

620747

FORM 1

REGULATION 9

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

..... We, HILTI AKTIENGESELLSCHAFT, a Corporation organised under
..... the laws of the Principality of Liechtenstein, of Schaan,
..... Liechtenstein, hereby apply for the grant of a Standard Patent for
..... an invention entitled:-

..... "MORTAR PASTE"

which is described in the accompanying Complete Specification.

Details of basic application:-

..... Number: P39 40 309.2
..... Country: Federal Republic of Germany
..... Date: 6th December, 1989

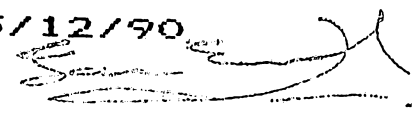
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.....

Our address for service is: SHELSTON WATERS
55 Clarence Street
SYDNEY, N.S.W. 2000.

DATED this 5th Day of December, 1990
HILTI AKTIENGESELLSCHAFT

5018818 05/12/90

by 

Shelston Waters, Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

To: The Commissioner of Patents
WODEN A.C.T. 2606

File: D.B. H-167

Fee: \$227.00

CONVENTION APPLICATION BY A COMPANY

FORM 8 - REGULATION 12 (2)

AUSTRALIA
PATENTS ACT 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

(a) Here insert (in full)
Name of Company.

In support of the Convention Application made by.....
(a) Hilti Aktiengesellschaft
..... FL-9494 Schaan

(b) Here insert Title of
Invention.

(hereinafter referred to as "Applicant") for a patent for an invention entitled:
(b) "MORTAR PASTE"

(c) and (d) Here insert
Full Name and Address
of Company Official
authorised to make
declaration.

We, (c) Roland Wildi Albert Böni
of (d) FL-9494 Schaan, Principality of Lichtenstein

do solemnly and sincerely declare as follows:

We are
1. authorised by Applicant to make this declaration on its behalf.

2. The basic Application(s) as defined by section 141 of the Act was / ~~were~~ made

in (e) West Germany on the 6th day of December 1989

by (f) Hilti Aktiengesellschaft

in on the day of 19

by

in on the day of 19

by

in on the day of 19

by

(g) Here insert (in full)
Name and Address of
actual Inventor or
Inventors.

3. (g)

Alwin Herdlicka of D-8900 Augsburg 1, Lilienthalstr. 4

Ludwig Gebauer of D-8037 Olching 2, Eulenweg 6

Gabriele Grundmann of D-8910 Landsberg, Wettersteinstr. 13,

all of Germany.

..... is/are

the actual Inventor(s) of the invention and the facts upon which Applicant is entitled to make the
Application are as follows:

Applicant is Assignee of the said inventors.

4. The basic Application(s) referred to in paragraph 2 of this Declaration was/were the first
Application(s) made in a Convention country in respect of the invention, the subject of the
Application.

DECLARED at Schaan, Lichtenstein.

this 22nd day of October 1990

(h) Personal Signature
of Declarant (c) (no seal,
witness or legalisation).

(h) HILTI AKTIENGESELLSCHAFT

(12) PATENT ABRIDGMENT (11) Document No. AU-B-67790/90
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 620747

- (54) Title
MORTAR PASTE
- International Patent Classification(s)
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- (21) Application No. : **67790/90** (22) Application Date : **05.12.90**
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- (74) Attorney or Agent
SHELSTON WATERS , 55 Clarence Street, SYDNEY NSW 2000
- (56) Prior Art Documents
US 4213837
GB 1357611
- (57) Claim

1. Radical-hardening vinylesterurethane resins when used as mortars for the fastening of anchoring devices in solid base material.

620747

COMMONWEALTH OF AUSTRALIA

FORM 10

PATENTS ACT 1952

C O M P L E T E S P E C I F I C A T I O N

FOR OFFICE USE:

	Class	Int.Class
Application Number:		
Lodged:		

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

Name of Applicant: HILTI AKTIENGESELLSCHAFT

Address of Applicant: Schaan, Lichtenstein

Actual Inventor: Alwin Herdlicka, Ludwig Gebauer and
 Gabriele Grundmann

Address for Service: SHELSTON WATERS, 55 Clarence Street, Sydney

Complete Specification for the Invention entitled:

"MORTAR PASTE"

The following statement is a full description of this invention,
including the best method of performing it known to us:-

Mortar paste

The application of pastes containing hardenable unsaturated polyesters, epoxyacrylates, urethane-forming isocyanates and/or epoxides for the expansion-pressure - free fastening of anchorbars in boreholes is known. To this purpose the pastes are introduced into the borehole together with a hardener. In so doing, the pastes may be mixed in the borehole by means of a cartridge, by an extrusion apparatus and by a static mixer and dosaged for application. It is also possible to aliquot the component to be hardened and a hardener, viz, the components available in each case initially, in two chambers of a cartridge separately. By introducing a revolving anchor into the borehole containing the cartridge the chambers are destroyed and the two components become mixed.

