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GYPSUM BOARD

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1 Claim. (Cl. 106—34)

Our present invention relates to a composite board of gypsum and fibrous material, without paper covers and produced under pressure as a dense homogeneous product.

The principal object of the invention is to produce a commercial board having maximum strength and rigidity throughout without reliance being had upon paper covers or liners, which will have a modulus of rupture, (breaking strength) exceeding any of the commercial wall or plaster boards in which gypsum is incorporated, which will meet the standard fire test procedure of the American Engineering Standards Association for gypsum wall board, which will be readily adapted to receive either ornamentation such as paint and decorative paper, or wall plaster as desired, and which may be economically manufactured as a commercial product.

In the gypsum board art as commercially practiced, it is usual to produce boards of two types, namely, wall board and plaster board. Both are usually composed of a core of gypsum either with or without a filler such as sawdust or wood chips, and having each side covered with paper of some sort by rolling, molding or the like.

Ordinarily the term "wall board" indicates a gypsum product having sized paper covers of a heavy grade, bonded thereto while the gypsum is wet, which will take a paint coating or receive wall paper. The term "plaster board" usually indicates a product having the same type of core but with unsized paper covers, so that gypsum plaster may be applied to the paper and form a bond therewith. The bond between such paper covers and gypsum core is not entirely satisfactory as conditions of temperature and humidity at the time of manufacture, at the time of application of the plaster, and also the characteristics of the paper, are factors which affect the bond. In instances where a plaster ceiling which has been applied to a plaster board falls, it is due to a weakening of the bond between the gypsum core and its paper cover.

Due to the different characteristics of the paper covers, necessarily chosen because either paint or plaster is intended to be applied thereto, boards embodying paper covers are not capable of both uses. Hence a manufacturer must be prepared to furnish both types of board, many times for the same job. Inasmuch as the paper covers represent from 25% to 50% of the total board cost and 10% of its weight, the production of a gypsum board product which would eliminate the necessity for the use thereof would represent a real advance in the art. It is, therefore, one of the principal objects of this invention to produce a board without paper covers, capable of universal use wherever the present wall or plaster board has been specified.

Another inherent disadvantage of paper covered boards is that both types rely upon the paper covers to contribute 90% of the requisite strength, as the gypsum core is, in and of itself relatively weak. This is true whether the gypsum is used without admixture or whether there is incorporated such materials as sawdust, wood chips, starchy matter and the like, due either to the nature of the material itself or to the process of manufacture. This inherent weakness of the plaster core manifests itself first at edges and corners when the board is subjected to the usual abuse incident to shipping and installation. This breakage and damage occurs to such an extent that the expedient of reinforcing the edges with other and stronger material, or carrying the cover sheets over or into the edge has been resorted to. All of these attempts to strengthen the board edges obviously add to the manufacturing costs and they have not been fully satisfactory in the production of a board of the gypsum type which is rigid and strong throughout, and particularly at the edges.

One of the serious defects of ordinary paper covered gypsum board of the usual thickness, about ⅜ in., resides in the fact that when subjected to the standard fire test procedure of the American Engineering Standards Association, it will transmit sufficient heat through to the other side to ignite the paper cover of that side. The board of this invention inasmuch as it does not have paper surfaces, is not subject to the same criticism.

We have developed a board which has none of the above defects, but has many decided and unexpected advantages.

The present invention contemplates in its preferred form a composite homogeneous board without paper covers, formed by mixing calcined gypsum with from 15% to 40% of organic fibers, calculated on a dry basis, and the requisite amount of water, subjecting the wet mix to pressure up to 1,000 lbs. per sq. in. until the excess water has been removed and the gypsum is set, and then drying the thus produced board. In some instances it may be found desirable to add to the wet mix up to 3% of some long fiber such as sisal, cotton threads, or the like for the sole purpose of mechanically tying the board together should it become broken. The product of this

invention will weigh approximately 1,750 to 2,250 lbs. per thousand square feet when produced in thicknesses of substantially 3/8" and have a modulus of rupture between 850 and 1,750 lbs. per sq. in.

As a convenient method of preparing the board of this invention, we prefer to use fibers of an organic nature of which old newsprint is an example. This stock may be, and preferably is, subjected to a beating operation in water, such as is usually followed in the paper industry. The purpose of the beating operation is simply to disintegrate the paper and separate the fibers thereof so that they may be uniformly and expeditiously distributed throughout the mix without undue segregation and to produce a substantially homogeneous product. When wet beating is resorted to for disintegration, we prefer to use approximately 14 lbs. of newsprint to 300 lbs. of water; this proportion, however, may vary with varying mechanical equipment, the operation being continued until complete disintegration takes place. Obviously, the paper or other stock may be disintegrated in the dry state when desired and subsequently mixed with substantially the same proportions of water and gypsum, the important point being simply to thoroughly separate the fibers.

