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(54) **A method of reducing the width of cracks in masonry**

(57) The invention relates to a method to reduce the width of cracks that may be induced in masonry. The method comprises the step of reinforcing at least one joint with reinforcement strips. The reinforcement strips comprise at least two straight, substantially parallel reinforcement wires connected to each other by means of a wire connecting structure. The reinforcement wires have a design yield strength f_{yd} equal or higher than $550/\gamma_s$ N/mm² and an equivalent diameter d equal or lower than 4 mm. The reinforcement strips have a resistance F against loads applied on said reinforcement strip. The resistance F has a design value of resistance F_d . The reinforcement strip embedded in said joint has a bond capacity F_{bok} . The bond capacity F_{bok} has a design bond capacity F_{bod} .

The design yield strength f_{yd} and the diameter d of said reinforcement wires are chosen in such a way that the design value F_d of the reinforcement strip is equal or lower than said design bond capacity F_{bod} of the reinforcement strip. The reinforcement wires are provided with ribs.

The invention furthermore relates to reinforcement strips and to masonry reinforced with such reinforcement strips.

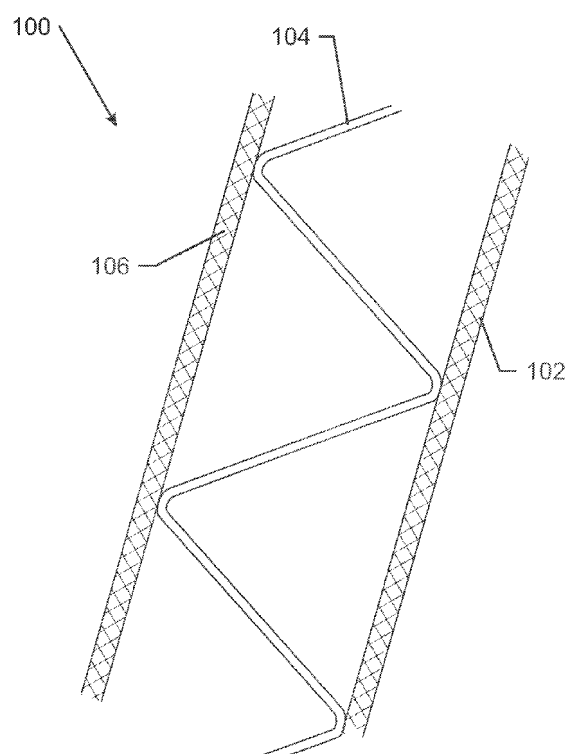


Fig. 1

Description

Technical Field

[0001] This invention relates to a method of reducing the width of cracks that may be induced in masonry reinforced with reinforcement strips.

The invention further relates to a strip for the reinforcement of masonry.

Background Art

[0002] Strips for the reinforcement of masonry are known in the art.

Masonry has a high compressive strength but a limited tensile strength. This leads to cracking when tensile and/or shear stresses develop. By reinforcing masonry with strips, the risk of cracking is substantially reduced.

[0003] Although reinforcement strips having longitudinal wires having a high yield strength are existing, up to now calculation in the design are done with the much lower design yield strength. Using a higher design yield strength is of high importance as this may lead to a reduction in the cross-section of the longitudinal wires. A reduction of the cross-section of the longitudinal wires not only result in a reduction of the amount of steel required but also in a reduction of the minimum required thickness of a mortar joint.

[0004] However it is not meaningful to simply increase the design yield strength of the longitudinal wires of a reinforcement strip. Increasing the design yield strength of the longitudinal wires has a direct influence on the width of cracks induced in masonry as a higher tensile stress in the longitudinal wires will result in an increase of the width of cracks that may be induced in the masonry.

[0005] To reduce the width of cracks it is common in the art to reduce the design stress in the steel, and thus increase the steel section of the reinforcement strip for a specific design load. Typically, a design yield strength of 435 MPa is used.

Disclosure of Invention

[0006] It is an object of the present invention to provide a method to reduce the width of cracks induced in masonry reinforced with reinforcement strips using longitudinal wires having a high design yield strength.

[0007] It is another object of the present invention to provide a strip for the reinforcement of masonry avoiding the drawbacks of the prior art.

[0008] According to a first aspect of the present invention a method to reduce the width of cracks that may be induced in masonry is provided. The masonry comprises layers of bricks and joints, preferably mortar joints.

The method according to the present invention comprises the step of reinforcing at least one joint with reinforcement strips.

The reinforcement strips comprise at least two straight,

substantially parallel reinforcement wires connected to each other by means of a wire connecting structure. The reinforcement wires are preferably connected to each other by welding a wire connecting structure between two adjacent reinforcement wires, for example by welding the wire connecting structure on mutually facing sides of the two reinforcement wires, alternately on the first reinforcement wire and the second reinforcement wire. The reinforcement wires are preferably steel wires. The wire connecting structure is preferably made of steel.

The reinforcement wires have a yield strength f_y and a design yield strength f_{yd} .

The design yield strength f_{yd} corresponds with the yield strength f_y divided by safety factor γ_s . The reinforcement wires of the reinforcement strip according to the present invention have a design yield strength f_{yd} equal or higher than $550/\gamma_s$ N/mm², more preferably a design yield strength f_{yd} equal or higher than $600/\gamma_s$ N/mm². The safety factor γ_s is a partial factor for a material property (steel), taking uncertainties in the material into account. The safety factor γ_s is for example equal to 1.15.

The reinforcement wires preferably have an equivalent diameter lower than 4 mm, more preferably lower than 3.80 mm for example 3.65 mm.

[0009] The reinforcement strip will provide a resistance F to the loads applied. The resistance F of the reinforcement strips to loads applied is equal to the cross-sectional area of the reinforcement strip in tension A_s multiplied by the yield strength f_y of the reinforcement wires:

$$F = A_s * f_y.$$

The design value of the resistance of the reinforcement strip to loads applied is called F_d . The design value of the resistance of the reinforcement strip to loads applied, F_d is equal to the cross-sectional area of the reinforcement strip in tension A_s multiplied by the design yield strength f_{yd} of the reinforcement wires :

$$F_d = A_s * f_{yd}.$$

[0010] The reinforcement strip once embedded in a mortar joint has a bond capacity F_{bok} (=characteristic bond capacity). The bond capacity F_{bok} of a reinforcement strip in masonry can be determined by European Standard EN846-2. In the test of this European Standard a strip is embedded in mortar in a small wall of bonded masonry units. The strip is then subjected to tension in order to determine its bond strength.

The reinforcement strip has a design value of the bond capacity F_{bod} also called design bond capacity. The design bond capacity F_{bod} is defined as the bond capacity F_{bok} divided by a safety factor γ_s , i.e. F_{bok}/γ_s .

