PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : **B28C 5/00 // B28C 5/06 C04B 24/16, 24/24, E04F 21/12 E04G 21/04**	**A1**	**(11) International Publication Number:** **WO 92/11982** **(43) International Publication Date:** 23 July 1992 (23.07.92)

(21) International Application Number: PCT/NO91/00160

(22) International Filing Date: 30 December 1991 (30.12.91)

(30) Priority data:
910082 8 January 1991 (08.01.91) NO

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(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, RU , SD, SE, SE (European patent), SN (OAPI patent), TD (OAPI patent), TG (OAPI patent), US.

Published
With international search report.
With amended claims.

(54) Title: METHOD FOR BLENDING OF ADMIXTURES IN A SPRAYED CONCRETE MASS AND AGENT FOR APPLICATION OF THE METHOD

(57) Abstract

In a method for blending of admixtures in a concrete mass which is transported through pipes/hoses to a casting site and in which the mass shall have a consistency which is suitable for casting of the mass on wall or roof surfaces there are used admixtures consisting of two components which react with each other. The two components are mixed into the mass at different points in time, possibly in combination with normally used additional admixtures for the mass.

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Method for blending of admixtures in a sprayed concrete mass and agent for application of the method

The invention concerns a method for blending of admixtures in a pouring mass which is transported to site and where the mass should have a consistency which is suitable for casting of the mass on a base of concrete, steel or other material construction, for repair, reinforcement, protection, sealing against water or other purposes. The invention also concerns an agent which is suitable for application of the method.

When spraying compounds on wall and roof surfaces, a predominant problem is to make the sprayed mass adhere to the surfaces, while at the same time the mass has a consistency which enables it to be sprayed. This problem applies particularly in cases of spraying of coats which have to have a certain thickness, the major working area in which this kind of spraying is used being concrete, mortar and plaster spraying. A similar spraying technique is also used, although to a lesser degree, on other materials, such as filling masses, plastic masses, etc. The following description, however, is based on the most common example, viz. concrete spraying; shotcreting.

Sprayed concrete pouring is a technique whereby in one and the same operation a concrete mass is fed to a spray nozzle from which the concrete is sprayed on to a surface where it sets almost immediately and forms the required concrete coating. It is transported via hoses or pipes either by pumping of a ready-mixed concrete (the wet method) or by transporting premixed dry concrete (without water) by compressed air (the dry method). Immediately after the concrete leaves the hose it will be intercepted and deposited against one side of formwork or a base.

When the concrete meets the base, it is vital that it should stick as the thickness of the concrete increases. The concrete must be sprayed firmly against the base and must be cohesive so that it is possible to spread it out in the required thickness.

A vertical surface coating is simple to perform, but in the case of thick layers, rejection can easily occur in the mass. When spraying concrete according to the wet method, the mass which is sprayed out must fulfil two conditions, viz. it must be easy to pump and must be adhesive as it leaves the nozzle.

In order to obtain this kind of quality, a number of admixtures are used for concrete. If it is to be fed through pipes and hoses, concrete must have a certain consistency which in practice prevents it from sticking to the base. To achieve the desired effect with regard to fixing and attachment to the base, accelerators are added to the mass, either before it is transported through the tubes or pipes, or preferably by adding the accelerator in the spray nozzle. The accelerator will cause an increase in the rate of hardening of the concrete, so that it will be vital to use the correct amounts. Alternatively, thickeners are added to the spray concrete, primarily of the type which react to water or the binding agent, i.e. the cement. One problem with introduction in the nozzle is that the distribution of accelerator can be uneven, which results in poor quality. Another problem with the addition of accelerator is that it will reduce the compressive strength of the concrete and thus reduce the quality of the end product.

When spraying masses on wall and roof surfaces, a problem thus arises with regard to the addition of substances, both in the correct quantities and to some extent also in adding the correct substances. For example, when adding water-reducing agents, the slump of the concrete will increase and the mixture will be easier to pump, but will not adhere so easily to the base and rejection can easily occur in the mass as the thickness increases. If water is added the quality of the concrete will decrease and more cement will have to be used, which will add to the cost and is not always desirable with regard to the quality of the end product. The use of accelerators which are added to the mass in a nozzle will lead to a reduction in the strength of the end product. There is, moreover, the disadvantage that the mass will harden directly

after application, thus making further treatment extremely difficult. Similar problems also arise in the application of spray masses other than concrete, particularly cement-based masses.

