United States Patent

Geschwender

[15] **3,655,478**

[45] **Apr. 11, 1972**

[54] CELLULAR STRUCTURAL PRODUCTS

[72] Inventor: **Robert C. Geschwender,** 1800 Center Park Road, Lincoln, Nebr. 68512

[22] Filed: **Aug. 10, 1970**

[21] Appl. No.: **62,625**

Related U.S. Application Data

[60] Continuation of Ser. No. 769,165, Oct. 21, 1968, abandoned, which is a division of Ser. No. 671,864, Sept. 29, 1967, Pat. No. 3,587,479.

[52] **U.S. Cl.** **156/202,** 156/197, 156/461, 156/468

[51] **Int. Cl.** **B31f 1/00**

[58] **Field of Search** 156/200, 201, 202, 461, 463, 156/468, 479, 483, 484, 297, 197; 118/212

[56] **References Cited**

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Primary Examiner—Benjamin A. Borchelt
Assistant Examiner—Gregory E. Montone

[57] **ABSTRACT**

A cellular plank is made by continuously pulling a band of cellular material from a supply of the material. As the band is pulled, adhesive is applied to its upper, lower and sidewise faces. It is then directed into a folder which also receives a strip of wrapping material from a supply. Before the wrapping material enters the folder, it is scored along lines which will register with the four corners of the cellular band. The width of the scored strip is equal to the perimeter of an orthogonal cross section of said band. Then as the band and the wrapper pass through the folder, the latter is wrapped about the former so as to be adhered to it by means of the adhesive. After the combined material leaves the folder and the adhesive has set, it is in the form of a wrapped plank which is then cut into appropriate lengths for structural use. A preferred form is that of a block. In some cases several strips are employed for wrapping the blocks but in any event the wrapper covers the top, bottom and two sides of the block leaving the end faces open. The preferred form of cellular material is of the honeycomb type, although it is contemplated that a polyurethane or other like foam material may also be employed.

6 Claims, 11 Drawing Figures

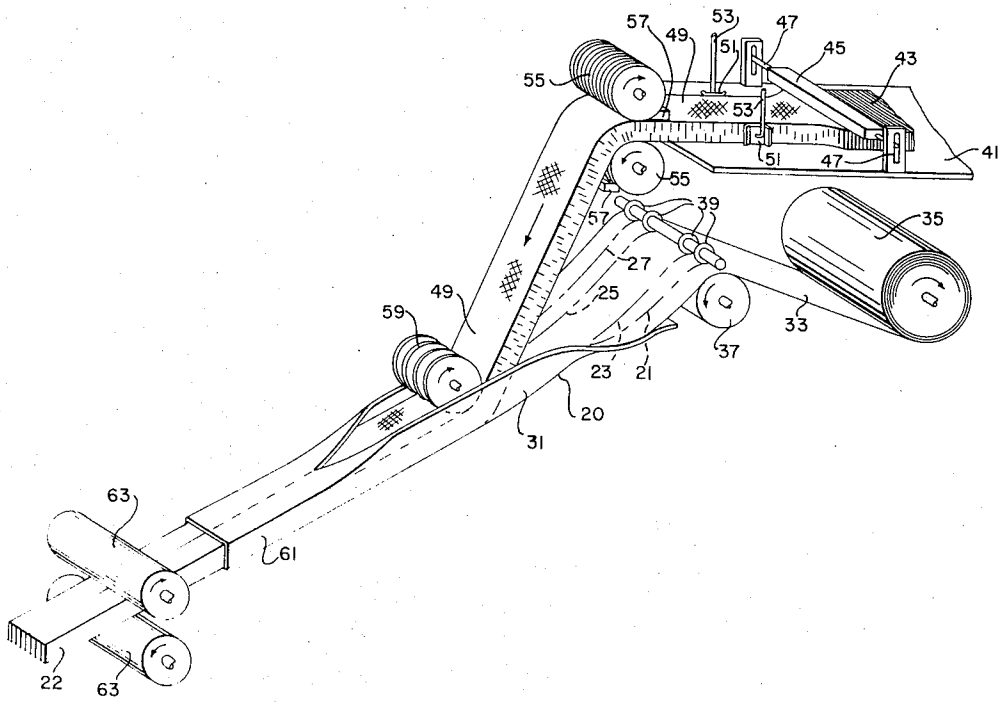


FIG. 1.