The safety factor γ_s is a partial factor for a material (steel reinforcement) including uncertainties about geometry and modeling. γ_s is typically ranging between 1.7 and 2.7

[0011] According to the present invention the design yield strength f_{yd} of the reinforcement wires and the equivalent diameter d of the reinforcement wires are chosen in such a way that the design value of the resistance of a reinforcement strip to loads applied F_d is equal or lower than the design bond capacity F_{bod} of the reinforcement strip without increasing the width of crack possibly induced in the masonry.

[0012] For a person skilled in the art it is clear that the design value of the resistance of a reinforcement strip to loads applied F_d has to be equal or higher than the design load E_d .

[0013] The bond capacity F_{bok} (=characteristic bond capacity) of a reinforcement strip and thus also the design bond capacity F_{bod} of a reinforcement strip can be increased by increasing the anchorage length of a reinforcement strip and/or by increasing the lap length of two neighbouring reinforcement strips.

However, in practice the anchorage length of a reinforcement strip is limited by the design of the reinforcement strip. More particularly, the wire connecting structure limits the lap length of two neighbouring reinforcement strips.

When overlapping neighbouring reinforcement strips, the reinforcement strips should be put next to each other and preferably not on top of each other, otherwise the mortar will not cover the reinforcement strip sufficiently and the thickness of the joint will be increased. A preferred method of overlapping reinforcement strips is by sliding one end of a second reinforcement strip in one end of a first reinforcement strip in such a way that the reinforcement wires of the neighbouring reinforcement strips remain in one plane and the first reinforcement wire of the first strip is thereby adjacent to the first wire of the second reinforcement strip and the second reinforcement wire of the first reinforcement strip is adjacent to the second wire reinforcement wire of the second reinforcement strip. The lap length of two neighbouring reinforcement strips is limited by the design of the reinforcement strip, more particularly by the wire connecting structure.

[0014] In order to avoid pull out of reinforcement strip, the design yield strength f_{yd} and the equivalent diameter of the reinforcement wires d have to be chosen in such a way that the design value of the resistance of a reinforcement strip to loads applied F_d is equal or lower than the design bond capacity F_{bod} of the reinforcement strip in the mortar over the anchorage length of the reinforcement strip.

As explained above, the anchorage length is limited by the design of the reinforcement strip.

This means that in case reinforcement wires of a specific equivalent diameter are used having a design yield strength f_{yd} higher than allowed by the bond capacity F_{bod} of the reinforcement strip, the equivalent diameter of the reinforcement wires should be reduced to balance

the design value of the resistance of a reinforcement strip F_d with the bond capacity F_{bod} and thus to avoid pull out over the provided anchorage length.

[0015] However, by using reinforcement wires having a higher design yield strength f_{yd} and a reduced equivalent diameter d other concerns arise as using such reinforcement wires may lead to an increase in the width of cracks that may be induced in masonry.

According to Hooke's law an increase in the stress in the reinforcement wires will result in an increase in strain :

$$\varepsilon = E * \sigma$$

with ε : strain

E : Young's modulus

σ : tensile stress

[0016] A crack is induced in a masonry cross-section when the local tensile strength of the masonry is exceeded. Once a crack is induced in the masonry, the tensile loads are taken by the reinforcement strip. The load at the crack is then further transmitted from the reinforcement strip to the mortar, more particularly from the reinforcement wires of the reinforcement strip to the mortar, over a length called the loading length l_a of the reinforcement strip or more particularly the loading length of the reinforcement wires of the reinforcement strip. At the end of the loading length, the strain in the steel is equal to the strain in the masonry.

[0017] The width of a crack is related to the loading length and the strain of the reinforcement strip at the crack. The width of a crack can be derived from the following formula :

$$w = 2 * l_a * \varepsilon_{crack}$$

with w : width of a crack in the masonry;

l_a : loading length of reinforcement strip;

ε_{crack} : strain of the reinforcement strip caused by the tensile stress σ_{crack} determined by the load in the crack

[0018] This means that by using reinforcement wires having a high design yield strength f_{yd} , the strain in the reinforcement strip is increased. As the strain in the reinforcement wires is increased, the width of the crack will increase unless the loading length is sufficiently reduced.

[0019] To avoid this problem the reinforcement wires of the reinforcement strip according to the present invention are provided with a plurality of ribs. By providing the reinforcement wires with ribs, the loading length can be reduced.

[0020] The method according to the present invention allows using reinforcement strips having high tensile reinforcement wires without increasing the width of cracks induced in masonry.

[0021] The reinforcement wires are preferably steel

wires. In particular embodiments the steel comprises stainless steel.

Possibly, the steel wires are coated, for example with a zinc or zinc alloy coating or with a polymer coating.

[0022] The reinforcement wires may have any type of cross-section. Preferred reinforcement wires have a circular cross-section, a rectangular or a square cross-section.

The reinforcement wires are preferably drawn wires, although wires made of sheet material and profiled wire can also be considered.

[0023] The equivalent diameter of the reinforcement wires is preferably equal or lower than 4 mm, for example 3.65 mm, 3.5 mm, 3.2 mm or 3 mm.

[0024] The wire connecting structure preferably comprises a wire having an equivalent diameter ranging between 2 and 4 mm. Preferably the wire is a steel wire.

[0025] In a preferred embodiment the reinforcement strips the wire connecting structure is provided with protuberances protruding from the plane comprising said at least two straight reinforcement wires. The protuberances of the wire connecting structure form a spacing element which keep the at least two straight reinforcement wires at a specific distance from the layer of bricks below or from the layer of bricks above or from both the layer of bricks below and above in order to guarantee the embedment of the reinforcing wires in the mortar.

The mortar can be applied before the laying of the reinforcement strips, after the laying of the reinforcement strips or before and after the layer of the reinforcement strips.

[0026] The advantage of providing the wire connecting structure with protuberances protruding from the plane comprising the at least two reinforcement wires allows the complete embedment of the reinforcement wires in mortar. By using a reinforcement strip having a wire connecting structure provided with protuberances, the thickness of the joint, more particularly the mortar joint is higher than the "thickness" of the reinforcement strip. With thickness of the reinforcement strip is meant the height or depth of the protuberances of the wire connecting structure or the sum or the height of dept of the protuberances of the wire connecting structure and the diameter of the reinforcement wires.

A further advantage of using reinforcement strip having a wire connecting structure provided with protuberances is that as the reinforcement wires are completely embedded in the mortar layer, loads induced at a crack are transmitted over the shortest possible loading length from the reinforcement strip to the mortar.

Furthermore, the reinforcement wires will not be weakened by any deformation and maintain their full tensile strength along their whole length.

