April 1, 1969 V. V. DISNEY ET AL 3,435,582

WALLBOARD CONSTRUCTION

Filed March 2, 1966 Sheet 1 of 2

Fig. 1

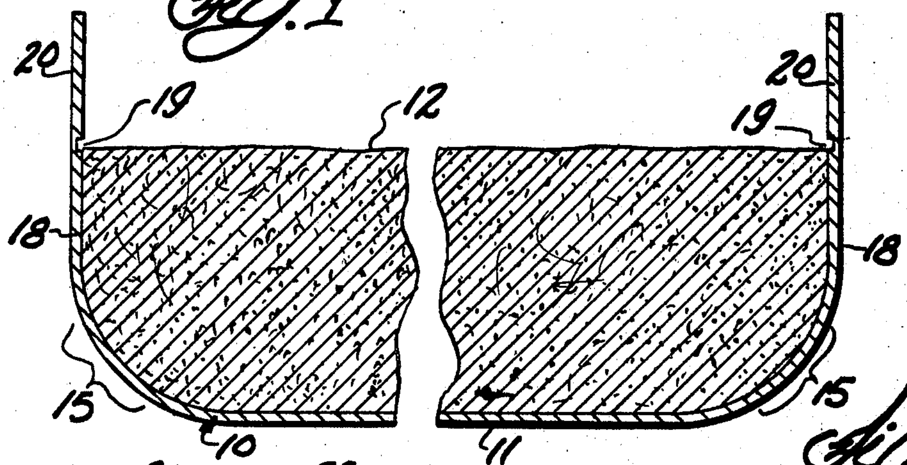


Fig. 2

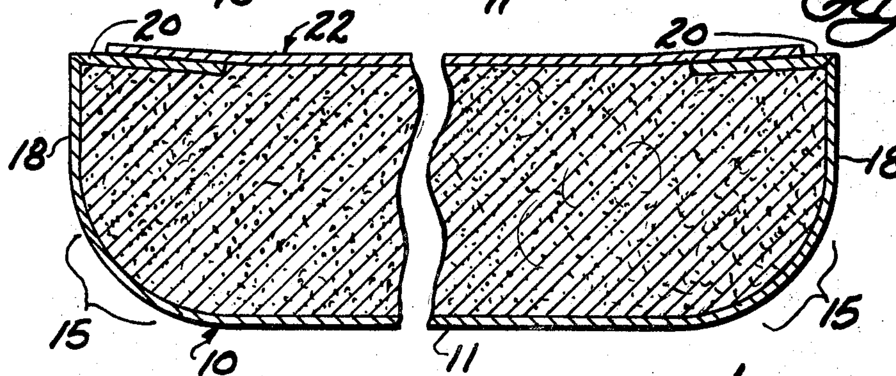


Fig. 3

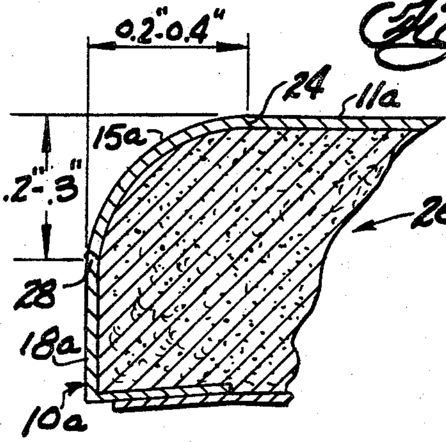
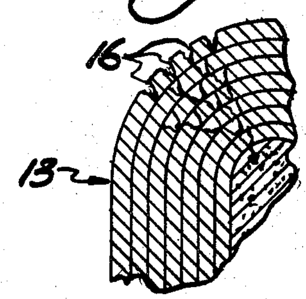