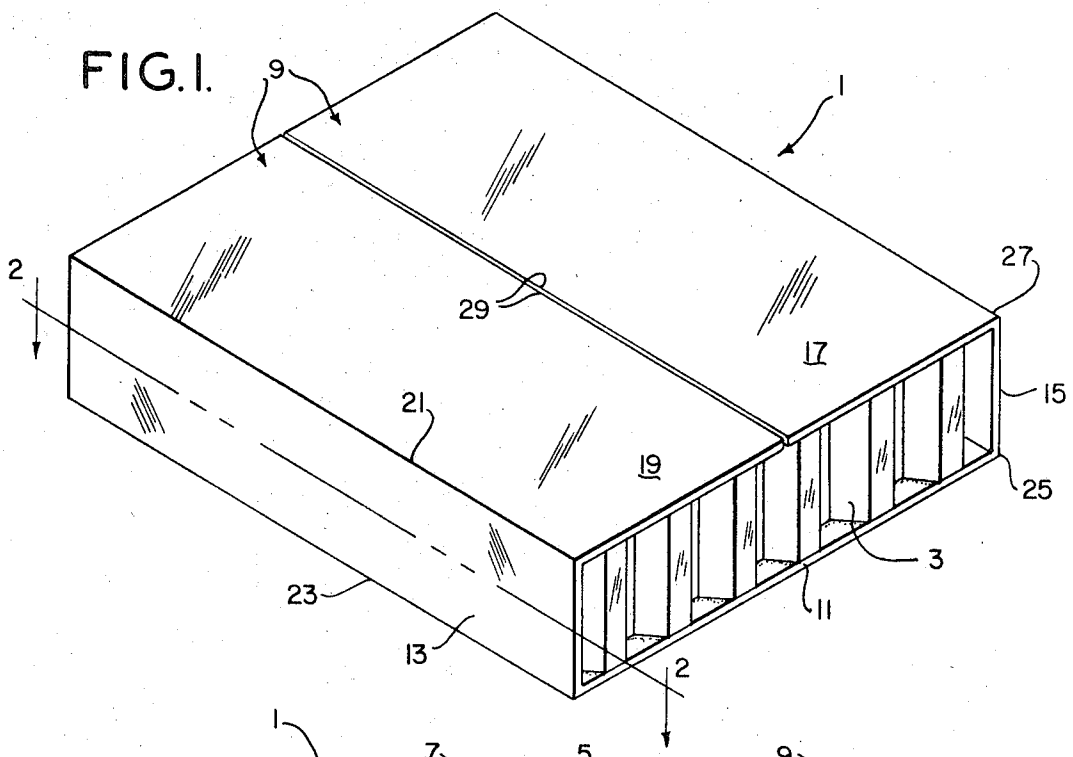
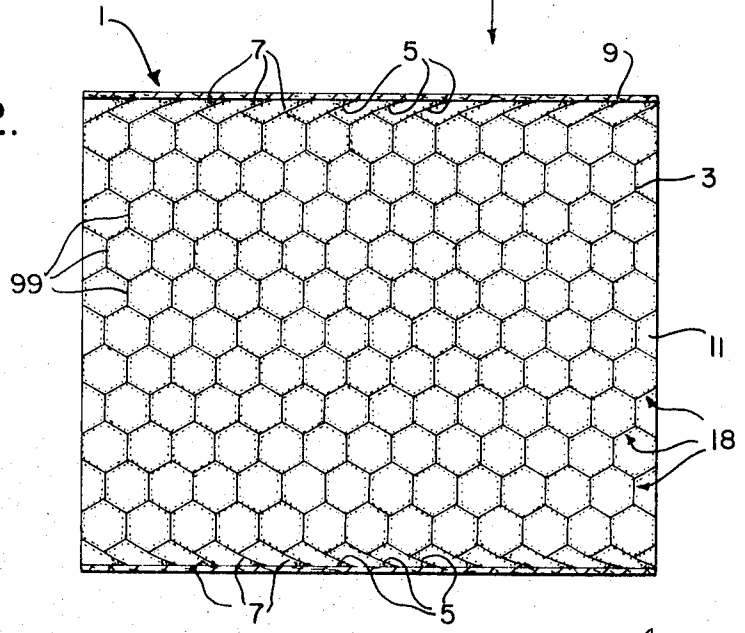
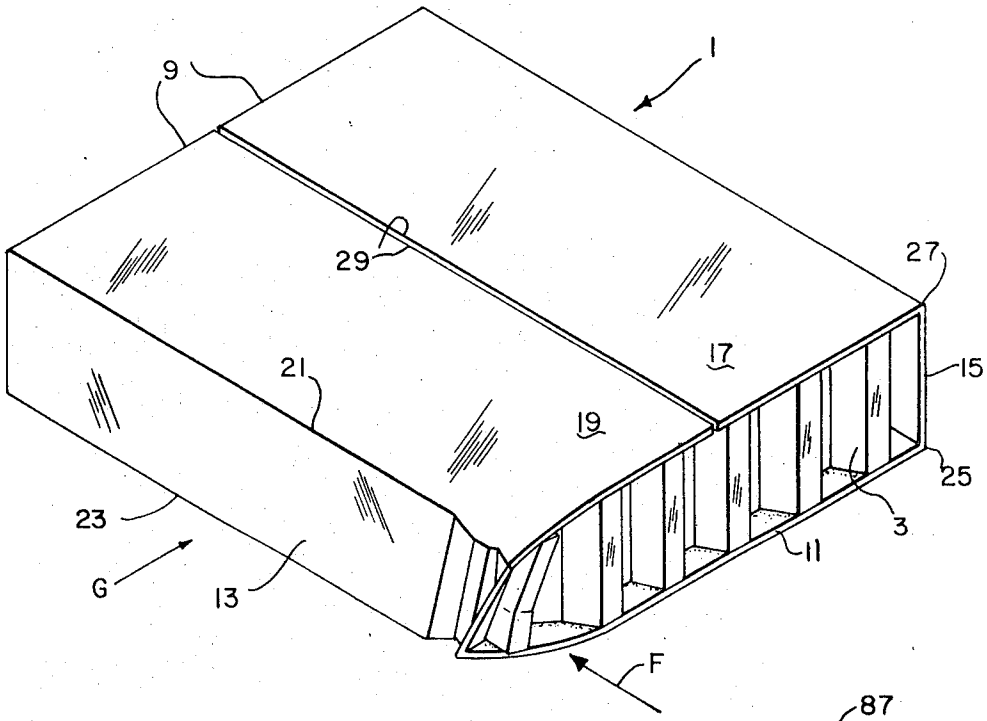