One solution which has been considered is to add several substances simultaneously, so that the mass to be sprayed has both good pumping properties as well as good hardening properties, but this has been impossible to achieve as the substances affect one another, i.e. react with one another and neutralize the respective desired effects and to some extent have made application impossible. This has therefore not been a solution to the problems.

The object of the present invention is to find an admixture which does not affect the concrete mass, i.e. the binding agent in the concrete, such as cement, but which nevertheless produces the required binding effect to the base surface and the actual concrete mass, and the desired hardening during and after application. The object, therefore, is to provide a method for the addition of substances to the spray mass, together with agents suitable for this purpose which make it possible to transport the spray mass through pipes and hoses in an optimal manner and allow the mass to set so quickly that rejection and drop-out are prevented, while at the same time retaining a consistency which enable it to be treated and possibly smoothed and/or dressed.

This object is achieved by means of the method together with the agent which is characterized by the claims. The invention also concerns the application of admixtures to improve the consistency of concrete masses, plastering or filling masses.

In connection with the invention the surprising discovery has been made that with a two-component admixture, in which the reaction between the two components gives the desired effect of improving consistency and in which the components react with each other, but not with the mass, in other words independently

of the binding agent in the mass, especially cement in these masses, it has become possible to add substances which both give the desired fluidity, and particularly increased pumpability, during transport, while at the same time the quality of the concreted coating mass is retained. This can be achieved despite the fact that components of this type are not traditionally used in combination. This has been made possible by the fact that the components are added at different points in time and that they only react with each other, but not necessarily with the mass. In addition to the agents in accordance with the invention, other conventional admixtures can also be added, such as accelerators which react with the binding agent in the mass, e.g. cement, and have a further effect.

For example, a component can be added which increases the slump of a concrete mixture, e.g. a water reducing agent and/or super plasticiser and in the other component a substance which neutralizes the effect of the water reducing agent and effects a rapid change in the consistency together with hardening. At the same time accelerator, fibre, silica, etc. can also be added in quantities which do not cause an inadmissable reduction in the quality of the concrete, but on the contrary improve its quality. Such extra admixtures can be added separately or mixed directly with one or distributed between both components, in that admixture can be performed both during mixing or during the spraying of the mass. Such combinations and mixtures of the two components can be in the form of liquid solutions or mixtures or as mixtures of powders.

It is advantageous to add one component directly to the concrete or spray mass, while the other component is added in the nozzle under pressure, or together with pressurised air and the other admixtures. The sequence, however, is immaterial since all that matters is that the substances should not be added simultaneously, so that the reaction between the components of the substances does not occur until the moment of casting. Thus all the side-effects of reactions between the

substances during transport are avoided and, as it is the reaction between the components which causes adhesion to the surface, it will also be possible to adjust its strength by means of the admixtures, while the quality of the concrete remains unaffected, or only affected in the desired direction by means of a smaller admixture of accelerator, silica or the like.

As components in the agent in accordance with the invention, substances are used which are recognized admixtures for cement, mortar and concrete. The components act together as a flocculant, coagulant and/or association compound or as a gelling agent. For one component substances are chosen from water soluble synthetic and natural organic polymers of cellulose (ether) derivatives, including methylcellulose, carboxylic methylcellulose, hydroxyethylcellulose, methyl and hydroxypropylmethylcellulose, polyvinylalcohol, polyethylenoxide, polyacrylamides, algenates and derivates of these, in that substances from the above-mentioned groups can be combined as components.

As the other component, recognized water reducing, dispergant and/or super wetting admixtures for cement, mortar and concrete are chosen, e.g. lignin derivatives, sulphonated condensation derivatives between melamine, naphthalene and formalin, and/or recognized retarders based on carboxylic acid derivatives, phosphates, etc. One component can be added in dosing quantities, calculated as a percentage of, e.g., cement weight and 0.005-0.5%, calculated as active pure solid matter. The other component can be added with advantage in dosing quantities of 0.05-5% based on the same calculations. In practice the substances will be added to the combination and then preferably mixed with recognized admixtures for concrete. These mixtures can be in powder or liquid form after mixing.

The substances in one component can be described as stabilising, gelling, water retarding, viscosity adjusting,

with a thixotropic effect, primarily aimed at improving workability, pumpability, etc.
The invention is particularly applicable when adding admixtures in order to improve the consistency of a concrete spray mass, but since the agents mainly react with each other and not with the actual spray mass, the agents will also be able to be used in connection with plaster masses or spraying of fillers, in that case without cement.

