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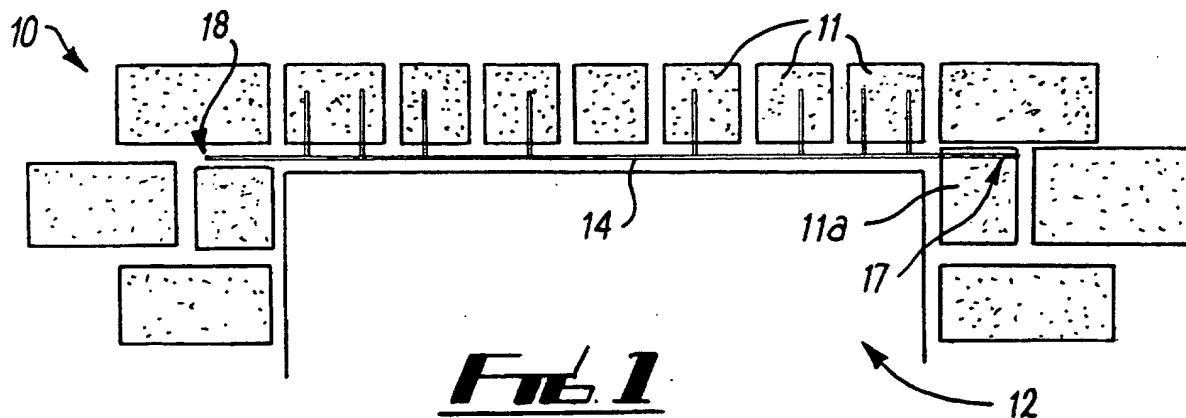
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(54) **Reinforcement of Masonry structures**

(57) A method of reinforcing a masonry structure 10 includes the steps of inserting at least a part of an elongate reinforcing member 14 into the structure 10, and

securing the inserted part of the reinforcing member 14 to each of a plurality of masonry elements 11 above the reinforcing member 10.



## Description

**[0001]** The invention relates to the reinforcement of masonry structures and particularly but not exclusively to the reinforcement of masonry over window and door openings.

**[0002]** Traditionally, masonry was supported over window and door openings by forming an arch or, in order to reduce costs, by inserting wood, steel or stone beams in the form of lintels over the openings. When the lintel supported an outer leaf of brickwork and it was considered necessary to hide the lintel, angled lintels or flat plate lintels were generally inserted into the brickwork, these consisting of elongate lengths of supporting material. In each case the lintel rested on brickwork piers provided at each side of the window, the load from the brickwork above being transferred by the lintel onto those piers. This technique may also be used to reinforce arches.

**[0003]** The above lintels have a tendency to fail. The flat plate inherently lacks vertical stiffness and may bend under the load imposed by the masonry. Angled lintels are stronger as they include a flat lower plate and an additional plate located at right angles to the lower plate. However, unless the vertical part of the angle is screwed to the inner leaf of a wall, the lintel may twist, allowing the bricks to move and cracks to appear in the brickwork over the opening.

**[0004]** In older houses with cavity walls, the outer leaf of a wall was often originally built directly onto the window frame, with no additional lintel being installed. However, when the original windows are removed they are often replaced with light plastic windows which cannot take the loads imposed by the brickwork above.

**[0005]** It is known to provide reinforcement above such openings by drilling angled holes through the bricks and inserting stainless steel pins to join the bricks together. However, if the brickwork is not in good condition, failures can occur.

**[0006]** According to the invention there is provided a method of reinforcing a masonry structure, the method including the steps of:

inserting at least a part of an elongate reinforcing member into the structure; and  
securing the inserted part of the reinforcing member to each of a plurality of masonry elements above the reinforcing member.

**[0007]** Preferably substantially the whole of the elongate reinforcing member is inserted into the structure.

**[0008]** Preferably the masonry structure is an existing structure. However, it may comprise a new build.

**[0009]** The masonry elements may be, for example, bricks, breeze blocks, stone blocks, etc.

**[0010]** Preferably the method comprises reinforcing a masonry structure above a weakened area or an opening such as a door or window opening. The weakened

area may be an existing weakened area.

**[0011]** The method may provide for the formation of a beam above the weakened area or opening, the beam being made up of the reinforcing member and the masonry elements attached thereto. The reinforcing member may be located directly above the weakened area or opening.

**[0012]** Preferably the length of the beam so formed is such that it extends beyond the weakened area or opening on both sides, such that its ends rest on sound masonry. Preferably the beam so formed is substantially horizontal.