The level of mechanical strength of the joint ultimately established is dependent above all on the system of bonding agents being applied and on the extent of the fill.

Unsaturated polyester resin systems based on ortho- and/or iso-phthalic acid, maleic- or fumaric acid as dicarboxylic acid and diols reveal certain weakness in the light of the more stringent requirements for fastenings. The limits set to these systems to date are:

resistance to deformation due to heating, stability with aging - especially when exposed to humidity, temperature changes and alkalinity - heavy shrinkage, insufficient adhesion and inhibition of hardening at the



surface by oxygen. Epoxy - acrylates, condensation products of methacrylic acid and/or of acrylic acid with epoxide compounds based on bisphenol-A, bisphenol-F or novolaks possess greater resistance to climatic influences as well as, above all, to alkalinity and they have improved adhesion properties in comparison to unsaturated polyester resins, but they display a reduced extent of three-dimensional crosslinking. Shrinkage and surface hardening due to oxygen are comparable to those of unsaturated polyester resins. Polyurethanes possess very good adhesion properties but, should they have an adequate pot-life, they also require substantially longer times to harden than radically-hardenable polyester resins and epoxy - acrylates. In the presence of humidity they display a high sensitivity to enter into side-reactions due to a competitive reaction with water, causing discontinuities in the texture (emulsion structure), that will weaken the bond. Finally, epoxide resins also have very long hardening times and cannot be used in applications at temperatures below +5°C. Their systems for hardening at low temperatures are sensitive to humidity. Their adhesion properties at room temperature are very good.

The aim of the present invention is the creation of a mortar paste for the fastening of anchors that will be exempt from the disadvantages of known mortar pastes and yet it will yield fastenings of excellent stability and strength.



Vinylurethanes, often also referred to as vinylurethane resins, are linear or branched polyurethanes that exist in liquid form or are soluble in such solvents as reaction diluents and that contain acrylate and/or methacrylate groups. Compounds of this type and their production are known (of. e.g. DE-OS 35 36 246, EP 0 123 081 and EP 0 002 129 and the bibliography referred to therein). Vinylurethane resins may be cross-linked or hardened, respectively, by radical polymerisation or co-polymerisation with reaction diluent(s).

Vinylurethane resins may be represented, e.g., by transposition of di- and/or higher-substituted isocyanates with suitable acrylic compounds, possibly with the simultaneous application of hydroxyl compounds containing at least two hydroxyl groups.

Aliphatic (cyclic or linear) and/or aromatic di- or higher-substituted isocyanates or pre-polymers, respectively, may be utilized as isocyanates. The use of such compounds enhances the cross-linking propensity and thus it improves the adhesive properties. Especially favoured are toluenediisocyanates (TDI), diisocyanatodiphenylmethane (MDI) for improving chain stability, and hexanediisocyanate (HDI) and isophoronediiisocyanate (IPDI), that will improve flexibility.

As acrylic compounds are suitable: acrylic acid and hydrocarbon-radical-substituted acrylic acids such as



methacrylic acid; esters, containing hydroxyl groups, of acrylic or methacrylic acid, respectively, with higher substituted alcohols, e.g. pentaerythritetriacrylate, glyceroldiacrylate, trimethylolpropanediacylate, 5 neopentylglycolmonoacrylate. Preferred are acrylic or methacrylic-acid-hydroxylalkylesters, e.g. hydroxyethylacrylate, hydroxypropylacrylate, polyoxyethyleneacrylate, polyoxypropyleneacrylate, in view of such compounds posing a steric hindrance to the saponification reaction. 10

