



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.02.2013 Bulletin 2013/09

(51) Int Cl.:
E04B 1/41 (2006.01) E04B 1/76 (2006.01)

(21) Application number: **11178394.0**

(22) Date of filing: **23.08.2011**

(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

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(54) **A binding element for a building wall structure**

(57) A binding element for a building wall structure, wherein said binding element has a minimum tensile strength of at least 100 N/mm² and said binding element comprises an elongated steel element coated with a thermoplastic material. The building wall structure comprising an inner wall, an outer wall spaced from said inner wall and provided with at least one insulation layer(s) in between, at least one binding element comprising an elongated steel element coated with a thermoplastic ma-

terial interconnecting said outer wall and inner wall through the insulation layer, wherein ends of said binding element is fixed to the said outer wall and said inner wall respectively and wherein middle portion of said binding element is in contact with the said insulation layer(s). The binding element may comprise a intermediate metallic coating selected from a group consisting of copper, copper alloy, zinc, zinc alloy, nickel, nickel alloy, tin or tin alloy or combinations thereof.

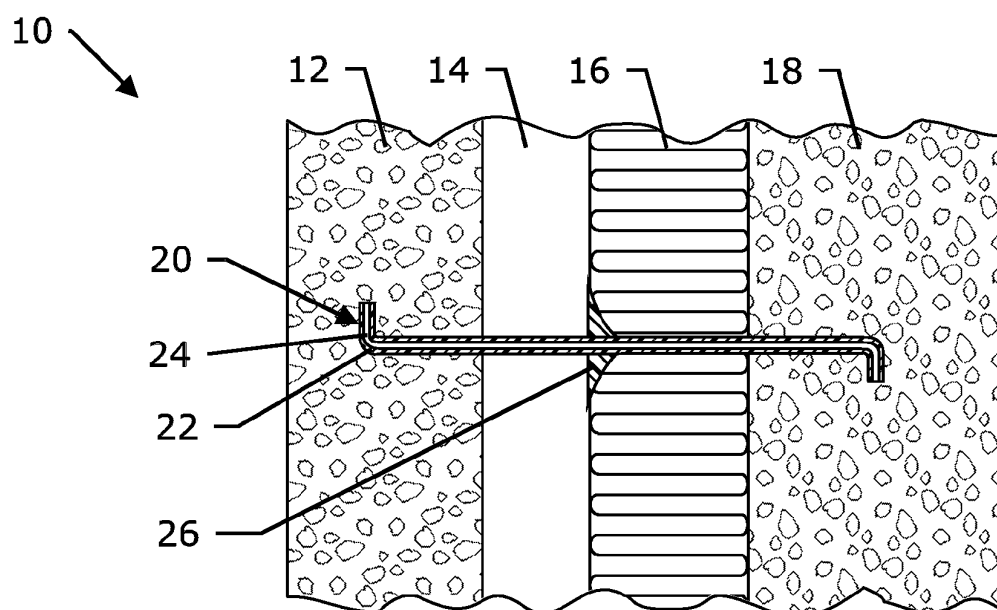


Fig. 1

Description**Technical Field**

5 **[0001]** The present invention relates to use of a binding element for a building wall structure, particularly to binding elements having a thermoplastic coating. The binding element has been developed primarily for use in construction industry for wall structures made of concrete, brick, and wood or like composition layers, and will be described hereinafter with reference to this application.

10 **Background Art**

[0002] A metal rod that joins and reinforces parts in a structure is well known in the art. Insulated concrete walls are held together with plurality of such metal rods and are widely used in the construction industry for buildings. Galvanized wire was often used as a metal rod for this purpose. In meantime, energy conservation has become a vital component in the construction industry and developments were focused on increasing thermal insulation and reducing cold bridges between outer and inner walls. Hence a split hook was developed which functions as a static connection between the outer and inner wall, provides a fixation of the insulation layer and does not form a cold bridge between outer and inner wall. A typical split hook has two components: a metal wire and a plastic plug. EP 0502302, DE8008619 and DE8606959 are few examples describing the split plug system. The problem often encountered is the installation of such split hook which is a cumbersome process involving multiple steps such as drilling a hole in the outer wall, hammering the plug in to the hole, installing the metal wire in to the plug, covering the metal wire with a shield, hammer the metal wire in to the plug and removing the shield. Another disadvantage of this system is strength. The location of the drilled holes is rather random, sometimes a lot of anchoring in bricks will occur and sometimes limited anchoring will occur when the split hook is going through a hole in the brick.

