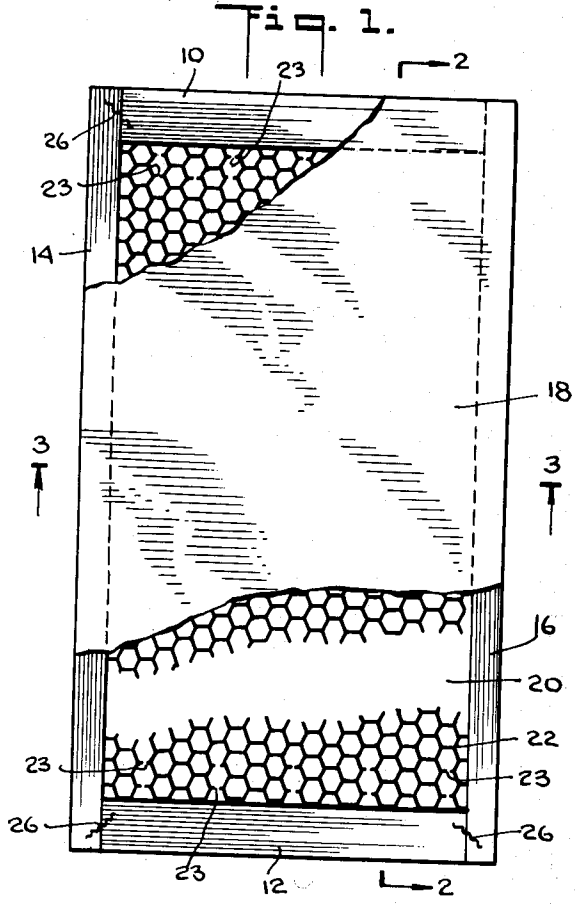
Oct. 4, 1955 J. H. B. HERTS 2,719,809

METHOD OF MAKING HOLLOW PANEL STRUCTURAL UNITS

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Fig. 1.



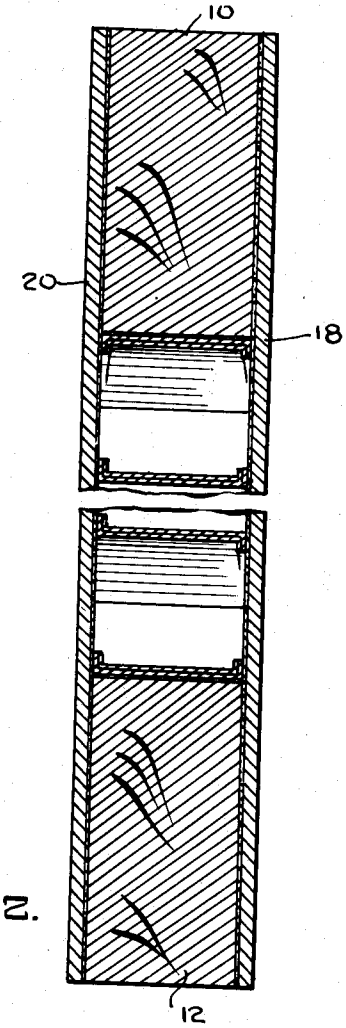


Fig. 2.

Fig. 3.

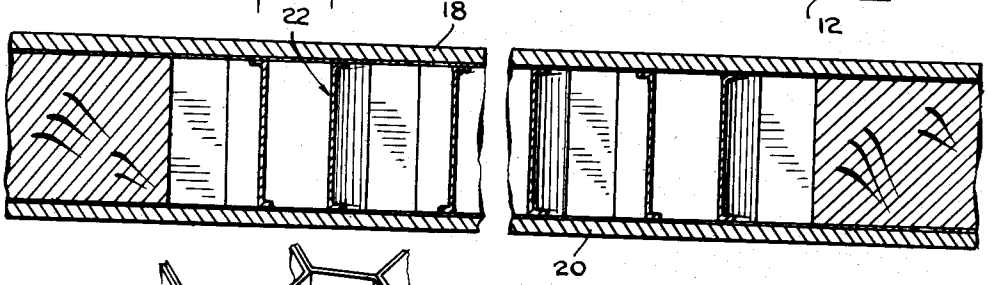
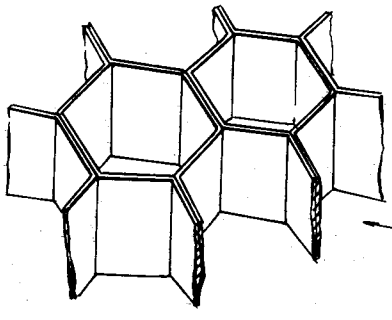


