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Anchoring cartridge for a
hardening multi-component composition

The invention relates to an anchoring cartridge for a hardening multi-component composition on the basis of a resin hardening by the reaction of radicals (e.g. polyester resin, vinylester resin or (meth)acrylate resin) according to the preamble of claim 1.

An anchoring cartridge of the type mentioned in the preamble, the inner cartridge of which contains the resin component and the outer cartridge of which contains the hardener component, is known from DE-OS 38 06 598. To form and fix an annular space between the inner cartridge and the outer cartridge, a quartz sand coated with benzoyl peroxide hardener is used. The different grain sizes of the filler in the annular space between the two cartridges, filler of finer grain being located in the leading region and filler of coarser grain being located in the rear region, make it difficult to drive an anchoring rod into a drilled hole, especially by hand. The different grains and the resulting coatable surfaces of different sizes furthermore produce differences in concentration in the hardener component in the annular region, so that the hardening process progresses unevenly.

To avoid those disadvantages, in the Upat UES steel rod anchoring it is proposed to fix the inner cartridge in the outer cartridge by means of a mixture of a peroxide

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hardener and a polymer filler. But this mixture, which is in the form of a powder, necessitates a very small annular space to avoid settling of the hardener component in the annular region between the inner and outer cartridges. Moreover, this powder has only a slight cleaning effect on the wall of the drilled hole, so that drilling dust clinging to the wall of the drilled hole reduces the bond strength. To compensate for that, the viscosity of the resin component with which the inner cartridge is filled is adjusted to be very low, to achieve a good wetting of the wall of the drilled hole. The drawback of that construction, however, is that the low-viscosity resin spurts out of the drilled hole or, in the case of wall mounting, runs out, when the anchoring rod is put in position by hammering. Furthermore, it is not possible to use fillers in the resin, since they would settle in the cartridge on account of their higher density. In particular in the case of floor mountings, the filler that had settled at the bottom of the cartridge would make it very difficult to drive the anchoring rod in fully.

The invention is based on the problem of improving a composite anchor cartridge such that it is possible to put the anchoring rod into position by hand by driving it in fully, without spurting out or running out occurring during the operation of putting the anchoring rod into position, and to use fillers in both components to increase the strength.

That problem is solved by the features specified in claim 1.

By virtue of an annular space corresponding at least to the wall thickness of a cartridge and at most to 5% of

the external diameter of the outer cartridge, both cartridges are relatively easy to crush and an advantageous ratio of volumes between the resin and hardener components for good blending is achieved. Furthermore, it is possible for fillers having a grain size corresponding at most to the wall thickness of the glass cartridges to be incorporated in both components. The volume proportion of the hardener component is increased by mixing the hardener component with a liquid, for example, water or an organic solvent, and a suitable thixotropic agent and, optionally, fillers, to form a paste which completely fills the annular space between the inner and outer cartridge. The high viscosity of the paste prevents settling even in a relatively large annular region and enables a uniform distribution of the hardener component over the entire length of the cartridge to be achieved.

Further, a thixotropic agent increases the viscosity of the resin to such an extent that settling phenomena of the fillers are avoided. Increasing the viscosity of the resin at the same time prevents running out and spurting out occurring during the positioning operation. The uniform distribution of the two components in the anchoring cartridge, combined with the additional fillers in the resin component, and optionally also in the hardener component, ensures a uniform, complete hardening of the composition, high strength of the hardened synthetic resin mortar and good bond strength between synthetic resin mortar and the wall of the drilled hole.

A reactive mineral bonding agent on a cement basis has proved to be an especially advantageous filler in the resin component. In that case, it is advantageous to use a pyrogenic silicic acid as the thixotropic agent

in the resin component. The hardener component has glass beads as filler and a hydrophobic pyrogenic silicic acid as thixotropic agent. The mineral bonding agent promotes the flow of the resin-hardener mixture, as the fluid, for example, water, incorporated in the hardener component combines with the mineral bonding agent. The resin-hardener mixture therefore becomes more liquid. Pyrogenic silicic acids, when used as thixotropic agents, have the property that as the anchoring rod is driven in and the shearing forces occurring in that operation act on the mixture, the viscosity of both the resin component and the hardener component is reduced. Blending of the two components is thus promoted and at the same time driving in of the anchoring rod is facilitated. The glass beads incorporated in the paste-like hardener component on the one hand increase the compressive strength of the multi-component composition after it has hardened, and on the other hand enable a centring effect to be achieved for a uniform annular space between inner and outer cartridge.

Steel balls can also be used as filler in the resin component. In that case, pyrogenic silicic acid is used as thixotropic agent both in the resin component and in the hardener component and decahydro-naphthalene (decalin) is used as liquid in the hardener component.

The diameter of the steel balls, made of stainless steel, is 10-50 μm , preferably 22 μm . This on the one hand (ensures)¹ satisfactory flowability of the mixture to reduce the energy required for driving in the anchoring rod and on the other hand avoids settling phenomena.

¹ verb in brackets added for clarity - translator.

The hardener mixture consists of a pasty mixture of decahydro-naphthalene (decalin) with hardener. A large-surface intermingling of resin and hardener is consequently ensured. The pyrogenic silicic acids prevent separation of the hardener from the decahydro-naphthalene (decalin). As the hardener component is blended with the resin component, the decahydro-naphthalene (decalin) separates so that the reaction takes place only between resin and hardener.

To achieve a comminution of the glass cartridge into particles that are as small as possible, it is advantageous for the external diameter of the outer cartridge to be the same as or smaller than the external diameter of the anchoring rod.