Suitable to be used in given cases as hydroxyl compounds are: di- or higher-substituted alcohols, e.g. secondary products of ethylene- and propyleneoxide, such as ethanediol, di- or tri-ethyleneglycol, propanediol, 15 dipropyleneglycol, other diols such as 1,4-butanediol, 1, 6-hexanediol, neopentylglycol, diethanolamine, also bisphenol-A or-F or their oxethylation- and/or hydration- or halogenation products, respectively; higher substituted alcohols, as e.g. glycerine, trimethylolpropane, 20 hexanetriol and pentaerythrite; polyethers containing hydroxyl groups, e.g. oligomers of aliphatic or aromatic oxirans and/or of higher cyclic ethers, e.g. ethylenoxide, propyleneoxide, styroloxiide, and furan; polyethers incorporating aromatic structural units in their main 25 chain, e.g. bisphenol A or F, respectively, hydroxyl-group-containing polyesters on the basis of the above-mentioned alcohols, polyethers or dicarboxylic acids or their anhydrides, respectively, e.g. adipic acid,



phthalic acid, tetra- or hexa - hydrophthalic acid,
chlorendic acid, maleic acid, fumaric acid, itaconic acid,
sebacic acid and similar others. Special preference is
given to hydroxyl compounds incorporating aromatic units
of structure for the stabilisation of chains and for
increasing the hot-strength figure of the resin; hydroxyl
compounds containing unsaturated structural units, such as
fumaric acid, in order to enhance the cross-linking
density; branched or star-patterned hydroxyl compounds,
especially tri- or higher substituted alcohols and/or
polyethers or polyesters, respectively, that contain
structural units of the former; branched or star-patterned
urethaneacrylates for attaining lower viscosity for the
resins and their solutions in reaction diluents,
respectively, as well as for higher reactivity and
cross-linking density.

Together with or instead of, respectively, homo -
polymerisation, vinylesterurethane resins may enter into
reactions with the reaction diluents contained in mortar
pastes. As reaction diluents all suitable olefinic -
unsaturated compounds may be utilised, especially
compounds containing vinyl- including acrylic- groups, for
example monostyrol, divinylbenzol, methacrylic-acid-
methylester, methacrylic-acid-i-propolyester,
methacrylic-acid-i-butylester, hexanedioldiacrylate,
tetraethyleneglycoldiacrylate,
trimethylolpropanetriacrylate and similar others.

The resins and their solutions, respectively, may be



preactivated by activators such as are commonly applicable for cold-hardening UP-resins. Such activators are, e.g., tertiary aromatic amines, such as dimethylaniline, diethylaniline, dimethyl-p-toluidine, heavy metal salts, such as dibasic acid salts of transition metals, like cobalt-octanoate, cobalt-naphthenate or organic vanadium salts. Combinations of the above activators are also of advantage, e.g. the simultaneous use of cobalt- and amine-activators. The activators may be added to the resin solutions in pure form, or as a 1 to 10% solution in styrol, in other reaction diluents or plasticizers, e.g. in phthalic acid- or sebacic acid-esters. The concentration of pure activators ranges from 0.03% to 0.5% of weight, referred to that of the resin solution.

For hardening, radical hardening agents are added to the vinylesterurethane - containing mortar pastes, followed by thorough mixing. This may take place, e.g., by stirring the component containing the vinylesterurethane resin with the hardener; or by means of a static mixer; or else, as described above, by the destruction of dual-chamber cartridges. The role of hardener component may be assumed by organic peroxides, such as diacylperoxides, e.g. dibenzolperoxide and bis(4-chlorinebenzoyl) peroxide, ketone peroxides, e.g. methylethylketoneperoxide and cyclohexanone peroxide, further by alkylperesters, e.g. t-butyl- perbenzoate. The initiators may be used in pure form, e.g. TBPB; or admixed, e.g. with plaster of Paris, chalk, pyrogenic



silica, phthalate, chorine paraffin, water, as powder, emulsion or paste. When ready to be aliquoted, i.e. in the state of being used, the mortar pastes contain the hardener mostly in a range of 0.2 to 5%, preferably 0.5 to

5 4% of weight, referred to the total mass.

As yet another component, mortar pastes may contain fillers. As fillers may, e.g., be used: quartz, glass, corundum, porcelain, stoneware, aluminiumhydroxide, heavy spar, chalk, polymers; they are admixed to the resin solution and/or to the hardener (initiator) in the form of sand, powders, or specially-formed objects (cylinders, spheres, small plates).

When aliquoting the cartridge, the wall material of the cartridge may also be considered to act as a filler when the setting and mixing process is completed.

Finally, the scope of the invention includes the use of radically-hardenable vinylesterurethane resins in mortar pastes for the fastening of anchorbars in boreholes.

According to a broad form of the present invention there is provided radical-hardening vinylesterurethane resins when used as mortars for the fastening of anchoring devices in solid base material.