25 **Summary of the Invention**

[0003] It is an object of at least certain embodiments of the present invention to devise a binding element for a building wall structure of concrete or like composition which address the drawbacks of the present split hooks in the market.

30 **[0004]** It is an object of at least certain embodiments of the present invention to devise a binding element that is easier to install in the wall structure.

[0005] It is an object of at least certain embodiments of the present invention to devise a binding element that is resistant to corrosion and fire.

[0006] It is an object of at least certain embodiments of the present invention to devise a binding element that has a minimal heat conduction coefficient.

35 **[0007]** In one aspect, the present invention relates to a use of a binding element for a building wall structure, wherein said binding element has a minimum tensile strength of at least 100 N/mm² and said binding element comprises an elongated steel element coated with a thermoplastic material. One of many advantages of the present invention is the ease in installation of such binding elements in the wall structure. The ends of the binding element can be for instance fixed for example in a bent state in the masonry joint of the brick wall. Furthermore the ratio of thickness of thermoplastic coating and the steel element may be altered to provide better thermal insulation. The thermal conductivity of such binding elements is minimal.

40 **[0008]** In one aspect, the present invention relates to a building wall structure of concrete or like composition comprising an inner wall, an outer wall spaced from said inner wall and provided with at least one insulation layer(s) in between, at least one binding element comprising an elongated steel element coated with a thermoplastic material interconnecting said outer wall and inner wall through the insulation layer, wherein ends of said binding element is fixed to the said outer wall and said inner wall respectively and wherein middle portion of said binding element is in contact with the said insulation layer(s).

50 **Brief Description of Figures in the Drawings**

[0009] Fig. 1 and 2 shows a lateral view of a wall structure depicting the embodiment according to the invention.

[0010] Fig. 3, 4, 5 and 6 shows different embodiments of the invention relating to the binding element.

55 **Mode(s) for Carrying Out the Invention**

[0011] Fig. 1 depicts a building wall structure of concrete or like composition comprising an inner wall (18), an outer wall (12) spaced from said inner wall and provided with an insulation layer (16) in between, at least one binding element

(20) interconnecting said outer wall and inner wall through the insulation layer, the said binding element (20) comprises a elongated steel element (24) having a minimum tensile strength of at least 100 N/mm² coated with a thermoplastic material (22). In one embodiment of the present invention the elongated steel element (24) is coated with thermoplastic material (22) in it's entire length. In one embodiment of the present invention the elongated steel element (24) is coated with thermoplastic material (22) preferably the middle portion and end portion of binding element fixed to the outer wall (12), more preferably the middle portion of the binding element. The middle portion of the binding element is the represented as that length which equates the spacing between outer wall (12) and inner wall (18). In other words the thickness of insulation layer(s) (16) and the spacing (14) should represent the middle portion. The binding element may be secured to the insulation layer by using a stopper (26). Fig. 2 depicts a brick wall structure showing layers of brick wherein the binding elements are fixed in a bent state in to the masonry joint during brick wall construction. The number of binding elements range from 4 to 5 /m² of the wall structure. The bending elements have a standard length of 15 - 20cm, and may also have a higher range from 15 - 60 cm.

[0012] The term "building wall structure" refers to a wall as used in the construction industry. Typically, the wall structure may be made from layers of bricks; the term may also refer to concrete or wood or like structures.

[0013] In one embodiment of the present invention the tensile strength of binding element is at least 100 N/mm², preferably in range of 100-125 N/mm². The tensile strength of a test specimen is the breaking load of the test specimen per unit of unstrained cross-sectional area. The tensile strength is expressed in newtons per square millimeter or megapascals.

[0014] In one embodiment of the present invention the binding element is in accordance with regulations specified in NEN-EN 846.

[0015] In one embodiment of the present invention the shape of said elongated steel element is selected from the group consisting of I-profile, H-profile, round, flat, square, rectangular, triangular, trapezoidal, oval, half-round and mixtures thereof. In another embodiment of the present invention the elongated steel element is an elongated steel wire having a diameter ranging from 2mm to 5mm.

[0016] In one embodiment of the present invention the thermoplastic coating is selected from a group consisting of polyolefins, foamed thermoplastic resins, thermoplastic polyurethane. Examples of suitable thermoplastic materials are : polyethylene (PE), polypropylene (PP), polystyrene (PS), polyethylene terephthalate (PET), polyethylene naphthalate (PEN), polybutene terephthalate (PBT) polyvinylchloride (PVC), polyamide (PA) , polyester (PES), polyimide (PI), polycarbonate (PC) , styrene acrylonitril (SAN), acrylonitril-butadiene-styrene (ABS), thermoplastic polyurethane (TPU), thermoplastic polyolefins (TPO), thermoplastic copolyetheresters , copolymers of these polymers or similar materials.