When using the method in connection with a concrete mass, it is advantageous to use a dry mass into which one component is introduced and mixed with water in a continuous stream through a flow mixer or other mixer, or the mass is mixed on site, in which case a ready-mixed mass is used, e.g. pre-mixed concrete, but in such a way that both components are added at the casting site, but at different points in the process.

The consistency of the concrete mass can be further regulated/-adjusted by allowing the mass to become harsher, primarily by reducing the slump of the concrete, in that the effect of wetting admixtures, especially superplasticisers, is reduced or eliminated.

The relative proportions of the two components can be adjusted in order to regulate the consistency of the spray mass or pouring mass to the required value. Many modifications as well as other areas of application will be possible within the framework of the invention. Concrete applied by means of the method according to the invention will be able to be dressed after spraying and it will be possible to regulate the softness of the concrete. The method will also be applicable for dry spraying, and not only for the wet method.

PATENT CLAIMS

1. A method for blending of admixtures in a concrete mass which is transported to a casting site and in which the mass shall have a consistency which is suitable for casting of the mass on substrates of concrete, steel or other material for repair, reinforcement, protection, sealing against water or other purposes, said admixtures with each other and possibly may be added in combination with normally used additional admixtures for the mass, such as accelerators, fibre, etc., and that substances can be used with advantage as components chosen from recognized admixtures for cement, mortar and concrete, c h a r a c t e r i z e d i n that the admixtures are divided into two groups of components which are selected on basis of the reaction properties of the substances in relation to each other, that the component groups are added and mixed into the mass at different points in times or at different positions in the transport path of the mass in order to achieve a desired reaction pattern between the components in the mixture by which the consistency of the concrete mass can be regulated/adjusted by the mass becoming harsher, primarily by reducing the slump of the concrete, thereby reducing or eliminating the effect of wetting admixtures, especially super plasticisers.

2. A method in accordance with claim 1, c h a r a c t e r i z e d i n that one component is added to the mass before it is transported, e.g. through a pipe/hose system, while the other component is added to the mass at the moment of casting.

3. A method in accordance with claim 1, c h a r a c t e r i z e d i n that there as one of the components are used substances chosen from water-soluble, synthetic and natural organic polymers of cellulose (ether) derivatives, including metylcellulose (MC), carboxymethyl-cellulose (CMC), hydroxyethylcellulose (HEC), methyl and hydroxypropylmethylcellulose (HPMC), polyvinylalcohol,

polyethyleneoxide, polyacrylamides, alginates and derivates of these, etc., in that substances from the above-mentioned groups can be combined as components.

4. A method in accordance with claim 1, c h a r a c t e r i z e d i n that there as the other component are used substances chosen from recognized water-reducing, dispergant and super wetting admixtures which are recognized in their use for cement, mortar and concrete, including, e.g., lignin derivatives, sulphonated condensation derivatives between melamine, naphthalene and formalin, and/or retarders based on carboxylic acid derivates, phospates, etc.

5. A method in accordance with claims 1-4, c h a r a c t e r i z e d i n that there as concrete mass is used a dry mass in which one component is introduced and mixed with water in a continuous stream through a flow mixer or a ready-mixed mass is used, e.g. pre-mixed concrete, but in such a way that both components are added at the casting site, but at different points in the process.

6. A method in accordance with claims 1-4, c h a r a c t e r i z e d i n that the relative proportions of the two components is adjusted in such a way that the consistency of the spray mass (cement mass) can be regulated to the required value.

7. Admixture for use in improvement of the consistency of the cement mass/spray mass which is to be applied to substrates of concrete, steel or other material for repair, reinforcement, protection, sealing against water or other purposes, c h a r a c t e r i z e d i n that the admixture is composed of a two-component agent in the form of a flocculant and/or coagulator or an association compound, in that the components are composed of substances chosen from those detailed in claim 3 together with substances chosen from those detailed in claim 4.

8. Admixture in accordance with claim 5, c h a r a c t e r i z e d i n that the two-component agent consists of Polyox, polyethyleneoxide, preferably the high-viscosity varieties thereof and Lomar D, sodium naphthalenesulphonate.

9. Application of an admixture in accordance with claim (7) or (8) for the improvement of the consistency of a concrete, plaster or mortar mass.

