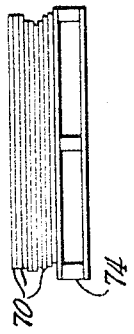
Aug. 19, 1969 R. J. LITTIN 3,462,341

GYPSUM WALLBOARD

Original Filed June 15, 1966



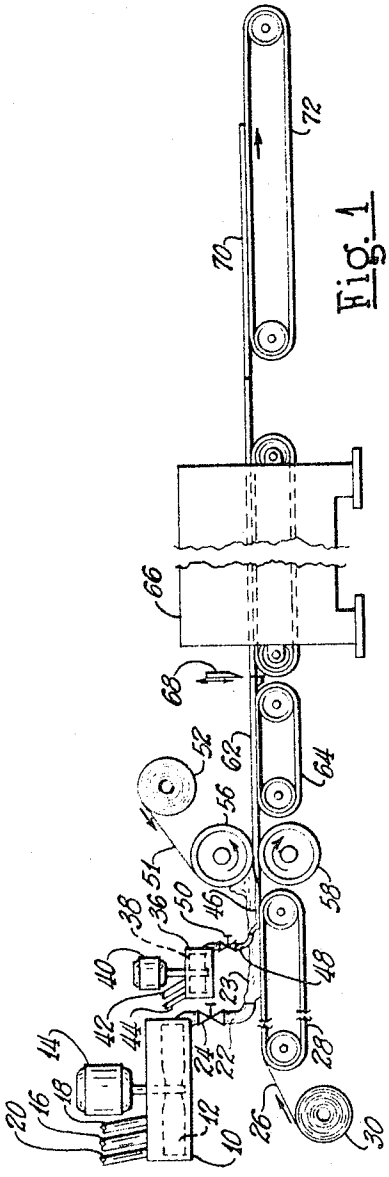


Fig. 1

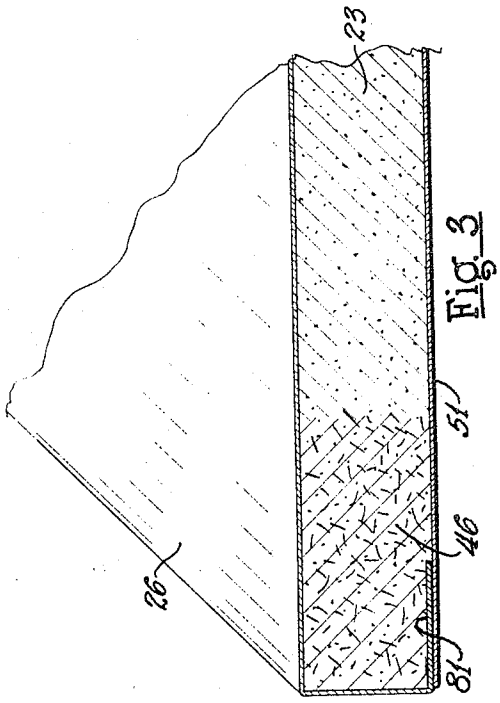


Fig. 3

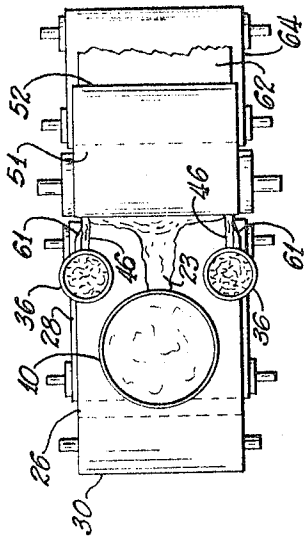


Fig. 2

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GYPSUM WALLBOARD

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Int. Cl. B32b 3/02; E04c 2/04; E04b 5/04
U.S. Cl. 161—149 3 Claims

ABSTRACT OF THE DISCLOSURE

A gypsum wallboard having a fully integrated main body of uniform density with a continuous gypsum content throughout its full area, the longitudinal center section of the body being free of glass fibers and glass fibers derived from cut strands being sparsely dispersed through the longitudinal edge portions of the board, said edge portions being two to five inches wide and having greater rigidity than the center section.