Mortar pastes ready for use will preferably have the following composition in percentages of weight, referred to the total mass:

- a) Vinylesterurethane resin 9 to 65, preferably 16 to 32
Reaction diluent 0 to 30, preferably 8 to 22
Activator 0 to 1.5, preferably 0.01 to 1



Initiator mixture

	(softener)	0 to 10, preferably 0.5 to 7
	Mineral fillers	15 to 85, preferably 45 to 65
	Thixotropic agents	0 to 5, preferably 0.5 to 4
5	b) Organic peroxides	0.2 to 5, preferably 0.5 to 4

Application Examples:

Example 1

	a)	Aliquoted mortar for the anchoring of threaded bolts in solid walls (brick)	
10		Vinylesterurethane resin on the basis of novolak, methacrylic acid and diisocyanatodiphenylmethane	20.45%
		Monostyrol	11.50%
		Diethylaniline	0.11%
15		Chloro-paraffin (C10 - C13, 49% chlorine)	4.26%
		Pyrogenic silica, organically treated	1.26%
		Siliceous earth, 44...200µm (68% cristobalite, 31% kaolinite, treated with distearyl-dimethylammonium chloride)	12.69%
20	b)	Quartz sand 0.1...0.25mm	46.80%
		Spherical glass shells	1.75%
		Dibenzoylperoxide	<u>1.18%</u>
			100.00%



Example 2

- a) Aliquoted vinylesterurethane mortar for the fastening of smooth, epoxy-coated steel bars ("smooth dowel bars")

5	Vinylesterurethane resin on the basis of bisphenol-A, methacrylic acid and hexanediisocyanate	21.29%
	Monostyrol	15.79%
	Diethyleneaniline	0.18%
10	Pyrogenic silica, (organically treated)	2.66%
	Quartz sand, 50 - 150µm	3.66%
	Quartz sand, 100 - 250 µm	48.80%

	b) Paraffin, flash point 46 - 48°C	0.18%
	Di-2-ethylhexylphthalate	3.72%
15	Dibenzoylperoxide	<u>3.72%</u>
		100.00%



Example 3

5	a)	Vinylurethane mortar for fastening threaded bolts in solid walls (brick)	
		Vinylesterurethane resin on the basis of	
		bisphenol-A, acrylic acid and	
		toluylendiisocyanate	32.00%
		Monostyrol	13.72%
		Diethylaniline	0.18%
		Chloro-paraffin (Cl10-Cl13,49% chlorine content)	1.42%
		Pyrogenic silica, organically after-treated	1.16%
10		Quartz powder, 0 - 63µm	9.17%
		Quartz sand, 100 - 250µm	35.68%
15	b)	Spherical glass shells	1.83%
		Di-2-ethylhexylphthalate	2.42%
		Dibenzoylperoxide	<u>2.42%</u>
			100.00%



Example 4

a)		Aliquoted vinylesterurethane mortar for the fastening of threaded bolts and of steel trussing in concrete and in rocks	
5		Vinylesterurethane resin on the basis of novolak, methacrylic acid and diisocyanatodiphenylmethane	9.85%
		Vinylesterurethane resin on the basis of bisphenol-A, methacrylic acid and diisocyanatodiphenylmethane	7.63%
10		Monostyrol	12.10%
		Divinylbenzene	4.14%
		Dimethylaniline	0.04%
		Pyrogenic silica, organically treated	0.62%
15		Quartz powder, 0 - 63µm	14.04%
		Quartz sand, 50 - 150µm	15.23%
		Quartz sand, 100 - 250µm	35.73%
b)		Paraffin, flash-point 46 - 48°C	0.12%
20		Di-2-ethylhexylphthalat	0.08%
		Dibenzoylperoxide	<u>0.52%</u>
			100.00%



Example 5

- a) Vinylesterurethane mortar for the fastening of threaded bolts in concrete and in solid brick

Vinylesterurethane resin on the basis of

5	bisphenol-A, methacrylic acid and	
	diisocyanatodiphenylmethane	26.79%
	Monostyrol	21.41%
	Diethylaniline	0.31%
	Chloro-paraffin (C10-C13, 49% chlorine)	3.01%
10	Siliceous earth, 44...200µm	
	(68% christobalite, 31% kaolinite, treated	
	with distearyldimethylammoniumchloride)	22.03%
	Pyrogenic silica, organically treated	0.52%

