106. COMPOSITIONS, COATING OR PLASTIC.

Examiner

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WILBUR S. RANDEL, OF FARNAMS, MASSACHUSETTS, ASSIGNOR TO UNITED STATES GYPSUM COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

MODEL PLASTER

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This invention relates to cementitious materials, and has reference more particularly to cementitious materials made of high strength calcined gypsum and suitable for use in the making of models.

In the use of die sinking machines in the automobile industry, it is a practice to cast models of fenders and other parts which are to be reproduced in steel dies by die sinking machines. In these models, it is essential that accurate reproduction of dimensions be secured in the steel die. It is also desirable to have the model plaster used for making the model set within an hour after the model is cast and to have a sufficient strength so that it can be handled without breaking, and a sufficient hardness so that the feeler of the die sinking machine will leave no impression as it travels over the model, thus insuring accuracy in reproduction of dimensions of the steel die. In the casting of very large models, the necessity for an extremely low expansion is apparent when it is considered that an expansion of 0.15%, the normal expansion of ordinary molding plaster, is in a 5 foot length equivalent to $\frac{3}{32}$" lineal dimensional change. Models 5 feet in length are quite common.

An object of this invention, therefore, is to provide a molding plaster for the making of large models, which will be quick setting and will have sufficient strength to be readily handled, and have sufficient hardness so that the feeler of a die sinking machine will leave no impression as it travels over the model.

Another object of the invention is to provide a model plaster which will have a very low expansion on setting, thus insuring accurate dimensions of the steel die; also to improve cementitious materials in other respects hereinafter specified and claimed.

In the copending application of Randel and Daily, Serial No. 384,343, filed August 9, 1929, and entitled, "High strength calcined gypsum," a new, high strength calcined gypsum is described, together with its method of manufacture. This high strength calcined gypsum has unique properties in that its compressive and tensile strengths equal or exceed that of Portland cement, whereas its setting time is approximately that of ordinary plaster of Paris, viz., 15 to 30 minutes. The compressive strength of this product will range from 2,500 to 6,000 pounds per square inch and it has a pouring consistency of less than 50 cc's. This high strength calcined gypsum which I shall in the future designate as alpha gypsum, is manufactured by treating lumps of gypsum rock, having a diameter of ½" to 2", in a closed container with steam at 17 to 20 pounds gauge pressure. Steam at 15 to 50 pounds pressure may be used, but outside of the preferred range of 17–20 pounds gauge, the strength and quality of the resulting product diminishes. This steam calcination is carried on for 5 to 7 hours with a constant steam pressure, and with a constant withdrawal of water of condensation obtained from the heating steam and also from the expelled water of crystallization. After calcination, the product is dried while maintaining at a temperature under 400° F. and the product is ground so that 86% or more of same passes through a 100 mesh screen.

The crystals of ordinary first settle, calcined stucco as seen under crossed nicols in a petrographic microscope, are seen to be very fine and needle-like, these crystals being mostly less than 5 microns in diameter. The crystals of the improved alpha gypsum, under the same microscope and at the same time magnification, appear rather short, thick and well formed. The crystals of alpha gypsum are practically pure calcium sulphate hemihydrate, and under the crossed nicols of this microscope, they appear brilliantly colored, while little or no color is visible in the case of the tiny, needle-like crystals of ordinary plaster of Paris.

The present invention deals more particularly with a composition containing this alpha gypsum, together with a substantial proportion of Portland cement to reduce the expansion of the composition upon setting to substantially zero. An alpha gypsum—Portland cement composition consisting of 65 parts alpha gypsum and 35 parts Portland cement has a setting expansion of 0.03% to 0.05%. The following table gives the prop-

erties of straight alpha gypsum, Keenes cement, ordinary molding plaster, a mixture of 65 parts of molding plaster and 35 parts of Portland cement, and a mixture of 65 parts of alpha gypsum and 35 parts of Portland cement:

Properties	Alpha gypsum	65 alpha gypsum, 35 Portland cement	65 molding plaster, 35 Portland cement	Keenes cement	Molding plaster
Consistency	40 cc.	42	63	40	63
Compressive strength (#/sq. in.)	5800	4600	1350	4500	2500
Dry density (#/cu. ft.)	94	94	70	105	70
Expansion (per cent)	.25	.03	.06	.1	.15
Hardness	90	70	18	100	23
Setting time (minutes)	:30	:30	:30	2:00–24:00	:30

In comparing these materials, it will be noted that only one mixture, the molding plaster-Portland cement mixture, has an expansion comparable to that of the alpha gypsum-Portland cement composition although still twice as great. This molding plaster-Portland cement mixture has one desirable property of quick setting, but has two very undesirable features, viz., low strength and poor hardness. The alpha gypsum has satisfactory strength, hardness and set, but its expansion is much too high. The Keenes cement has satisfactory strength and hardness, but the expansion is rather high and the set is quite long,—Keenes cement casts, in general, not being usable until the day following the casting operation. Straight molding plaster has a quick set, rather high expansion and low strength and hardness.

The amount of Portland cement used in the composition is dependent upon the expansion characteristics desired. The expansion of neat alpha gypsum is about 0.25%. The expansion is progressively decreased by increasing amounts of Portland cement, until a minimum expansion of about 0.02 to 0.03 is reached at 50% Portland cement. Proportions of cement above 50% cause a progressive weakening of the cast. It is desirable, therefore, to use a minimum amount of Portland cement consistent with obtaining the desirable low expansion so that maximum strength and hardness, due to the alpha gypsum constituent, are obtained. One composition consisting of 65% alpha gypsum and 35% Portland cement has been found to work out very well in practice. On a test bar 4 feet in length, the expansion of this mix is so slight that it is hardly measurable with a steel rule, being to the extent of 1/64″ or less. In comparison, ordinary molding plaster cast in a 4 foot test bar shows a very discernible expansion which measures about $\frac{3}{32}$″ in total by the steel rule. The percentage of alpha gypsum may range from 50–80 and Portland cement from 50–20. Other types of hydraulic cement may be substituted for Portland cement, but a white Portland cement is preferred.

I would state in conclusion that while the illustrated examples constitute a practical embodiment of my invention, I do not wish to limit myself precisely to these details, since manifestly, the same may be considerably varied without departing from the spirit of the invention as defined in the appended claim.

Having thus described my invention, I claim as new and desire to secure by Letters Patent:

A molding plaster composition comprising 50–80% alpha gypsum and an amount of Portland cement sufficient to control the setting and expansion of said composition when mixed with water.

WILBUR S. RANDEL.