[0017] In one embodiment of the present invention the elongated steel element is covered with an intermediate metallic coating. The intermediate metallic coating is a copper, copper alloy, zinc, zinc alloy, nickel, nickel alloy, tin or tin alloy or combinations thereof. Another preferred method is to coat the elongated steel element by running it through a bath of molten metal. This method is particularly suited to coat the elongated steel element with zinc (hot dip galvanising) or a zinc alloy - such as zinc aluminium alloy like Bezinal® coated wire of Bekaert - or copper or a copper alloy or tin. Figures 4 and 6 depicts certain embodiments of the present invention showing the intermediate metallic coating (23).

[0018] In a further embodiment the elongated steel element is a steel wire and diameter of said steel wire is at least 0.2 mm and the thickness of intermediate metallic coating is at least 20% of the steel wire thickness. In one embodiment the total diameter of the steel wire with the coating is lower than 5 mm. In a preferred embodiment the total diameter of the steel wire with the coating is lower than 3 mm, and may vary between 0.60 mm and 1.60 mm.

[0019] In yet a further embodiment the steel wire is a low carbon steel wire with carbon content below 0.20 wt%. In this embodiment the steel wire has preferably a carbon content ranging between 0.04 wt % and 0.20 wt %. The complete composition of the wire rod may be as follows : a carbon content of 0.06 wt %, a silicon content of 0.166 wt %, a chromium content of 0.042 wt %, a copper content of 0.173 wt %, a manganese content of 0.382 wt %, a molybdenum content of 0.013 wt %, a nitrogen content of 0.006 wt %, a nickel content of 0.077 wt %, a phosphorus content of 0.007 wt %, a sulfur content of 0.013 wt %.

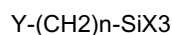
[0020] In a further embodiment the elongated steel element is a stainless steel alloy wire and diameter of said stainless steel alloy wire is at least 0.2 mm and the thickness of intermediate metallic coating is at least 20% of the steel wire thickness. The stainless steel alloy is selected from a group consisting of 201, 202, 301, 302, 303, 303Se, 304; 304L, 309S, 310S, 306, 316L, 317, 317L, 321, 329, 330, 347, 409, 410, 416, 416Se, 420, 430, 440C, 442, 904L, 17-4 PH, 17-7PH, 2205, CA-6NM, CA-15, CA-40, CF-3, CF-3M, CF-8, CF-8M, CH-20, CK-20, HF, HH, HK.

[0021] In another embodiment the steel wire is a high carbon steel wire with a carbon content above 0.25 wt% and lower than 1.0 wt%. The steel wire is highly mechanically deformed.

[0022] In one embodiment of the present invention an adhesion layer is at least partially applied between the elongated steel element and the thermoplastic coating, the adhesion layer comprises a compound selected from organo functional silanes, organo functional titanates, and organo functional zirconates.

[0023] The adhesion layer is selected from organo functional silanes, organo functional titanates and organo functional zirconates which are known in the art for said purpose. Preferably, but not exclusively, the organo functional silanes are

selected from the compounds of the following formula:



- 5 wherein : Y represents an organo functional group selected from -NH₂, CH₂=CH-, CH₂=C(CH₃)COO-, 2,3-epoxypropoxy, HS- and, Cl
- X represents a silicon functional group selected from -OR, -OC(=O)R',
 - 10 - Cl wherein R and R' are independently selected from C1 to C4 alkyl, preferably -CH₃, and —C₂H₅; and n is an integer between 0 and 10, preferably from 0 to 10 and most preferably from 0 to 3.

[0024] The organo functional silanes described above are commercially available products.

[0025] The thickness of thermoplastic material ranges from 150 μm to 1000 μm, preferably from 250 μm to 500 μm.

15 **[0026]** In one embodiment of the present invention the thermoplastic material may further comprise coloring agents. The advantage of such coloring agent is to impart color to the portion of binding element which is still exposed during construction of wall and such color may also have glow in the dark agents which can be used for safety purposes so that these protruding binding elements are visible in the dark. Some examples of such coloring agents are color masterbatches which impart color to plastics.

20 **[0027]** In one embodiment of the present invention the thermoplastic material may further comprise flame retarding agents. Some examples of such flame retarding are bishydroxydeoxybenzoin, bromine or non-halogenated agents that are added to thermoplastic.