FIG. 2.



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Powers and Leavitt,
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FIG. 3.



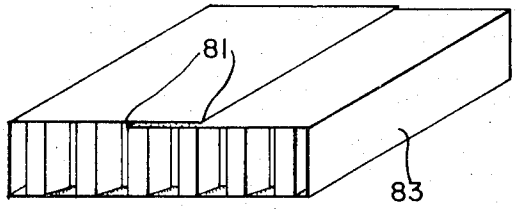


FIG. 8.

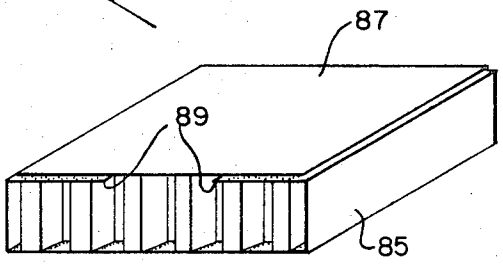


FIG. 9.

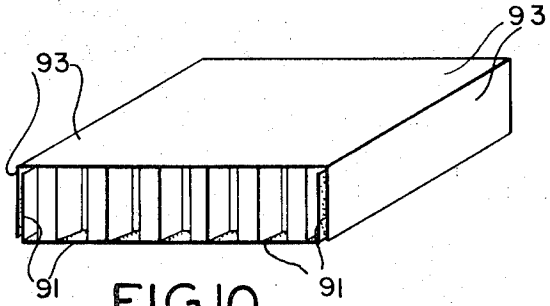


FIG. 10.

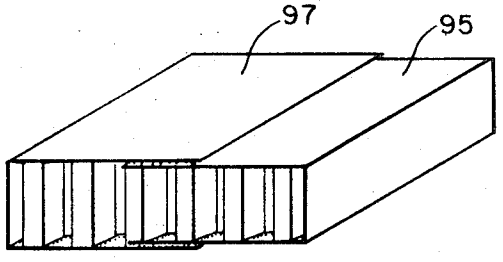


FIG. 11.