**[0013]** Preferably the method includes the step of forming an elongate slot in the structure, and inserting at least a part of the reinforcing member into the slot.

**[0014]** The slot is preferably substantially horizontal and may be formed at least partially in mortar between masonry elements.

**[0015]** Preferably the reinforcing member includes a substantially planar plate member which is inserted into the masonry structure. Preferably the reinforcing member is made of a material which is strong in tension. The reinforcing member may be made of metal, for example steel.

**[0016]** Preferably the width of the reinforcing member is at least 20mm and preferably about 30mm and the thickness is at least 2mm and preferably between 3 and 4mm. Preferably the reinforcing member includes a plurality of holes passing therethrough and the reinforcing member is secured to the masonry structure by means of securing elements passing through the holes.

**[0017]** The holes may be arranged so as to be positioned evenly along the length of the reinforcing member. Alternatively the holes may be closer together towards the ends of the reinforcing member. The holes may be between 50 and 150mm apart. The holes may be located generally centrally in relation to the width of the reinforcing member or may be offset. The holes are preferably between 5 and 10mm and most preferably about 8mm in diameter and may be countersunk to receive a screw head.

**[0018]** Preferably the inserted part of the reinforcing member is secured by screws to the masonry elements above. Preferably the screws extend through the reinforcing member into the masonry elements. The screws are preferably between 25mm and 80mm long. The screws may be angled at between 45° and 90° to the horizontal.

**[0019]** An embodiment of the invention will be described for the purpose of illustration only with reference to the accompanying drawings in which.

Fig. 1 is a diagrammatic side view of a part of a masonry structure reinforced according to the invention;

Fig. 2 is a sectional view of a reinforcement according to one embodiment of the invention;

Fig. 3 is a sectional view of a reinforcement accord-

ing to another embodiment of the invention;

Fig. 4 is a diagrammatic plan view of a reinforcing member for use with the method of the invention; and

Fig. 5 is a diagrammatic plan view of an alternative reinforcing member for use with the method of the invention.

**[0020]** Referring to Fig. 1, there is illustrated a masonry structure 10 made up of bricks 11 and provided with a window opening 12 therein. A window frame 13 is located within the opening 12 (see Figs. 2 and 3 which illustrate two alternative arrangements).

**[0021]** The masonry structure 10 has been reinforced using a method according to the invention. Referring to Figs. 2 and 3, a reinforcing member in the form of a flat plate 14 has been inserted into a horizontal elongate groove 16 provided in the masonry structure. The groove 16 is provided partly in a bed joint 18. If the bed joint is too high (as on the right hand side of the window opening 12), a slot 17 is cut into the brickwork (see brick 11 a). The flat plate 14 is inserted into the groove 16 such that it lies in a generally horizontal plane.

**[0022]** The flat plate 14 may be positioned next to the window frame 13, as in Fig. 2, if there is sufficient room. If the window frame obstructs this positioning, a bottom corner 15 of a brick (see brick 11 b in Fig. 3) may be cut away.

**[0023]** The flat plate may be inserted with the window in position. Alternatively the window could be removed first, with the brickwork temporarily propped.

**[0024]** The flat plate 14 is illustrated in more detail in Fig. 4. The flat plate is planar and has a length which is chosen such that it is greater than the length of the window opening. The width of the flat plate 14 is typically around 30mm and its thickness is typically 3 or 4 mm.

**[0025]** The flat plate 14 is provided with a number of holes 20 spaced apart along its length, for example around 100mm apart. The holes have diameters of around 8mm and are preferably countersunk to receive a screw head. The holes may be located centrally across the width of the flat plate 14 (as indicated on the left side of Fig. 4) or offset (as indicated on the right side of Fig. 4). However these two are alternatives and would not appear on the same flat plate, Fig. 4 being only for illustration purposes. The holes 20 may be arranged in a staggered pattern as illustrated in Fig. 5. As an alternative to being countersunk, the fixings may have mushroom heads or may have no heads but be screwed through a plate with threaded holes.

**[0026]** The holes 22 in the flat plate 14 are preferably positioned under the centres of the bricks.

**[0027]** Referring again to Figs. 1 to 3, once the flat plate 14 is inserted into the groove 16, securing elements in the form of stainless steel screws 22 are screwed through the holes 20 into the bricks 11 above the flat plate 14, directly above the window opening 12. Referring to Fig. 3, holes for the screws may be drilled

initially and plastic plugs 26 inserted therein to receive the screws 22. Alternatively, a bonding resin may be used to hold the screws 22 in place.

**[0028]** The flat plate 14 may be put into position first and holes drilled subsequently into the bricks 11 above, using the holes 20 as guides.

