LIGHTWEIGHT GYPSUM PANEL

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10 Claims

ABSTRACT OF THE DISCLOSURE

Gypsum wallboard in which about half the volume of the core consists of very lightweight particles formed by tearing foamed polystyrene beads into a shredded form.

This invention relates to a lightweight gypsum wallboard having a substantial portion of lightweight aggregate consisting of shredded polystyrene beads. Several types of lightweight aggregate have been tried, some successfully and some unsuccessfully, in forming the core of gypsum wallboard. The most common means for providing a lower density of the set gypsum core involves the use of a soap to produce a foam which results in a multitude of voids throughout the core. Various problems have presented themselves with regard to the use of various lightweight aggregates. There are practical limits to how low the density can be for any aggregate, without effectively destroying the integrity of the aggregate. Inability of some aggregates to adhere to the gypsum matrix can result in inadequate core integrity. Cost of an aggregate can outweigh its advantages.

It is an object of the present invention to provide an improved lightweight gypsum board. It is a further object to provide a novel core formulation of set gypsum and lightweight aggregate.

Briefly, the present invention provides a lightweight gypsum board having an aggregate formed by shredding low density polystyrene beads.

These and other objects and advantages of the invention will be more readily apparent when considered in relation to the preferred embodiments as set forth in the specification and shown in the drawings in which:

FIG. 1 is a perspective view of a paper covered gypsum wallboard embodying the present invention.

FIG. 2 is an enlarged view of a portion of the gypsum wallboard of FIG. 1.

FIG. 3 is an elevational view illustrating, in enlarged form, particles of low density shredded plastic foam aggregate.

Referring to FIG. 1 there is shown a gypsum wallboard 10 consisting of a core 12 enclosed with a face paper 14, which extends across the wallboard face 16 and completely around each edge 18, and a back paper 20 which extends almost across the wallboard back 22. Face paper 14 has edges 24 extending onto the wallboard back 22. Edges 26 of back paper 20 overlap the edges 24 of face paper 14.

Each wallboard edge 18 is of tapered form for use in drywall construction with well known joint-concealing systems; however, the invention is suited for wallboards having a square edge, beveled edge or round edge.

Wallboard 10 is preferably made on well known continuous machines for producing gypsum wallboard of all kinds, wherein face paper 14, in continuous form, is disposed on a continuous conveyor, a water slurry of the settable gypsum core material is disposed on the face paper, back paper 20, in continuous form, is applied on the slurry, the edges 24 of the face paper are folded up and over the edges 26 of the back paper, the settable gypsum core material hardens, the continuous hardened board is cut into desired lengths and the boards 10 are dried.

The paper may be of the type commonly employed for gypsum boards, such as relatively high quality cream face paper for face paper 14 and a greyback grade of paper for back paper 20. These papers are commonly made on a cylinder type paper-making machine wherein about six to ten plies are combined to form a unitary paper sheet of about .020 inch thickness. The creamface type paper differs from the greyback in that the top ply or top two plies of creamface consist of a lighter colored pulp stock, forming a cream-colored outer surface on the wallboard face 16.

FIG. 2 is an enlarged view of the end of wallboard 10, showing the combination in the core 12 of shredded plastic foam fragments 30, and a continuous matrix therebetween of set gypsum 32. The composition of the core of wallboard 10, containing these very lightweight fragments 30, produces a very lightweight wallboard.

EXAMPLE I

A formulation of core 12 that has been found highly advantageous in accordance with the invention, based on 1000 sq. ft. of 1/2 inch wallboard, is as follows:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Lbs.</th>
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<tbody>
<tr>
<td>Settable gypsum</td>
<td>946</td>
</tr>
<tr>
<td>Water of rehydration</td>
<td>123</td>
</tr>
<tr>
<td>Starch</td>
<td>9.33</td>
</tr>
<tr>
<td>Pulp</td>
<td>7.2</td>
</tr>
<tr>
<td>Set gypsum Accelerator</td>
<td>12</td>
</tr>
<tr>
<td>Shredded plastic foam</td>
<td>18.3</td>
</tr>
<tr>
<td>Soap</td>
<td>.17</td>
</tr>
</tbody>
</table>

Core weight: 1106.00

Face and back paper: 144.00

Wallboard weight: 1250.00

As is well known in wallboard manufacture, there will also be needed an additional amount of water to provide the desired consistency during forming of the core, which excess water is evaporated off in the drying step.

EXAMPLE II

An even lighter wallboard has been satisfactorily produced with the following core formulation:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Lbs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settable gypsum</td>
<td>915.8</td>
</tr>
<tr>
<td>Water of rehydration</td>
<td>119.1</td>
</tr>
<tr>
<td>Starch</td>
<td>8.93</td>
</tr>
<tr>
<td>Shredded plastic foam</td>
<td>1.8</td>
</tr>
<tr>
<td>Soap</td>
<td>.17</td>
</tr>
</tbody>
</table>

Core weight: 1065.00

Face and back paper: 144.00

Wallboard weight: 1209.00

3.0 lb./cu. ft.

Waste newspaper pulp, a common ingredient in wallboard, has been omitted in Example II. A second difference, essentially unrelated to the omission of the pulp, is the lighter weight, which resulted from a different mixing of the wet ingredients avoiding breaking down as much of the soap-produced foam in the mix. The pulp in Example I may have lessened the stability of the soap-produced foam to some extent.