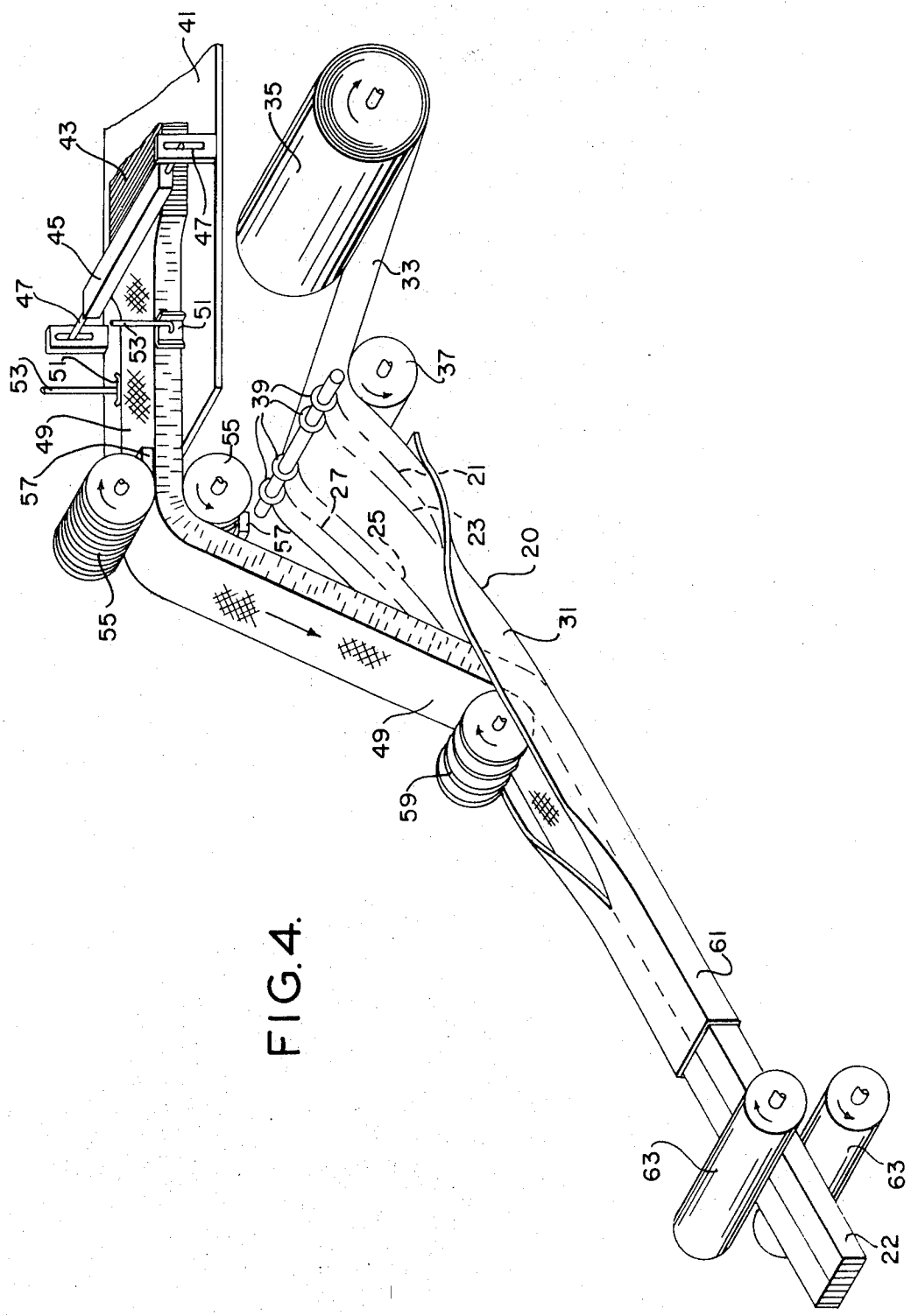

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FIG. 4.

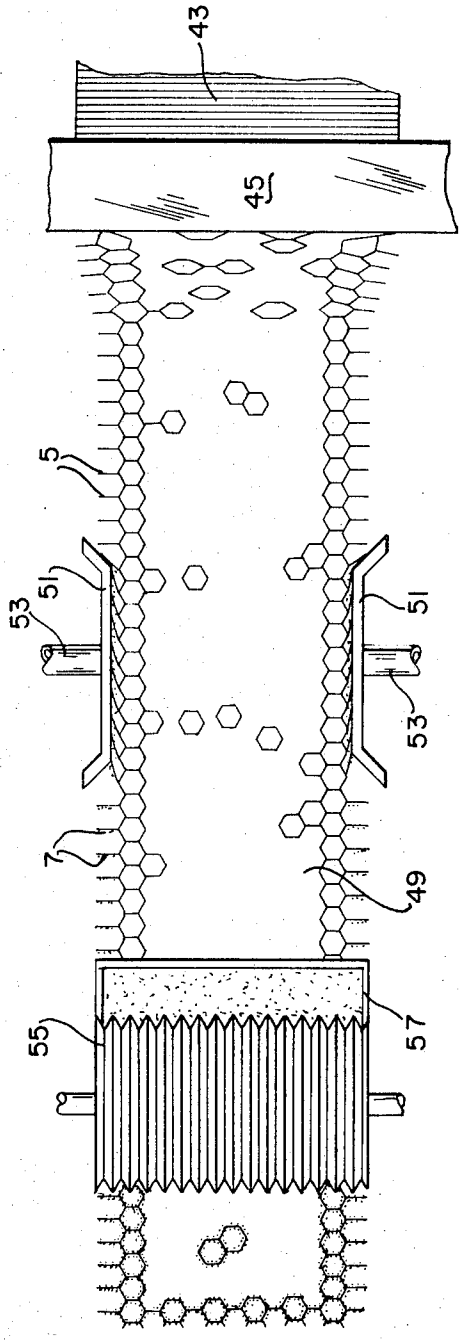


FIG. 5.

FIG. 6.

