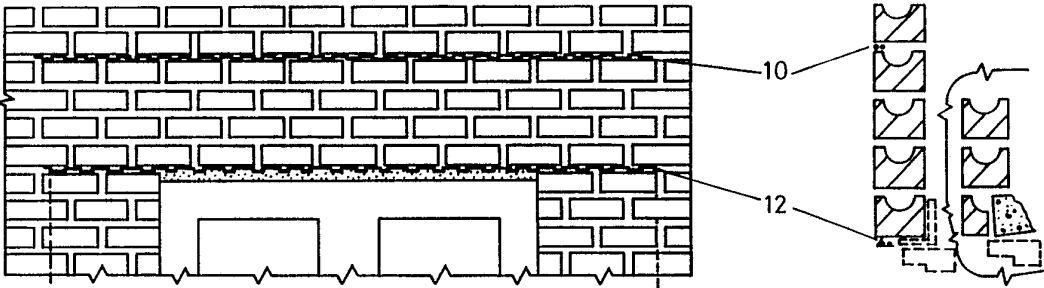




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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| <p>(51) International Patent Classification <sup>5</sup> :<br/><b>E04G 23/02</b></p>   | <p><b>A1</b></p> | <p>(11) International Publication Number: <b>WO 92/13155</b><br/>(43) International Publication Date: 6 August 1992 (06.08.92)</p>   |
| <p>(21) International Application Number: PCT/GB91/02329<br/>(22) International Filing Date: 31 December 1991 (31.12.91)<br/>(30) Priority data:<br/>9101748.3 26 January 1991 (26.01.91) GB<br/>9102711.0 8 February 1991 (08.02.91) GB<br/>(71) Applicant: EXECUTIVE INSULATION (MIDLANDS) LIMITED [GB/GB]; Mill Lane, Blaby, Leicestershire LE8 3FG (GB).<br/>(72) Inventors: ATKINS, David, Peter ; The Welby, Nottingham Road, Melton Mowbray, Leicestershire LE13 0NP (GB). FREER, Krystyna, Danuta ; The Woodlands, 43 Gaulby Lane, Stoughton, Leicester LE2 2FL (GB). AINSWORTH, John, Bernard, Alfred ; 58 Stoughton Lane, Stoughton, Leicester LE2 2FM (GB).</p> |                  | <p>(74) Agent: SERJEANT, Andrew, Charles; Serjeants, 25 The Crescent, King Street, Leicester LE1 6RX (GB).<br/><br/>(81) Designated States: AT (European patent), BE (European patent), BG, CH (European patent), CS, DE (European patent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), GR (European patent), HU, IT (European patent), LU (European patent), MC (European patent), NL (European patent), NO, PL, RO, RU, SE (European patent).<br/><br/><b>Published</b><br/><i>With international search report.</i></p> |
| <p>(54) Title: STRUCTURAL REPAIR PROCESS</p> <div style="text-align: center;">  </div> <p>(57) Abstract</p> <p>A building structure is repaired by cutting a groove in the surface of a wall, injecting a grouting material into the groove, and embedding a rod in the grouting material. Further grouting material is injected into the groove, a second rod is embedded, and further grouting material is injected. The groove is finally pointed to match the existing surface. The preferred grouting material is an epoxy resin.</p>   |                  |  |

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Title

Structural Repair Process

DescriptionTechnical Field

The invention relates to the repair of building structures, particularly the external skins of cavity walls and solid masonry constructions.

Background Art

Structural failure in a wall generally calls for underpinning, which is expensive, or re-building, with consequent internal disruption and possible re-housing of the inhabitants. The falling away of a wall or skin can sometimes be arrested by the introduction of ties normal to the surface. EP 171250 A2 covers helical stainless steel rods for this purpose and such ties may be secured in an outer skin with a polyester resin, but this is not effective against compressive loads, such as are encountered through differential subsidence along a wall, for example. EP 171250 A2 also says that a length of the (helical) wire may be inserted in the space left by raking out the mortar in cracked brickwork, after which the wall can be repointed around the inserted reinforcement.

The Invention

The invention provides a process of repairing a structure which comprises cutting a groove in a surface of a wall, injecting a grouting material into the groove, embedding a rod along the groove in the grouting material, characterized by injecting further grouting material into the groove, embedding a second rod along the groove in the grouting material, and injecting further grouting material into the groove. The groove is finally pointed preferably to match the existing surface. All these steps can be performed externally, without internal disruption.