Fig. 4



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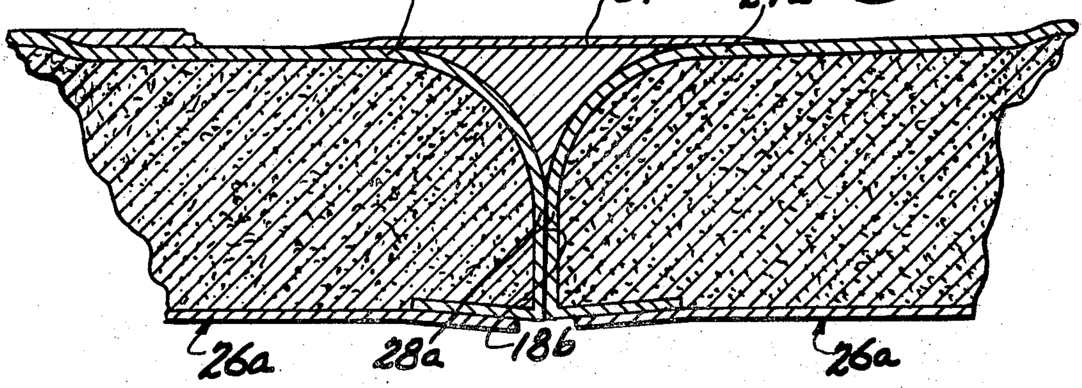

Fig. 5

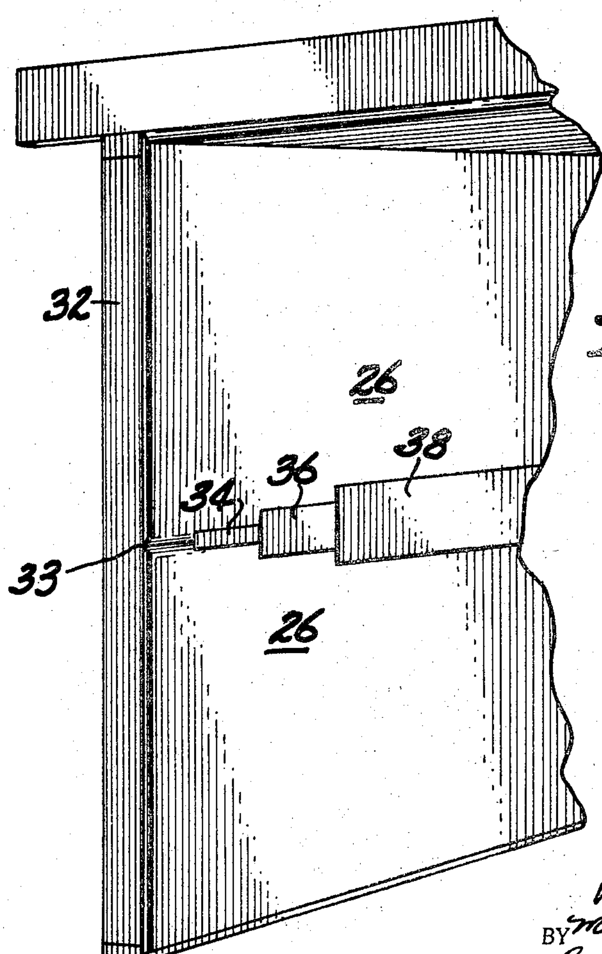

Fig. 6

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WALLBOARD CONSTRUCTION

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U.S. Cl. 52—608 8 Claims

ABSTRACT OF THE DISCLOSURE

A gypsum wallboard construction is provided with a particular board edge construction adapted to obviate the occurrence of a joint deformity known as "ridging." The wallboard has opposed front and rear planar faces, a cellular gypsum core, and a plurality of multiply paper cover sheets conforming and adhering to the core which has been provided with longitudinal edges which comprise one portion adjacent and perpendicular to the rear planar face and another, curvilinear portion adjacent the front planar face to provide a depression for receiving a sealing composition when two panels are joined in edge abutting relationship.

This invention relates to a gypsum wallboard construction, and more particularly pertains to a board edge construction adapted to obviate the occurrence of a joint deformity known as "ridging."