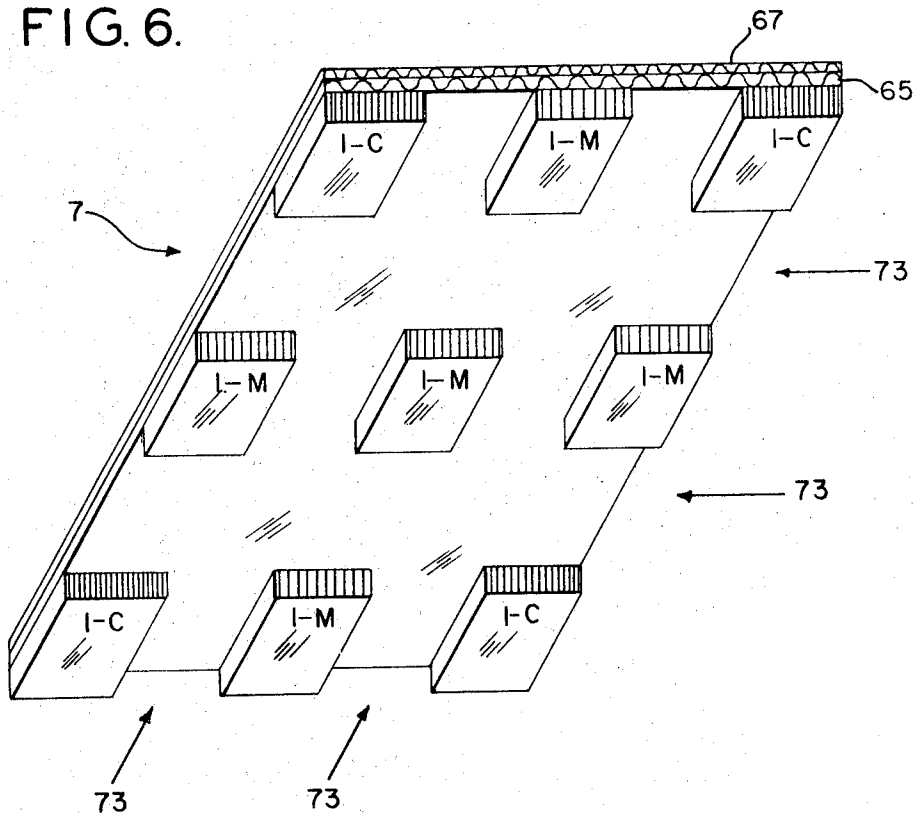
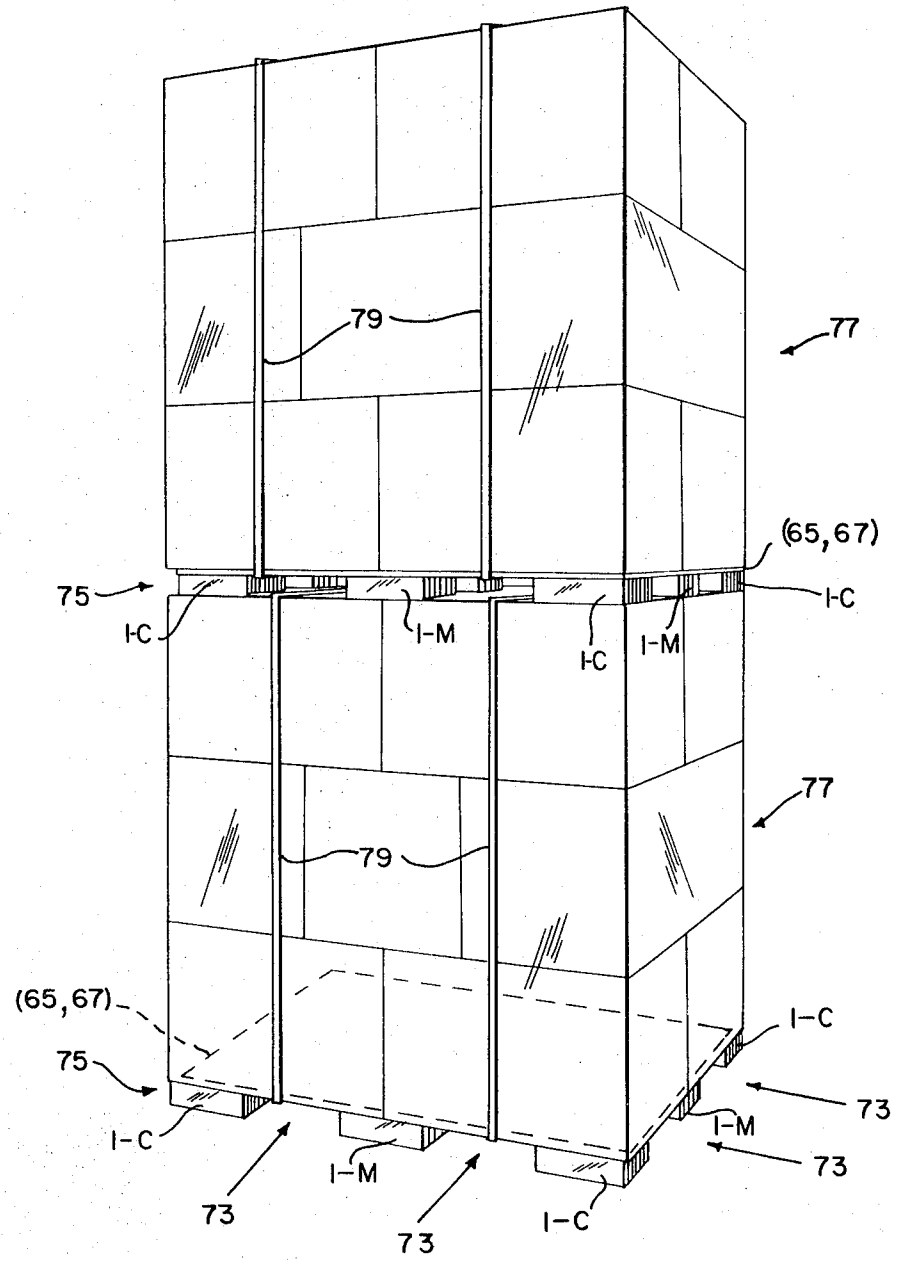


FIG. 7.