[0027] This preferred type of reinforcement strips allows masons at a building site to use the following way of operation: applying firstly a reinforcement strip on the upper side of the last laid layer of bricks followed by applying a mortar layer before the next layer of bricks is

applied. This way of operation offers serious advantages compared to the recommended way of operation comprising the steps of: applying firstly a mortar layer on the upper surface of the last laid layer of bricks, then applying the reinforcement strip, finally applying another mortar layer on the reinforcement strip before the next layer of bricks is applied. The usually recommended way of operation is a cumbersome operation.

[0028] The protuberances may be provided by bending the wire connecting structure.

[0029] The protuberances may be provided at one side of the plane comprising the reinforcement wires, for example at the upper side or at the lower side. Alternatively, the protuberances are provided at both sides of the plane comprising the reinforcement wires, i.e. at the upper and at the lower side.

[0030] The bent protuberances of the wire connecting structure may have any form as for example a sinusoidal form.

[0031] In a preferred embodiment, the protuberances of the wire connecting structure are located close to the reinforcement wires, e.g. within a distance of maximum 10 cm from the connecting points between the wire connecting structure and the reinforcement wires, e.g. within a distance of maximum 8 cm, e.g. of maximum 5 cm, e.g. of maximum 3 cm. This embodiment is particularly advantageous for reinforcement strips to be used to reinforce walls where the bricks have hollow spaces inside. In case the spacing elements are located in the middle of the wire connecting structure, the protuberances risk to fall inside the hollow spaces and to miss completely their spacing function.

[0032] According to a second aspect of the present invention a reinforcement strip adapted for the reinforcement of masonry is provided.

The reinforcement strip comprises reinforcement at least two straight, substantially parallel reinforcement wires connected to each other by means of a wire connecting structure. Preferably, the reinforcement strip comprises two straight, substantially parallel steel reinforcement wires. The wire connecting structure is preferably made of steel.

The reinforcement wires have a yield strength f_y and a design yield strength f_{yd} .

The reinforcement wires of the reinforcement strip according to the present invention have a design yield strength f_{yd} equal or higher than $550/\gamma_s$ N/mm², more preferably a design yield strength f_{yd} equal or higher than $600/\gamma_s$ N/mm². The safety factor γ_s is for example equal to 1.15.

The reinforcement

The reinforcement wires preferably have an equivalent diameter lower than 4 mm, more preferably lower than 3.80 mm for example 3.65 mm. The reinforcement wires are provided with a plurality of ribs.

[0033] According to a third aspect of the present invention masonry reinforced with the above described reinforcement strips is provided.

Brief Description of Figures in the Drawings

[0034] The invention will now be described into more detail with reference to the accompanying drawings where

- Figure 1 shows a first embodiment of a reinforcement strip according to the present invention;
- Figure 2 shows a second embodiment of a reinforcement strip according to the present invention;
- Figure 3 shows a perspective view of a part of masonry comprising two layers of bricks and an intermediate mortar joint, reinforced with a reinforcement strip as shown in Figure 2;
- Figure 4 shows a cross-section of the embodiment of figure 3 along the line II-II' in Figure 3;
- Figure 5 shows a cross-section similar to Figure 4, but with another type of reinforcement strip;
- Figure 6 shows a cross-section similar to Figure 4 and Figure 5 but with still another form of the reinforcement strip;
- Figure 7a and Figure 7b shows a particular embodiment of a ladder type of reinforcement strip;
- Figure 8a, Figure 8b and Figure 8c illustrate reinforcing strips according to the invention whereby the protuberances of the wire connecting structure are located close to the reinforcement wires.

Mode(s) for Carrying Out the Invention

[0035] The present invention will be described with respect to particular embodiments and with reference to certain drawings but the invention is not limited thereto but only by the claims. The drawings described are only schematic and are non-limiting. In the drawings, the size of some of the elements may be exaggerated and not drawn on scale for illustrative purposes. The dimensions and the relative dimensions do not correspond to actual reductions to practice of the invention.

[0036] The following terms are provided solely to aid in the understanding of the inventions.

- Masonry: all building systems that are constructed by stacking relatively small units of stone, clay, or concrete, joined by for example mortar or glue into the form of walls, columns, arches, beams or domes;
- Tensile strength: the maximum stress a material withstands when subjected to an applied load. The value of the tensile strength corresponds with the load at failure divided by the original cross-sectional area;
- Yield strength: the stress at which a material begins to deform plastically;
- Stress: the ratio of applied load to the cross-sectional area of an element in tension;
- Strain: a measure of the deformation of the material;
- Equivalent diameter of a wire: the diameter of an imaginary wire having a circular radial cross-section,

which cross-section has a surface identical to the surface area of the particular wire.

[0037] Figure 1 describes a reinforcement strip 100 comprising two straight, substantially parallel steel reinforcement wires 102 welded to each other by means of a steel wire connecting structure 104.

The wire connecting structure 104 of the embodiment shown in Figure 1 runs between the two reinforcement wires 102 along a substantially zig-zag line. Such a wire reinforcement strip is called a truss type. Ladder type reinforcement strips having as wire connecting structure a series of cross members as described in US2929238 and US6629393 can also be considered.

[0038] The reinforcement wires 102 are steel wires having a yield strength f_y equal or higher than 550 N/mm². More preferably, the reinforcement wires 102 have a yield strength f_y higher than 600 N/mm².

The reinforcement wires 102 have a design yield strength f_{yd} . The design yield strength f_{yd} of the reinforcement wires 102 is equal or higher than 550/ γ_s N/mm². More preferably the design yield strength f_{yd} of the reinforcement wires 102 is equal or higher than 600/ γ_s N/mm². The reinforcement wires 102 have an equivalent diameter d equal or lower than 4 mm. In the embodiment shown in Figure 1 the reinforcement wires 102 are wires having a circular cross-section having a diameter of 3.65 mm. The reinforcement wires 102 are provided with a plurality of ribs 106.

[0039] The reinforcement strip 100 has a resistance F against loads applied on the reinforcement strip. The resistance F has a design value F_d equal to the cross-sectional area of the reinforcement wires 102 in tension multiplied by the design yield strength f_{yd} .

The reinforcement strip 100 once embedded in mortar has a design bond capacity F_{bod} .

According to the present invention the design yield strength f_{yd} of the reinforcement wires 102 and the equivalent diameter d of the reinforcement wires 102 are chosen in such a way that the design value F_d of the reinforcement strip is equal or lower than the bond capacity F_{bod} . It is essential for the reinforcement strip according to the present invention that the reinforcement wires are provided with a plurality of ribs.

[0040] The diameter of the wire connecting structure 104 is preferably lower than 4 mm, for example ranging between 2 and 4 mm, as for example 2.5 mm or 3 mm.

[0041] Figure 2 shows an embodiment of a reinforcement strip 200 according to the present invention whereby the wire connecting structure 204 of the strip is provided with protuberances.