Ridging is one of the most troublesome of the imperfections existing in drywall construction, and may be briefly described as an elongate protuberance which forms along the length of a finished wallboard joint. With the continuous progress which has been made in the quality of drywall constructions, the irregular and unpredictable presence of ridges on otherwise perfectly constructed ceiling and wall surfaces has become more and more of a frustrating problem for which many varied solutions have been suggested.

The protruding ridge deformity, while most noticeable in ceiling constructions, is nevertheless present to the same degree and with the same frequency in sidewalls. However, since the ceiling is ordinarily the largest unbroken surface in the room and the angle of view and light conditions are normally such as to magnify the presence of ridging, it is sometimes mistakenly believed that ridging occurs most often in ceiling constructions.

Upon recognition of ridging in a drywall system, certain time-consuming and costly procedures must be followed to rectify the condition. Prior to attempting repair, the ridge must "run its course" or become fully developed. Upon attaining its maximum size, the ridge is sanded down and refinished. Strong side lighting may be applied to the repaired area to insure that the ridge has been completely removed, and evidence of its previous existence is eliminated.

Although the complete answer to the ridging problem had previously escaped detection, it has long been recognized that high humidity conditions are a concomitant of this deformity. By erecting drywall during dry seasonal periods of the year, and by preventing humid conditions in rooms containting newly-erected drywall through the appropriate use of heat, the ridging problem has been partially solved in the past. However, inasmuch as the continuous maintenance of dry atmospheres is in some instances substantially impossible, ridging under certain changing climatic conditions appeared months after drywall constructions were erected.

In the evolvement of this invention, it has been found that ridging occurs under high humidity conditions when

2

a portion of the paper covering of the drywall edge disposed adjacent the joint surface has been altered through abrasion, scoring or other disturbance. The disturbed areas of the paper constitute hygroscopic focuses at which moisture of the surrounding atmosphere is absorbed with resulting swelling of the paper. The swelling produces forces directed toward the joint surface and ridging of the overlying portions of the joint system where the swelling forces emerge at such surface.

The paper disturbance which creates the affinity for moisture may be occasioned by deformation of the paper effected in the normal course of wallboard manufacture. Mechanical abrasion resulting from rough handling of the boards and flexing or warping movements of the boards after erection, which may be minimized through edge reinforcement, may also create the paper disturbance adequate to provide centers for water absorption.

Many basic edge formations of wallboards possess paper "disturbance" areas disposed adjacent the normal exteriorly-disposed board surface which have an affinity for water. Ridging will occur, therefore, upon subjecting boards possessing such standard edge formations to high-humidity conditions after erection of the boards into a finished surface. Humid conditions may not occur until months after the wall has been erected, thereby causing great consternation to the owner of the wall construction which had appeared to be free of defects for an extended time period after erection.

In accordance with this invention, a wallboard construction is provided in which the board edges are carefully formed to avoid paper disturbance sufficient to produce hygroscopic areas and subsequent sites for ridging in critical edge areas.

It is an object of this invention, therefore, to provide a wallboard construction in which the edge formation thereof has been carefully controlled to obviate the joint deformity known as ridging after such board is erected and incorporated into a finished surface.

It is another object of this invention to provide a wallboard edge construction which possesses an inner planar surface portion normally disposed to the opposed faces of the board to assure a desired abutting relationship between adjacent boards, in combination with a curved edge portion which eliminates paper disturbance and attendant ridging problems.

It is a still further object of this invention to provide a board construction in which curved portions of the longitudinal edges thereof are formed within critical dimensional limits whereby common joint deformities known as ridging and dishing are both avoided.

In a board construction made pursuant to this invention, a gypsum core is partially covered by a paper facing sheet which extends over the core front face normally exteriorly disposed for decoration. The multiply paper sheet which may be, and is commonly, seven-ply extends over the side edges and inwardly over the rear core face short distances from each edge. A multiply backing sheet is adhered to the core back surface and terminates on the facing sheet portions disposed over the opposed edge portions of the core back.

