

Sealing stirrup and its fixing method

The invention concerns a tubular stirrup designed to be fixed in the wall of a concrete structure and that consists of a U-shaped metal tubular element and of two or of several fixing bushes fitted to the ends of the tubular element.

5 The invention also concerns the fixing method for the aforesaid sealing stirrup in the wall of a concrete structure.

We already know from the former state of the art, stirrups designed for similar use and that consist, in general, of a tubular element that features the shape of a "U", with the end of the legs designed to be positioned in the wall of a brickwork wall through the intermediate of plastic material bushes.

15 Thus through document FR-A-2 071 601, we know a stirrup that consists of a steel tube provided with a plastic material or aluminium cover to prevent corrosion, with this tube installed in brickwork or in a concrete wall by means of attached fixing elements that consist here of plastic material bushes provided on the outside with ring-shaped ribs.

The Fixing of this type of stirrup according to the aforesaid document consists in inserting fixing bushes into corresponding holes drilled previously in the brickwork, then in forcing the ends of the tubular element of the stirrup into the already installed fixing bushes.

25 The tubular stirrup and its fixing method according to this document have several drawbacks.

30 As a matter of fact, before the tubular element can be installed in the fixing bushes, appropriate holes have to be drilled for the latter in hard and dry concrete of the structures to be fitted. This is rendered particularly critical because the holes have to feature an accurate and constant diameter as otherwise the quality of the stirrup fixation will vary.

Furthermore, the installation of the stirrup as described above requires important means applied to drive the ends of the bent tubular body into the bushes.

The draw-out resistance of this type of stirrup with regard to the linkage bushes can not be greater than the force applied for driving the aforesaid stirrup into the bushes. Actually, it is very frequently possible to pull out the tubular element by applying a tractive force considerably below specified standard level i.e. 360 kg. The result is a risky and even dangerous use of certain stirrups installed according to the specifications of this patent.

We know, in addition, through document FR-A-2 440 461, a safety stirrup that also consists of a tubular element bent in the shape of a "U" and the ends of which carry plastic material bushes designed to be installed in a concrete wall.

In this case, the fixing bushes feature a cone-shaped end section that possibly allows for installing these bushes in the fresh concrete of a wall being cast. However, the connection between the ends of the tubular element and the fixing bushes is achieved simply by making the latter fit tightly over the ends, _____

with the inherent risks to the strength of the entire unit. This risk is made greater by the fact that the fixing bushes are made of plastic material and the tubular element of metal, with different coefficients of expansion which, consequently, significantly affects the tightening forces applied to the metal tubular element and, consequently, the strength of the latter.

It has been considered, furthermore, that the draw-out resistance of the bent tubular element could be improved by glueing the ends of this element in the fixing bushes. This method, however, requires the use of a special glue with a critical method of application, resulting in excessive manufacturing and installation costs for the stirrup involved.

In addition, tests have shown that this solution would allow to achieve a draw-out resistance of 360 to 380 kg only, i.e. the specified standard level without any safety coefficient.

5 The present invention seeks to remedy these drawbacks.

According to a first aspect of the present invention, there is provided a tubular stirrup, designed to be fixed in the wall of a concrete
10 structure, the stirrup comprising a U-shaped tubular element and two or more fixing bushes fitted to the ends of the tubular element, the U-shaped tubular element having, at each of its ends, a peripheral projection obtained by deforming the aforesaid ends,
15 the projection co-operating with the inside wall of each fixing bush.

According to a second aspect of the invention, there is provided a method of fixing a tubular stirrup as defined above, characterised in that the ends of the
20 legs of the tubular element fitted with the fixing bushes are sunk into soft concrete up to the respective shoulders provided projected from the bushes.

The benefits from this invention consist essentially in that the deformed metal of the ends of
25 the bent element will literally dig into the inside wall of each fixing bush when the user climbs a vertical wall fitted with these stirrups and grips the stirrup above to pull himself up by applying a pulling effort on the latter. According to tests carried out,
30 the draw-out resistance may be as high as 600 and even 700 kg. Thus, this stirrup features a draw-out resistance significantly better than that of stirrups known from the former state of the art.

The invention will be detailed below by means of
35 drawings that show one method of execution only.

Figure 1 shows the plan view of a stirrup according to the invention with this stirrup fixed into a concrete wall.

Figure 2 shows the lateral and the sectional view of one of the stirrup ends installed in a fixing bush.

Figure 3 shows a detail view of part "A" schematized in figure

We are referring to figure 2.

