boards forming the casting box.

[0020] A hole (3) is provided near the eyelets (2) to insert a nail used to fix the tie rod (1) on the upper edge

of the board below, if necessary.

[0021] The hole (3) is located in intermediate position between the eyelet (2) at the end of the tie rod (1) and a tooth (4). During operation, the tooth (4) acts as stop element for the internal sides of the two overlapped boards that are located immediately below and above the tie rod in the formwork wall.

[0022] The tie rod (1) of the invention is characterised in that the intermediate section (1a), that is to say the section that extends between the two holes (3), is totally or partially coated with hydro-expandible material. In the preferred embodiment shown in the enclosed figures, the intermediate section (1a) is partially coated with a pair of plates (5) of hydro-expandible material located near the holes (3).

[0023] The peripheral location of the plates (5) is the preferred position since the ends (1b) of the strip (1) with the eyelets (2) are cut off after the cement casting has solidified and the formwork has been removed.

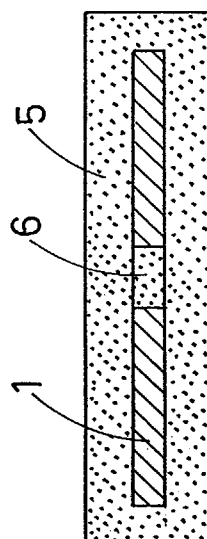
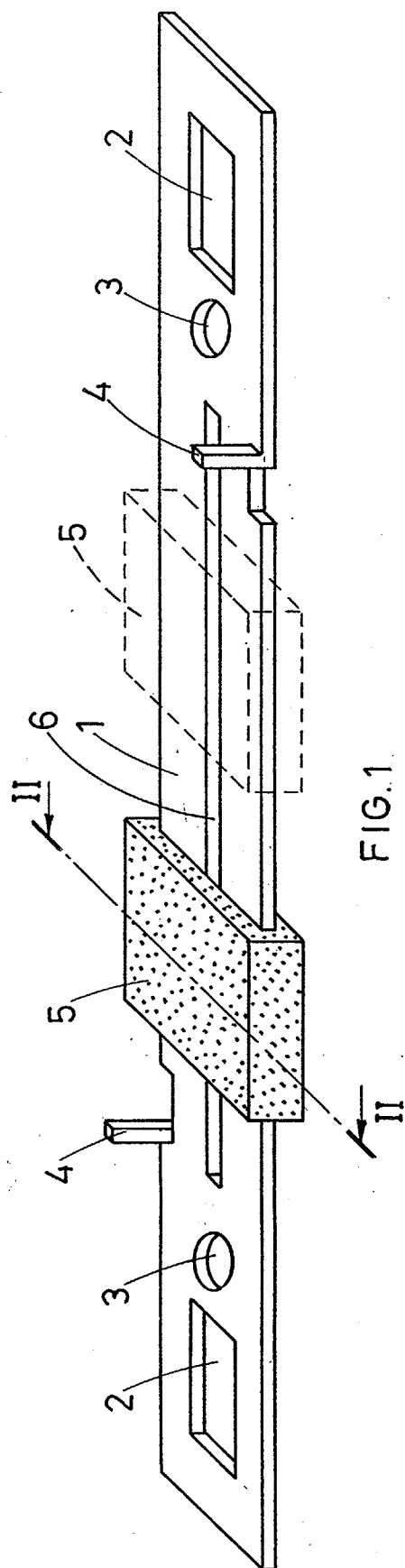
[0024] This means that the two plates (5) are embedded in the wall and positioned immediately behind the two opposite sides of the wall, thus preventing any water penetration.

[0025] Finally, attention is drawn on the longitudinal slot (6) that provides continuity to the plates (5), allowing the hydro-expandible material to adhere and set to the surface of the tie rod (1).

6. Tie rod for reinforced concrete formworks as defined in claims 1 to 4, **characterised in that** the hydro-expandible material is sodium bentonite with the addition of other substances capable of retarding expansion and contraction phases.

Claims

1. Tie rod for reinforced cement formworks, **characterised in that** the central section, that is to say the section embedded in the cement wall cast inside the formwork, is totally or partially coated with a layer of hydro-expandible material.
2. Tie rod as defined in claim 1, **characterised in that** it consists in a strip (1) with monolithic structure, configured as a thin long rod, having two eyelets (2) at the end and an intermediate section (1a) - that is to say the section extending between the two ends with eyelets (2) - totally or partially coated with hydro-expandible material.
3. Tie rod for reinforced concrete formworks as defined in the foregoing claims, **characterised in that** the central section is coated with one or more plates (5) of hydro-expandible material.
4. Tie rod as defined in claims 2 and 3, **characterised in that** the intermediate section (1a) is provided with slots (6).
5. Tie rod for reinforced concrete formworks as defined in the foregoing claims, **characterised in that** the hydro-expandible material is pure sodium bentonite.





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EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5447

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 1 160 394 A (CAPELLO ANGELO VITTORIO ;PISTONE MARCO (IT)) 5 December 2001 (2001-12-05)	1-4	E04G17/06
Y	* paragraphs [0011],[0012],[0015],[0016]; figures 1,2 *	5,6	

X	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 06, 30 June 1997 (1997-06-30)	1	
	-& JP 09 032291 A (C K:KK;MITSUI TOATSU CHEM INC), 4 February 1997 (1997-02-04)		
Y	* abstract * * paragraphs [0011],[0033]; figure 12 *	5	

X	DATABASE WPI Section Ch, Week 199151 Derwent Publications Ltd., London, GB; Class A18, AN 1991-374652 XP002255707	1	
	-& JP 03 253669 A (CI KASEI CO LTD), 12 November 1991 (1991-11-12)		
Y	* abstract; figure 2 *	6	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
	---		E04G
X	GB 2 247 272 A (RAPID METAL DEVELOPMENTS LTD) 26 February 1992 (1992-02-26)	1	
A	* page 4, line 5 - page 6, line 9; figures 1-6 *	5,6	

A	GB 1 188 549 A (BARBEY S) 15 April 1970 (1970-04-15)	4	
	* figures 7,8 *		

A	DE 22 30 535 A (HUEWA W HUEBNER HANDELSVERTRET) 31 January 1974 (1974-01-31)	4	
	* figure 1 *		

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The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 25 September 2003	Examiner Bouyssy, V
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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Application Number
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 1 913 326 A (AWBREY SAMUEL C) 6 June 1933 (1933-06-06) * the whole document * -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 25 September 2003	Examiner Bouyssy, V
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 03 42 5447

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The members are as contained in the European Patent Office EDP file on
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25-09-2003

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 1160394	A	05-12-2001	IT IM20000004 U1 EP 1160394 A2	29-11-2001 05-12-2001
JP 09032291	A	04-02-1997	NONE	
JP 3253669	A	12-11-1991	NONE	
GB 2247272	A	26-02-1992	NONE	
GB 1188549	A	15-04-1970	NONE	
DE 2230535	A	31-01-1974	DE 2230535 A1	31-01-1974
US 1913326	A	06-06-1933	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82