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Description

This invention relates to the reinforcement of the walls. Reinforcement in this sense includes mainly the stabilisation of existing walls, but can involve new walls in certain circumstances.

One object of the present invention is to provide a reinforcement system for an existing wall or wall leaf which has cracked or slipped.

GB-A-2007287 discloses a method of reinforcing a brick wall in which a deep slit is cut into the masonry. In order to prevent collapse, support plugs are located in the slit at intervals. A number of carbon steel wires are then embedded in the slit in an epoxy resin cement.

It is a further object of the invention to provide a reinforcement system which can use conventional cement and which does not require any support plugs. GB-A-1233175 discloses a dovel-like pin with helical flanges which is intended to be used in connecting two ore more separate structural members always introduced axially.

According to the present invention, there is provided a method for reinforcing a wall which comprises forming a space in the wall material, locating a structural tie in the space formed and grouting or cementing the tie in position, whereby the maximum diameter of the entire tie being 10mm, characterised in that tie comprises a length of wire preferably of corrosion resistant material including a core and preferably two or more externally projecting fins or ridges, the diameter of the core being 2 to 6mm.

When used for stabilisation or reinforcement in a brick wall, the length might be up to 1 or 2 metres, or about nine bricks' length.

The fins or ridges might be about 1 or 2 millimetres proud of the surface of the core or possibly they might be a distance from the core equal to the diameter of the core to leave a substantial flange providing a good grip in the surrounding wall material. However the overall cross section of maximum 10 millimetres is sufficiently small to enable the tie to be inserted in the space left by raking out the mortar in cracked brickwork, after which the wall would be repointed around the inserted reinforcement. A tie (or ties) can easily be introduced into a long line of mortar between several bricks, and if necessary can be bent to extend both vertically and horizontally. The ease with which the tie can be bent is another advantage arising from the small core dimensions and it enables a tie to have two bends so that its two ends are parallel with each other and are joined by an intermediate portion at an angle to the two ends.

The tie can be easily made using a pair of rollers of novel form. The rollers will have generally cylindrical surfaces with a parallel sided slot at the centre and then as round or square section rod is fed into the nip of the rolls, the section will be first out at the edge of the slots and then deformed so that the cut material is squeezed into the gap between the rollers at their closest point to define a pair of opposed fins. No material is lost but the material is deformed to leave a generally rectangular sectioned core with fins extending from either side, and the section can then be uniformly twisted in a subsequent manufacturing step. This generally forms the subject matter of the present Applicants' EP-A-171250, from which the present Application is divided.

The method of forming the fins by a combination of shearing and squeezing forces work hardens and stretches the fin material without hardening the core material. This predisposes the material for transformation by twisting into a tight and constant helix without the need for annealing and provides maximum hardness in the fins.

If the slot is deep enough, wear on the rollers can be easily taken up by adjusting the spacing between them, and in general the width of the fins can be chosen by appropriate setting of the spacing between the rollers.

A single pass of the rollers can be sufficient to form the desired section, even with a hard metal such as stainless steel. However, a double pass enables four fins to be provided.

Another possible form of the wire is a triangular section, simply uniformly twisted along its length, with a squared off end. The corner edges of the triangular section will act nearly as well as the fins in embodiments involving embeddment in mortar.

The invention also provides for the use of a tie to provide tensile reinforcement to improve the performance of structural members made of materials in which a particularly efficient mechanical bond is necessary to transfer the stresses from the material to the reinforcing wire. Such materials may include for example portland cement and/or resin based concretes which are aerated or made with lightweight aggregates and natural organic materials such as timber. The ties may be embedded in some materials as they are cast and with others such as timber may be pressed into grooves cut in their surfaces. Since the wires are made of a corrosion resistant material such as stainless steel they can be used close to the surface of a member exposed to moisture in a corrosive environment.

The ties can also assist in the transfer of loads from the end of one structural member into another structural member which may be of a dissimilar material.

The invention may be carried into practice in various ways, and certain embodiments will now be described by way of example with reference to the accompanying drawings of which:-

Figures 1, 2, 3 and 4 are perspective views showing the configuration of four rods, any of which may be used in accordance with the invention;

Figure 5 is a sectional elevation illustrating a method of manufacture of a rod of cross section similar to that shown in Figure 1, from a round section bar;

Figure 6 is a section that can be achieved from the rod of Figure 5;

Figures 7 and 8 are an elevation and a section of brickwork reinforced by a rod as shown in any of Figures 1 to 4; and

Figure 9 shows cracks and a lintel in brickwork for which the reinforcement of Figures 9 and 10 is suitable.