This application is a continuation of copending application Ser. No. 557,781 filed June 15, 1966, now abandoned by the present applicant.

This invention relates to gypsum wallboard of the conventional type having a gypsum core between surfacing sheets of paper and to such boards having improved properties.

With planar dimensions of sixteen by forty-eight inches and in a thickness of three-eighths of an inch, gypsum wallboards are used for lath with a paper covering particularly suitable as a plaster base. For sheathing, the planar dimensions of the boards are usually two by eight feet with a thickness of one-half inch and the boards may then have a water repellent paper covering.

The boards are more generally employed, however, for walls and ceilings as "dry wall" structure in place of wet plastering. They are then four feet wide and eight to sixteen feet long in thicknesses from three-eighths to five-eighths of an inch. For such interior finishing the boards have a facing paper of highly calendered stock suitable for further decoration, a paper scored for tile effect or one imprinted and stained with a wood grain such as knotty pine or walnut.

When installed as wall panels the boards are secured by screws where particularly high quality workmanship is required but are generally fastened in place with nails driven into studding and top and bottom plates. The nails are spaced from six to eight inches apart along the side borders and ends of the boards, but preferably no closer than three-eighths of an inch from the edges of the board. Nails with the same spacing are driven through the board into studding intermediate of the board edges.

Gypsum wallboard is manufactured commercially by processes that are capable of high speed continuous operation. An aqueous slurry of calcined gypsum is continuously deposited on a moving sheet of paper which constitutes the cover for one side of the final product. The deposited slurry is leveled by a roller while a second cover sheet is applied over the top of the slurry. One of the cover sheets is sufficiently wide to be folded over the edges of the composite and under the border of the paper on the opposite face of the composite.

The gypsum forming the core between the opposed sheets is then allowed to set and the composite is cut crosswise to produce boards of the required length.

It is usually desired that the board be of light weight. This may be accomplished by incorporating a pre-generated tenacious foam directly into the gypsum and water slurry at the time that it is initially mixed.

By reducing the thickness of the boards the weight per square foot is correspondingly decreased. However, the thinner boards are more easily damaged from surface blows and the striking of the edges against other objects during storage, shipment and installation. They also have less flexure resistance and are more inclined to warp.

In the manufacture of such lightweight gypsum wallboards the product is subjected to a kiln drying operation in order to remove any residual free water that may be left in the board. This drying sometimes results in a weakening of the board at its edges due to the fact that some dehydration of the gypsum may occur there due to overheating.

A consequential characteristic of certain of the lightweight boards so previously produced is that they have a tendency to be weak adjacent their edge portions. For this and other reasons it has been desirable to add extra strength to these portions of the board if at all possible. Such strengthening tends to prevent the edges of the boards from becoming damaged during rough handling and will also permit such boards to be nailed closer to the edges than might otherwise be permissible.

One process proposed for strengthening the edges of the boards involves depositing a separate gypsum slurry along each edge of the main slurry stream of which the board is formed. These outer streams are composed of a gypsum slurry to which a hardening agent such as a gummy colloid has been added. The product resulting from such a process is not always entirely satisfactory, however, because the edges have a high sensitivity to water. Also the process is not adaptable to economical high speed operations.

Another proposed method for protecting the edges of gypsum wallboard calls for the deposit of an unfoamed slurry along the edges of the main foamed slurry stream prior to the time that the second cover sheet is applied in the final forming operation of the board machine. The unfoamed slurry at the edges is relatively dense and is alleged to protect the wallboard against accidental marginal breakage.

The objection to the product prepared in accordance with this process is that the density of the core adjacent the edge is considerably greater than the center core portion. This variation in densities may cause bowing or ridging when the board is nailed in place. The high density edge core portion also lacks resistance to mechanical shock and has a tendency to shatter when nails are driven through it. Also such boards have a line of weakness at the juncture between the low density central core and the high density edge core.

A prime object of this invention is to provide a gypsum wallboard with edge portions with no greater density than the center section but still having greater resistance to destructive contacts of installation and use and with improved nailing characteristics.