**[0029]** The screws 22 are inserted at a slight angle to the vertical, for ease of insertion.

**[0030]** Using the method as described above, the flat plate 14 is stiffened by the brickwork 24 above and the two together act as a single composite unit to form a beam which supports the weight imposed by the brickwork above the window.

**[0031]** The screws hold the plate 14 firmly in position and prevent any sideways movement. If sideways movement did take place, the plate 14 and the bricks 11 above would no longer effectively form a composite unit, the plate would bend and a beam would not be formed.

**[0032]** The invention is particularly applicable where there are only a few courses of bricks, for example up to about five or six above the opening. However, if there are greater numbers of courses above the opening, the screws 22 may be extended to encompass two or more layers of bricks thus forming a stronger beam which could support a greater load of brickwork above.

**[0033]** The holes may be more numerous towards the outer edges of the flat plate 14 in order to ensure that the flat plate works in tension. The grooves or holes into which the ends of the flat plate are inserted are filled with mortar to ensure that there is no movement of the plate ends.

**[0034]** Any cracks in the joints or loose mortar should be replaced with new mortar which can be injected into the joints.

**[0035]** The above described preferred embodiment thus provides an improved method of reinforcing a masonry structure, which is safe, convenient and economical.

**[0036]** The method is preferably used to reinforce an existing structure. However, it could also be used for new build structures. In this case the brickwork would normally be constructed and the plate fitted before the windows/doors were fitted.

**[0037]** Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the Applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

## Claims

1. A method of reinforcing a masonry structure, the method including the steps of:

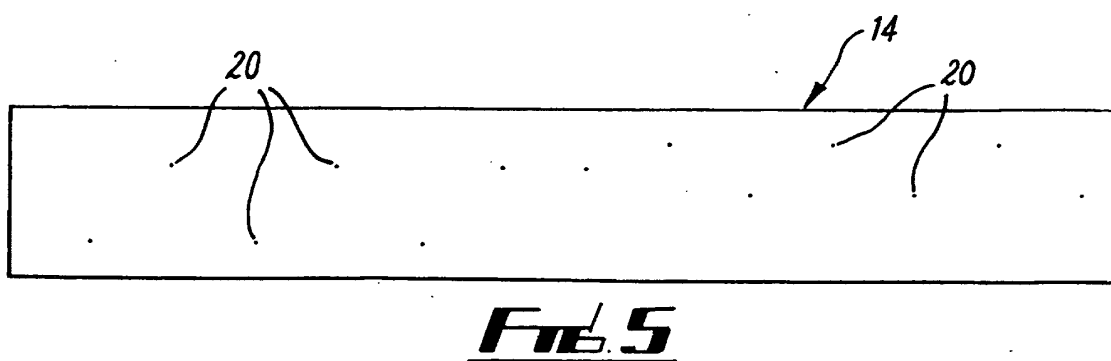
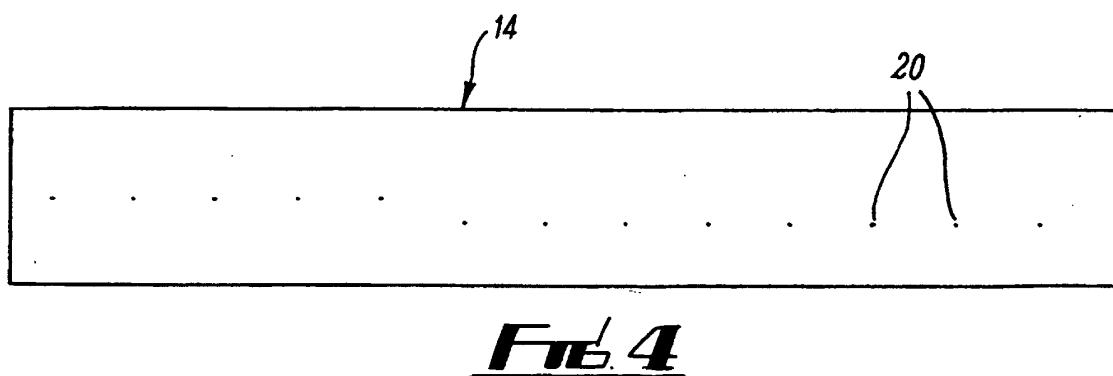
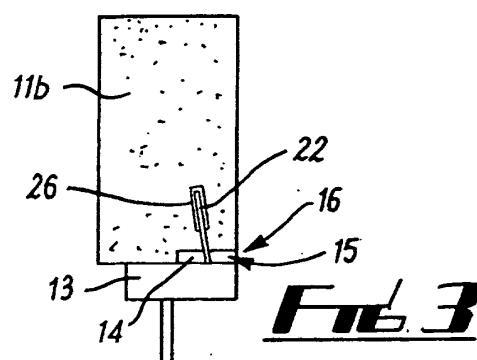
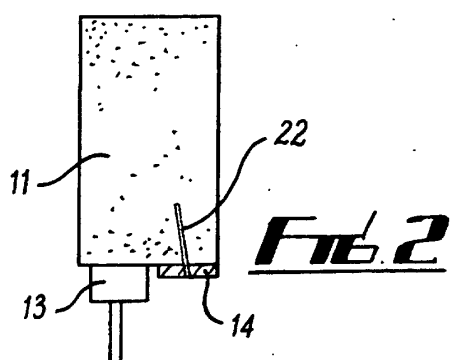
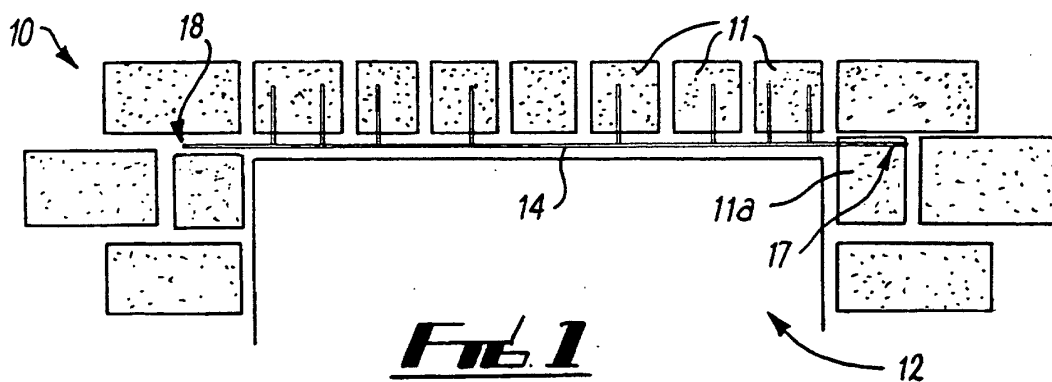
inserting at least a part of an elongate reinforcing member into the structure; and securing the inserted part of the reinforcing member to each of a plurality of masonry elements above the reinforcing member.