The reinforcement strip 200 has two straight, substantially parallel steel reinforcement wires 202 welded to each other by means of a steel wire connecting structure 204. The welding may be any type of welding such as spot welding or butt welding. The reinforcement wires 202 are provided with a plurality of ribs 206.

The wire connecting structure 204 runs between the two

reinforcement wires 202 along a substantially zig-zag line and is provided with protuberances 208 protruding at one side from the plane comprising the two reinforcement wires 202.

The protuberances 208 are formed by bending some parts of the wire connecting structure 204 out of the plane formed by the two reinforcement wires at one side of this plane. It is possible to provide each length of wire 210 between the reinforcement wires 202 with one or more protuberance(s) 208.

It is also possible that not all lengths of wire 210 between the reinforcement wires 202 are provided with one or more protuberance(s) 208. In the embodiment shown in Figure 2 there is a protuberance 208 for each pair of successive steel wire lengths 210.

[0042] The protuberances 208 have a certain depth (or height) of for example 1 to 6 mm with respect to the plane formed by the upper part of the two reinforcement wires 202. In this way the protuberances 208 form spacing elements. More preferably the protuberances 208 have a depth (or height) ranging between 1 mm and 4 mm, for example between 2 or 3 mm with respect to the plane formed by the upper part of the two reinforcement wires 202. In this way the protuberances 208 form spacing elements or distance holders for the reinforcement strip 200. The protuberances define in this way a certain thickness of the joint between the two adjacent brick layers which is higher than the total thickness of the reinforcement strip, i.e. the sum of the diameter of the reinforcement wire 202 and the depth (or height) of the protuberances 208 of the wire connecting structure.

[0043] Figure 3 shows a perspective view of a small part of masonry 320 comprising two adjacent layers of bricks 301, 303 and an intermediate joint 305 of mortar or another adhesive. The joint 305 is reinforced by means of a reinforcement strip 300 similar to the reinforcement strip shown in Figure 2. The reinforcement strip has two reinforcement wires 302, each reinforcement wire 302 provided with a plurality of ribs. The reinforcement wires 302 are connected by a wire connecting structure 304. The wire connecting structure 304 is provided with protuberances 308.

[0044] Figure 4 shows a cross-section of the embodiment of figure 3 along the line II-II' in Figure 3. Figure 4 shows clearly that each protuberance 308 is designed to support on the upper surface of the lower layer 301 of bricks. It is clear, that by means of the protuberances 308 of the wire connecting structure 304, the reinforcement wires 302 are situated at a desired or specific distance above the upper surface of the lower layer of bricks 301 and therefore are correctly embedded in the mortar joint 305.

[0045] The embodiment of reinforcement strip 500 shown in Figure 5 has a wire connecting structure 504 having protuberances 508 protruding at both sides of the plane comprising the two reinforcement wires 502. The protuberances 508 are designed to extend upwardly (dashed lines) and downwardly (full lines) from the plane

defined by the two longitudinal reinforcement wires 502. It is again clear, that the reinforcement wires 502 are situated at a certain distance above the upper surface of the lower layer 501 of bricks, but also at a certain distance under the lower surface of the upper layer 503 of bricks because the protuberances 508 are now designed to contact the upper surface of the lower layer 501, as well as the lower surface of the upper layer 503. This means that the reinforcement wires 502 are still better embedded in the mortar joint 503.

[0046] A reinforcement strip 500 with both protuberances 508 upward and downward is very advantageous. First of all it can be placed on any side, there will always be a gap created both under and above the reinforcement wires 502.

It is important to notice that the function of the reinforcement strip 500 according to the present invention is not to keep a fixed and constant distance between two layers of bricks, as disclosed in US-A-2004/182029, but to allow the reinforcement wires 502 to be completely embedded in mortar. A layer of mortar is preferably provided above the reinforcement strip, under the reinforcement strip or above and under the reinforcement strip.

[0047] Figure 6 shows a cross-section through a masonry 620 with still a further embodiment of the reinforcement strip 600. The reinforcement strip 600 is a ladder-type strip, whereby some steel wires 604 connecting the two reinforcement wires 602 are bent to form protuberances 608 showing a substantially crenel-form. In the embodiment shown in Figure 6 all the undulations or corrugations of the deformed connecting wires 604 have the same height or depth. It is also possible to deform the steel wire connecting wires 604 to give these wires 604 a substantially sinusoidal form.

[0048] Figure 7a shows a cross-section of another embodiment of a reinforcement strip 700 at a certain location and Figure 7b shows a cross-section of this another embodiment of a reinforcement strip 700 at another location. This reinforcement strip 700 is of the ladder type, i.e. the connecting structure 704 comprises several separate pieces of wire. The separate pieces of wire are point welded alternately above the plane of the reinforcement wires 5 (Figure 7a) and under the plane of the reinforcement wires (Figure 7b). In case of an upward protuberance 708, the wire piece is point welded above the reinforcement wires 702 (Figure 7a). In case of a downward protuberance 708', the wire piece is point-welded under the reinforcement wires 702 (Figure 7b). The embodiment of Figure 7a and Figure 7b has the advantage that the height or depth of the protuberances can be reduced with the thickness or diameter of the reinforcement wires 702.

[0049] Figure 8a, Figure 8b, and Figure 8c all illustrate embodiments of the reinforcement strip 800 where the spacing elements 808', 808'' are located close to the reinforcement wires 802 in order to avoid that the spacing elements fall inside the hollow space of certain bricks.

[0050] The embodiment of Figure 8a is of a zigzag type

reinforcement strip 800. Each piece of connecting wire 804 has two parts 808' which have been bent downwards and two parts 808" which have been bent upwards. The reason for providing both downwards and upwards bending is that the strip will provide its spacing function independent of the way it is laid down on the layer of bricks. The spacing elements 808', 808" may each have a length of 1.5 cm to 2.5 cm in order to provide sufficient stability to the reinforcing strip on the layer of bricks and yet to avoid too much contact between the connecting wires and the layer of bricks.

[0051] The embodiment of Figure 8b is also of a zigzag type reinforcement strip 800 but here each piece of connecting wire 804 has only one part 808' and one part 808". Experience has shown that this is sufficient for stability.

[0052] The embodiment of Figure 8c is of a ladder type. Each piece of connecting wire 804 has two parts 808' which have been bent downwards and two parts 808" which have been bent upwards.