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In brickwork, a horizontal groove is preferably cut in a mortar joint, and pointed to match adjacent mortar joints. In a concrete wall or foundations, for example for underpinning a building, again the groove is preferably horizontal. Concrete pads are positioned at intervals along the wall, and compression-resistant beams are created between the pads by a process according to the invention. If vertical, diagonal or inclined support is required the groove is cut accordingly, and the cut bricks are preferably repaired with brick slips adhered to a planed brick face.

The location and length of the groove(s) is determined from a survey to diagnose the cause of a fault, which might be lintel failure, thermal movement, roof loading, wall tie failure or differential movement. The reinforcement requirement can be calculated from tables incorporating live and dead loading, bending movements, shear, tensile and compressive strengths. Thus a repair may be effected immediately without the need for a preliminary survey and calculation.

The groove is generally cut about 40 mm deep and 10 mm wide. If the groove is deeper, and it could be much deeper, up to about 175 mm for a 215 mm solid brick wall, the upper courses have to be reinforced first to prevent collapse. To reinforce adjacent courses in this way supports the whole section and eliminates gyratory forces. Debris is preferably blown out with compressed air.

The grouting material is preferably an epoxy resin, but may be a cementitious material in some circumstances, as they do not shrink on setting. More than two rods may be embedded in a single groove, each in the same way as the first two. The rods should be generally parallel to give

lateral strength to the reinforcement, and to this end may be inserted with plastics sleeves along parts of the length of the rods or with spacers to centralize them in the grouting material.

The final layer of grouting material should be brought to about 25 mm of the surface to allow the pointing material to be retained. The rods are preferably helical stainless steel rods about 6 mm in diameter. They may be provided with a central vein to increase the surface area and therefore the adhesion of the grouting material. Alternatively, the rods may be of another material, for example a steel, another metal or alloy, or polypropylene. The rods may be plain cylindrical, of or polygonal section, for example rectangular, square or triangular, and may be roughened or deformed to improve adhesion with the grouting material.

The above dimensions are not precise, but may be varied according to need and availability, as is usual in the construction industry.

#### Drawings

Fig. 1a is a front view of a stretcher bond lintel repaired by a process according to the invention;

Fig. 1b is a corresponding section on a slightly larger scale;

Fig. 1c is a slightly modified alternative to Fig. 1b:

Fig. 2a is a front view of a flat soldier arch repaired by a process according to the invention;

Fig. 2b is a corresponding section on a slightly larger scale;

Fig. 3a is a front view of a curved arch repaired by a process according to the invention.

Fig. 3b is a corresponding section on a slightly larger scale; and

Fig. 4 is a section through a 215 solid brick wall repaired by a process according to the invention.

#### Best Mode

The same reference numerals have been used in all Figs. of drawings to indicate corresponding parts. A repair 10 comprises two helical stainless steel rods in compression, while a repair 12 comprises two such rods in tension. It will be noted that the repairs extend beyond the width of the window openings.

In Fig. 4, the external section of the wall on the course above is reinforced first in order to prevent collapse.

Grooves are cut in the surface of the walls illustrated for the production of repairs 10 or 12. Grouting material is injected into the grooves. A helical stainless steel rod is embedded along the groove in the grouting material. Further grouting material is injected into the groove. A second helical stainless steel rod is embedded along the groove in the grouting material. Further grouting material is injected into the groove. The groove is finally pointed to match the original surface.

Claims

1. A process of repairing a structure which comprises cutting a groove in a surface of a wall, injecting a grouting material into the groove, embedding a rod along the groove in the grouting material, characterized by injecting further grouting material into the groove, embedding a second rod along the groove in the grouting material, and injecting further grouting material into the groove.
2. A process according to claim 1 or claim 2 in which the groove is finally pointed to match the existing surface.
3. A process according to claim 1 or claim 2 in which the groove is horizontal.
4. A process according to claim 1 in which cut bricks are repaired with brick slips adhered to a planed brick face.
5. A process according to any preceding claim in which the groove is cut about 40 mm deep and 10 mm wide.
6. A process of repairing a structure in which upper brick courses are reinforced first to prevent collapse, and then a process according to any of claims 1 to 4 is applied, the groove being cut up to 175 mm deep for a 215 mm solid brick wall.
7. A process according to any preceding claim in which the grouting material is an epoxy resin.
8. A process according to any preceding claim in which more than two rods are embedded in a single groove.

