Sept. 28, 1954 R. S. FRENCH 2,689,988

CONSTRUCTION PANEL

Filed Dec. 21, 1950

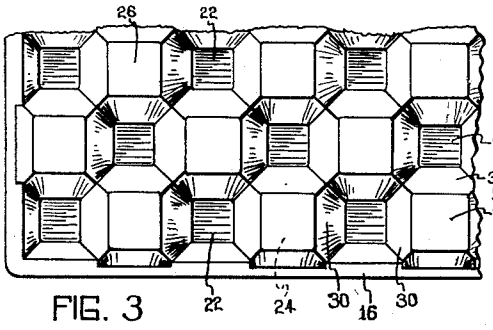


FIG. 3

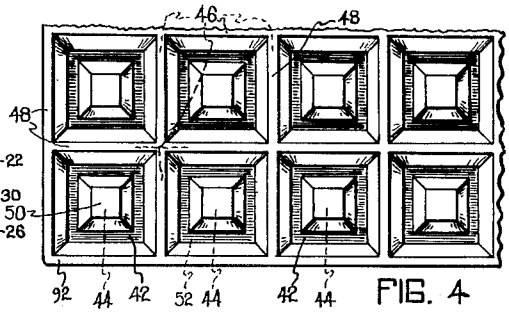


FIG. 4

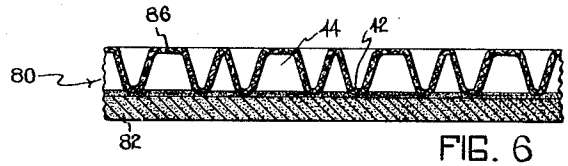


FIG. 6

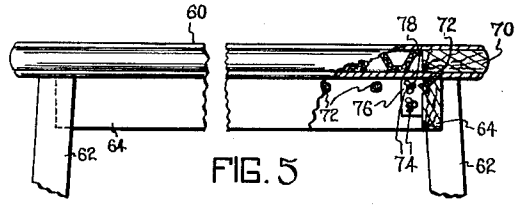


FIG. 5

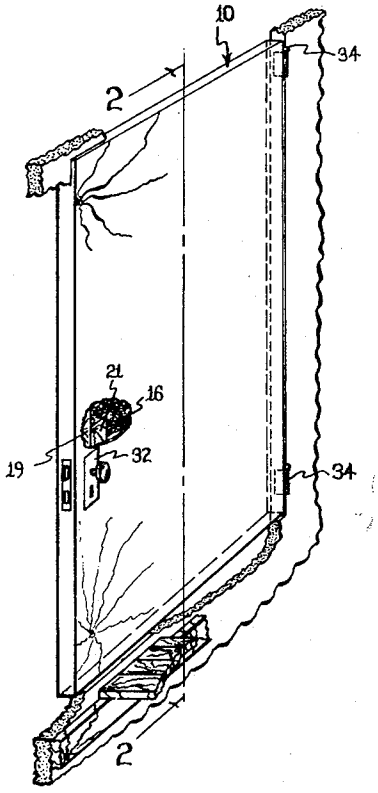


FIG. 1

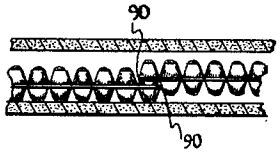


FIG. 7

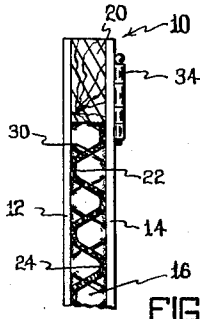


FIG. 2



INVENTOR.
RICHARD S. FRENCH

BY

Arthur G. Connolly

HIS ATTORNEY

Patented Sept. 28, 1954

2,689,988

UNITED STATES PATENT OFFICE

2,689,988

CONSTRUCTION PANEL

Richard S. French, Waterville, Maine, assignor to Keyes Fibre Company, Portland, Maine, a corporation of Maine

Application December 21, 1950, Serial No. 201,933

2 Claims. (Cl. 20—35)

1

The present invention relates to construction panels, and particularly to such panels having a composite structure.

Among the objects of the present invention is the provision of new types of construction panels that are relatively inexpensive to make and yet are highly suited for various types of structures.