10. Application of an admixture according to claim (7) or (8) for the improvement of the consistency of a plaster or filling spray mass without cement.

AMENDED CLAIMS

[received by the International Bureau on 25 May 1992 (25.05.92); original claims 1 - 10 replaced by amended claims 1 - 6 (3 pages)]

1. A method for blending of admixtures in a concrete mass which is transported to a casting site and in which the mass shall have a consistency which is suitable for casting of the mass on substrates of concrete, steel or other material for repair, reinforcement, protection, sealing against water or other purposes, said admixtures which may react with each other and possibly may be added in combination with normally used additional admixtures for the mass, such as accelerators, fibre, etc., and that substances can be used with advantage as components chosen from recognized admixtures for cement, mortar and concrete, c h a r a c t e r i z e d i n that the admixtures are divided into two groups of components which are selected on basis of the reaction properties of the substances in relation to each other,
that the component groups are added and mixed at random into the mass, at different points in times or at different positions in the transport path of the mass so that the reaction between the components in the mixture will regulate/adjust the consistency of the mass for changing its harchness, primarily by changing the slump of the concrete, the effect of the plasticising admixtures, especially super plasticising agents are neutralized by combining the component groups,
using in one of the component group substances chosen from known per se, water-reducing, dispergant and super plasticising admixtures which are recognized in their use for cement, mortar and concrete, including, e.g., lignin derivatives, sulphonated condensation derivatives between melamine, naphthalene and formalin, and/or retarders based on carboxylic acid derivates, phospates, etc., and
in the other component group substances chosen from water-soluble, synthetic and natural organic polymers of cellulose (ether) derivatives, including metylcellulose (MC), carboxymethylcellulose (CMC), hydroxyethylcellulose (HEC), methyl and hydroxypropylmethylcellulose (HPMC), polyvinylalcohol, polyethyleneoxide, polyacrylamides, alginates

and derivates of these, etc., and that substances from the above-mentioned groups can be combined as components within the groups and/or between the groups thereby reducing or eliminating the effect of plasticising admixtures, especially super plasticisers.

2. A method in accordance with claim 1, c h a r a c t e r i z e d i n that one component is added to the mass before it is transported, e.g. through a pipe/hose system, while the other component is added to the mass at the moment of casting.

3. A method in accordance with claim 1, c h a r a c t e r i z e d i n that there as concrete mass is used a dry mass in which one component is introduced and mixed with water, for instance in a continuous stream through a flow mixer or a ready-mixed mass is used, e.g. pre-mixed concrete, but in such a way that both components are added at the casting site, but at different points in the process.

4. A method in accordance with claim 1, c h a r a c t e r i z e d i n that the relative proportions of the two components is adjusted in such a way that the consistency of the spray mass (cement mass) can be regulated to the required value.

5. Admixture for use in the method according to claim 1, for improvement of the consistency of the cement mass/spray mass which is to be applied to substrates of concrete, steel or other material for repair, reinforcement, protection, sealing against water or other purposes, c h a r a c t e r i z e d i n that the admixture is composed of a two-component agent in the form of a flocculant and/or coagulator or a reaction product, which is independent of the cement reaction.

6. Admixture in accordance with claim 5,

characterized in that the two-component agent consists of a polyethyleneoxide such as "Polyox", preferably the high-viscosity varieties thereof and a naphthalenesulphonate, such as "Lomar D".

INTERNATIONAL SEARCH REPORT

International Application No PCT/NO 91/00160

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: B 28 C 5/00 // B 28 C 5/06, C 04 B 24/16, 24/24
E 04 F 21/12, E 04 G 21/04

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	B 28 C; C 04 B; E 04 F; E 04 G

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	SE, B, 411 724 B (SANDELL) 4 February 1980, see page 4, line 16 - line 29 --	1,2,5,6
X	SE, B, 422427 (B SANDELL) 8 March 1982, see page 5, line 17 - line 30 --	1,2,5,6
X	NO, B, 150851 (B SANDELL) 17 September 1984, see figure 1, detail 11, 12 and 13 --	1
X	GB, A, 2020722 (YASURO ITO ET AL) 21 November 1979, see claims 1-15 --	1,2,5,6
X	GB, A, 2221673 (SANDOZ LTD.) 14 February 1990, see page 16; claim 1 --	3,4,7-10

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
20th March 1992	1992 -03- 23
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Vilho Juvonen

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/NO 91/00160

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 28/02/92
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