[0028] The term "thermal conductivity" is defined as the quantity of heat transmitted through a unit thickness in a direction normal to a surface of unit area, due to a unit temperature gradient under steady state conditions. Thermal conductivity λ is expressed in W/Km. Some values: steel has a HTC of 50 W/Km; stainless steel of 15 W/Km. In one embodiment of the present invention the binding element has thermal conductivity below 5 W/Km, preferably below 2 W/Km, more preferably below 1 W/Km.

[0029] In one embodiment of the present invention at least a portion or the ends of the binding element has a surface texture selected from a group consisting of taper, indentation, serration, thread, ribbed and combinations thereof. Such a surface provides better anchorage to the wall structure. For instance an indentation in the ends of the binding element improves anchorage to the cement mortar embedded in the masonry joint during brick wall construction. Such surface texture may be imparted on the elongated steel element by passing through surface textured rollers.

[0030] In one embodiment of the present invention at least a portion or the ends of said binding element are bent at angle ranging from 20° to 90° with respect to the axis of the middle portion of the said binding element.

35 **[0031]** In one embodiment of the present invention at least a portion or the ends of said binding element are crimped. Fig 5 and 6 show such a crimped or wavy structure. The advantage of this form is to provide better anchorage of the binding agents to the wall structure.

40 Claims

1. Use of a binding element for a building wall structure of concrete or like composition, wherein said binding element has a minimum tensile strength of at least 100 N/mm² and said binding element comprises an elongated steel element coated with a thermoplastic material.
- 45 2. Use of the binding element of claim 1, wherein shape of said elongated steel element is selected from the group consisting of I-profile, H-profile, round, flat, square, rectangular, triangular, trapezoidal, oval, half-round and mixtures thereof.
- 50 3. Use of the binding element of claim 2, wherein said elongated steel element is an elongated steel wire having a diameter ranging from 2mm to 5mm.
4. Use of the binding element according to any one of the claims 1 to 3, wherein said thermoplastic material is selected from a group consisting of polyolefins, foamed thermoplastic resins, thermoplastic polyurethane.
- 55 5. Use of the binding element according to any one of the claims 1 to 4, wherein an adhesion layer is at least partially applied between the elongated steel element and the thermoplastic coating, the adhesion layer comprises a compound selected from organo functional silanes, organo functional titanates, and organo functional zirconates.

6. Use of the binding element according to any one of the claims 1 to 5 comprising a thermoplastic coating in its entire length of said elongated steel element.
7. Use of the binding element according to any one of the claims 1 to 6, said thermoplastic coating comprises a coloring agent and/or a flame retardant agent.
8. Use of the binding element according to any one of the claims 1 to 7, wherein thickness of said thermoplastic coatings ranges from 150 μm to 1000 μm .
9. Use of the binding element according to any one of the claims 2 to 8, wherein said elongated steel element is covered with an intermediate metallic coating and wherein said intermediate metallic coating is selected from a group consisting of copper, copper alloy, zinc, zinc alloy, nickel, nickel alloy, tin or tin alloy or combinations thereof.
10. Use of the binding element according to any one of the claims 1 to 9, wherein at least a portion or the ends of said binding element has a surface texture selected from a group consisting of taper, indentation, serration, thread, ribbed and combinations thereof.
11. Use of the binding element according to any one of the claims 1 to 10, wherein at least a portion or the ends of said binding element are bent at angle ranging from 20° to 90° with respect to the axis of the middle portion of the said binding element.
12. Use of the binding element according to any one of the claims 1 to 11, wherein at least a portion or the ends of said binding element are crimped.
13. A building wall structure comprising an inner wall, an outer wall spaced from said inner wall and provided with at least one insulation layer(s) in between, at least one binding element as defined in any one of the claims 1 to 10 interconnecting said outer wall and inner wall through the insulation layer, wherein ends of said binding element is fixed to the said outer wall and said inner wall respectively and wherein middle portion of said binding element is in contact with the said insulation layer(s).
14. The building wall structure of claim 12, wherein the length of the said middle portion of said binding element equates the spacing between the said outer wall and inner wall.