Fig. 4.



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Fig. 7.

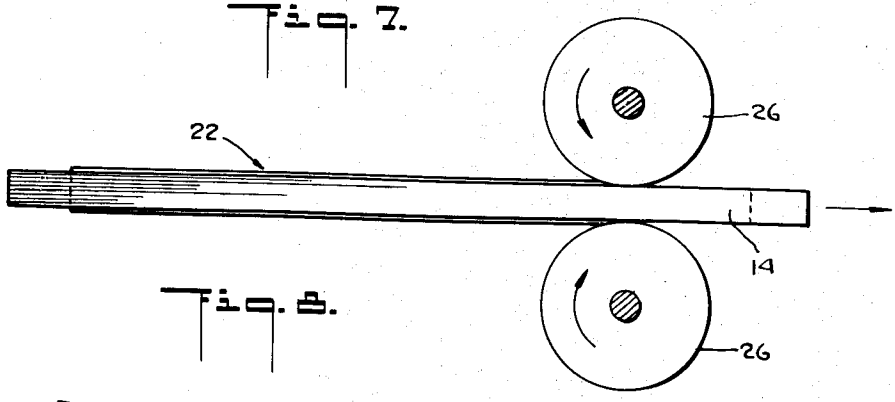


Fig. 8.

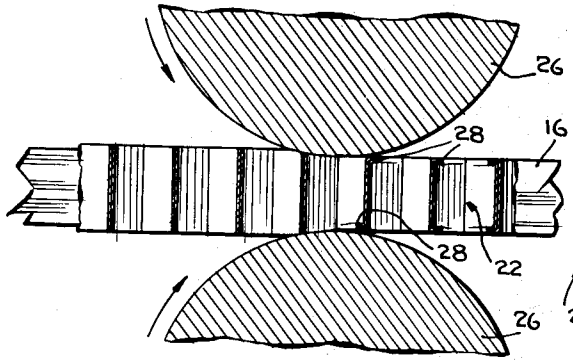


Fig. 5.

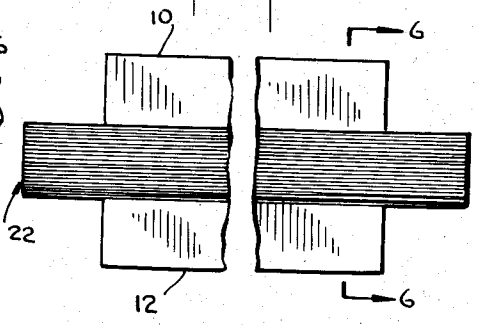


Fig. 9.