9. A process according to any preceding claim in which the rods are of helical steel about 6 mm in diameter.

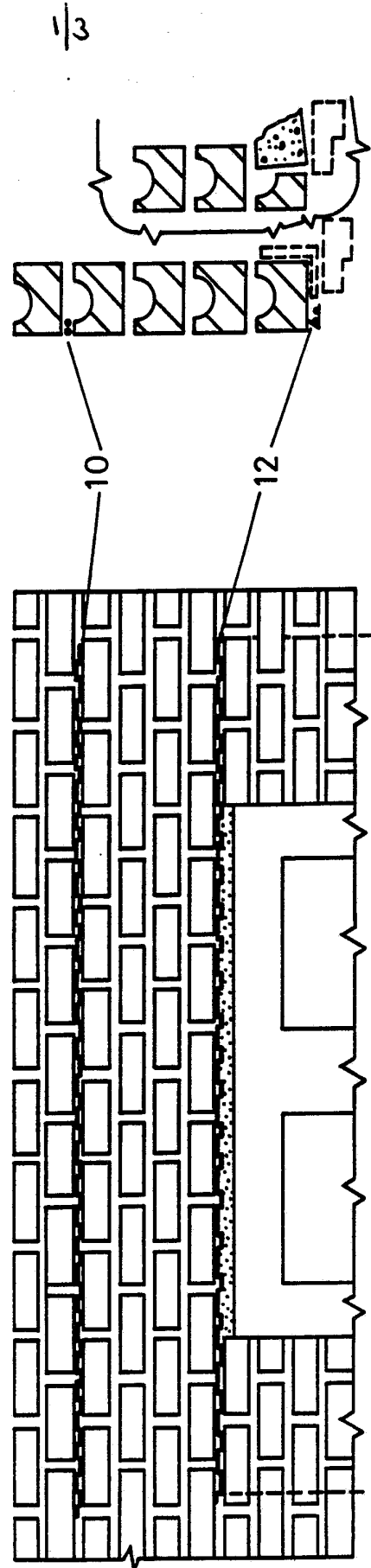


FIG. 1a

FIG. 1b

FIG. 1c

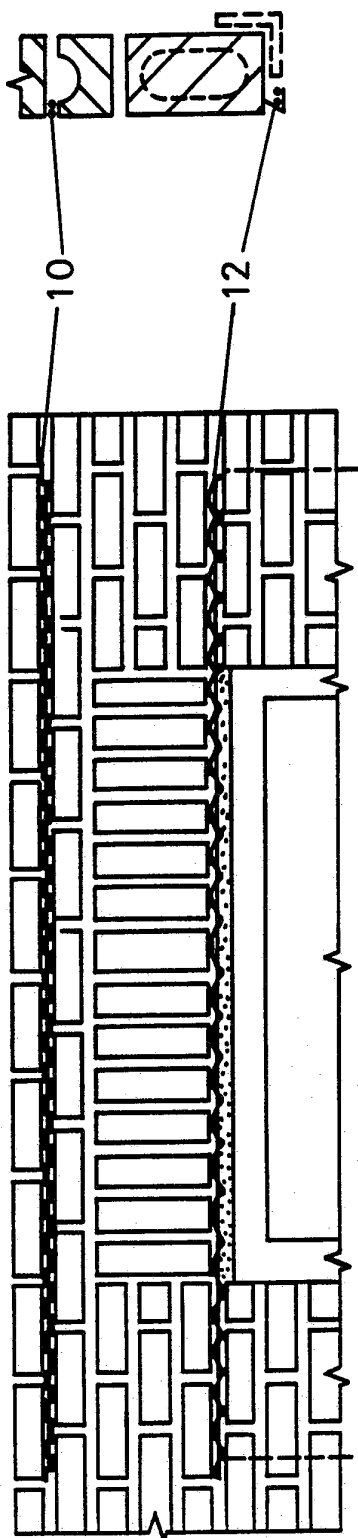


FIG. 2b

FIG. 2a

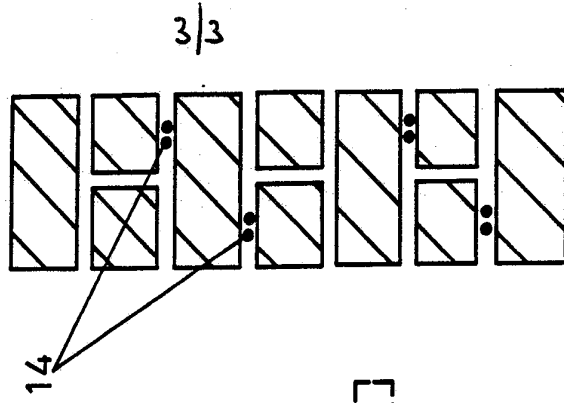


FIG. 4

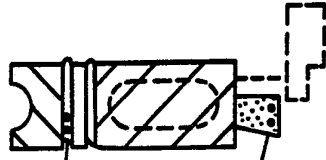


FIG. 3b

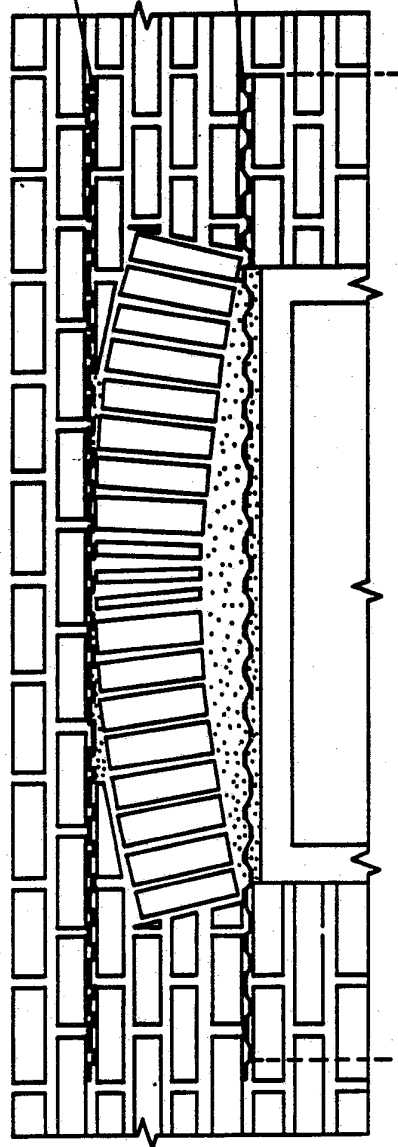
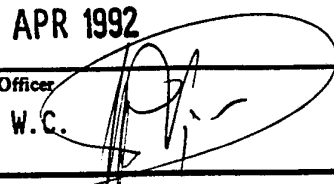


FIG. 3a

# INTERNATIONAL SEARCH REPORT

PCT/GB 91/02329

International Application No

|  |  |                                     |  |  |
|--|--|-------------------------------------|--|--|
| <b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup>  |  |                                     |  |  |
| According to International Patent Classification (IPC) or to both National Classification and IPC  |  |                                     |  |  |
| Int.Cl. 5 E04G23/02  |  |                                     |  |  |
| <b>II. FIELDS SEARCHED</b>   |  |                                     |  |  |
| Minimum Documentation Searched <sup>7</sup>  |  |                                     |  |  |
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|  |  |                                     |  |  |
| <b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>  |  |                                     |  |  |
| Category <sup>*</sup>  | Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>   | Relevant to Claim No. <sup>13</sup> |  |  |
| X  | GB,A,2 007 287 (PYNFORD LTD.) 16 May 1979<br><br>see the whole document<br>---   | 1,2,3,7,<br>8                       |  |  |
| X  | DE,C,237 526 (WOLFSHOLZ) 29 January 1907<br>see the whole document<br>---  | 1,8                                 |  |  |
| A  | DE,A,1 434 075 (GYL-LABOR DR. KARL NEY) 31<br>October 1968<br>---  |                                     |  |  |
| A  | GB,A,2 134 956 (RICKARDS TIMBER TREATMENT) 22<br>August 1984<br>---  |                                     |  |  |
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| Date of the Actual Completion of the International Search  | Date of Mailing of this International Search Report  |                                     |  |  |
| 26 MARCH 1992  | 0.7 APR 1992   |                                     |  |  |
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**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
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| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|-------------------------|------------------|
| GB-A-2007287                           | 16-05-79         | None                    |                  |
| DE-C-237526                            |                  | None                    |                  |
| DE-A-1434075                           | 31-10-68         | None                    |                  |
| GB-A-2134956                           | 22-08-84         | None                    |                  |

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