Further objects of the present invention include the provision of improved light-weight panels suitable for doors, table tops, wall or ceiling surfaces or the like.

Additional objects of the present invention will be more readily understood from the following description of several of its exemplifications, reference being made to the accompanying drawings wherein:

Fig. 1 is a perspective view of a door embodying a panel construction of the present invention;

Fig. 2 is a sectional view of the door panel of Fig. 1, taken along line 2—2;

Fig. 3 is a plan view of the core sheet in the panel of Figs. 1 and 2, before it is united with the other parts of the panel;

Fig. 4 is a view similar to Fig. 3 of a modified form of core sheet in accordance with the present invention;

Fig. 5 is a partly sectional side view of a table top made from a panel of the present invention;

Fig. 6 is a sectional view of a different form of panel embodying the present invention; and

Fig. 7 is a side view showing a modified panel construction in incompletely assembled form.

It has been discovered that highly suitable construction panels can be provided by cementing between two facing sheets, or to a supporting base sheet, a molded fibrous pulp sheet that has a multiplicity of pockets on both its surfaces generally, but not necessarily, extending substantially its entire depth, each pocket being of limited lateral size and surrounded on all adjacent sides of the sheet by other spaced pockets. Such a core sheet is exceptionally light-weight and inexpensive to make, yet it unexpectedly provides both a very good rigidifying core and an acoustic and thermal insulation that greatly reduces the passage of sound and heat through the panel.

One of the most effective forms of the present invention is a door panel as shown in Figs. 1 and 2 for example. In these figures a door 10 is shown as having a pair of plywood facings 12, 14 cemented together on both sides of cellular core sheet 16. At the side edges of the door, edge inserts 19, 20 are provided to extend from the marginal edges of the core sheet 16 to the

2

door margin. These inserts form a stile and rail door frame assembly. Reenforcement inserts can also be used as indicated at 21, where the frame is to be extensively weakened as by the cutting out of an opening for receiving a mortised latch set 32.

In plan view the core sheet as shown in Fig. 3 resembles somewhat the molded pulp egg crate filler flats. A multiplicity of separate pockets 22, 24 in the sheet extend from the opposite faces substantially completely through the depth of the core sheet, and each pocket is bounded on all adjacent sides of the sheet by other pockets facing in the opposite direction. The blind ends of the pockets provide flat external walls 26 of limited area that form suitable cementing surfaces against which the facings 12, 14 are readily adhered. At the same time generally transversely extending walls 30 which form the sides of pockets 22, 24 extend from one face of the sheet to the other and are approximately flat or straight in transverse section. These walls 30 run in at least two different directions along the sheet and appear to be one of the important rigidifying factors of the construction of the invention.

The core sheet is of any fibrous material capable of being molded from an aqueous suspension, preferably wood pulp. A molding die such as shown in U. S. Patent No. 2,192,937 issued March 12, 1940, to E. L. Shepard, may be used for this purpose. It can be immersed in a slurry of the conventional pulp fibers such as ground wood, chemical and semi-chemical fibers, admixtures of said materials, etc. It is to be understood that glass fibers, hemp, asbestos and the like may also be employed. The fibers, when molded in the above-referred to manner, become interfelted so that the final core sheet is a coherent shape-retaining product after it is dried, and has a structure resembling that of ordinary paper.

While a single core sheet for an entire panel may be used, this is not essential. A plurality of individual small core sheets, which are much more readily manufactured, are more suitable to use particularly where additional reenforced spacers such as mullions or center rails are used as intermediate rigidifying panel supports. A convenient size and shape for the individual core sheets would be a one foot square or a one foot by one and a half foot rectangle, approximately.

In one highly effective form of the invention a door, 32 inches wide by 80 inches high, and 1½ inches thick, is made by cementing two three-sixteenth-inch-thick three-ply plywood sheets to

substantially abutting or interlocking core sheets, each 12 by 12 inches and approximately 1⅛ inches between opposed surfaces, with approximately 1½ inch wide stiles and rails secured between the plywood face pieces. The standard casein type wood glue or the newer type resin adhesives gives the resulting door, which is exceptionally light, an unusually high resistance to deformation. A latch set **32** and hinges **34** are readily mortised into the edge blocks in the regular manner.