Another object of the invention is the provision of a board with increased tensile strength to oppose severe flexure and warping.

A still further object is to improve the general strength of the boards whereby thinner and less costly boards may be utilized.

An additional object of the invention is to increase the resistance to edge cracking and the propagation of such cracking.

These and other objects and advantages of the invention are attained mainly through the incorporation of fibrous glass elements in the gypsum forming the edge portions of the board.

The objects of the invention and the means of their accomplishment will be more clearly understood with reference to the following description and the accompanying drawings in which:

FIGURE 1 is a diagrammatic side elevation of apparatus for forming boards embodying this invention.

FIGURE 2 is an enlarged plan view of a portion of the apparatus of FIGURE 1; and

FIGURE 3 is a perspective view of an end corner portion of a board embodying this invention.

Referring to the drawings in more detail the apparatus of FIGURES 1 and 2 include a primary mixing tank **10** which has a stirring paddle **12** rotated by motor **14**.

Gypsum in dry powder form is delivered to the mixing tank **10** through supply conduit **16**. Water is brought to the mixing tank through pipe **18** while pipe **20** may be used for a density reducing foaming agent.

Instead of being brought together in the mixing tank, the water and the dry gypsum may be combined prior to their delivery thereto by joining conduit **16** and pipe **18** to a common discharge outlet.

The gypsum mix **23** is discharged from tank **10** through outlet pipe **22** controlled by valve **24** and is laid upon a continuous lower paper covering sheet **26** traveling upon conveyor **28** which is positioned below the mixing tank **10**. The continuous paper sheet **26** is drawn from supply roll **30**.

A pair of supplemental mixing tanks **36** are mounted near the edge portions of conveyor **28** and receive dry gypsum through conduits **42**. Mixing paddles **38** driven by motor **40** stir the gypsum in tanks **36**. Water is delivered to the supplemental tanks **36** through pipes **44**, and additional supply means may be provided for a foaming agent.

Fibrous glass elements are incorporated in the gypsum slurry in tanks **36**. The preferred form of the glass elements are short single filaments thoroughly dispersed in the slurry in random positioning and in an amount constituting between one half and four percent by weight of the finally dried and set gypsum.

The most economical source of such fibres is presently an untwisted roving of strands of continuous glass filaments which are cut into short pieces, preferably in lengths of one half inch by being passed through a chopping device.

The basic filaments are formed by attenuating fine streams of molten glass flowing through orifices of a furnace outlet bushing. A filament diameter of approximately thirty-seven hundred-thousandths of an inch serves quite satisfactorily. However, filaments of a smaller gauge such as twenty-six hundred-thousandths of an inch give better results. A lubricating size is applied to the filaments imediately after their formation. The filaments are then collected, preferably in the number of 51 or less in bundles or strands. These strands are smaller than conventional strands which have between 204 and 408 filaments therein. Some 60 to 120 of such strands are then gathered into a rather loosely integrated untwisted roving and wound into a tubeless package.

From the package the roving is led between a revolving mandrel carrying radial knives and a rubber covered roll of a chopping device. The blades are spaced one half inch apart or whatever distance is required to chop the roving in the lengths desired.

The cut roving from the chopper may be fed to the mixer by a screw type conveyor or alternately added to the dry gypsum or the water and thus carried to the mixers **36**.

The chopping of the roving and the transportation of the cut roving to the mixer initiates a filamentizing action which is carried through to completion in the mixer. The separation of the individual fibers or short filaments and their dispersion through the gypsum slurry should be as complete as possible. A starch size on the filaments appears to be superior to a vinyl size in aiding the filamentizing.

With each of the fibers of the reinforcing surrounded by gypsum the full strength of the fiber will be transferred to the gypsum. Because fibrous reinforcing and particularly siliceous fibers such as glass have such high strength relative to the crystalline structure of the gypsum, the fibers should have a high length to radius ratio; and for those instances wherein the fibers are not longer than approximately one half an inch as herein prescribed, the fibers should preferably be as fine as possible. Because bundles of fibers constitute a great loss of reniforcing potential and because it is imperative that all regions of the gypsum be reinforced, the degree to which the bundles or cut strands of fibers are separated into individual fibers and dispersed throughout the gypsum becomes of the utmost importance.