Claims

1. A method to reduce the width of cracks that may be induced in masonry, said masonry comprising layers of bricks and joints, said method comprising the step of reinforcing at least one joint with reinforcement strips, said reinforcement strips comprising at least two straight, substantially parallel reinforcement wires connected to each other by means of a wire connecting structure, said reinforcement wires have a design yield strength f_{yd} equal or higher than $550/\gamma_s$ N/mm² and an equivalent diameter d equal or lower than 4 mm, said reinforcement strip having a resistance F against loads applied on said reinforcement strip, said resistance F having a design value of resistance F_d , said design value F_d being equal to the cross-sectional area of the reinforcement wires in tension multiplied by the design yield strength f_{yd} , said reinforcement strip embedded in said joint having a bond capacity F_{bok} , said bond capacity F_{bok} having a design bond capacity F_{bod} , **characterized in that** said design yield strength f_{yd} of said reinforcement wires and said diameter d of said reinforcement wires being chosen in such a way that said design value F_d of said reinforcement strip is equal or lower than said design bond capacity F_{bod} of said reinforcement strip and that said reinforcement wires are provided with a plurality of ribs.
2. A method according to claim 1, wherein said reinforcement wires comprise steel wires.
3. A method according to claim 1 or claim 2, wherein said wire connecting structure comprises a steel wire or a number of steel wires.
4. A method according to any one of the preceding claims, wherein said reinforcement wires are connected to each other by welding said wire connecting structure between two adjacent reinforcement wires.
5. A method according to any one of the preceding claims, wherein said reinforcement wires have a design yield strength f_{yd} higher than $600/\gamma_s$ N/mm².
6. A method according to any one of the preceding claims, wherein said reinforcement wires have an equivalent diameter equal or lower than 3.65 mm.
7. A reinforcement strip comprising at least two straight, substantially parallel reinforcement wires connected to each other by means of a wire connecting structure, said reinforcement wires having a design yield strength f_{yd} equal or higher than $550/\gamma_s$ N/mm² and an equivalent diameter d equal or lower than 4 mm, said reinforcement strip having a resistance F against loads applied on said reinforcement strip, said resistance F having a design value of resistance F_d , said design value F_d being equal to the cross-sectional area of the reinforcement wires in tension multiplied by the design yield strength f_{yd} , said reinforcement strip embedded in said joint having a bond capacity F_{bod} , said bond capacity F_{bok} having a design bond capacity F_{bod} , **characterized in that** said design yield strength f_{yd} of said reinforcement wires and said diameter d of said reinforcement wires being chosen in such a way that said design value F_d of said reinforcement strip is equal or lower than said design bond capacity F_{bod} of said reinforcement strip and that said reinforcement wires are provided with a plurality of ribs.
8. A reinforcement strip according to claim 7, wherein said reinforcement wires comprise steel wires.
9. A reinforcement strip according to claim 7 or claim 8, wherein said wire connecting structure comprises a steel wire or a number of steel wires.
10. A reinforcement strip according to any one of claims 7 to 9, wherein said reinforcement wires are connected to each other by welding said wire connecting structure between two adjacent reinforcement wires.
11. A reinforcement strip according to any one of claims 7 to 10, wherein said reinforcement wires have a design yield strength f_{yd} higher than $600/\gamma_s$ N/mm².
12. A reinforcement strip according to any one of claims 7 to 11, wherein said reinforcement wires have an equivalent diameter equal or lower than 3.65 mm.
13. A reinforcement strip according to any one of claims 7 to 12, wherein said wire connecting structure is

provided with protuberances protruding from the plane comprising said reinforcement wires and forming spacing elements which allow an embedment of said reinforcement wires in mortar.

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- 14.** A reinforcement strip according to claim 13, wherein said protuberances of said wire connecting structure are present at both side of said plane comprising said reinforcement wires.

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- 15.** Masonry comprising layers of bricks and joints, whereby at least one joint is reinforced by a number of reinforcement strips as defined in any one of claims 7 to 14.

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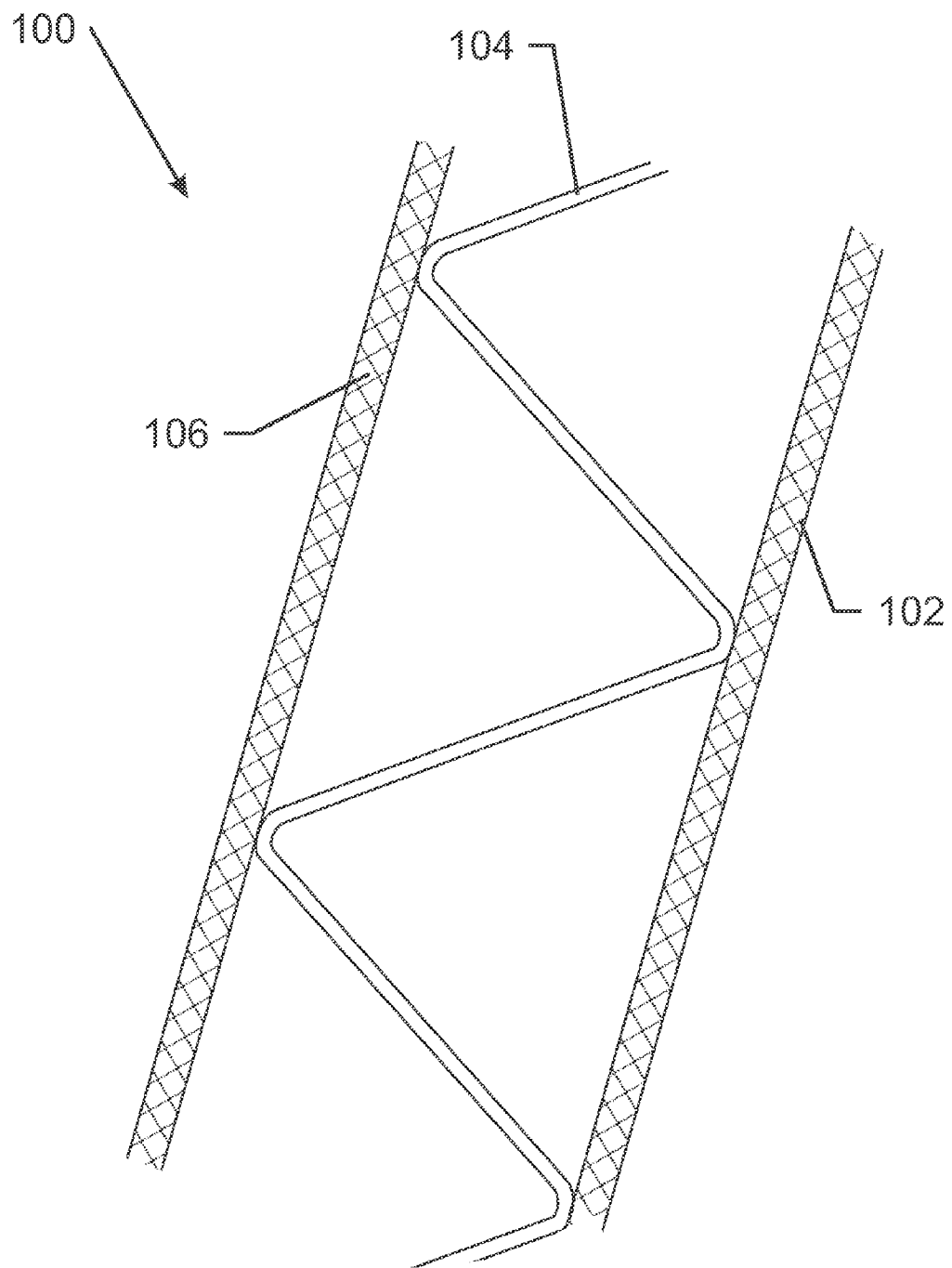