Where the latch set is particularly large, an extra support block **21** is needed and can be merely cemented in place along with the facings. With filler sheets having relatively large widths it is advantageous to use two reenforcing blocks each half the width of one sheet, and positioned alongside opposite portions of the respective stiles. This gives greater strength and enables the use of a single size of filler sheet.

Thicker or thinner plywood facings and core sheets are also practicable, and the thickness of the molded pulp walls can likewise be varied if desired. The distance between the walls defining each pocket can vary within wide limits depending upon the ultimate structure which is desired, for example it may vary from about ¼ inch to about 4 inches. It is preferred that these walls be substantially flat and extend through the depth of the sheet from one face to the other at an angle varying from 90° to 45° with respect to the plane of the facings. In general, where additional stiffness is desired, from about 5 to 25% phenolformaldehyde or other types of resin may be incorporated in the core material.

Fig. 4 shows a different form of core sheet construction that is also suitable for use in accordance with the present invention. Here the sheet has a series of central pockets **44** shown in the figure as facing downwardly, each of these pockets being surrounded by upwardly facing pockets **42**. Around these pockets **42** there is in turn a grid work of additional downwardly facing interconnecting pockets or grooves **46**. The tops of the groove-defining walls **48**, and the walls **50** forming the blind end of pockets **44**, provide the upper cementing surface of the sheet, while the outer faces of walls **52** forming the blind end of pockets **42** provide the opposite cementing surface.

The thinner sizes of the core sheets **16** down to thicknesses of about one-fourth inch are suitable for use with wall, ceiling or other construction panels that are not of the self-supporting type. Fig. 5 shows such a panel **60** used as a table top in conjunction with conventional type legs **62**. The legs can be attached to the top in any convenient manner such as by using the conventional attachment skirts **64** extending along the under side of the panel margins and secured to edge blocks **70** as by obliquely directed screws **72** countersunk in the inner surface of the skirts. The legs **62** may have their tops of generally rectangular cross section wedged between the spaced end faces of adjacent skirt **64** as by studs **74** fixed to the legs, projected through holes in the corner wedge **76** and held in place as by nuts **78**. The marginal edges of top **60** can be shaped to provide a more or less artistic appearance as by the rounded configuration shown in the figure.

For increased flexing rigidity where a plurality of small core sheets are used, these sheets can be overlapped so that a row of pockets of the overlapping edge nest in the corresponding row of the overlapped edge, as shown in Fig. 7. Where the core sheet of Fig. 3 is used, the marginal edge

flanges can be trimmed down as shown at **90** so as not to obstruct the nesting. When the assembled panel is pressed together to cure the cement, the nested portions are squeezed together to approximately the face-to-face thickness of the unnested portions. The individual core sheets of Fig. 3 can have an even number of rows of pockets, so that any one edge has a pocket facing one way on one end, and a pocket facing the other way on the other end. However to simplify the nesting, uneven rows of pockets can be used in the sheet length and/or the sheet width. This assures that the rows on opposite ends are of identical shape and nesting is conveniently effected without having to rotate the sheets to match the overlapping edges. To effect this simplification the odd number of pocket rows need only extend in one direction, particularly where the sheets are rectangularly shaped, so that the overlapping edges are more conveniently oriented. The overlapping rows can be positioned transverse or longitudinal with respect to the axis of flexure along which the panel is to show maximum resistance.

Core sheets of the type illustrated in Fig. 4 are more readily overlapped inasmuch as the edge flanges **92** do not interfere with the nesting and all sheet edges terminating in grooves **48** are of identical pattern and will nest. The reenforcing effect of the nested overlap with any type core sheet is improved by cementing together the overlapped portions. However this cementing can be confined to only the projecting sheet face portions without appreciable loss of reenforcing strength, so that no special cement application is required for the overlapped portions.

The construction panel of the invention is also highly suited for walls and ceilings, in which case one of the surface facings can be eliminated. Fig. 6 shows such a typical panel construction **80** in which a base sheet **82** is cemented to a molded pulp sheet **86** shown of the form illustrated in Fig. 4. Here the molded pulp sheet is not relied on so much for rigidity or strength, but for its ability to reduce the transmission of heat and sound. The low transmission appears to be due at least in part to the air cells provided by the pockets. Even the exposed pockets make effective air cells, particularly so when the pocket openings are of the smaller sizes. However the pulp layer itself is a good sound and heat insulator, and its insulation is improved by decreasing its density, as by limiting the pressing it undergoes during manufacture.