The plaster mix preferably consists of calcined gypsum with from 15% to 40% of fibers as above described, calculated on the dry weight of the gypsum, 30% being a highly desirable content, thoroughly incorporated therewith and distributed therethru, together with the requisite amount of water. To this mix may be added an accelerator or retarder as found necessary. This slurry may then be placed in any desired mold or machine where it is subjected to pressure up to 1,000 lbs. per square inch in such a manner and over such a length of time that the major portion of the excess water, that is, the water over and above that necessary for the crystallization of the gypsum, may drain or be squeezed therefrom. The length of time that the slurry is subjected to pressure should be such that the gypsum will not set until the excess water has drained. This period may be regulated, of course, by manipulation of the pressure means or judicious use of a retarder or accelerator.

At the time that the gypsum sets, it has been found that there is present in the board about 30% to 35% of moisture which must be removed by drying. This may be done in and by the usual and ordinary apparatus and methods.

In some instances it has been found desirable to incorporate with the wet mix and before compression, up to 3% of long fibers, such as sisal, cotton threads, or the like, the remaining operations being as above described.

We have found that many desirable characteristics are inherent in a board as above prepared over and above any commercial boards of which we are aware. The board as above prepared, substantially 3/8" in thickness, has a modulus of rupture from 850 to 1,750 lbs. per square inch. A board of the same thickness prepared from gypsum with or without a 5% filler of sawdust or wood chips and having paper covers has a modulus of rupture of from 455 lbs. per square inch to 720 lbs. per square inch when tested with the grain of the paper covers and of from 853 lbs. per square inch to 1,440 lbs. per square inch when subjected to test across the grain. All of the above tests are according to the standard specifications for gypsum boards of the American Society for Testing Materials. It is to be noted that the ordinary plaster boards have two different moduli due to the fact that the paper covers have a decided grain. Inasmuch as there are no paper covers on the board of this invention, the same modulus of rupture exists in all directions, which is extremely important, in that the strength of the board is uniform.

From the above, it will be seen that we have produced a board essentially of gypsum which exceeds in strength those heretofore used where paper liners or covers were relied on for the major part of the board strength. As the board of this invention is dense, composite and homogeneous throughout and of equal strength in all directions, no reinforcements are required at the edges or corners.

Our improved board weighs from 1,750 to 2,250 lbs. per thousand square feet, which is substantially the same as the ordinary paper covered gypsum board.

An important consideration in the manufacturing cost of gypsum boards is the drying step. The usual practice is to mix with the gypsum about 80% of its weight of water. This is necessary in order to get a mix or slurry of the proper consistency to permit it to flow when rolled upon or between the paper covers. As calcined gypsum (calcium sulphate hemihydrate) in the process of crystallization can only take up about 15%, the remaining 85% of the water added in the usual board must be driven off through the paper covering by supplied heat. This procedure is only accomplished with some difficulty, as the more or less impervious paper covers offer considerable resistance to such evaporation. Obviously a board having no covers, such as that of this invention, may be dried quicker and with less difficulty than is experienced with a paper covered board, and consequentially entails an appreciable saving in this step of the manufacturing operation.

Due to the fact that the surface of the board of this invention contains a material amount of exposed gypsum, it will readily form an excellent bond with gypsum plaster. The compressed nature of the product likewise forms a smooth and even surface so that paint or other decorative material may be applied thereto. This board, therefore, is capable of universal use in contradistinction to the previously used wall and plaster board of commerce.

It may be found desirable during the compression operation to form recesses or keys on the surface of the board to serve as a mechanical bond where a cement or lime plaster or stucco is to be applied.

The board of this invention may be produced in single sheets or as an endless sheet or web in a continuous operation, and cut to length as desired.

While the invention has been described with reference to a specific composition and proportions and certain definite characteristics have been attributed to this product, yet we do not wish to be strictly limited thereto as the invention is directed broadly to a gypsum board without paper covers, having an organic fiber incorporated therewith, produced under pressure and having characteristics which are of extreme importance to the art. The invention, therefore, is to be construed broadly and is to be restricted only by the scope of the claim appended hereto.

We claim:—

An article of manufacture comprising a compressed board having an exposed gypsum surface and consisting of gypsum and 15% to 40% newspaper fibers, formed under a compression up to 1,000 lbs. per square inch, having a modulus of rupture between 850 and 1,750 lbs. per square inch and weighing from 1,750 to 2,250 lbs. per thousand square feet when 3/8" in thickness.

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