For satisfactory strength of the hardened multi-component composition, the total amount of additives, including the glass particles of the anchoring cartridge, should be 2 to 3.5 times the resin composition. By virtue of the additives already contained in the resin component and hardener component, the wall thickness of the cartridges can be restricted to 0.3 to 0.5 mm. The energy required for driving in the anchoring rod is consequently also reduced.

Two embodiments of an anchoring cartridge according to the invention for an M16 anchoring rod are described below.

length of outer cartridge:	105 mm
diameter of outer cartridge:	15.5 mm
length of inner cartridge:	90 mm
diameter of inner cartridge:	12.5 mm
wall thickness of inner and outer cartridge:	0.4 mm

Contents of first embodiment:

Inner cartridge

vinyl ester resin	6.5 g
mineral bonding agent	3.7 g
hydrophobic pyrogenic silicic acid	0.30 g

Outer cartridge

hardener (peroxide with 50% proportion of hardener/50% inert additive)	0.53 g
glass beads	1.1 g
pyrogenic silicic acid	0.08 g
water	1.4 g

Contents of second embodiment:

Inner cartridge

vinyl ester resin	6.5 g
steel balls ($\varnothing$ 22 μ m)	11.6 g
pyrogenic silicic acid	0.25 g

Outer cartridge

hardener (50% peroxide/50% inert additive)	0.53 g
decahydro-naphthalene (decalin)	2.14 g
pyrogenic silicic acid	0.18 g

Positioning operation:

diameter of drilled hole:	18 mm
length of drilled hole:	150 mm
driven in with hand hammer	

using 800 g blows:	18
withdrawal value (kN)	100

The invention is explained in detail hereinafter with reference to the drawing.

The glass anchoring cartridge for a hardening multi-component composition on the basis of a resin hardening by the reaction of radicals (e.g. polyester resin, vinylester resin or (meth)acrylate resin) consists of an outer cartridge 1 and, lying inside the outer cartridge, an inner cartridge 2, which is centred, by the hardener component 3 with which the outer cartridge 1 is filled, to form an annular space 4. The inner cartridge 2 is filled with the resin component 5 with fillers 6. The hardener component present in the form of a pasty mixture can also contain fillers, for example, glass beads 7.

The anchoring cartridge is inserted in a hole 8 drilled in a building component 9. By driving in the anchoring rod 11 provided with a wedge-shaped tip 10, the anchoring cartridge is crushed and the components contained in the anchoring cartridge are activated. To reduce the energy required for driving in, in particular when putting the anchoring rod in position by hand using a hand hammer, the external diameter of the anchoring rod 11 is somewhat smaller than the external diameter of the outer cartridge 1. Further, the wall thickness of the cartridge is 0.3 - 0.5 mm, and the inside width of the annular space 4 corresponds at least to the wall thickness of a cartridge and at most to 5% of the external diameter of the outer cartridge.

Patent Claims

1. An anchoring cartridge for a hardening multi-component composition on the basis of a resin hardening by the reaction of radicals, the inner cartridge containing the resin component with fillers and the annular space between the inner cartridge and the outer cartridge containing the hardener component, and both components being activated by driving an anchoring rod into the hole drilled in a building component receiving the anchoring cartridge, characterized in that the inside width of the annular space corresponds at least to the wall thickness of a cartridge and at most to 5% of the external diameter of the outer cartridge, in that the resin contains a thixotropic agent which increases the viscosity of the resin to such an extent that the filler parts are suspended in the resin, and in that the hardener component is present with a liquid and optionally fillers and a thixotropic agent as a pasty mixture which completely fills the annular space between the inner and outer cartridge.

2. An anchoring cartridge according to claim 1, characterized in that the filler in the resin component is a reactive mineral bonding agent and the thixotropic agent is a hydrophobic pyrogenic silicic acid, and in that the filler in the hardener component comprises glass beads, the thixotropic agent is a pyrogenic silicic acid and the liquid is water.



3. An anchoring cartridge according to claim 1 and 2, characterized in that the proportions by weight of the resin component related to the contents of the inner cartridge are

- | | |
|---------------------------------------|-------------------|
| a) resin | 60-64 % by weight |
| b) mineral bonding agent | 34-37 % by weight |
| c) hydrophobic pyrogenic silicic acid | 2-3 % by weight |

and the proportions by weight of the hardener component related to the contents of the outer cartridge are

- | | |
|---|--------------------|
| d) hardener
(50% hardener proportion/
50% inert additive) | 16-18 % by weight |
| e) glass beads | 32-38 % by weight |
| f) pyrogenic silicic acid | 2-3 % by weight |
| g) water | 42-48 % by weight. |

4. An anchoring cartridge according to claim 1, characterized in that the filler in the resin component comprises steel balls and the thixotropic agent in both the resin component and in the hardener component is pyrogenic silicic acid, and in that decahydro-naphthalene (decalin) is contained in the hardener component as liquid.

5. An anchoring cartridge according to claim 1 and 4, characterized in that the proportions by weight of the resin component related to the contents of the inner cartridge are

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|--|-------------------|
| a) resin | 30-36 % by weight |
| b) stainless steel balls
having a diameter of 10-50 μm | 60-66 % by weight |
| c) pyrogenic silicic acid | 1-1.5 % by weight |

and the proportions by weight of the hardener component



related to the contents of the inner² cartridge are

- d) hardener 17-19 % by weight
(50% hardener proportion/
50% inert additive)
- e) decahydro-naphthalene (decalin) 71-80 % by weight
- f) pyrogenic silicic acid 5-8 % by weight

6. An anchoring cartridge according to claim 1, characterized in that the external diameter of the outer cartridge is the same as or smaller than the external diameter of the anchoring rod.

7. An anchoring cartridge according to claim 1, characterized in that the wall thickness of the cartridges is 0.3 to 0.5 mm.



² "inner" presumably in error for "outer" here - translator.