The rod shown in Figure 1 is straight and of constant cruciform cross section, the arms of the cruciform being uniformly twisted about the axis of the rod and forming helical ribs or fins 4 around the central solid core of the rod. The rod shown in Figure 2 is of constant triangular cross-section and is uniformly twisted with a pitch of approximately twice the maximum cross-sectional dimension of the rod. Figure 3 shows a straight bulbous rod of varying circular cross section, having annular rings 8 in the form of truncated spheres. Uses of the above described rods as wall ties, and mortar reinforcing bars will be described below, but firstly the important features of each of the types of rod will be outlined.

Figure 4 shows a rod having one end formed with axially arranged flat sections 9 alternately in planes at right angles to their neighbours.

The helical ribs 4 of the rod shown in Figure 1 served to provide a strong grip of the rod within mortar over short distances of embedment or penetration; the curves 6 of the rod shown in Figure 2, the rings 8 of the rod shown in Figure 3, and the sections 9 in Figure 4, also provide a strong grip of the respective rod when set within mortar.

The helical ribs 4 of the Figure 1 embodiment may be as shown in Figure 1 with two opposed thick ribs 11 alternating with thinner ribs 12; but alternatively the uniform section may be as shown in Figure 6 with four equally circumferential spaced ribs 13 extending from the sides of a square.

The bending of the rod about the axes perpendicular to the general axis of the rod of Figure 5 is easier in a direction parallel to the plane of the thicker ribs 11. Therefore since the helix transposes this being axis through one complete revolution per helix pitch, this relatively easy bending of the rod can be achieved in all directions perpendicular to the general axis of the rod, without variation in axial strength at any point along the rod since the cross sectional area of the rod remains constant.

The overall diameter of the rods is such as to enable the rods to be incorporated within a mortar layer of a wall, ie. about 4-8mms in a layer about 8-14mms thick. The rods are made from a strong flexible non-corrosive material such as copper or stainless steel so that a rod of the diameter as stated above may hold an outer wall against wind suction and pressure and not corrode after long exposure to the atmosphere or encasement in mortar.

In a simple form of the invention, the wire is merely a uniformly twisted length of triangular cross-section, with a squared-off end.

Uses of the rod shown in Figure 1 will now be described and it will be appreciated that rods of the types shown in Figures 2, 3 and 4, may be similarly utilised as well as those described in the preceding paragraph.

The rods shown in Figures 1-4 can be used as mortar reinforcing rods as shown in Figures 7, 8 and 9. A crack as shown at 51 or 52 in Figure 11 can be reinforced by removing about a quarter - say 25mm - into the wall, of the layer of mortar for some distances to each side of the crack, positioning the rod 53 longitudinally between the bricks, and repointing the wall as shown at 54 in Figures 9 and 10. Brick lintels can also be reinforced using the above method and by overlapping the rods as at 55, the reinforced bricks can be made to act as beams.

The inserted reinforcing rods may be long enough to extend through the length of at least 2, and perhaps 3 or 4 bricks, or even 9 bricks as shown in Figure 9.

The preferred helical rod shown in Figure 1 is conveniently produced from square, rectangular, or round, section austenitic stainless steel wire by a single or double pass rolling-shearing process shown in Figures 5 followed by twisting. The rollers 56 and 57 are each approximately 150mm in diameter and each has a rectangular section circumferential groove 58 around its mid portion. The very pronounced fins, which are required to provide a good anchorage within mortar, are formed by shearing and squeezing the material in the area of A so that it is transferred to the adjacent area of B of the fin. The fins become work hardened due to the above process, but the core remains unhardened, thus giving a desirable configuration of hardened fins with good cutting and wear resistant properties, and an unhardened core with good flexibility. Because the space between the rollers 60 and 62 can be adjusted it is possible to alter the fin thickness. Sharpening of the cutting edges 59 of the grooves 58 is possible by use of a grinding stone between the sides of the grooves while the rollers are rotated. The bevels 60 can also be sharpened by application of a square grinding

stone to the groove away from the common tangential space between the two rollers. The groove depths are made to allow for a substantial amount of re-sharpening resulting in a reduction in roller diameter and hence groove depth. Further adjustablility of the rollers can be achieved by dividing them along the line marked x-x so that they may be bolted together with shims inserted, thus enabling the cutting space between the edges to varied, and hence different size wire to be accommodated.