During the board formation, care is taken to form the facing sheet and core molded thereby so that the side edges have planar portions extending at substantially right angles from the rear face of the board. These planar portions are contiguous with curved edge portions which smoothly join the terminal edges of the planar side portions, disposed adjacent the core front face, with planar portions of the core front face spaced inwardly from the board edges. By forming the board core edges and overlying paper in such manner within critical dimensional limits hereinafter disclosed, an abrupt bending and resulting disturbance of the paper adjacent to the normally-exposed board surface, which disturbance is hygroscopic in character, is prevented. The resulting board edge thus assures a stable surface construction which is free from the common joint deformity of ridging. Also, the critical edge dimensions of the provided board limit the extent of the volume of plastic compound which may enter between abutting board edges.

For a more complete understanding of this invention, reference will now be made to the drawings, wherein:

FIGURE 1 is an enlarged, fragmentary transverse sectional view of a paper facing member and plastic gypsum body in an initial stage of wallboard formation;

FIG. 2 is a view similar to FIG. 1 illustrating the completed wallboard instruction with a backing sheet in place;

FIG. 3 is an enlarged, fragmentary sectional view of an edge portion of a wallboard made in accordance with this invention, critical dimensions for the curved portions of the wallboard edge being set forth therein;

FIG. 4 is a fragmentary sectional view, illustrated on a greatly enlarged scale, of a right-angle bend in a wallboard facing sheet in which ridge-causing hygroscopic paper fibers define the bend;

FIG. 5 is an enlarged, fragmentary transverse sectional view of a wallboard joint defined in part by two board edge portions, said boards being made in accordance with the teachings of this invention; and

FIG. 6 is a fragmentary perspective view of a wall construction utilizing wallboards made in accordance with this invention, and illustrating a joint therein in various stages of completion.

The basic process steps and apparatus employed in manufacturing the board hereinafter described in detail are well known, and accordingly, will not be described at great length. The continuous processes presently employed in the manufacture of wallboard having a gypsum core enveloped in multiply paper facing and backing sheets are readily adaptable to the formation of the board construction to be described. The process changes and apparatus alterations necessary to accommodate the novel board edge configuration of this invention will become evident from the following detailed discussion.

Referring now more particularly to FIGS. 1 and 2 of the drawing, two basic stages of board formation are illustrated whereby the wallboard of this invention is formed.

In FIG. 1 a multiply facing sheet **10** is disposed lowermost and has a plastic, gypsum mass **12** spread across the sheet bottom. The mass **12** has incorporated therein the necessary accelerators, starch, fibers, etc. to provide a resulting cellular core of desired physical properties which adheres in the desired manner to the sheet **10** after setting.

In accordance with well-known manufacturing techniques, the sheet **10** may be fed from a supply roll and continuously moved by a supporting conveyor in a direction parallel to the sheet length. In the course of sheet movement, the plastic gypsum mass **12** is deposited on the sheet and spread to evenly distribute the gypsum across the paper width. Bottom planar surface **11** of the sheet **10** illustrated in FIG. 1 is adapted to serve as the normally exteriorly-disposed face of the finished board.

Pursuant to the teachings of this invention, opposed corner portions **15** of the paper longitudinal edges are carefully formed so that there is no abrupt bending or disturbance of the paper. Such a condition will result in hygroscopic fibers being disposed in the board edges adjacent planar face **11**, as illustrated in FIG. 4, which is a greatly enlarged view of a corner of seven-ply manila facing paper **13**, identical to sheet **10**. Facing paper **13** is illustrated in a sharply bent condition which so deforms the paper that ridge-creating lines of disturbance **16** result.

It is believed that such lines **16** are defined by fine paper fiber ends which are hygroscopic in character. These longitudinally-aligned fibers, upon being exposed to a high-humidity atmosphere, swell with the absorption of moisture. If disposed adjacent the exterior planar board face, the swelling is distinctly visible as the joint deformity known as ridging. If two board edges having similar lines of disturbance are in abutting relationship, the two lines may be sufficiently close to provide a single ridge. If the board edges do not meet, and the lines of disturbance are spaced apart a significant distance, parallel ridges will result.