The stirrup 1 according to the invention consists, in a well-known manner, of one tubular element 2 bent to U-shape

and the two legs 3 and 4 of which are designed to be fixed in a concrete wall 5. According to the invention, this fixing will be performed either in hard and dry concrete of an existing structure or in fresh concrete of a concrete wall being cast.

In the first case, suitably spaced holes 6 are drilled into the wall 5. In these holes 6 are then installed fixing bushes 7 that are simply driven into the holes 6 until a peripheral shoulder 8 of the fixing bushes 7 stops their progression in the holes 6.

In the second case, the bushes 7 are previously slipped onto the ends 9 and 10 of the legs 3 and 4 of the tubular element 2, then the entire system is inserted into the concrete wall 5 being cast, as shown by figure 1.

We are referring to figures 2 and 3.

Obviously it is necessary, in view of making the installation of the stirrup according to the invention easier and of ensuring the latter's resistance against stress and deterioration in time, to provide for means that, firstly, make the installation of the stirrup easier and, secondly, provide this stirrup with extremely reliable fit that will yield only under very great strain.

For this purpose, the tubular element 2 is provided at its ends 9 and 10 with fixing means in relation with the fixing bushes 7. According to one version shown by figure 2, these fixing means consist of a peripheral bead 11 provided close to the ends 9 and 10 of the tubular element 2 and that co-operates with the inside wall 12 of each fixing bush 7. This peripheral bead 11 is formed by displacement of material from the aforesaid ends.

As the fixing bush 7 may be made of plastic material, this peripheral bead 11 will preferably have the shape of a peripheral step in relief as compared to the outside wall 13 of the tubular element 2 and be located away from the ends 9 and 10 of the legs 3 and 4 of the aforesaid tubular element 2.

In addition, each of the fixing bushes 7 has at its opening 14 a peripheral guide clearance 15.

Thus, when the ends 9 and 10 of the legs 3 and 4 of the tubular body 2 are inserted into the fixing bushes 7, these ends 9 and 10 provided with their peripheral step will be positioned in front of the guide clearances 15. Pressure applied to the tubular element 2 then forces the ends 9 and 10 into the fixing bushes 7 with these ends deforming elastically the walls 16 provided possibly with peripheral ribs known as such. Then the ends 9 and 10 abut against the cone-shaped part 18 of the fixing bushes 7. In this position, the design chosen for the peripheral bead 11 will have any attempt at pulling out the tubular element 2 result in having the aforesaid peripheral bead 11 dig into the wall 16 of the fixing bushes 7, which will cause the fixation of the stirrup to become even more effective.

To note that the thickness of wall 16 of the fixing bushes 7 made of plastic material as well as the height of the relief featured by the peripheral bead 11 as compared to the outside wall 13 of the tubular element 2 will be determined by the size of the stirrup.

The stirrup as well as its fixing method as described above have the advantage of providing a very reliable fixation for the aforesaid stirrup even in the event where it is fixed in dry concrete.

In addition, fixing the stirrup in a concrete wall being cast is made easier as we only have to push the ends 9 and 10 of the stirrup fitted with their fixing bushes into the soft concrete up to the shoulder 8 of the aforesaid bushes.

Pull-out tests carried out with the stirrup as described above have shown that a force of 700 kg was required to pull out the stirrup which is significantly better than the minimum specified standard level.

Furthermore, the possibility of sinking the stirrups directly into soft concrete allows for avoiding any problems regarding tightness or cracking of the walls fitted in this manner as the fresh concrete will easily penetrate between the various ribs 17 of the fixing bushes 7 and the stirrup will thus become a perfectly integrated part of the wall.

CLAIMS

1. A tubular stirrup, designed to be fixed in the wall of a concrete structure, the stirrup comprising a U-shaped tubular element and two or more fixing bushes fitted to the ends of the tubular element, the U-shaped tubular element having, at each of its ends, a peripheral projection obtained by deforming the aforesaid ends, the projection co-operating with the inside wall of each fixing bush.
2. A stirrup according to claim 1, wherein the tubular element is made of metal.
3. A stirrup according to claim 1 or 2, characterised in that the peripheral projection projects from the outside wall of the tubular element and is formed by displacement of material from the ends of the legs of the element.
4. A stirrup according to claim 1, 2 or 3, characterised in that each bush has, at its opening, a peripheral guide clearance.
5. A method of fixing a tubular stirrup as claimed in one of claims 1 to 4 and further comprising a shoulder projecting from each of the bushes, characterised in that the ends of the legs of the tubular element fitted with the fixing bushes are sunk into soft concrete up to the respective shoulders.
6. A stirrup, substantially as herein described with reference to, and as shown in, the accompanying drawings.

