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(54) **Method of reinforcing a masonry structure**

Verstärkungsverfahren einer Mauerwerkstrukture

Procédé pour renforcer une structure de maçonnerie

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Description

[0001] The invention relates to the reinforcement of masonry structures above a pre-existing opening and particularly but not exclusively to the reinforcement of masonry over window and door openings.

[0002] GB-A-2 271 601 discloses such a reinforcement method.

[0003] 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.

[0004] 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.

[0005] 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.

[0006] 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.

[0007] According to the invention there is provided a method of reinforcing a masonry structure as defined in claim 1

[0008] Further embodiments of the invention are defined in the subclaims.

[0009] 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 according 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 alterative reinforcing member for use with the method of the invention.

[0010] 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).

[0011] 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 11a). The flat plate 14 is inserted into the groove 16 such that it lies in a generally horizontal plane.

[0012] 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.

[0013] The flat plate may be inserted with the window in position. Alternatively the window could be removed first, with the brickwork temporarily propped.

[0014] 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.

[0015] 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.

[0016] The holes 22 in the flat plate 14 are preferably positioned under the centres of the bricks.

[0017] 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.

[0018] 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.

[0019] The screws 22 are inserted at a slight angle to the vertical, for ease of insertion.

[0020] 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.

[0021] 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.

[0022] 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.

[0023] 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.

[0024] Any cracks in the joints or lose mortar should be replaced with new mortar which can be injected into the joints.

[0025] The above described preferred embodiment thus provides an improved method of reinforcing a masonry structure above a pre-existing opening in the structure, which is safe, convenient and economical.

Claims

1. A method of reinforcing a masonry structure (10) above a pre-existing opening (12) in the structure, the method including the steps of:

   inserting at least a part of an elongate reinforcing member (14) into the structure, the reinforcing member (14) including a plurality of holes (20) passing therethrough; and
   securing the reinforcing member (14) to a lower surface of each of a plurality of masonry elements (11) above the reinforcing member (14) and directly above the pre-existing opening (12) by passing securing elements (22) through the holes (20) into the masonry elements to form a beam above the pre-existing opening, the beam being made up of the reinforcing member and the masonry elements secured thereto.

2. A method according to claim 1, wherein the beam so formed is substantially horizontal.

3. A method according to any preceding claim wherein the method includes the step of forming an elongate slot (16) in the structure, and inserting at least a part of the reinforcing member (14) into the slot (16).

4. A method according to claim 3 wherein the slot (16) is substantially horizontal and is formed at least partially in mortar between masonry elements.

5. A method according to any preceding claim wherein the reinforcing member (14) includes a substantially planar plate member which is inserted into the masonry structure.

6. A method according to any preceding claim wherein the reinforcing member (14) is made of a material which is strong in tension.

7. A method according to any preceding claim wherein the holes (20) are arranged so as to be positioned evenly along the length of the reinforcing member (14).

8. A method according to any of claims 1 to 6 wherein the holes (20) are closer together towards the ends of the reinforcing member (14).

9. A method according to any preceding claim wherein the inserted part of the reinforcing member (14) is secured by screws (22) to the masonry elements (11) above.

Patentansprüche

1. Verfahren zum Verstärken einer Mauerwerk-Struktur (10) oberhalb einer schon bestehenden Öffnung (12) in der Struktur, wobei das Verfahren die folgenden Schritte aufweist:

   - Einführen mindestens eines Teils eines länglichen Verstärkungsgliedes (14) in die Struktur, wobei das Verstärkungsglied (14) eine Vielzahl von Löchern (20) enthält, die sich durch das Verstärkungsglied hindurch erstrecken; und
   - Befestigen des Verstärkungsgliedes (14) an einer unteren Oberfläche jedes Elements einer Vielzahl von Mauerwerk-Elementen (11) oberhalb des Verstärkungsgliedes (14) und unmittelbar oberhalb der schon bestehenden Öffnung (12), indem man Befestigungs-Elemente (22) durch die Löcher (20) hindurch in die Mauerwerk-Elemente einführt, um oberhalb der schon bestehenden Öffnung einen Träger zu bilden, wobei der Träger aus dem Verstärkungsglied und den daran befestigten Mauerwerk-Elementen besteht.