CELLULAR STRUCTURAL PRODUCTS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of an application, Ser. No. 769,165, filed Oct. 21, 1968, now abandoned, which was a division of applicant's prior copending application, Ser. No. 671,864, filed Sept. 29, 1967, now U.S. Pat. No. 3,587,479.

BACKGROUND OF THE INVENTION

The field of art to which the invention pertains is the manufacture of cellular structural forms for general use and particularly in the production of pallets. Heretofore cellular slabs of stretched cellular honeycomb material have been produced by providing individual upper and lower skins thereon to maintain the desired stretched conformation. The absence of any integral skin connecting the upper and lower skins on the sides of a block caused weakness in the cellular material in shearing between its upper and lower surfaces, as is expected to occur in supports of pallet boards.

SUMMARY

The invention in general provides for rapid low-cost manufacture of stronger, light-weight structural products and more particularly to blocks for supporting purposes, and to improved load supporting pallets employing such supporting blocks, the pallets being adapted to be moved about by means of lift forks.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a trimetric view of a honeycomb type of block made according to the invention;

FIG. 2 is a horizontal section as indicated by line 2—2 on FIG. 1;

FIG. 3 is a view similar to FIG. 1 illustrating how a crushing force operating at a vulnerable corner of the block is prevented from catastrophically shearing the block;

FIG. 4 is a diagrammatic view illustrating my method of manufacturing a plank from which blocks such as shown in FIGS. 1–3 are made;

FIG. 5 is a detail plan view of portions of FIG. 4;

FIG. 6 is a trimetric bottom view of a cellular pallet board to which supporting blocks have been adhered according to the invention;

FIG. 7 is a trimetric view illustrating how the pallet board of FIG. 6 is used; and

FIGS. 8–11 are diagrammatic views illustrating alternative wrapper forms.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings. Because of the various thin sections of materials used, the drawings are not to scale throughout.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now more particularly to FIGS. 1 and 2 of the drawings, there is shown a prismatic block 1 made according to the invention. This employs a honeycomb core 3 which has been stretched from a compaction of the same (FIG. 4). The honeycomb core may be formed from any suitable sheet material such as kraft paper, thin metal foil or the like. One example of how such material is made into honeycomb form appears in my U.S. Pat. No. 3,218,217. Such honeycomb material includes fins such as shown at 5 (FIGS. 2 and 5). These by means described below are provided with adhesive 7 and angled inwardly as shown in FIG. 2. A kraft paper or other web material wrapper is illustrated at numeral 9 which consists of panels 11, 13, 15, 17 and 19 folded along score lines 21, 23, 25 and 27. The margins 29 of wrapper 9 abut one another. The interior surfaces of the panels 13 and 15 are adhered to said fins 5 by the adhesive 7. The interiors of the panels 11, 17 and 19 are attached by adhesive 18 to the upper and lower hexagonal edges of the honeycombs 3.

An advantage of the wrapped construction shown in FIGS. 1 and 2 is illustrated in FIGS. 3 wherein a shearing and cornering force F is being applied to the prism constituted by the block. Such a force or a similar one would without the side panels 13 and 15 provided by the wrapper 9 successively and more or less break down one after another of the succeeding ranks of the honeycomb cells. As illustrated in FIG. 3 this does not occur in the structure made according to the invention. The sidewise panels 13 and 15, forming an integral part of the wrapper, act as strengthening webs between the lower panel 11 on the one hand, and the upper panels 17 and 19 on the other hand. The strengthening effects of the side panels is enhanced by the adhesive attachment thereto of the turned-in ribs 5. If the shearing force F were to be distributed along the entire width of the block then the strength of both of the panels 13 and 15 would come into play. If the shear direction should be such as shown by the arrow G (FIG. 3) the strength of the panels 13 and 15 would again come into play to resist collapse of the honeycomb cells by spreading and reducing local concentrations of force.

It may be remarked that a second wrapper may be wrapped at right angles around the block so as to provide additional panels covering the open end faces. However this increases the cost of manufacture, since each block would require an individual wrapping step, and the gain in strength is marginal.