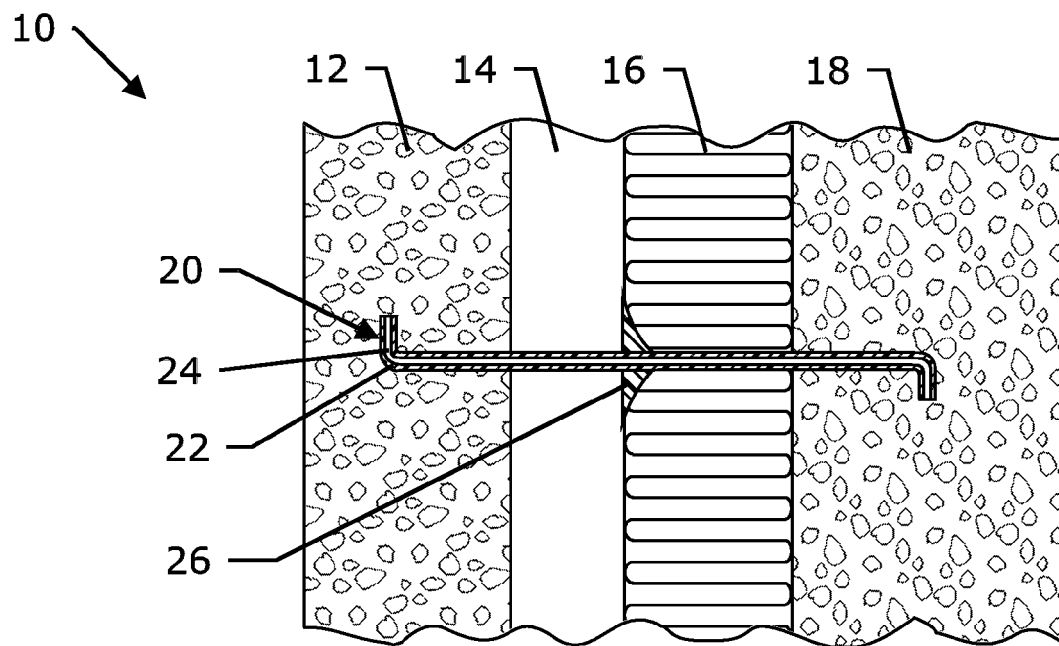


Fig. 1

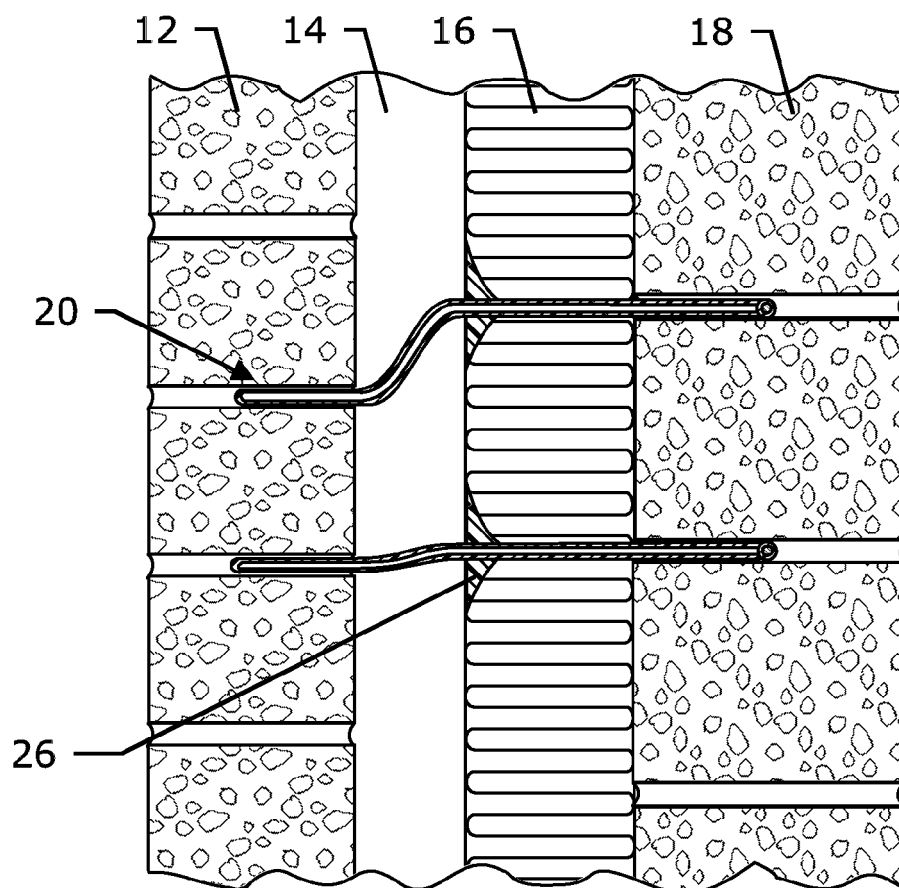


Fig. 2

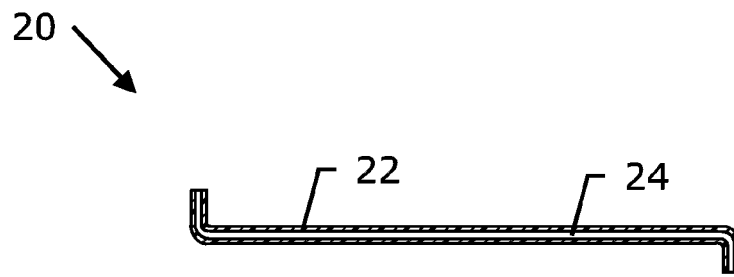


Fig. 3

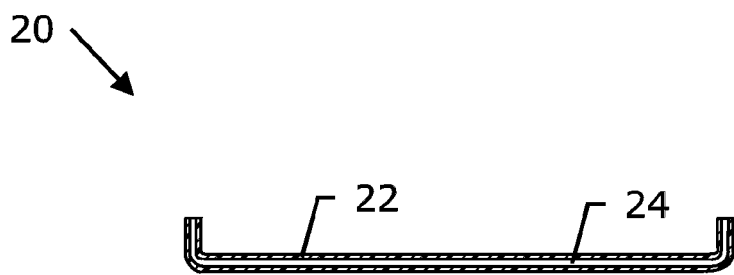


Fig. 4

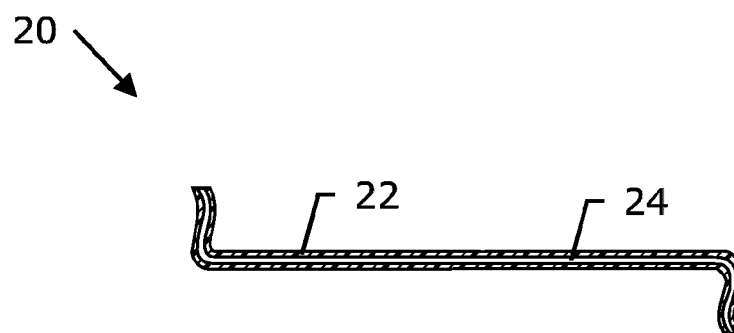


Fig. 5

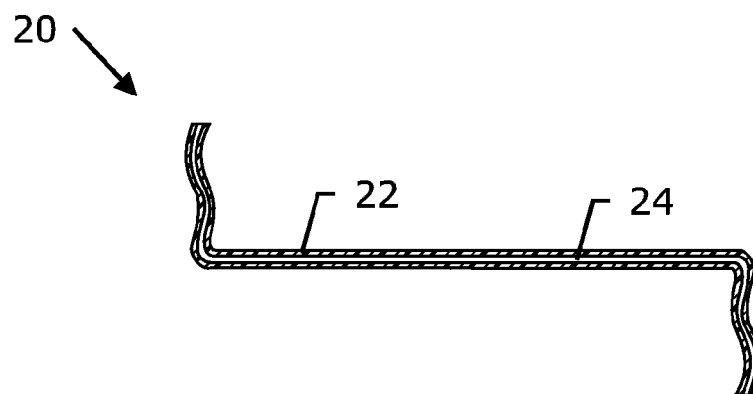


Fig. 6



EUROPEAN SEARCH REPORT

 Application Number
EP 11 17 8394

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	FR 2 593 209 A1 (MARQUET & CIE NOEL [BE]) 24 July 1987 (1987-07-24) * figures 1,4-7 * * claims 1,3,5,7 * * page 2, lines 1-19 * * page 4, lines 7-15 * * page 6, lines 21-30 * -----	1-14	INV. E04B1/41 E04B1/76
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A	DE 44 00 356 A1 (PLIBRICO GMBH [DE]) 13 July 1995 (1995-07-13) * figures 1-3 * * claims 1,6 * * column 2, lines 47-59 * -----	7	
A	EP 0 494 099 A2 (OLLIS WILLIAM JOHN BERNARD [GB]; OLLIS WILLIAM HENRY [GB]) 8 July 1992 (1992-07-08) * figures 3,4,8 * * column 5, lines 15-23 * -----	2,10, 12-14	TECHNICAL FIELDS SEARCHED (IPC) E04B
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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 3 February 2012	Examiner Schnedler, Marlon
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
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