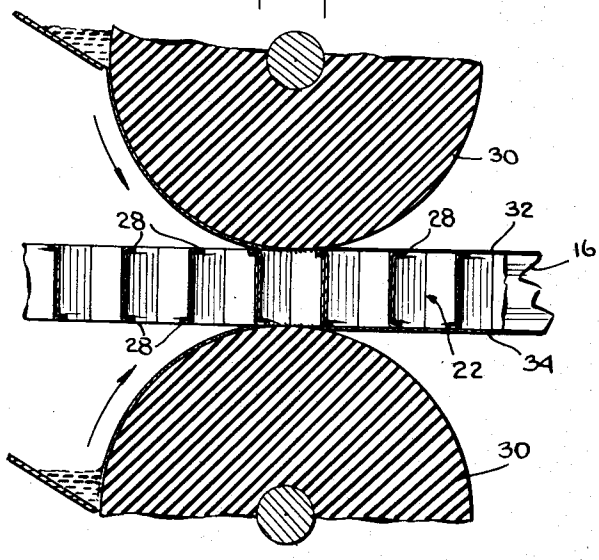
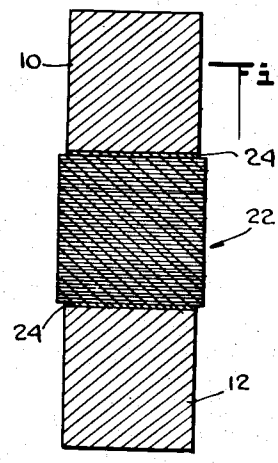


Fig. 6.



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METHOD OF MAKING HOLLOW PANEL STRUCTURAL UNITS

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Application October 14, 1954, Serial No. 462,352

4 Claims. (Cl. 154—118)

This invention relates to hollow panels and is directed particularly to a method of manufacturing hollow panel structural units for use as flush or panel doors, table tops, and the like.

Hollow panels consisting in general of a rectangular frame, usually of wood, to the front and back of which sheets or so-called skins of facing material such as plywood or plyboard are glued, are in general use. In order to give strength to such panels, various web or grid-like constructions of wood lathing and corrugated cardboard or paper are commonly used, these being glued between the facing sheets. In the interest of developing a less expensive hollow panel, however, attempts have been made to utilize a cellular paper strengthening construction glued within the panel and between the facings. Such paper cell panels however, because of difficulties in gluing and for other reasons that will become apparent from the following description, have not heretofore been manufactured in commercial quantities.

My invention accordingly comprises a simple and effective process for the quantity production of panel structure of the character described, utilizing an internal cellular paper construction for strengthening.

In brief, as a principal step in the process according to my invention, the panel framework is fitted with a cellular paper construction the thickness of which is greater than the frame thickness, and is then run flatwise through steel rollers to bend over the top and bottom edges of the cellular paper construction so that they lie flush with the upper and lower (or front and back) planes of the frame.

Among other advantages of the process according to this invention, as will be apparent from the following description, such deformation of the cellular paper edges provides a greatly increased surface area for the application of glue and consequently insures effective and uniform bonding between the cellular paper strengthening insert and the finally applied facing sheets.

It is accordingly the principal object of my invention to provide an improved method for quantity production of panel structures having internal strengthening means of cellular paper construction.

It is another object of this invention to provide a process for the mass production of panel units of the character described, wherein glue is applied directly to the edges of the paper construction and thereby only to the surface areas actually to be glued, rather than to the whole inner surface of the facing sheets, whereby economy is further enhanced.

Another object of this invention is to provide a process for the mass production of panel units of the character described, wherein each panel unit is constructed with planar parallel surfaces to within close tolerances, so that a plurality of panels can be stacked and subjected to compression for drying without danger of faulty internal gluing or twisting due to the accumulation of non-uniformities of thickness or non-parallelism in individual panels.

A further object of this invention is to provide a new and improved method of making accurately planar panel units that are comparatively inexpensive because of the use of paper for internal strengthening, and yet which are comparatively strong.

Still another object is to provide a panel construction of the character described, containing a partial vacuum whereby its sound and heat insulating properties are enhanced.

These and other objects and features of this invention will be apparent from the following specification and from the attached drawings illustrating by way of example the process according to the invention applied to the manufacture of a panel door.