2. A method according to claim 1 wherein substantially the whole of the elongate reinforcing member is inserted into the structure.
3. A method according to claim 1 or claim 2 where the masonry structure is an existing structure.
4. A method according to any of claims 1 to 3 wherein the method comprises reinforcing a masonry structure above a weakened area or an opening such as a door or window opening.
5. A method according to claim 4 wherein the method comprises reinforcing an existing masonry structure above an existing weakened area or opening.
6. A method according to claim 5 wherein the method provides for the formation of a beam above the weakened area or opening, the beam being made up of the reinforcing member and the masonry elements attached thereto.
7. A method according to claim 6, wherein the beam so formed is substantially horizontal.
8. A method according to any preceding claim wherein the method includes the step of forming an elongate slot in the structure, and inserting at least a part of the reinforcing member into the slot.
9. A method according to claim 7 wherein the slot is substantially horizontal and is formed at least partially in mortar between masonry elements.
10. A method according to any preceding claim wherein the reinforcing member includes a substantially planar plate member which is inserted into the masonry structure.
11. A method according to any preceding claim wherein the reinforcing member is made of a material which is strong in tension.
12. A method according to any preceding claim wherein the reinforcing member includes a plurality of holes passing therethrough and the reinforcing member is secured to the masonry structure by means of securing elements passing through the holes.
13. A method according to claim 12 wherein the holes are arranged so as to be positioned evenly along the length of the reinforcing member.

14. A method according to claim 12 wherein the holes are closer together towards the ends of the reinforcing member.

15. A method according to any preceding claim wherein the inserted part of the reinforcing member is secured by screws to the masonry elements above.

16. Any novel subject matter or combination including novel subject matter disclosed herein, whether or not within the scope of or relating to the same invention as any of the preceding claims.





European Patent  
Office

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Application Number  
EP 04 25 0084

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                        |                                                          |                                                         |
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| Place of search<br><b>THE HAGUE</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                        | Date of completion of the search<br><b>13 April 2004</b> | Examiner<br><b>Demeester, J</b>                         |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                                                                                                        |                                                          |                                                         |

EPO FORM 1503 03/92 (P04C01)

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EP 04 25 0084

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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13-04-2004

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