It will be apparent that the fibers need not be produced in the form of a strand or bundle which is later broken apart, but can be in the form of loose mats of staple fibers. These fibers will have the advantage of not being etirely straight, and may in some instances provide better anchorage in the gypsum. It will further be apparent that various compositions of glass fibers can be used, and that higher melting glasses will be preferable where fire rating is an important factor. Asbestos fibers, and fibers formed of naturally occurring minerals, as for example, those drawn from molten igneous material may be used.

Since the difference in density between glass fibers and gypsum is very slight the small percentage of glass fibers added to the marginal portions of the gypsum boards does not increase the density thereof and thus avoids the density differentiation which has proved objectionable in prior attempts to strengthen the borders of the gypsum boards.

The gypsum **46** with the fiber additive is discharged through conduits **48** from tanks **36** and is deposited upon the edge portions of the paper sheets **26**. The rate of discharge may be controlled by valves **50**.

As may be seen in FIGURE 2 the gypsum mix **23** from tank **10** spreads across the central portion of the paper sheet **26** to form the main body of the board while plaster mix **46** is deposited along the side borders of the paper sheet **26** to form the edge portions of the board.

An upper paper sheet **51** from a supply roll **52** is laid over the combined streams of plaster mix by drum **56**.

Drum **56** works with lower drum **58** in leveling the composite plaster mix and thus fixes the thickness of the board. The spacing of the drums is set with a conventional adjusting mechanism not here shown. The edges of the lower paper sheet **26** are turned upwardly and over the border portions of the composite plaster mix just before the upper paper sheet **51** is laid thereon as indicated at **61** in FIGURE 2. The lower sheet **26** must accordingly be wider than the upper sheet. By applicators which are not shown, glue is placed along the upper side edges of sheet **51** as it passes over drum **56** for adhering it to the turned up and over edges of the lower sheet **26**.

The body of plaster mix incased between the paper covers and as shaped by drums **56** and **58** proceeds as a continuous integrated body **62** upon conveyor **64** from which it is directed through oven **66** where the plaster composition is dried and hardened. A vertically reciprocating knife **68** is stationed at the entrance of the oven for cutting the board into units **70** of selected lengths. From oven **66** the individual boards **70** continue on conveyor **72** from which they may be removed and piled on pallets **74**. A fork truck is then utilized for transferring the boards to inspection and packaging stations.

In FIGURE 3 is illustrated a corner portion of a board produced by the apparatus of FIGURES 1 and 2. The board is shown in reverse position with the paper sheet **26** originally applied to the bottom of the board now at the top, since this is the exposed face of the board when installed as a wall panel. As may be noted, the turned under edge **81** of sheet **26** is covered by the paper sheet **51**.

The gypsum and fiber glass mixture **46** in the edge portion of the board should be in a quantity that extends at least two inches from the border of the board. This

encompasses the area through which fastening screws or nails are usually driven.

Greater resistance to damage is provided however if the reinforced portion is four or five inches wide. Handling stresses are believed to be especially heavy within this region. Such a width of the gypsum and glass mixture is accordingly recommended.

While particular embodiments of this invention have been disclosed for purposes of explanation, it will be understood that variations therein within the spirit of the invention and the scope of the appended claims will occur to those skilled in the art.

I claim:

1. A gypsum wallboard having a completely inorganic main body, said body being fully integrated with a continuous gypsum content throughout its full area, the gypsum in the longitudinal center section of the body being substantially free of glass fibers, and glass fibers being sparsely dispersed through the gypsum in the longitudinal edge portions of the body, said longitudinal edge portions being between two and five inches wide and having greater rigidity but the same density as the center section.

2. A gypsum wallboard according to claim 1 in which the glass fibers dispersed through the gypsum in the longitudinal edge portions of the body amount to between one half and four percent by weight thereof.

3. A gypsum wallboard according to claim 1 in which the glass fibers are between twenty-six and thirty-seven hundred-thousandths of an inch in diameter.

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