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(54) Process for the preparation of manufactured products based on hydraulic binders.

(57) Manufactured articles are prepared, based on hydraulic binders, having a fibrilled polymeric reinforcement, by distributing dry powdery binder on one or more superimposed fibrilled films, and by then sprinkling the surface of the resulting assembly with water with simultaneous or successive application of vibratory motion, and by finally compressing the whole thus obtained.

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# "PROCESS FOR THE PREPARATION OF MANUFACTURED PRODUCTS BASED ON HYDRAULIC BINDERS"

The present invention relates to a process for the preparation of manufactured products based on hydraulic binders, provided with a reinforcement of a fibrilled synthetic polymeric material.

It is known from Spanish patent No. 460,292 to prepare manufactured articles by superimposing a plurality of fibrilled film layers, in the form of an open net, in layers of an aqueous mixture or paste of hydraulic binder.

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According to such a method there are generally used water/hydraulic binder mixtures in a weight ratio of 15:100 to 50:100, and before the drying of the manufactured product it is necessary to carry out one or more extractions under vacuum of the excess water, which extractions also contribute to the diffusion of the binder inside the net-like reinforcement layers. This method requires the use of preparation, mixing, pumping, distributing and mixture dosing equipment, and involves the difficulties connected with the hazards

of clogging because of premature hardening of the hydraulic binder in suspension, and also involves drawbacks due to the need to provide ducts with a high flow rate for feeding and recovering the used water.

The present invention provides a process for preparing a manufactured product based on a hydraulic binder and containing a reinforcement of fibrilled film of synthetic polymeric material, characterized by comprising:

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(a) distributing a hydraulic binder in the form of a dry powder on at least one fibrilled film arranged as an open net, or on a plurality of such fibrilled films, superimposed on each other;

(b) applying vibratory motion to the said film or films, thereby promoting penetration of the powdery binder between the meshes of the net;

(c) distributing water uniformly over the surface of the assembly of film or films and binder powder thus obtained;

(d) applying vibratory motion to the assembly of film or films, water and binder, to obtain a homogeneous mixture of the water and the binder inside the net formed by the film or films; and

(e) compressing the whole assembly thus obtained.

The above mentioned drawbacks of the process according to Spanish patent No. 460,292 may be eliminated or at least mitigated by means of the process of the present invention, according to which there is first carried out a dry mixing between the layer or layers of fibrilled film and the hydraulic binding powder, followed by the inhibition or soaking with water of the two solid phases, in

a quantity sufficient for obtaining a composite manufactured product.

The operations (a) and (b) may be carried out simultaneously; operations (c) and (d) may likewise be carried out simultaneously.

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Before the compression operation (e), the assembly thus obtained by operation (d) or by the combination of operations (c) and (d) may be subjected to a treatment under vacuum in order to eliminate any possible excess of water.

A series of operations (a) to (d) may be repeated on the non-compressed product obtained from a preceding series of operations (a) to (d), until there is obtained a manufactured product, for example a plate, of the required thickness, the compression operation (e) being subsequently applied to obtain the finished or end product. In such a case, the vacuum treatment may be carried out at the end of each series of operations (a) to (d), or before the final compression operation (e).

The fibrilled films usable in the present invention may be made of any orientable synthetic polymer, and may be prepared according to various different techniques, the most important of which comprises fissuring or splitting a mono-oriented film by means of heated reliefs, points or blades, and by stretching the film thus obtained crosswise, thus conferring to it a net-like structure.

Such methods are for example described in U.S. patent No.3,137,746 and in British patent Nos. 1,073,741, 1,083,847 and 1,481,520.

In order to facilitate the adhesion of the fibrilled film to the binder incorporated therein , the film may also incorporate a suitable filler, such as a zirconium compound, a diatomite, or a cement mix, as described in Italian patent application Nos. 26463/79 and 26861/79.

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Convenient methods for achieving the stretching of the open-net-like fibrilled film, as well as for obtaining composite net-like structures of a plurality of super-imposed fibrilled films, usable in the present invention, are described in European patent application No. 80102722.8.

All known hydraulic binders, such as Portland cements, aluminous cements, hydraulic limes, and chalk, may be used in the process of the present invention.

One advantage of the process according to the present invention, in comparison with the preparation from aqueous mixes of binders, is that of using only the quantity of water necessary for the development of the hydration of the binder, or a quantity only slightly greater, and consequently a considerable reduction in the installation costs and the energy consumption of the process may be achieved.

The number of superimposed fibrilled films, used in one distribution of the hydraulic binder according to operation (a), is preferably from 2 to 100.

The quantity by weight of fibrilled film utilized is preferably from 2% to 7.5% by weight of the weight of the hydraulic binder, considered in the dry state. The quantity of the water added in the operation (c) is

preferably from 12% to 30% by weight based on the weight of the binder in the dry state.

The invention will be further described with reference to the following illustrative Examples.