Fig. 1

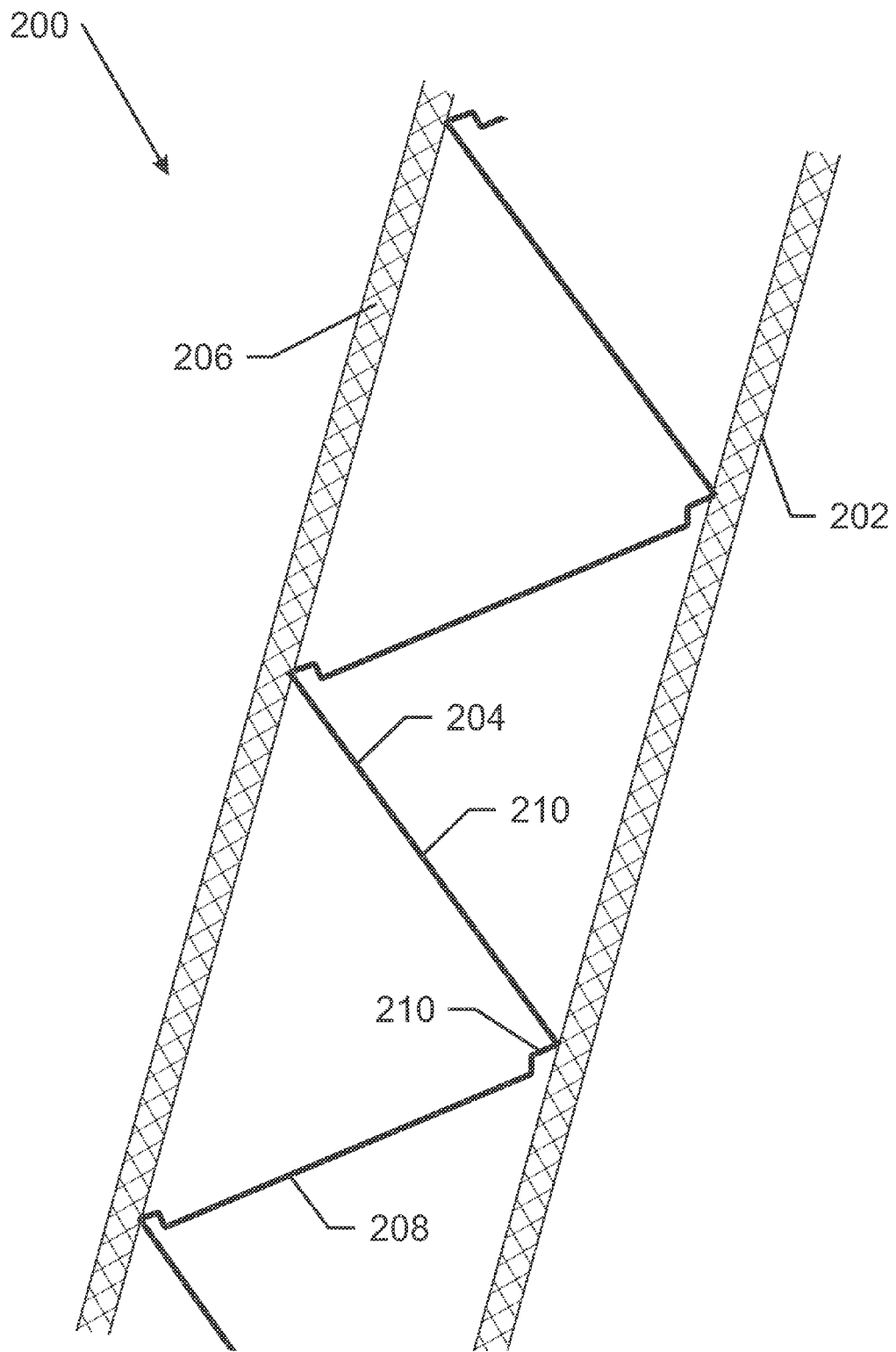


Fig. 2

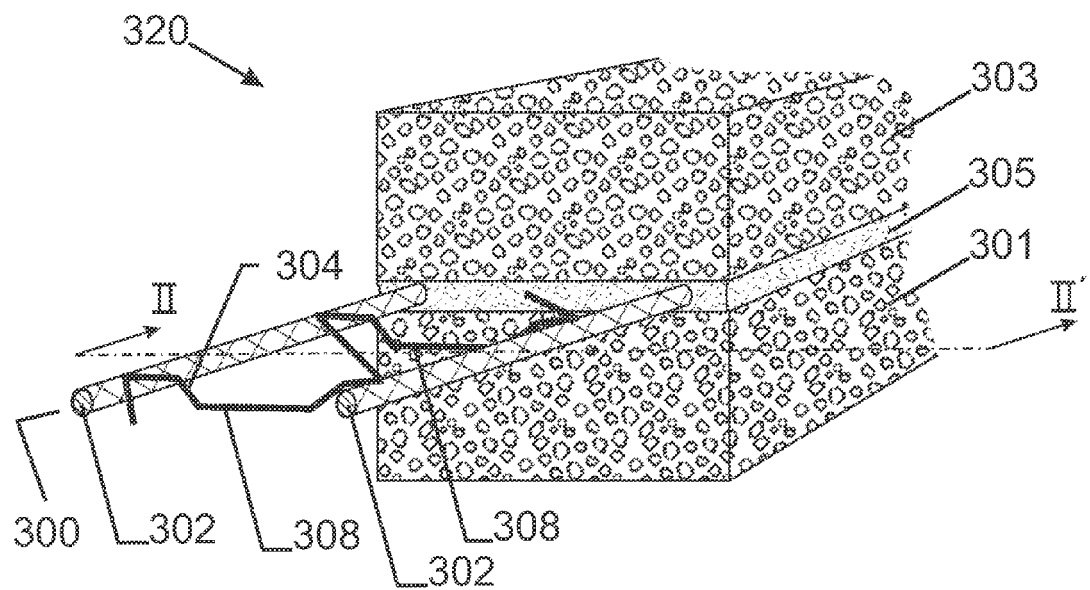


Fig. 3

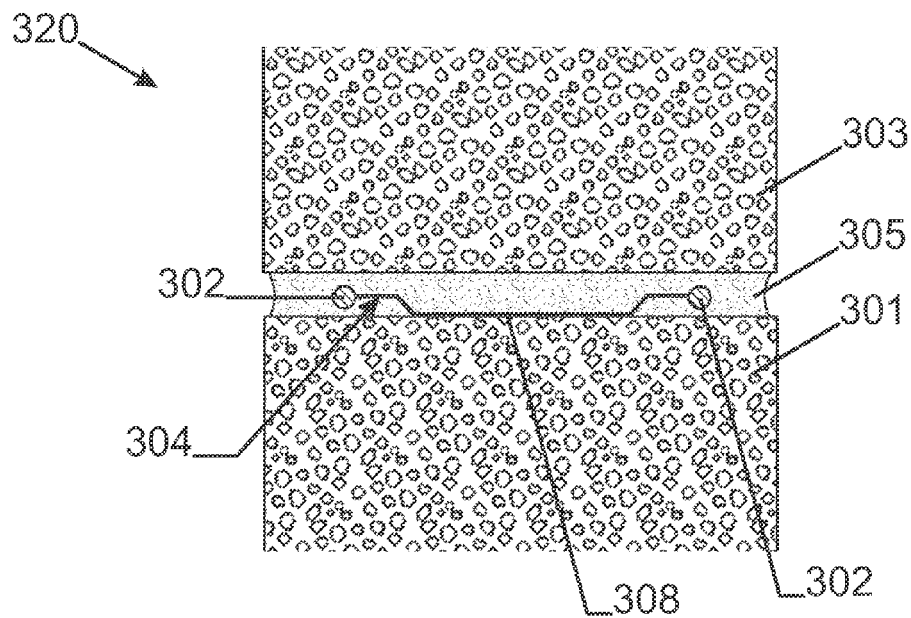


Fig. 4

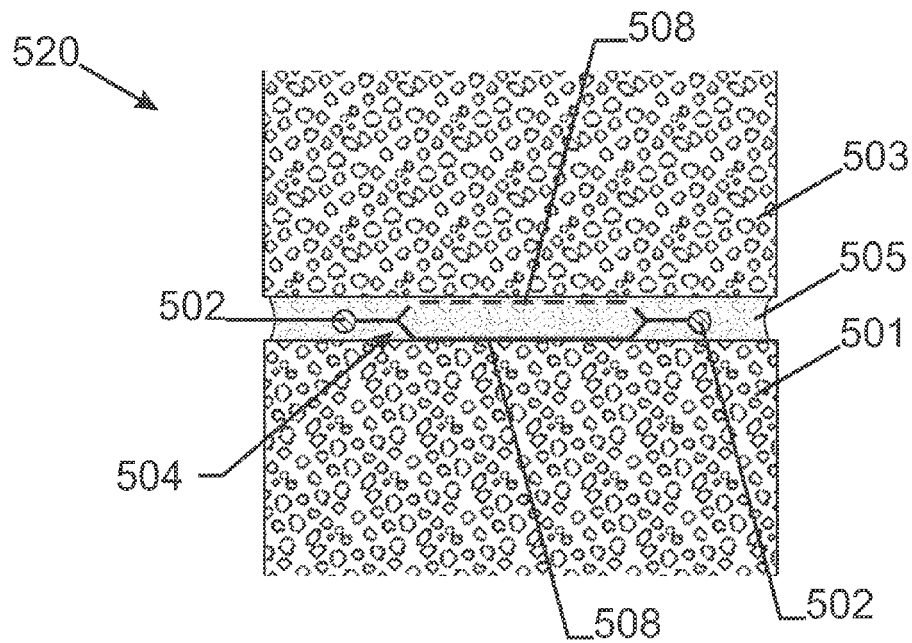


Fig. 5

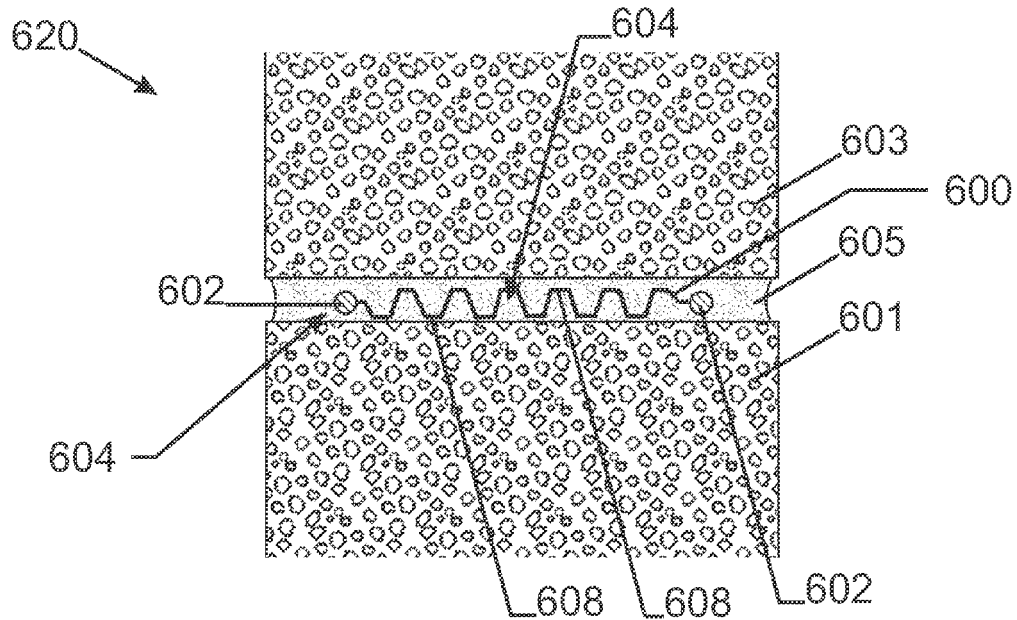