Referring again to FIGS. 1 and 2, as the sheet **10** and mass **12** move forward, conventional forming means fold opposed terminal edge portions **20**, connected to vertical edge portions **18**, inwardly over the rear face of core **12** along score lines **19**. If the score lines **19** are absent, the latter folding operation comprising right-angle bends is obviously abrupt enough to create lines of disturbance such as are illustrated in FIG. 4. However, the score lines **19** defined by hygroscopic fiber ends are disposed sufficiently distant from the finished face of any surface construction in which such board would be utilized that moisture is never able to pentrate to such depth to swell the hygroscopic fibers normally disposed adjacent the supporting framework.

As the plastic mass **12** and facing sheet **10** continue to advance, edge formers, not illustrated, engage opposed bottom edge portions to support and retain the same in the smooth curve-like configuration illustrated. The forming operation is such that there is no abrupt bending or creasing at any stage which could give rise to a line of disturbance and resulting hygroscopic paper fiber ends such as are illustrated in FIG. 4.

A backing sheet **22** is applied to the back of the mass **12** and secured to opposed edge portions **20** of the facing sheet **10** after the folding of said edge portions (see FIG. 2). It is seen from the latter figure that sheet **22** is of lesser width than the mass **12** but of greater width than the interval between the distal ends of the facing sheet portions **20**. The assembly of FIG. 2 may then be passed between vertically spaced rolls arranged transversely to the movement of the conveyor to assist in finalizing the shape of the board. As the formed board continues to move, the core **12** sets and the board is cut into desired lengths and dried in ovens to remove a desired amount of moisture.

The facing sheet **10** is normally of a better grade of paper than backing sheet **22**. At least the outer plies of sheet **10** are formed of manila and the inner plies may be of repulped newsprint. The sheet **22** used to line the rear surface of the board is usually made of a plurality of plies of repulped newsprint. Both surfacing sheets are made on a cylinder machine wherein pulp is picked up on rotating screens whereby a plurality of ply layers may be formed into a laminated sheet as illustrated in FIG. 4. The latter method of forming paper surfacing sheets is well known and does not comprise any part of this invention. However, care should always be exercised during board formation to match the expansion-shrinkage characteristics of the two paper surfacings as closely as possible.

As above pointed out, it has been found that if the edge portions of the paper facing sheet of any wallboard are of appropriate curvature, formation of lines of disturbance adjacent the board front face will be obviated. To assure such a curvature, the curved edge terminus contiguous with the exterior planar surface of the board must be located within a critical dimensional range relative to the adjacent vertical edge portion of the board. Also, the curved edge terminus contiguous with the vertical edge portion of the board must be located within a critical dimensional range relative to the plane of the exterior or front board surface.

In FIG. 3 curved edge terminus **24** comprises the upper end limit of a curved edge portion **15***a* which is within .2–.4 inch of the plane of edge portion **18***a* of board fragment **26** illustrated. The latter critical range limits the width of the valley or recess formed by two abutting curved edge boards **26**. Lower curved edge terminus **28** shown in FIG. 3 is within .2–.3 inch of the main plane of surface **11**_a_ of the board **26**. The term "main plane" relates to the major planar surface portion of the board face which may have a slight hump portion adjacent an edge, raised from the remainder of the face plane and caused by manufacturing techniques, or the face may have some other slight planar surface deviation. The latter dimensional range limits the depth of the valley which is formed by abutting edges of two boards formed in accordance with this invention. The curved edge portion **15**_a_ may be employed with a nontapered or tapered edge board construction such as illustrated in FIG. 5; in either construction, the location of curve terminus **28** (FIG. 3), or **28**_a_ (FIG. 5), is calculated within the above critical range relative to the upper, exteriorly-disposed planar face.

The standard method of erecting wallboards such as above described is well known. The boards are nailed to wooden studs and the joints between the boards are covered with an adhesive cement such, for example, as that disclosed in Ptasienski et al. U.S. Patent No. 3,003,979 in which is embedded a thin paper tape such, for example, as is disclosed in Gill U.S. Patent No. 2,749,267. After the embedding cement has dried, additional coats are applied to provide a smooth, level monolithic wall surface which is ready to be decorated.