A single pass would produce a section as shown dotted in Figure 5. A second pass with the rod rotated through 90° could produce the four-finned section shown in Figure 6. In each case material is cut and squeezed from the original section to the fins.

Uniform twisting follows to leave a long length of formed wire which can be cut into suitable lengths and cranked as necessary.

Claims

1. A method for reinforcing a wall which comprises forming a space in the wall material, locating a structural tie (53) in the space formed and grouting or cementing the tie (53) in position, whereby the maximum diameter of the entire tie is 10mm, characterised in that the tie comprises a length of wire (15) of corrosion resistant material including a core and externally projecting fins or ridges (4), the diameter of the core being 2 to 6mm.

2. A method as claimed in Claim 1, characterised in that the space is formed in a mortar layer (54).

3. A method as claimed in Claim 1 or Claim 2, characterised in that the space is formed as the wall is being built.

4. A method as claimed in Claim 1 or Claim 2, characterised in that the space is formed in an existing mortar layer (54).

5. A method as claimed in any of Claims 1 to 4, characterised in that the space is formed in a wall spanning a zone of weakness such as a crack (51,52).

6. A method as claimed in Claim 5, characterised in that a series of overlapping ties (55) are grouted into the space formed.

7. A method as claimed in any preceding Claim, characterised in that the ends of the tie are bent at right angles.

8. A method as claimed in any preceding Claim, characterised in that the tie (53) has a substantially uniform cross-section and two or more fins or ridges (4) which follow a continuous helical path about the axis of the core.

9. A method as claimed in any preceding Claim, characterised in that the fins or ridges (4) are equiangularly spaced about the core and extend equally from the core in a radial direction.

10. A method as claimed in Claim 8 or Claim 9, characterised in that the fins (4) are formed by repositioning material from the wire and subsequently twisting the wire (15).

Patentansprüche

1. Verfahren zur Verstärkung einer Mauer, welches das Ausformen eines Zwischenraumes im Mauermaterial, das Einbringen einer Baustrebe (53) in den ausgeformten Zwischenraum und das Umgießen oder Einzementieren der Strebe (53) in ihrer Lage umfaßt, wobei der Maximaldurchmesser der gesamten Strebe 10 mm beträgt, **dadurch gekenzeichnet**, **daß** die Strebe einen Drahtabschnitt (15) aus korrosionsbeständigem Material aufweist, der einen Kern mit einem Durchmesser von 2 bis 6 mm und nach außen vorspringende Rippen oder Grate (4) aufweist.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Zwischenraum in einer Mörtelschicht (54) ausgeformt wird.

3. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Zwischenraum bei Errichtung der Mauer ausgeformt wird.

4. Verfahren nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Zwischenraum in einer vorhandenen Mörtelschicht (54) ausgeformt wird.

5. Verfahren nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, daß der Zwischenraum in einer Mauer ausgeformt wird, die sich über einen Schwachstellen-Bereich, wie einen Riß (51, 52), erstreckt.

6. Verfahren nach Anspruch 5, dadurch gekennzeichnet, daß eine Reihe überlappender Streben (55) in dem ausgeformten Zwischenraum mit Mörtel befestigt werden.

7. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die En-

den der Strebe zu rechten Winkeln umgebogen werden.

8. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Strebe (53) einen im wesentlichen gleichförmigen Querschnitt sowie zwei oder mehrere Rippen oder Grate (4) aufweist, die einem durchgehenden, schraubenförmigen Verlauf um die Achse des Kerns folgen.

9. Verfahren nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Rippen oder Grate (4) um den Kern herum in gleich großen Winkeln versetzt sind und sich vom Kern aus in einer radialen Richtung gleich weit erstrecken.

10. Verfahren nach Anspruch 8 oder 9, dadurch gekennzeichnet, daß die Rippen (4) dadurch ausgeformt werden, daß Material aus dem Draht fixiert und anschließend der Draht (15) verdrillt wird.

Revendications

1. Procédé de renforcement d'un mur qui consiste à former un espace dans la matière du mur, à placer un tirant structurel (53) dans l'espace formé et à sceller ou cimenter le tirant (53) en place, le diamètre maximum du tirant entier étant de 10 mm, caractérisé en ce que le tirant comporte une longueur de fil métallique (15) en une matière résistant à la corrosion, comprenant une âme et des nervures ou arêtes (4) faisant saillie vers l'extérieur, le diamètre de l'âme étant de 2 à 6 mm.