Fig. 6

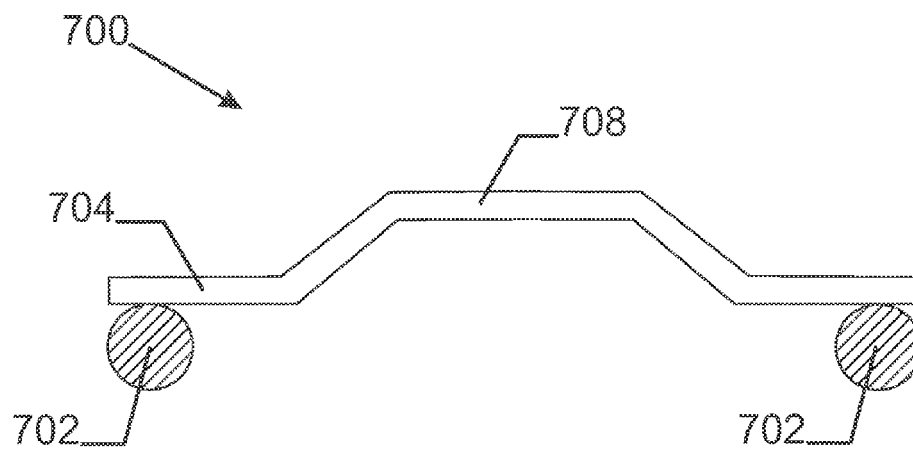


Fig. 7a

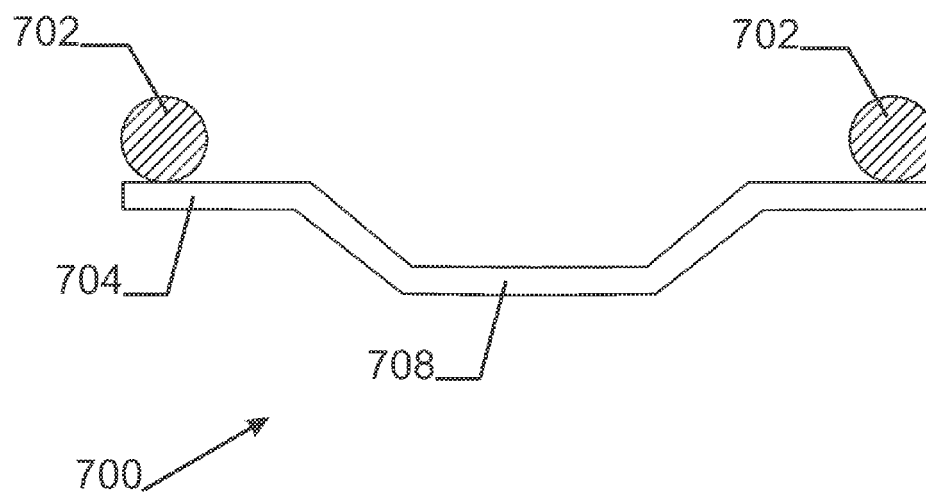


Fig. 7b

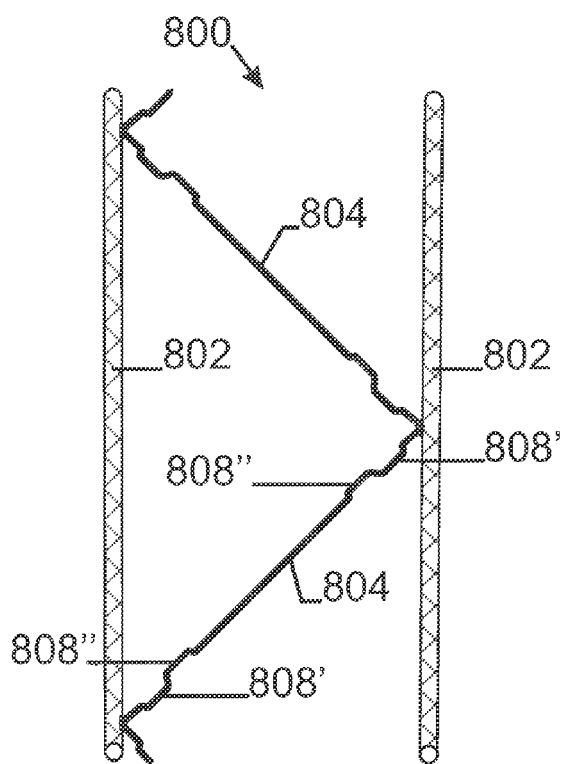


Fig. 8a

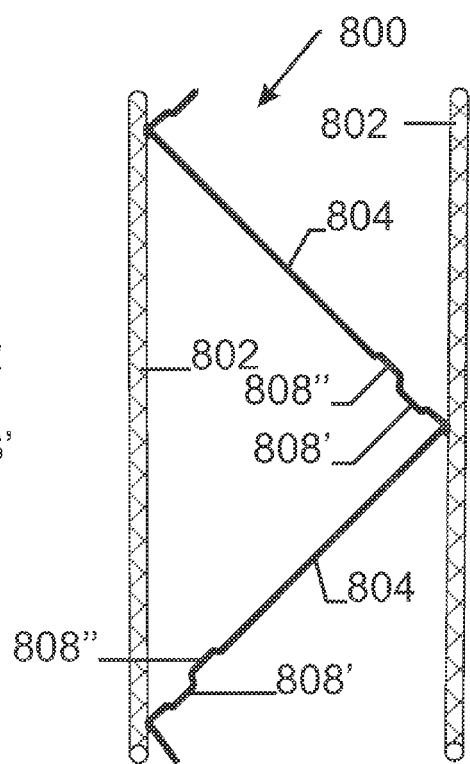


Fig. 8b