## 5 EXAMPLE 1

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A mono-oriented polypropylene film, 60 microns thick, was fibrilled by passing it over a pin-roller device of the type described in British patent No. 1,073,741, and by then opening it to form a net-like structure by a cross-wise stretching equal to about 12 times the original width of the film.

Thereupon there were superimposed one over the other 15 such net-like structures, arranged with their reticular axes parallel to each other, thereby obtaining a package weighing about 96 g/m $^2$ , and sized 50 x 50 cm.

This package was then placed into a suitable mold and strewn with Portland cement powder by means of a powder-dispenser which, according to known techniques, spread uniformly over the whole 50x50 cm plane a quantity of 650 g of cement, while simultaneously carrying out a slight vibratory motion to promote easy penetration by the cement powder into the package

Subsequently, the net uniformly dispersed with the cement was sprinkled uniformly by means of a set of drizzling nozzles with 130 cc of water, corresponding to a water/cement ratio of 23%.

The same operations were repeated using 4 other packages, each one consisting of 15 nets, maintaining the

same cement to water ratios, and finally obtaining an assembly of 15 x 4 = 60 layers of fibrilled nets mixed with 650 x 4 = 2600 g of cement and 130 x 4 = 520 cc of water.

The water was additioned with a cement super-fluidizer (Melment 10 of SKW in a 20% concentration) in a ratio of 13 g per 130 cc of water.

The assembly thus obtained was subjected to lateral vibrations by means of mechanical vibrators, and to a downward compacting action with a compacting blade connected to a vibrator, according to known techniques in the field of cement processing.

Subsequently the assembly was subjected to a vacuum of 200 mmHg for about 1 minute, thereby extracting 200 cc of water; the impregnated plate formed was thereupon removed from the mold, compressed at a pressure of 45 kg/sq.cm and finally allowed to age and harden for 28 days.

The flexural strength of the obtained hardened plate, about 6 cm thick, was then measured, according to the UNI 3948 method, thereby obtaining unitary flexural strength values equal to 348 kg/sq.cm lengthwise (or in the direction of the fissuring of the fibrilled film), and equal to 115 kg/cm<sup>2</sup> crosswise.

### EXAMPLE 2

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Into a mold, sized 50 x 50 cm, fitted with vibrators for longitudinal and transversal motion, and provided with filtering means on the underside, there was placed a

package of nets obtained by opening a fibrilled polypropylene film of the same characteristics as those of the film used in the preceding example 1.

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The package was formed by a total of 40 nets, arranged in groups or batches of 10 nets with their main reticular axes, derived from the fibrillation, at 90° to each other, so as to impart to the cement plate to be prepared a mechanical isotropy.

The package was then dispersed uniformly with 1730 g of dry Portland cement powder as in the preceding example; the mold was then subjected to a slight vibration in order to facilitate penetration of the cement into the meshes of the nets.

Thereupon the nets were sprinkled with 350 g of atomized water additioned with 35 g of Melment 10, while simultaneously maintaining the slight vibration.

The mold was then subjected to a vacuum of about 200 mmHg for about 1 minute, removing thereby about 100 cc of water and thus reducing the excess water contained in the net-cement mass to about 13% of the cement.

The plate was then compressed under a pressure of 45 kg/sq.cm and was then allowed to age and harden for 28 days. The flexural strength at break of the hardened plate, about 4 mm thick, was then measured and found to be equal to 338 kg/sq.cm in one direction and to 345 kg/sq.cm in the orthogonal direction.

## CLAIMS:

- 1. A process for preparing a manufactured product based on a hydraulic binder and containing a reinforcement of fibrilled film of synthetic polymeric material, characterized by comprising:
  - (a) distributing a hydraulic binder in the form of a dry powder on at least one fibrilled film arranged as an open net, or on a plurality of such fibrilled films superimposed on each other;
  - (b) applying vibratory motion to the said film or films, thereby promoting penetration of the powdery binder between the meshes of the net;
  - (c) distributing water uniformly over the surface of the assembly of film or films and binder powder thus obtained;
  - (d) applying vibratory motion to the assembly of film or films, water and binder, to obtain a homogeneous mixture of the water and the binder inside the net formed by the film or films; and
  - (e) compressing the whole assembly thus obtained.
- 2. A process as claimed in claim 1, characterized in that the plurality of superimposed fibrilled films comprises from 2 to 100 films.
- 3. A process as claimed in claim 1 or 2, characterized in that the fibrilled film or films comprise from 2% to 7.5% by weight of the weight of the hydraulic binder in the dry state.

- 4. A process as claimed in any of claims 1 to 3, characterized in that the water is added in an amount of 12 to 30% by weight based on the weight of the binder in the dry state.
- 5. A process as claimed in any of claims 1 to 4, characterized in that at the end of the operation (d) there is carried out a vacuum treatment for the removal of any excess water.