Referring now more particularly to FIGS. 4 and 5, there is shown a low-cost method of manufacturing wrapped blocks from a wrapped plank of material forming an intermediate product from which the blocks may readily be cut. Thus in FIG. 4 numeral 31 indicates a folder for the reception of a strip of kraft paper 33 which enters the folder from a supply 35 by movement over a guide roll 37. The width of the strip 33 is equal to the perimeter of a right cross section of the block 1. Scoring wheels 39 associated with roll 37 apply score lines 21, 23, 25 and 27 as illustrated.

At numeral 41 is shown a plate which supports a compaction 43 of honeycomb material as it comes from the machine which makes it as shown, for example, in said patent. A gravity operated brake bar 45 having end guide means 47 functions to slow egress of the compaction 43 from the manufacturing machine. This forms the compaction 43. Then the honeycomb cells are made by pulling from the compaction and forming a band 49 of open cells. The width of the band 49 will automatically become less than the width of the compaction. This is more clearly shown in FIG. 5.

At numerals 51 are shown sidewise adhesive applicator shoes supplied with adhesive over lines 53. The spacing between the pads 51, as shown in FIG. 5, is such that the laterally extending fins 5 angle back i.e., are laterally compressed in an angular relationship, as adhesive is applied to their forward faces.

Next the band 49 enters between corrugated adhesive rolls 55. These operate in conjunction with so-called fountain type adhesive wells 57 to pick up adhesive and apply it to the upper and lower edges of the honeycomb cells. The glue rolls are ridged similar to those of a screw thread in order to sufficiently apply adhesive to the exposed honeycomb end edges even though there may occur some unevenness in those edges. The relatively sharp threaded rolls break down to a level any unevenness in the honeycomb edges thus making this possible. A second purpose of these ridges is to draw off excessive adhesive through cohesion of adhesive and at the same time bringing the applied adhesive up so that it stands on the upper edges of the honeycomb. With adhesive thus applied, the band descends as shown by the arrow to a set of guiding disks 59 located at the open inlet end 20 of the folder 31. Thus the band becomes cradled within the infolding sides of the strip 33. The score lines 21, 23, 25 and 27 are located at the four longitudinal corners of the band 49. As the contiguous band 49 and the scored and folded strip pass through the folder 31 they become adhered and issue from the outlet end 61 of the folder 31 as shown at the lower left in FIG. 4. The issuing material is in the form of a plank 22 of honeycomb core

around which the strip 33 is formed as a wrapper adhered to. Draw rolls 63 draw both the band 49 and strip 33 through the apparatus and deliver the plank in a continuous indefinitely long length. The plank 22 is then transversely segmented by sawing, cutting or the like to form blocks such as illustrated in FIGS. 1–3.

A use of blocks such as 1 made according to the invention is illustrated in FIGS. 6 and 7, which illustrate a new, strong, load-supporting pallet of very light weight. This comprises a platen of corrugated board preferably composed of two layers 65 and 67 which are interfacially adhered. Preferably one of these is made with coarse corrugations and the other with finer corrugations, the latter being on top. Attached to the bottom by means of adhesive applied to panels 17, 19 are blocks such as 1. A preferable number of blocks is nine, as illustrated. Four of these blocks are located at the corners of the board 65, 67 and are lettered 1-C. These blocks 1-C incorporate higher density small hexagonal honeycomb core cells which are stronger than comparatively lower density of blocks 1-M. The remaining five blocks lettered 1-M are disposed along crossing ranks and files of the same with one block 1-M midway between each pair of corner blocks 1-C on a side of the board 65, 67 and one block 1-M at the center of board 65, 67. The blocks 1-M are composed of lower density honeycomb core cells and thus are not as strong as the blocks 1-C, for purposes which will appear. The disposition of the flat blocks as described leaves spaces such as indicated by the arrows 73 for the reception of the power lifting forks when the platen (numbered 75 as a whole) rests on the floor or on another surface. All of the blocks are flat as shown for maximum stability. FIG. 7 illustrates how stacked packaged loads 77 are supported by platens. Numeral 79 indicates holding bands around the loads and around the boards. These are not always used.

Sometimes a platen may be overloaded. If so, the first blocks to crush under compression would be the weaker ones lettered 1-M. The stronger corner blocks 1-C assure that any tilt in the load occurs toward the center, instead of away from the center and possibly onto the floor in the absence of any bands such as 79. Any crushed condition of the blocks 1-M indicates to a user that the platen has been overloaded and corrections can be made on a substituted pallet. In any event a catastrophic spillage such as in a supermarket would not by this time have occurred. It is contemplated that the pallets being light and of low cost may be used as portable shelving to be delivered in loaded condition to reception or other areas in such markets and, if desired, thrown away after removal of their loads.