- | | | |
|----|------------------------|--------------|
| b) | Spherical glass shells | 23.01% |
| 15 | Dibenzoylperoxide | <u>2.52%</u> |
| | | 100.00% |



Cartridges

The following mixtures, which contain, together with other components, the following 3 ingredients in the aliquots indicated below, have proved to be especially suitable:

5

Vinylesterurethane resin	9 - 28% weight
Reaction diluents	4 - 16% weight
Fillers	56 - 82% weight



Example 6

Size M12

a) Outer cartridge

Weight of glass 5.6g

External diameter of glass 10.75mm

5 Wall thickness 0.55mm

Length of cartridge 100mm

Vinylesterurethane resin on the basis of

bisphenol-A, methacrylic acid and

diisocyanatodiphenylmethane (to 65% in

10 monostyrol) preactivated with amine 4.3g

Quartz (grain size 1.5 - 2.0mm) 6.6g

b) Inner cartridge

Glass weight 1.2g

External diameter of glass 6.3mm

15 Wall thickness of glass 0.65mm

Length of cartridge 80mm

Dibenzoylperoxide (20% in plaster of Paris) 0.8g



Example 7

a) Outer cartridge

Weight of glass	5.8g
External diameter of glass	10.75mm
5 Wall thickness of glass	0.45mm
Length of cartridge	110mm

40 parts by weight of: vinylester -
urethane resin on the basis of
bisphenol-A, acrylic acid and
10 diisocyanatodiphenylmethane (to 55% in
monostyrol); 5 parts by weight of:
divinylbenzol, activated with dimethyl-
p-toluidine (0.15%)

3.8g

b) Inner cartridge

15 Weight of glass	2.2g
External diameter of glass	9.20mm
Wall thickness of glass	0.45mm
Length of cartridge	90mm
Quartz (1.2 - 1.8 mm)	5.4g
20 Dibenzoylperoxide (to 50% in phthalate)	0.8g



Example 8

a) Outer cartridge

Weight of glass	5.8g
External diameter of glass	10.75mm
5 Wall thickness of glass	0.45mm
Length of cartridge	110mm

Vinylesterurethane resin on the basis of
bisphenol-A, methacrylic acid and
toluylenediisocyanate, to 80% in methacrylic-
10 acid-ester, pre-activated with amine 4.2g

b) Outer cartridge

Weight of glass	2.2g
External diameter of glass	9.20mm
Wall thickness of glass	0.45mm
15 Length of cartridge	90mm
Quartz (0.04 - 0.15mm)	0.4g
Quartz (1.2 - 1.8mm)	5.0g
Dibenzoylperoxide (to 50% in chalk)	0.5g



Example 9

5	a)	Outer cartridge	
		Weight of glass	5.6g
		External diameter of glass	10.75mm
		Wall thickness of glass	0.45mm
		Length of cartridge	100mm
10		Vinylesterurethane resin on the basis of	
		bisphenol-A, methacrylic acid and	
		diisocyanatodiphenylmethane (to 75% in	
		monostyrol)	3.0g
		Vinylesterurethane resin on the basis of	
15		novolak, methacrylic acid and	
		diisocyanatodiphenylmethane (to 60% in	
		monostyrol)	1.2g
		Cobalt octanoate	0.001g
		Dimethylaniline	0.004g
20	b)	Inner cartridge	
		Weight of glass	0.7g
		External diameter of glass	43mm
		Wall thickness of glass	0.65mm
		Length of cartridge	80mm
		Methylethylketonperoxide	0.35g



THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Radical-hardening vinylesterurethane resins when used as mortars for the fastening of anchoring devices in solid base material.
2. Vinylesterurethane resins according to claim 1 when used for the fastening of anchorbars in boreholes.
3. Vinylesterurethane resins according to claim 1 or 2 further comprising a reaction diluent.
4. Vinylesterurethane resins according to any one of the preceding claims wherein the vinylesterurethane resin is pre-activated.
5. Vinylesterurethane resins according to any one of the preceding claims wherein the resin contains a hardening agent.
6. Vinylesterurethane resins according to claim 5 wherein the resin comprises a peroxide as hardening agent.
7. Vinylesterurethane resins when used for fastening of anchoring devices, substantially as herein described with reference to any one of the Examples.

DATED THIS 11th Day of December 1991

HILTI AKTIENGESELLSCHAFT

Attorney: IAN T. ERNST

Fellow Institute of Patent Attorneys of Australia
of SHELSTON WATERS