In the drawings:

Fig. 1 illustrates a door according to the invention, portions being broken away to show internal construction;

Fig. 2 is an enlarged view taken along the line **2—2** of Fig. 1, a central section being broken away;

Fig. 3 is an enlarged cross-sectional view taken along the line **3—3** of Fig. 1, a central section and end sections being broken away;

Fig. 4 is a perspective view of a portion of the cellular paper construction used as the strengthening means within the door fabricated in accordance with the method comprising this invention;

Fig. 5 is an elevational view illustrating how the end members of the panel frame are glued to the paper structure while in unextended condition;

Fig. 6 is a vertical cross-sectional view taken along the line **6—6** of Fig. 5;

Fig. 7 illustrates how the panel frame together with its inserted paper strengthening structure is passed through steel rollers in accordance with the invention to turn over and size the edges to frame thickness;

Fig. 8 is an enlarged view in cross-section showing in detail the deformation of the paper edges during passage through the steel rollers; and

Fig. 9 illustrates how glue can be applied to the frame and deformed paper edges just prior to assembly of the facing sheets.

Referring now to the drawings, Fig. 1 illustrates a completed door having upper and lower ends or rails **10** and **12**, side frame members or stiles **14** and **16**, and front and back facing sheets **18** and **20**, respectively. According to the invention, the interior strengthening structure for the door comprises a paper cellular construction indicated generally by the number **22**. As is well known, such a paper structure consists of a plurality of side by side paper strips so glued together so that when the structure, called a "slice" in the trade, is sufficiently extended, hexagonal cells are developed, as best seen in Fig. 4. As illustrated in Figs. 5 and 6 the panel is fabricated by first gluing the upper and lower rails **10** and **12** to the upper and lower sides of the paper construction or slice **22** before its extension. The glue is indicated by numeral **24**. Because the paper construction **22** will contract in width after its extension, it is made wider to begin with than the rails **10** and **12**, as shown in Fig. 5. In accordance with the process comprising this invention, moreover, the thickness of the paper construction **22** is somewhat greater than the thickness of the rails **10** and **12** to which it is glued, as illustrated in Fig. 6.

After the glued assembly of the rails **10** and **12** and the paper structure or slice **22** has thoroughly dried, said rails are separated to extend the paper structure so as to assume its cellular configuration.

In order that the paper structure **22** will not remain bunched up at its ends glued to the rails **10** and **12**, because of resistance against contraction in width at these

points, two or three cells of every fourth or fifth row of cells are vertically slit as indicated by the numerals **23**. In this way maximum economy of paper use is obtained and the weight of the finished door is at the same time further reduced.

The rails **10** and **12** are then secured in butt joint fashion between the upper and lower ends of the stiles, as best seen in Fig. 1. The framework thus formed is held together in any conventional manner such as by the use of furniture nails **26**. During the extension of the paper slice **22** its width will have diminished to such an extent that it substantially just fills in the space between the side stiles **14** and **16**.

The next step in the panel construction process is the pressure roller treatment of the completed framework together with its interior cellular paper construction **22**, as illustrated in Figs. 7 and 8. In order to prevent the paper construction **22** from hanging heavily from between the end rails **10** and **12** during subsequent handling, however, it is preferable first to lightly tack the sides of said paper construction against the inside surfaces of the stiles **14** and **16**.

Fig. 7 illustrates a pair of steel rollers **26** spaced from each other at the thickness of the rails **10**, **12** and the stiles **14**, **16**, and driven to rotate as indicated by the arrows. The framework is passed between the rollers **26** as illustrated, whereupon the oversize upper and lower edges of the cellular paper construction **22** are bent over to lie flush with the upper and lower planes of the door frame. It is to be noted that even though the paper construction **22** may be loosely supported in the framework, both upper and lower edges will be deformed to bend over by substantially the same amount during the rolling process for the reason that the top and bottom edges of said paper construction are more readily subject to deformation than its central portion. In other words, the central portion of the thickness of the paper construction is stronger than the outermost top and bottom portions as illustrated in Figs. 7 and 8.