In FIG. 6 a wall construction **30** employing boards **26** having curved edges as above described is illustrated in which the boards are arranged in horizontal courses supported on wooden framework **32**. Central longitudinal joint **33** between the board courses is illustrated in various stages of completion. Tape **34** is shown in a bedding coat over which a second coat of adhesive **36** is applied. A wider adhesive coat **38** provides the final coat joining the board courses together with an unbroken surface.

The sectional view of FIG. 5 will aid in understanding the purposes of the dimensional ranges relating to the board curved edge portions above set forth. It is seen from FIG. 5 that if each upper curve end limit **24**_a_ of the boards **26**_a_ is disposed too close to the plane (less than .2 inch) of the vertical board edge portions **18**_b_ of the board in which disposed, too abrupt a curvature in the paper facing sheet will result creating a hygroscopic line of disturbance. Similarly, each lower curve end limit **28**_a_ should not be disposed closer to the exterior main plane of the board than about .2 inch to assure a curvature which obviates ridge formation.

In addition, any line of disturbance disposed at a minimum of .2 inch from the exterior board surface would not have a deleterious effect thereon because of the penetration of the joint system necessary for the moisture to reach the hygroscopic fiber ends. The .2 inch minimum distance between the lower curve end limit and the main plane of the board face is therefore applicable to both the board **26** of FIG. 3 and the tapered edge board **26**_a_ of FIG. 5 in which tapered marginal portions of the board connect the board face and the curve portions of the board edges. The deeper the disposition of the lower end of the curved edge in the joint system, the greater the paper disturbance permissible at its juncture with the vertical edge portion without any deleterious consequence. Thus, in FIG. 3, facing sheet **10**_a_ could be creased and even scored or cut at **28** without danger of a ridge forming from such disturbance.

With respect to the maximum dimensions of the ranges set forth, if the upper curve end limit is disposed greater than .4 inch from the plane of the adjacent board vertical edge portion, the excessively wide cement expanse will "dish" upon the joint cement drying and shrinking, thereby providing a visually noticeable joint deformity.

By providing a maximum depth of .3 inch for the cement in the joint shown in FIG. 6, the maximum cement volume and shrinkage is limited and dishing is obviated. In addition, joint cement usage is maintained at a minimum. Still further, a maximum curve depth assures a vertical board edge portion which must always be present regardless of the board thickness. A vertical edge portion is important to provide a surface-to-surface contact between the boards rather than the line contact obtained if the board edges are completely curved. A surface edge contact such as is illustrated in FIG. 5 renders the resulting surface more stable and minimizes the danger of relative movement occurring between the boards, which is obviously more apt to happen if the abutting boards meet only along a line, or spaced point, contact. Such relative movement, if of sufficient amplitude, would result in lines of paper disturbance and the creation of large numbers of hygroscopic paper fiber ends which might result in a ridge formation.

It has been found that the terminal facing paper edges are also hygroscopic in character. However, since the facing layer terminal ends are normally disposed on the board rear surface, far removed from the exterior surface of the board joint system, there is no danger of a ridge fomation being developed on the board exterior surface of the board joint system, there is no danger of a ridge formation being developed on the board exterior surface. Care should always be taken, therefore, not only to utilize boards having edges free from lines of disturbance adjacent the board face caused by scoring including cutting and paper removal, creasing, folding, and the like, but also to avoid unusual board constructions in which terminal ends of the paper sheets are disposed in proximity to the exterior surface of the board system. A line of disturbance may result from the rupture of merely a single outer ply or a multiply covering paper, and the hygroscopic ability of the terminal ends of all the plies combined is obviously much greater, particularly if positioned to create swelling pressure in the direction of the joint surface.

Although the curved edge portions of the boards illustrated are drawn about a uniform radius, it should be appreciated that any smooth curve free of a line of disturbance and resulting hygroscopic fiber ends within the critical dimensional ranges illustrated would work to advantage.