2. Verfahren nach Anspruch 1, **dadurch gekennzeichnet, dass** der so gebildete Träger im wesentlichen horizontal ist.

3. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verfahren einen Schritt enthält zum Bilden eines länglichen Schlitzes (16) in der Struktur und Einführen mindestens eines Teils des Verstärkungsgliedes (14) in den Schlitz (16).

4. Verfahren nach Anspruch 3, **dadurch gekennzeichnet, dass** der Schlitz (16) im wesentlichen horizontal ist und zumindest teilweise in Mörtel zwischen den Mauerwerk-Elementen gebildet wird.

5. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verstärkungsglied (14) ein im wesentlichen planares Plattenglied enthält, das in die Mauerwerk-Struktur eingeführt wird.

6. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** das Verstärkungsglied (14) aus einem Material besteht, das gegenüber Zugbelastung stabil ist.

7. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Löcher (20) so angeordnet sind, dass sie gleichmässig über die Länge des Verstärkungsgliedes (14) positioniert sind.

8. Verfahren nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** die Löcher (20) zu den Enden des Verstärkungsgliedes (14) hin näher beieinander sind.

9. Verfahren nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der eingeführte Teil des Verstärkungsgliedes (14) mittels Schrauben (22) an den darüberliegenden Mauerwerk-Elementen (11) befestigt wird.

Revendications

1. Procédé pour renforcer une structure de maçonnerie (10) au-dessus d'une ouverture (12) préexistante dans la structure, le procédé comprenant les étapes suivantes :

   insérer au moins une partie d'un élément de renforcement allongé (14) dans la structure, l'élément de renforcement (14) comportant plusieurs orifices (20) passant à travers; et
   fixer l'élément de renforcement (14) sur une surface inférieure de chacun parmi plusieurs éléments de maçonnerie(11) au-dessus de l'élément de renforcement (14) et directement au-dessus de l'ouverture pré-existante (12) en passant des éléments de fixation (22) à travers les orifices (20) dans les éléments de maçonnerie pour former une poutre au-dessus de l'ouverture pré-existante, la poutre étant formée de l'élément de renforcement et des éléments de maçonnerie qui y sont fixés.

2. Procédé selon la revendication 1, dans lequel la poutre ainsi formée est essentiellement horizontale.

3. Procédé selon l'une quelconque des revendications précédentes, dans lequel le procédé comprend l'étape consistant à former une fente allongée (16) dans la structure, et à insérer au moins une partie de l'élément de renforcement (14) dans la fente (16).

4. Procédé selon la revendication 3, dans lequel la fente (16) est essentiellement horizontale et est formée au moins partiellement dans le mortier entre des éléments de maçonnerie.

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'élément de renforcement (14) comprend un élément de plaque essentiellement plan qui est inséré dans la structure de maçonnerie.

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel l'élément de renforcement (14) est formé d'un matériau qui est résistant à la tension

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel les orifice (20) sont agencés de façon à être placés régulièrement le long de la longueur de l'élément de renforcement (14).

8. Procédé selon l'une quelconque des revendications 1 à 6, dans lequel les orifices (20) sont plus rapprochés les uns des autres vers les extrémités de l'élément de renforcement (14).

9. Procédé selon l'une quelconque des revendications précédentes, dans lequel la partie insérée de l'élément de renforcement (14) est fixée aux éléments de maçonnerie (11) au-dessus au moyen de vis (22).