2. Procédé suivant la revendication 1, caractérisé en ce que l'espace est formé dans une couche de mortier (54).

3. Procédé suivant la revendication 1 ou 2, caractérisé en ce que l'espace est formé à mesure que le mur est construit.

4. Procédé suivant la revendication 1 ou 2, caractérisé en ce que l'espace est formé dans une couche de mortier existante (54).

5. Procédé suivant l'une quelconque des revendications 1 à 4, caractérisé en ce que l'espace est formé dans un mur à travers une zone de faiblesse telle qu'une fissure (51, 52).

6. Procédé suivant la revendication 5, caractérisé en ce qu'une série de tirants (55) qui se chevauchent sont scellés dans l'espace formé.

7. Procédé suivant l'une quelconque des revendications précédentes, caractérisé en ce que les extrémités des tirants sont pliées à angle droit.

8. Procédé suivant l'une quelconque des revendications précédentes, caractérisé en ce que le tirant (53) présente une section transversale sensiblement uniforme et deux ou plus de deux nervures ou arêtes (4) qui suivent une trajectoire hélicoïdale continue autour de l'axe de l'âme.

9. Procédé suivant l'une quelconque des revendications précédentes, caractérisé en ce que les nervures ou arêtes (4) sont espacées de manière équiangle autour de l'âme et s'étendent de manière égale depuis l'âme dans une direction radiale.

10. Procédé suivant la revendication 8 ou 9, caractérisé en ce que les nervures (4) sont formées en repositionnant de la matière du fil métallique et en tordant ultérieurement le fil métallique (15).

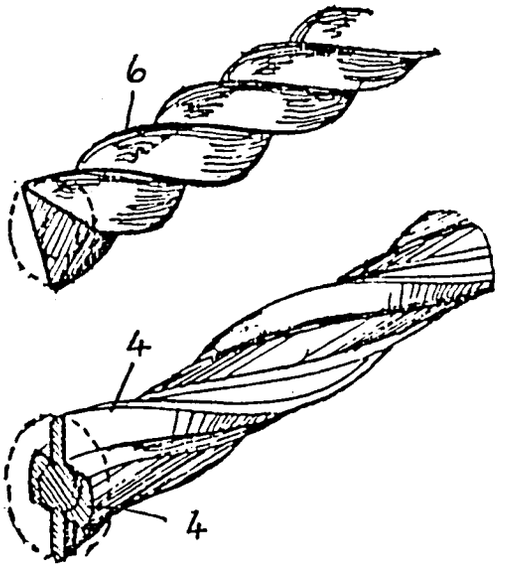

Fig. 2

Fig. 1.