While the above described form of the blocks is preferred because of the extremely low-cost, continuous manner of manufacture as in FIGS. 4 and 5, other wrapped forms may be employed such as illustrated in FIGS. 8–11. In FIG. 8, the margins 81 of the wrapper 83 are lapped and adhesively joined, instead of being abutted as in FIG. 1. This form may be made up from a plank essentially as illustrated in FIGS. 4 and 5. In FIG. 9 the wrapper is made in two parts, i.e., a scored and folded part 85 and an adhered covering strip part 87. The margins 89 of the part 85 are spaced apart. This form may also be made essentially as in FIGS. 4 and 5 by feeding a strip into the folder above the band 49 with suitable application of adhesive. FIG. 10 illustrates a form in which there are two wrapper parts 91 and 93 each of which is double scored, each being folded and wrapped around three faces of the cellular core. The folded panels of the members 91 and 93 which are overlapped on the sides of the core are adhesively attached to one another and to the ribs of the core. In effect the wrapper parts 91 and 93 are of U-shape. In FIG. 11 wrapper members 95 and 97, also of U-shape, are employed but in this case the overlapped margins are on the upper and lower faces of the honeycomb core, being adhered to one another and the core.

Appropriate dimensions (without limitations) are as follows: For the corrugated board 65,67 appropriate dimensions are 40 × 48 inches with a thickness of 0.330 inch. The appropriate size of each of the nine supporting blocks for such a board is 7 × 8 ½ ×2 inches. The appropriate thickness for the kraft paper forming the honeycomb core is 0.008 inch. Because of the manner in which the honeycomb material is made the sides of its hexagons such as 99 which extend crosswise of the length of the honeycomb band are composed of two plies of the material 3 joined by adhesive (see said patent). This two-ply condition applies also to the fins 5, these being also composed of two plies joined by adhesive. The total thickness of each fin is thus, for example, 0.016 inch. As a result the bracing effects of the multiply fins which are adhered to the side panels such as 13 and 15 (FIGS. 1 and 2) is considerable. An appropriate thickness of the wrapper material is 0.013 inch.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above methods without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. The method of producing a cellular structural product comprising feeding a flexible wrapper strip into a folder, concurrently applying adhesive to at least two respective opposite faces of a prismatic band of honeycomb cellular material while breaking down to a level unevenness in exposed end edges of honeycomb cells extending transversely across the band and bringing up and drawing off excess adhesive through cohesion thereof by moving the band between sharply peripherally ridged adhesive applicator rolls thereby to apply the adhesive evenly across substantially the entire width of the band to substantially all the exposed end edges of the honeycomb cells, feeding said band into the folder along with the strip to fold and transversely wrap the strip around the band in adherence thereto, and drawing the wrapped band from the folder.

2. The method according to claim 1 including the step of scoring the flexible strip before it enters the folder to produce score lines which when the strip is folded will register with the four corners of the band, and thereafter segmenting the band into blocks.

3. The method according to claim 2 including the step of scoring the flexible wrapping strip before it enters the folder to place score lines thereon which upon folding will register with the four corners of the honeycomb band.

4. The method of manufacturing a structural product comprising moving a strip of flexible wrapping material through a folder, drawing and stretching a honeycomb band from a cellular honeycomb compaction having laterally extending fins with face portions, applying adhesive to the top and bottom of the band and to the face portions of the laterally extending fins, directing said honeycomb band through said folder in engagement with said flexible strip, folding the flexible strip around the honeycomb band whereby said strip as it folds around the band laterally compresses said fins in an angular relationship and becomes adhered to end edges of the honeycomb cells and the facial portions of the fins, and withdrawing the wrapped band from the folder.

5. Apparatus for producing a continuous plank of structural material from a compaction of cellular material and a strip of flexible wrapper material, comprising means for guiding a compaction to be pulled into a prismatic four-side band of open cells, a pair of adhesive applicator rolls for applying adhesive to two respective opposite faces of the band, means for supplying adhesive to the rolls, each of the rolls being cylindrical in form and having a plurality of relatively closely spaced and relatively sharp annular peripheral ridges along the length of the roll, said rolls constituting means for concurrently breaking down to a level unevenness of exposed end edges of said cells while applying adhesive evenly to said end edges across substantially the entire width of said opposite faces and

bringing up and drawing off excess adhesive, a folder for wrapping said strip around said band in adherence thereto to form wrapped plank, and means for drawing the wrapped plank from the folder.

6. Apparatus as set forth in claim 5, including adhesive applicator means for applying adhesive to the two remaining opposite faces of the band, and means for scoring the wrapper strip to provide a plurality of score lines which will register with the four corners of said band when the wrapper strip is folded around the strip.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,655,478 Dated April 11, 1972

Inventor(s) Robert C. Geschwender

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Insert the following paragraph in the Abstract on the title page after the first paragraph: - - The finished product when in the form of blocks is useful for the production of a novel form of strong, light-weight pallets for support and transport of packaged loads, the blocks being adhered to the underside of a cellular pallet board. The arrangement allows the introduction of lifting forks under the board and between the blocks. Four of the blocks of the corners of the board incorporate cellular material of more dense structure for greater strength at the corners. Thus if perchance a load should become too great on a pallet, any resulting buckling will occur in a direction to cant the load inwardly so as to avoid spilling. - -

Signed and sealed this 12th day of September 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attest Officer

ROBERT GOTTSCHALK
Commissioner of Patents