In view of the foregoing description, it is apparent that the dimensional limitations set forth relative to the curved portion of the board edge are applicable to any thickness board able to utilize the same and still provide a vertical edge portion contiguous with the curved portion. The thickness of the board is immaterial to the ridging problem since it is paper disturbance in the board edges which creates swelling regardless of the board thickness over which disposed.

We claim:

1. A gypsum wallboard characterized by resistance to ridging when applied in coplanar, longitudinal, juxtaposision with a like gypsum board and the joint therebetween is concealed with a paper tape embedded in an adhesive cement, which comprises a cellular gypsum core having a first paper sheet covering and adhered to the front face and longitudinal edges thereof and extending from each of said longitudinal edges a short distance over the rear face and being adhered thereto; the first sheet portions covering said longitudinal edges each comprising a first portion extending from the rear face toward the front face which is perpendicular to the planes of the front and rear faces and a second portion which connects said first portion with the paper portion covering said front face in a smooth curve, the end of said first portion dsiposed closer to said front face being between about .2–.3 inch from the main plane of said front face, the end of said second portion which connects with said front face being located between about .2–.4 inch from the plane of said first portion, said second portion being undisturbed and substantially free of hygroscopic paper fiber ends; and a second paper sheet adhered to the opposed portions of said first paper sheet, which are adhered to the rear face of said core, and to the core rear surface extending between said opposed portions.

2. The wallboard construction of claim **1** in which tapered marginal portions connect said front face and the curved portions of the edges of said wallboard.

3. In a wallboard construction having opposed front and rear planar faces and opposed, parallel, longitudinal edges, a cellular gypsum core; a facing sheet covering the front face of said core, extending over the parallel edges and inwardly extending over the rear face of said core short distances from said parallel edges; said facing sheet conforming to and being in adhering engagement with said core; each of the paper-covered, parallel edges of said board having a planar portion substantially normally disposed to said board planar faces and extending from the rear face of said board; each of said parallel edges having a curved portion, one end of which is connected to the planar edge portion, and the other end of which is connected to said front planar face of said board; the curved edge portions of said facing sheet being undisturbed and free of linearly-arranged hygroscopic fiber ends; said one end of each of said curved edge portions being spaced .2–.3 inch from the main plane of said board front face; said other end of each of the curved edge portions of said board edges being spaced about .2–.4 inch from the plane of the adjacent planar edge portion; and a backing sheet covering the rear face of said core and terminating at opposed longitudinal edges on the inwardly-extending portions of said facing sheet.

4. The wallboard construction of claim **3** in which tapered marginal portions connect said front planar face and the curved portions of the edges of said wallboard.

5. The wallboard construction of claim **3** in which said facing and backing sheets have multiple plies and substantially identical coefficients of expansion.

6. The wallboard construction of claim **3** in which the core curved edge portions and the facing sheet portions disposed thereover are formed on a varying radius of curvature.

7. In a wallboard construction having opposed front and rear planar faces and opposed, parallel, longitudinal edges, a cellular gypsum core and a plurality of multiply paper cover sheets conforming and adhering to said core faces and longitudinal edges; said cover sheets including a single sheet extending over the core front face and both longitudinal edges; each of said wallboard longitudinal edges having a rectilinear surface portion disposed at right angles to the opposed faces of said wallboard and located closer to the wallboard rear face than to said front face; each of said edges also having a curved portion one end of which is connected to said rectilinear surface portion and the other end of which is connected to said front face of said wallboard; said one end being spaced .2–.3 inch from the main plane of the wallboard front face; said other end being spaced .2–.4 inch from the plane of the rectilinear surface portion of the adjacent wallboard edge; the curved edge portions of said single cover sheet being undisturbed and substantially free of hygroscopic paper fiber ends; the longitudinal free edges of said plurality of paper sheets being disposed at least .2 inch from the main plane of the wallboard front face.

8. The wallboard construction of claim **7** in which tapered marginal portions connect said front planar face and the curved portions of the edges of said wallboard.

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U.S. Cl. X.R.

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