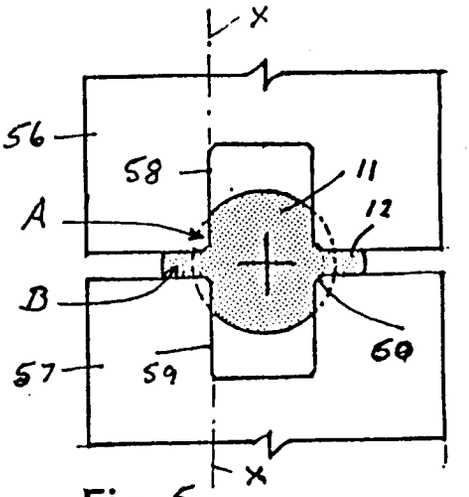

Fig 5

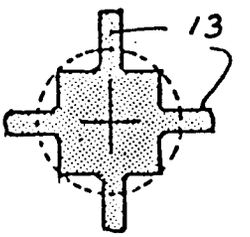

Fig 6

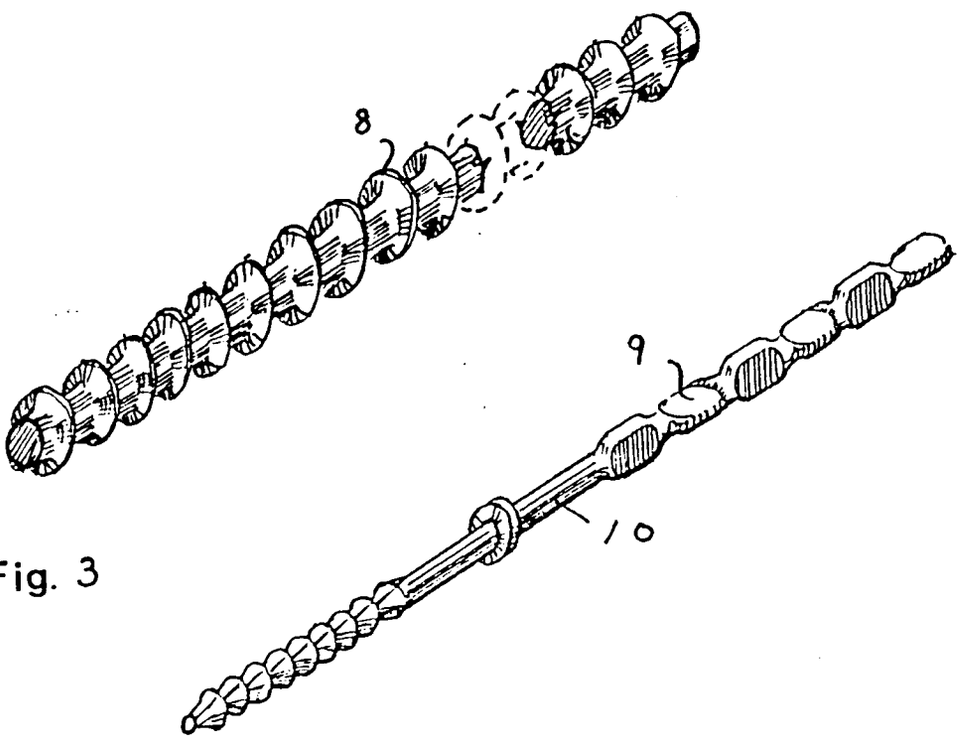

Fig. 3

Fig. 4

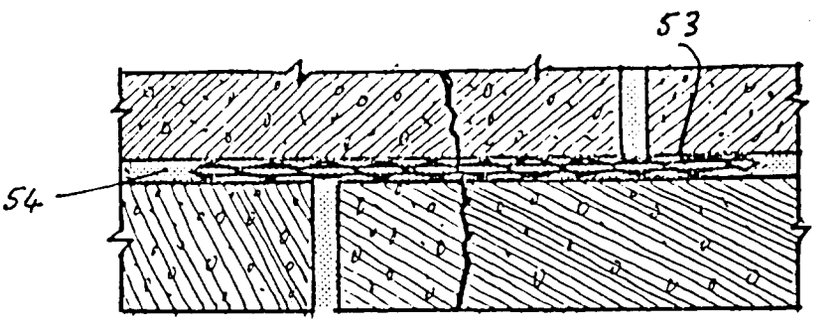

Fig. 7

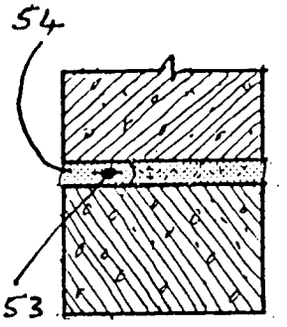

Fig. 8

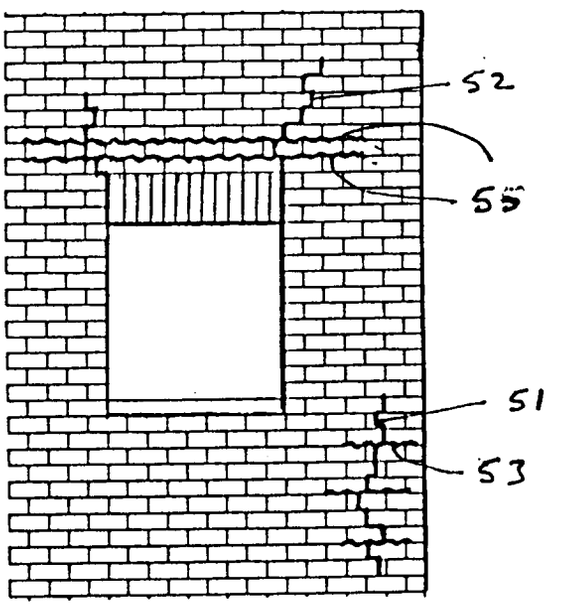

Fig. 9