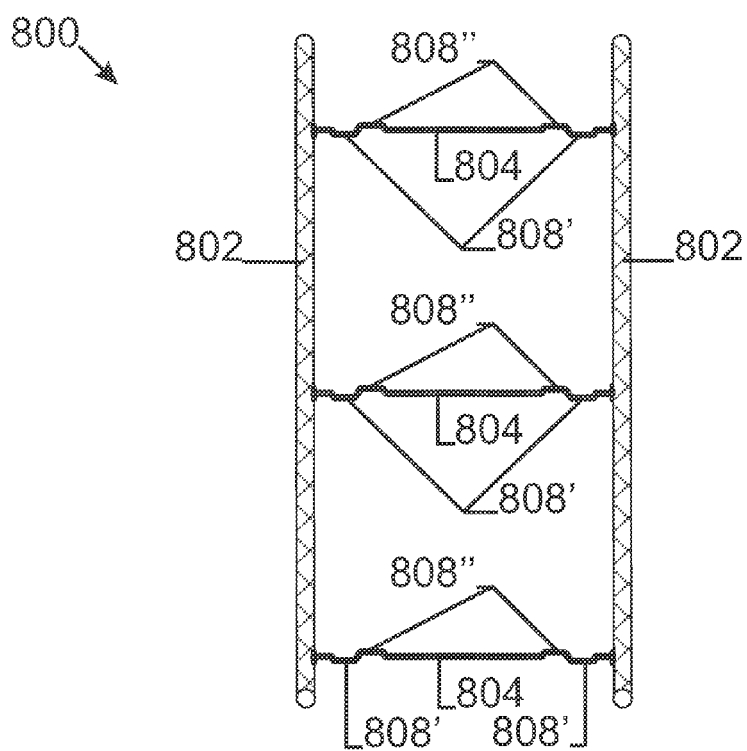


Fig. 8c



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 0780

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 December 2011	Examiner Mysliwetz, Wolfgang
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