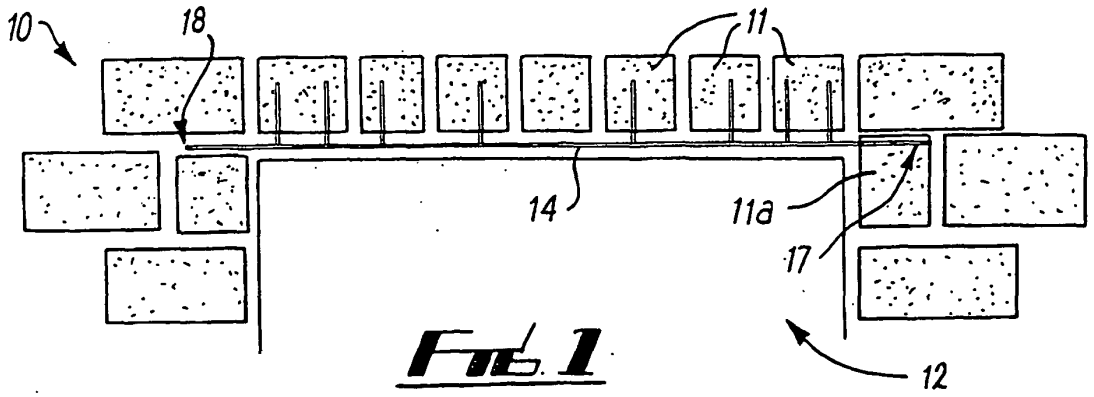

FIG. 1

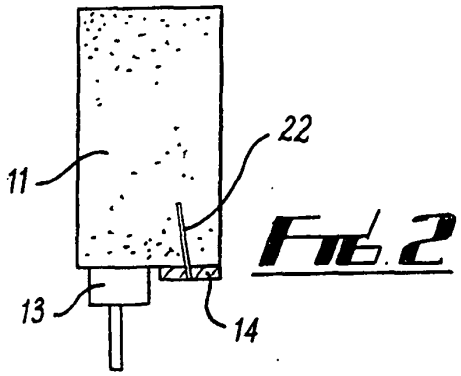

FIG. 2

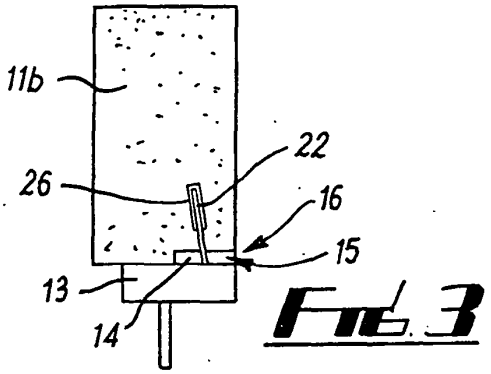

FIG. 3

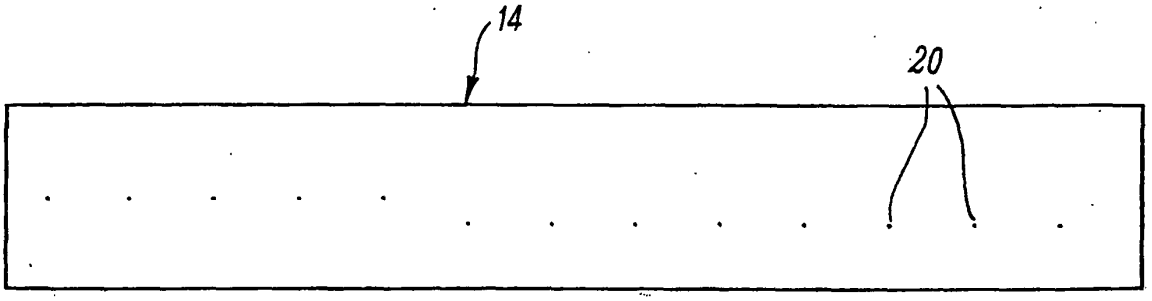

FIG. 4

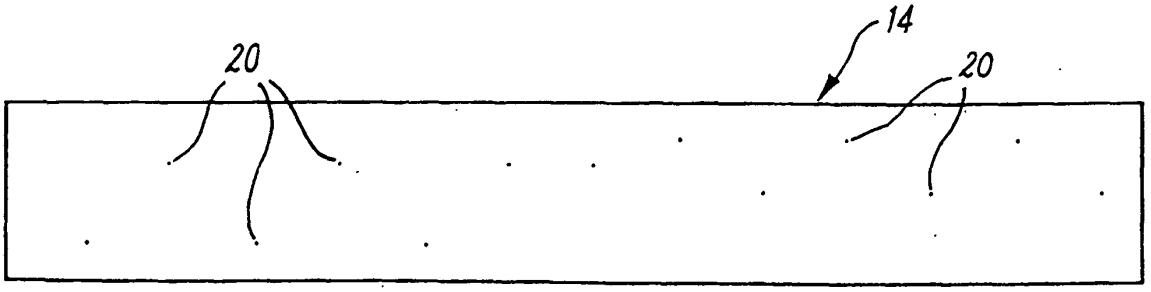

FIG. 5