Although determining variability in accordance with the invention would require endless evaluation, it is con-
3. templated that at least the following ranges of ingredients is possible:

- Settable gypsum: \[ 900 – 1200 \text{ lbs.} \]
- Water of rehydration: \[ \text{As required} \]
- Starch: \[ 0.6 – 14 \text{ lbs.} \]
- Pulp: \[ \text{As required} \]
- Accelerator: \[ 0 – 5 \text{ cu. ft.} \]
- Shredded plastic foam: \[ \text{Up to 35} \text{ cu. ft.} \]

The shredded plastic foam is preferably the product of shredding expanded polystyrene beads. Shredding is to be understood as distinctly different from a severing which produces a clean or smooth surface. It is essential, in accordance with the invention that the shredded plastic foam be small particles which are produced in a way which produces an extremely uneven surface.

One suitable method for producing the critical shredded rough surface is disclosed in U.S. Pat. 3,338,848 to be by a hammer mill, and since the fragmented particles which are described therein are equivalent to the critical shredded plastic foam of the present invention, reference thereto can assist in understanding the present invention.

The expanded polystyrene beads may be ellipsoids with a major diameter of about \( \frac{1}{4} \) to \( \frac{1}{2} \) inch and a density of about \( 0.3 \) to about \( 1.0 \text{ lb. /cu. ft.} \), preferably about \( 0.3 \text{ lb. /cu. ft.} \). After shredding the beads, the density of the shredded material should be about the same as the bead density and the shredded particles will mostly be of a size of about \( \frac{3}{4} \) to \( \frac{1}{4} \) inch.

In FIG. 3, two shredded plastic foam fragments are shown, enlarged, to give an idea of the randomness and roughness of the shape, which permits settable gypsum to form crystals which penetrate the fragments and become firmly bonded thereto, in the setting of the gypsum board core 12.

Wallboards made in accordance with the invention have a central cast gypsum core of unusual strength and integrity, in many respects equal to the characteristics of the present standard gypsum board cores which average about 50% higher weight.

As can be seen in FIG. 2, the surface of the central cast gypsum core conforms smoothly to the paper and has a surface formation which is independent of the shape of the fragments embedded within the cast, or, in this example, the wallboard core.

The formulations of the invention permit ease of manufacture of gypsum wallboard and result in improved drying characteristics, permitting faster drying and less heat requirement relative to standard wallboard. Warehousing and shipping costs are reduced since larger units, of equal weight, can be handled.

Having completed a detailed disclosure of the preferred embodiments of the invention, so that others may practice the same, we contemplate that variations may be made without departing from the essence of the invention.

We claim:

1. The method of making gypsum wallboard comprising the steps of forming lightweight expanded cellular plastic beads having a major diameter of about \( \frac{1}{4} \) to \( \frac{1}{2} \) inch and a density of about \( 0.3 \) to 1.0 lb./cu. ft., shredding said beads into lightweight fragments of a size of about \( \frac{3}{4} \) to \( \frac{1}{4} \) inch having highly uneven, rough exterior surfaces, mixing said shredded fragments with an aqueous settable gypsum slurry, placing said slurry between a face paper and a back paper to form a wallboard, the solids content of said slurry comprising a major portion of gypsum binder, and allowing said slurry to set and dry with said fragments embedded within said slurry between said face paper and said back paper, thus resulting in a very lightweight, strong gypsum core.

2. The method of claim 1, wherein said beads are formed of polystyrene.

3. The method of claim 1 wherein said set and dried wallboard has a nominal weight of about 1200 pounds per thousand square feet, per half inch thickness.

4. The method of claim 1 wherein said shredded fragments are about one-half the dry volume of said wallboard.

5. A set gypsum cast containing a lightweight aggregate and a major portion of weight of set gypsum binder, said aggregate consisting of shredded particles of low density cellular plastic, said particles having highly uneven, rough exterior surfaces, said set gypsum forming a substantially continuous binder matrix extending about and into said rough surfaces of said shredded particles, said cast having an exterior surface formation which is substantially independent of the shape of said particles.

6. A set gypsum cast as defined in claim 5, wherein said low density cellular plastic particles are shredded polystyrene beads of about 0.3 to 1.0 lbs. per cu. ft.

7. A lightweight gypsum wallboard having a central core disposed between a face paper and a back paper, said central core consisting of a set gypsum cast as defined in claim 5.

8. A lightweight gypsum wallboard as defined in claim 7 wherein said low density cellular plastic particles are shredded polystyrene beads of about 0.3 to 1.0 lbs. per cu. ft.

9. A lightweight gypsum wallboard as defined in claim 8 wherein said particles are of a size of about \( \frac{3}{4} \) to \( \frac{1}{4} \) inch.

10. A lightweight gypsum wallboard as defined in claim 8 wherein said particles are about half the volume of said central core.

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<th>Inventor</th>
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U.S. Cl. X.R.

260—2.5; 106—116, 156—42; 161—162

MORRIS SUSSMAN, Primary Examiner
Notice of Adverse Decision in Interference

In Interference No. 99,139, involving Patent No. 3,697,366, G. H. Harlock and E. A. Burkard, LIGHTWEIGHT GYPSUM PANEL, final judgment adverse to the patentees was rendered Oct. 29, 1976, as to claim 1.

[Official Gazette February 1, 1977.]