As best illustrated in Fig. 8, the rolling operation bends over the top and bottom portions of the cellular paper construction in a more or less haphazard fashion to provide end surfaces **28** of greatly increased area and substantially flush with the major planes of the frame. These surfaces **28** are capable of holding a sufficient quantity of glue for subsequent gluing to the facing sheets, whereas, by comparison, clean cut edges of the paper itself would be incapable of holding enough glue to insure satisfactory gluing even if it could be placed flush against a facing sheet.

The pressure-rolled framework is next run through a pair of resilient gluing rollers **30**, as illustrated in Fig. 9, whereupon upper and lower layers of glue **32**, **34**, respectively, are applied to the framework construction.

One of the facing sheets, the lower facing sheet **18** for example, is next placed against the lower glued side of the framework construction and the assembled structure is then subjected to heat furnished by a heat radiating appliance or a hot air blower. The remaining facing sheet **20** is then applied while the structure and the air enclosed is hot. The glue, kept tacky by the heating process, is then allowed to dry. Upon cooling, a partial vacuum develops within the door to improve its insulating properties. The drying is preferably done under pressure. Since each panel will have planar surfaces with little deviation from parallelism because of the rolling operation, many assembled panels can be piled for drying together in a single press without danger of warping or other detrimental effects as might be caused by accumulative dimensional deviation in individual panels. Practically one hundred per cent effective bonding between the edges of the paper construction **22** and the inner surfaces of the facing sheets **18**, **20** also results through use of the improved process described herein, to provide an exceptionally strong door of low conductivity. The process, moreover, is extremely economical both in its use of materials and its requirements as to time and labor.

Interior paper constructions **22** made of ordinary kraft paper as thin as .009 inch have been found to be entirely satisfactory for use in the process according to the invention. Inserts made of paper of such thinness would merely crumple if an attempt were made to apply the facing sheets to the framework under pressure without the intermediate rolling steps described herein, whereby the edges are progressively folded over at right angles.

Certain of the subject matter illustrated and described herein is claimed in my copending divisional application for Hollow Panels, Serial No. 528,355, filed August 15, 1955, and assigned to the assignee hereof.

While there has been shown and described herein a particular way in which the method according to the invention can be carried out, it will be understood that various changes and modifications can be made without departing from the invention. The appended claims therefore are meant to cover all such changes and modifications as fall within the true scope and spirit of the invention.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent of the United States is:

1. The method of manufacturing structural panels, comprising fitting into a panel frame a cellular core member which has a greater overall thickness than the frame so as to project from the opposite side surface planes, respectively, of the frame, bending the projecting portions of the core member into flanges which are flush with said surface planes, respectively, and adhesively securing facing sheets to the opposite frame sides and to the core flanges in surface-to-surface relation therewith, whereby each structural panel is constructed with planar parallel surfaces dimensioned to close tolerances.

2. The method of manufacturing structural panels, comprising fitting into a panel frame a cellular paper core member which has a greater overall thickness than the frame so as to project from the opposite side surface planes, respectively, of the frame, passing the fitted frame between pressure rollers to bend the projecting side portions of the core member into the planes of the opposite sides, respectively, of the frame, and adhesively securing facing sheets to the opposite frame sides and to the bent core portions in surface-to-surface relation therewith, whereby each structural panel is constructed with planar parallel surfaces dimensioned to close tolerances.

3. The method of making a panel having a frame in which a cellular core is disposed, comprising providing the cellular core member having the cells thereof defined by peripherally extending walls, forming flanges on the outer side edge portions of said peripheral walls of the core substantially throughout the area of the core at both sides thereof, and adhesively securing facing members to said flanges at the opposite sides, respectively, of the core.

4. The method of making a panel having a frame in which a cellular core is disposed, comprising providing the cellular core member having the cells thereof defined by peripherally extending walls, bending the marginal edge portions of said peripherally extending walls transversely of the direction of the thickness of said core so as to form flanges which are disposed substantially flush with the adjacent sides, respectively, of said panel frame, and adhesively securing panel facing members to said flanges of the core at the opposite sides thereof.

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