The panel **80** can be mounted in place as by nailing or otherwise fastening its marginal edges to wall supporting frameworks, studding or joists, with its base sheet **82** outmost, that is defining the exposed surface of the wall. Alternatively the panel can be mounted with core sheet **86** exposed as for example to make ceiling or acoustic panels. In the interest of improved acoustic absorption the molded sheet **86** can also be of large wall thickness.

The edge framework shown in the door of Figs. 1 and 2 is not needed for fixedly anchored panels unless the panels are intended for use where they are not adequately secured, as for example in large but thin partitions. A feature of the present invention is that the double faced panel makes a highly effective construction for a very thin partition that does not occupy much floor space and is particularly low in sound transmission.

The panel of the invention is not limited to

having facings or bases made of wood, whether laminated or unlaminated. Thus for special purposes a door, table top or wall panel may have a plastic or hard pressboard (Masonite) facing sheet. Alternatively and particularly for wall and ceiling use the facing or base sheet **82** may itself be a more loosely pressed fiber board. Where fireproofness is an important consideration a conventional plaster board facing sheet having a molded plaster layer covered by a cemented paper wrapping is especially effective. The core sheets may also be rendered fireproof, as by incorporating inert fibers or fillers in the wood pulp, or by impregnating it with fire-retardant chemicals such as sulfamic acid and ammonium phosphate. This is particularly desirable where only one facing sheet is used and the core is exposed.

For economy in manufacture, the glue used to adhere the core to the facing can be applied only to those portions of the core surface that engage the facing. This is easily effected as by using a roller type glue applicator, so that only the high areas become coated. The sizing of the pulp or finished sheet is also desirable, when very little or no resin is used, to keep the glue from being absorbed too deeply into the thick core sheet walls.

Substantially any type of resin can be used in place of the phenol-formaldehyde shown in the example. Specifically urea-aldehydes, amine-aldehydes, melamine-aldehydes, amine-phenol-formaldehydes, alkyds, glyptals, shellac, lignin are also effective. Thermosetting resins are preferred. Although only regular pocket patterns are shown in Figs. 3 and 4, the pockets can if desired be irregularly distributed.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope hereof, it is to be understood that the invention is not limited to the specific embodiments hereof except as defined in the appended claims.

What is claimed is:

1. A light-weight door having a pair of structural facing sheets cemented on both sides of a single substantially uninterrupted layer of core sheets molded from aqueous suspension, the layer being at least about ¼ inch thick and bounded by a set of structural rails and stiles at the edges of the sheets, the core sheets being interfelted cellulosic fibers and having a multiplicity of short walls extending from one facing sheet to the other and defining the side walls of pockets facing out from the opposite surfaces of the sheets, said walls being directed at an angle of between 45 and 90 degrees with respect to the facing sheets to stiffen the door against deformation.

2. A flush door having a pair of thin sheet wood faces cemented together in parallel on opposite sides of a single layer of a plurality of pocketed sheets molded from aqueous suspension, encircled by and filling all the space bounded by solid wood rail and stile spacers cemented between the edges of the sheets, said layer being at least about 1⅛ inches thick and the individual sheets being essentially interfelted cellulosic fibers with pocketed side walls extending directly between the wood faces at an angle of between 45 and 90 degrees with respect to these faces.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
784,831	Bird	Mar. 14, 1905
1,855,161	Wyman	Apr. 19, 1932
1,965,265	Spohn	July 3, 1934
2,481,046	Scurlock	Sept. 6, 1949
2,511,620	Clements	June 13, 1950
2,518,164	Meyer	Aug. 8, 1950
2,538,330	Rosenhagen	Jan. 16, 1951

FOREIGN PATENTS

Number	Country	Date
434,420	Great Britain	Aug. 27, 1935
457,428	Great Britain	Nov. 27, 1936
546,397	Great Britain	July 10, 1942

OTHER REFERENCES

Publication entitled "Honeycomb Core Structure," by O. S. Tuttle and W. B. Kennedy, in the Sept. 1946 issue of Modern Plastics.